Visas, travel, and international trade.

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Abstract

In this paper I show that visa requirements are associated with lower trade. I develop a model of international trade with heterogeneous firms where managers undertake business travel to export. The model incorporates a travel sector that provides travel services to tourists and business travelers. The price of air-transportation is thus determined in equilibrium. In the model, travel costs affect the extensive margin of firm participation to export. I calibrate the model to match international trade flows. I find that visa requirements are equivalent to buying a ticket between the EU and the US. Using the model, I find that, (i) a complete elimination of visa requirements around the world results in a median gain of 2.42% in real gdp per capital (my measure of welfare), (ii) the recent elimination of visas between China and the EU could result in a 0.31% increase in trade flows from EU to China, and 1% increase in welfare in China, and (iii) introduction of efficient airplanes can result in a median gain of 0.79% in welfare.

1 Introduction

What is the impact of visa requirements on international trade flows? Growing incomes and cheaper air-travel has resulted in a steady growth in demand for international travel. However, international travel is not determined by economic variables alone. A key determinant of international travel is the presence of visa requirements and the process to obtain them. This process can range from a short (and cheap) online application to costly in-person verification at local consular service centers. Countries have attempted to ease visa restrictions on incoming travelers overtime through simpler processes and sometimes through complete elimination of the requirements. The rationale behind these policies is to encourage tourism who contribute to the domestic economy through their consumption. But their impact on business travel is overlooked, largely because of the challenges in measuring the impact of business travel on international trade. In this paper, I provide a quantitative framework that allows us to quantify the impact of visa policy on business travel while simultaneously accounting for its impact on tourism.

Business managers engage in travel to overcome informational and contractual frictions. Face-to-face interaction with business partners enables them to effectively transmit information and secure trust. However, travel is costly, incurring transport and lodging costs, as well as securing immigration document when necessary. These costs determine whether managers in a firm travel, or how often they do, affecting trade between regions. Visa requirements are uniquely salient to international travel, and as such, their presence affects international travel, and through business travel, international trade.

Furthermore, in addition to direct costs, visas also have an indirect impact of business travel through an entirely overlooked determinant of cost of business travel — tourists/non-business travel. This is especially important in light of the recent backlash against tourists across the EU. Tourists and business travelers share the same travel infrastructure including airplanes, hotels, and in case of international travel, immigration services. The combined demand for these services encourages their production and allows tourists and business travelers to complement the other's presence. Demand for travel between a pair of location can determine the presence of direct or indirect flights between them and the price to travel between them. However, in addition to being the lion's share of travel demand, tourism demand is also more elastic than business travel demand. So, fluctuations in travel prices can change the composition of travelers substantially towards business travelers, and potentially increase prices for everyone. The joint modeling of tourism and business travel demand is a novel contribution of this paper, and allows for the quantification of the impact of anti-tourism specific policies on international trade.

I begin by showing that business travel consistently constitutes a sizable portion of international travel ($\approx 20\%$) while tourism and other non-business related activities account for the rest. I then present evidence that visa costs are nontrivial, and are negatively associated with trade flows. Based of these facts, I develop a model of international trade with tourism and business travel. In the model, the price of tourism and business travel are jointly determined in equilibrium, thus linking changes in tourism demand to business travel costs. I calibrate the model to best fit existing trade flows and use it to simulate changes in visa policy and transport technology to quantify their effect on trade flows, and welfare.

I augment the canonical gravity framework for international trade flows with the presence of passport-affixed visa requirements between countries. By adding visa costs to the gravity framework, I am able to control for potential determinants of visa presence such as origin and destination economies, and identify the relation between visa requirements to trade flows[1]. I find a strong negative relation between visa requirements and trade flows. Since, visas impact travel

[1]Note that I exclude direct trade flows attributable to tourism from my measure of trade flows.

directly, and not trade flows, the likely source of this correlation, having controlled for other common determinants of trade and travel, is business travel. While the gravity regression is robust and provides us with an aggregate estimate of the impact of visa requirement on international trade, it does not provide insight on the mechanisms at play, and to decompose the impact of visas across them.

To attribute the differential impact of visas on international trade through (i) direct impact on business travel and (ii) indirect impact through tourism, I extend a heterogeneous firms model of international trade, à la Melitz (2003), to feature tourism, business travel costs, and a travel sector. Firms incur a fixed cost to export and it is composed of endogenous travel costs that the firm incurs if it chooses to export to a specific destination. On the household side, I augment the standard CES demand for tradable goods with demand for international tourism. Tourism consists of consuming public goods at the destination but incurs the cost of travel and accommodation. Separately, I model a travel production sector that produces a composite good for international travel and accommodation using labor from the destination country. To generate the relation between tourism and business travel demand, the travel sector on each route is populated by a monopolist that takes the joint demand as given and sets the price to maximize profits. Thus the cost of travel is jointly determined by the demand for travel by firms and tourists.

The model delivers two key insights. First, the cost of travel effects international trade through the extensive margin of firm participation. Least productive firms cannot incur the cost of traveling and profitably export, and so they stay out of the international market. This is the standard mechanism of heterogeneous firms environments. Second, since the model features inelastic business travel demand with elastic tourism demand, the price set by the monopolist lies in between the price it would set if the economy was only populated by one type of travel demand. Consequently, the price set by the monopolist is less than the monopoly price with business travelers alone. This mechanism allows the presence of tourists to lower the price of business travelers.

I calibrate the model parameters to match aggregate bilateral trade flows and then use the model to simulate changes in visa policies and transport technologies. I first simulate a counterfactual scenario that eliminates all visa requirements around the world by setting the calibrated visa costs to zero. I find that real gdp per capita, the standard measure of welfare in international trade literature, increases for all countries ranging from 3.6% for Saudi Arabia to 0.79% for India. This result is driven by an increase in national incomes from profits from travel services, as well as a decrease in prices driven by more trade between countries. I then simulate an elimination of visa requirement to travel from EU to China, a policy that was recently implemented. This results in a 1% welfare gain, driven evenly by the income increase from profits from travel services and price decrease from increased trade. Finally, since the model features iceberg travel costs like trade, I am able to simulate the impact of changes in transport service by reducing the impact of distance on travel prices through a reduction in the iceberg travel cost-parameter. I find that a 20% increase in fuel efficiency, results in global increase in trade flows, as well as welfare.

The article contributes to three strands of literature: (i) determinants of trade costs, (ii) effects of tourism, and (ii) heterogeneous firms models in international trade featuring fixed costs to export.

It is well established that trade costs significantly shape trade flows around the world, and the sources of trade costs include transportation costs (Anderson and Van Wincoop (2004), Brancaccio et al. (2020)), informational, communication, and contracting frictions (Startz (2021), Poole (2009), Arkolakis (2010), Allen (2014), Guillouet et al. (2021)), and political costs (Fajgelbaum and Khandelwal (2022)). Using a regulatory discontinuity in flight operating costs around 9000 km distance between city-pairs, Campante and Yanagizawa-Drott (2018) show exogenous variation in business links determining economic outcomes. Söderlund (2023) estimates the impact of reduced air travel time on international trade using the liberalization of the Soviet airspace as a quasi-natural experiment that reduced travel time and encouraged business travel. Similarly, Blonigen and Cristea (2015) use the changes in air traffic induced by the 1978 Airline Deregulation Act in the US to link business travel to local economic growth. Umana-Dajud (2019) used the removal of Ecuador and Bolivio from the EU Schengen waiver as an exogenous increase in travel costs and find a strong negative relation between exclusion from visa waiver and trade flows between them and the EU. Contrary to most of the findings, Neiman and Swagel (2009) used changes in the intensity of visa requirements in the US after the 9/11 attacks for certain Latin American countries and find that visas do not hinder trade. In contrast to these papers, my study includes all the countries in the world, and proxies travel costs by augmenting the gravity framework with visa costs. My specification is able to include origin-year and destination-year fixed effects, thus delivering a highly robust relation between travel costs and trade.

The limited availability of data compels the use of structural tools to quantify the role of tourism on business travel. So the paper adds to a growing list of quantitative trade models featuring heterogeneous firms and fixed costs to export as in Melitz (2003) and Chaney (2008). In my model, firms incur fixed costs to export in a foreign country by sending managers to that country. The price of business travel depends on the capacity available on airplanes after tourism demand is met and thus is influenced by tourism demand. Thus the fixed costs are an equilibrium outcome in my model. Eaton et al. (2011) endogenize this fixed costs differently by relating them to marketing costs and allowing them to depend on the size of the destination market. Related to modeling tourism, Faber and Gaubert (2019) models demand for tourism in a spatial model of economic activity to quantify the local impact of tourism demand. So their model does not feature either business travel or the interdependence of tourism with business travel. Finally, Antràs et al. (2023) model business travel in a canonical model of international trade and augment it with the epidemiological SIRD model to study the role of business travel in the spread of pandemics. Their model is also silent on the interplay between tourism and business travel.

Finally, this paper also contributed to a nascent but growing literature on the economic impact of tourism. Faber and Gaubert (2019) and Allen et al. (2020) study the impact of tourism on the local economy with the former focusing on Mexico while the latter on Barcelona. The focus of these articles on the effects of tourism on the local economy ignores the role of the shared infrastructure between tourists and business travelers. Therefore, the impact of tourism on the local economy could also happen by its impact on international trade via business travel. This is the first paper to make that connection and to model it in a quantitative framework.

The rest of the paper is organized as follows. In Section 2, I describe the data used in this analysis. In Section 3 the empirical evidence on the composition of international travel, and the impact of visa costs on international trade. Then in Section 4 I develop the heterogeneous firm model of this paper. In Section 5, I estimate the parameters of the model and simulate the counterfactual scenarios. Section 7 concludes.

2 Data

In order to study the relation between travel costs and trade, I compile data on international trade, travel flows, and travel restrictions from various sources[2].

[2]All the data I use in this analysis is publicly available with the exception of the World Tourism Organization data. This data can be obtained by submitting a research proposal to the UN WTO. I will provide a link to each one of these in their respective sections.

2.1 International trade

I obtained the data on trade flows form the US International Trade Commission's *International Trade and Production Database for Estimation* (ITPD-E) database that contains industry-level trade flows between country-pairs from 2000 to 2016. It is administratively reported from several country sources and is provided without any extrapolation of missing information using any model[3]. The unbalanced panel consists of 170 industries across agriculture, mining and energy, manufacturing, and service sectors from 243 countries. I aggregate over all industry-level exports from an exporter-importer pair to compute trade flows from an exporter to an importer. My sample consists of trade flows between 1234 country-pairs between 2000 and 2016. I exclude travel exports (industry code: 157) from my analysis and focus on the indirect effects of travel costs on trade.

2.2 Visa requirements

Visa requirements vary widely between countries, and the process can be time-consuming and bureaucratic. Most countries require the passport of a traveler to be affixed with a paper visa prior to the international trip. According to the WTO, 47% of the world population still requires a traditional visa with a paper affixed to the passport. Visa processing delays and uncertainties can disrupt travel plans, and in turn disrupt international business transactions and collaborations.

A typical traveler obtains the paper visa in-person at a domestic office prior to the international trip. However this local office need not be close the site of production. For example, there are a total of 67 EU consulates and embassies in China that can grant a Schengen Visa. They are, however, all located in seven locations[4]. In 2023, the US embassy and consulates in India increased their staff to bring down the average wait time for an appointment from 1,000 days (32 months), to 250 days (8 months)! The average wait time across US consulates as of March 2024 is still more than 170 days, with some cities like Bogota experiencing wait times of 725 days. Furthermore, obtaining a visa is an uncertain process with rejection rates varying significantly across countries. The severity of visa enforcement can influence business travel decisions directly, or via reduced tourism which responds more elastically to travel costs.

To know which origin-destination pair require a visa, I use the Determinants of International Migration (DEMIG) database provided by the International

[3]The data is sourced from FAOSTAT, COMTRADE, MISTAT, UNIDO, INDSTAT, WTO-UNCTAD-ITC, and UN TSD. Source: Borchert et al. (2021).

[4]Beijing, Shanghai, Guangzhou (Canton), Chengdu, Wuhan, Shenyang, Chongqing

Migration Institute, University of Oxford. It records visa requirements between origin-destination pairs from 1973 to 2013. The source of this information is the Travel Information Manuals that are released monthly by the IATA (International Air Transport Association). The January manuals are used to populate the DEMIG database.

Since the period of trade data that I use is between 2000 and 2016, I restrict the DEMIG dataset to between 2000 and 2013. I supplement the remaining years (2014-2016) of visa restrictions from the Global Visa Costs (GVC) database constructed by Recchi et al. (2020). The GVC data is constructed manually and by web-scraping consulate/embassy/ministry websites, and contains information on visa processing fees associated with seven broad visa categories in 2019: (1) tourist, (2)student, (3) business, (4) work, (5) family reunification, (6) transit, and (7) other motives. Since the focus of my study is on short-term travel, I restrict myself to tourist and business visas, and check for origin-destination pairs where the fees for these visa categories is positive. I find that no country pair changed their visa requirements between 2013 and 2019 and thus I am able to extrapolate the visa requirements from 2013 to 2016 in the DEMIG database[5].

2.3 International travel

I obtained inbound trips data from the UN World Tourism Organization that records temporary cross-border movement for personal or business purposes. The data is obtained from immigration offices and border controls, border surveys or a mix of them. The data measures the flows of international visitors to a country where each arrival is treated as a single trip. So if an individual travels to a country multiple times, the WTO records it separately. If an individual visits multiple countries in a single trip, each country is recorded as a separate trip[6].

Another important point for this data is that border, seasonal and other short-term workers, long-term students are excluded and so the data prominently captures tourism or business travel. In addition to recording aggregate bilateral flows by country pairs, the data also records at country-level the total number of tourists, and business travelers separately. The period for the data is 1995 to 2020.

[5] According to GVC database there is a positive fees of travel between USA and EU but this is primarily incurred using an online portal and so the DEMIG database labels this arrangement as visa-free travel.

[6] While the first mode of recording is appropriate for our context, the second recording methodology diverges from the model where each exporting choice is a separate decision. So the possibility of trade with countries close to existing trade partners, as highlighted in Chaney (2014) is excluded from my model. My choice of modeling is primarily driven by the need for simplicity and a more sophisticated modeling choice is left for future.

3 Empirical analysis

3.1 International travel is composed of tourism and business travel

I first show the evolution of the mean composition of travel across destinations. The data ranges from 1995 to 2019, and for each year, I compute the average share of passengers that arrive for business purposes. In Figure 1 I plot this share. Business travel accounts for a minority fraction on most routes hovering around 20% and remaining stable over this long-horizon[7]. From the figure it is evident that non-business travel is an essential ingredient in determining the equilibrium price of travel and therefore can effect the cost faced by business travelers.

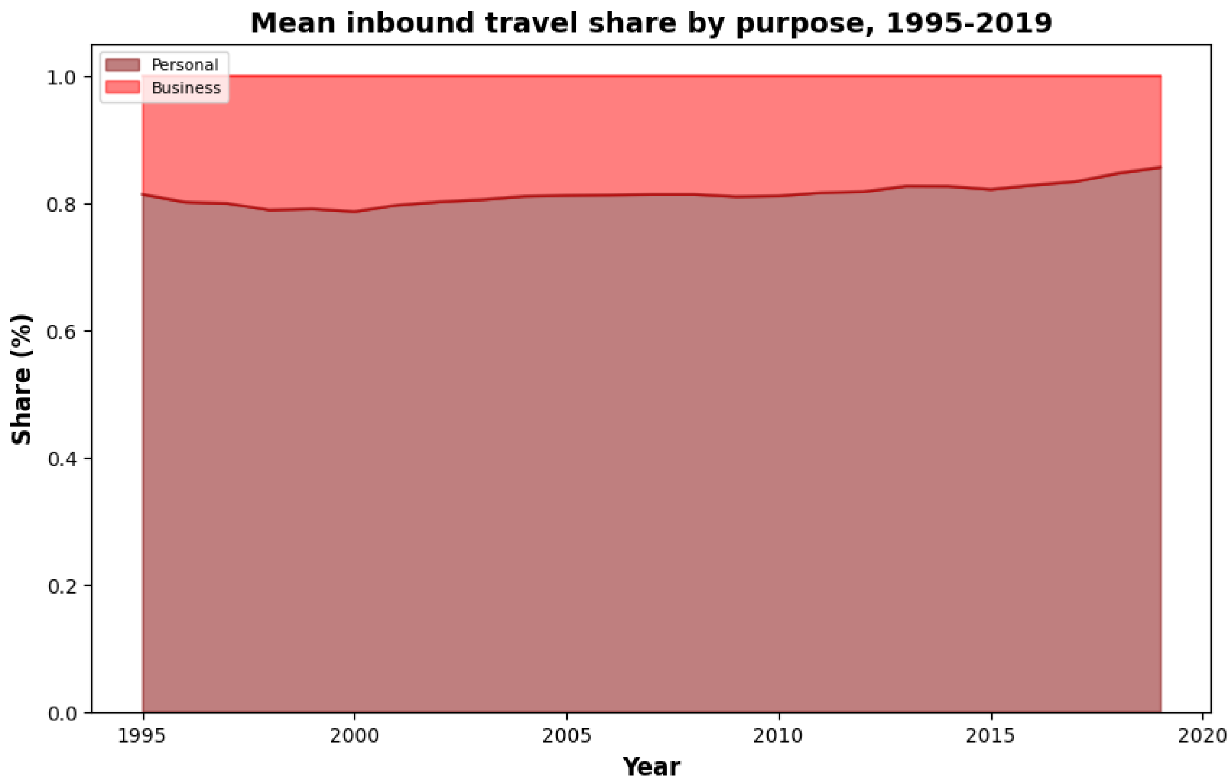

Figure 1: The figure plots the mean share of business travelers across countries in each year. Suppose b_{it} is the share of business travelers that arrive to country i in year t (so the share of leisure or non-business travelers is $(1 - b_{it})$), then for each year t, I compute $b_t = \frac{1}{N_t} \sum_i b_{it}$. Here N_t is the total number of countries for which the composition data is available.

3.2 Visas hinder trade.

I employ the structural gravity framework to show that visa requirements are a part of international trade costs. The gravity framework is the workhorse

[7]This is consistent with the estimates provided by the National Travel and Tourism Office from their Survey of International Air-travelers. The NTTO estimated that in 2018, 4.4m visitors, or 11% of the total visitors that arrived to the US came to visit customer or supplier or for sales/marketing or internal company meeting, and another 2.6m (6.5%) arrived for convention, conference or trade shows. In contrast, 30.8m (77.1%) visitors arrived for tourism or visiting family.

empirical framework for international trade flows and is consistent with several trade theories. I augment it with information on whether short-term travel between country pairs is subject to visa requirement on both sides. I follow the recommendations set forth in Piermartini and Yotov (2016) for structural gravity estimations and estimate the model using the Poisson Pseudo Maximum Likelihood (PPML) estimator, originally proposed in Silva and Tenreyro (2006). My specification is:

$$X_{nit} = \exp\left[\beta_0 + \beta_v v_{ni} + \beta_d d_{ni} + \delta_l + \delta_b + \delta_c + \delta_{it} + \delta_{nt}\right] + \epsilon_{nit} \tag{1}$$

X_{nit} is the total exports from exporter i to importer n in year t. d_{ni} is the log of distance (in km) between the country pair. δ_l is the coefficient on a language indicator that indicates if the pair share the same official language. δ_b is the coefficient on a border indicator that indicates if the pair share a border. δ_c is the coefficient on a colony indicator that indicates if the pair share a colonizer.

δ_{it} and δ_{nt} are exporter-year and importer-year fixed effects that capture the multilateral resistance indexes. They incorporate the indirect affect of fundamental changes in a country on trade between other countries through the global trade network. Trade between an importer-exporter pair can be influence by, the importers trade relation with another exporter, or the exporter's relation with another importer, or through second order effects that are transmitted through these relations. These changes in the importer's and exporter's trade relations are captured by the δ_{nt} and δ_{it} respectively in our specification. Structural formulation of the multilateral resistance terms typically include the productivity and the cost of production at various exporters, and the geographical barriers between an importer and the rest of the world.

The novel part of this estimation framework is v_{ni}. It is an indicator variable that indicates if citizens of i or n must present themselves in-person at a local office to obtain a visa to travel to the other country. Our coefficient of interest is β_v. This specification of gravity regression, including the extensive margin of visa requirement, has the advantage of simplicity of interpretation. β_v identifies the average impact of the presence of visas that require approval from local authorities across various channels such as online application, in person appointments, either once every few years or each time the traveler intends to travel.

3.3 Results

In table 1, I present results for the model specified in equation 1. Both OLS and PPML methods yield negative impacts of visa policies on international trade. When augmented with visa requirements, OLS estimates that the presence of visa restriction is associated with 0.5% less exports. In contrast, the PPML estimates the same relation at 0.15% lower trade. The PPML estimates is our preferred estimates since they are robust to issues like heteroskedasticity and zero trade that is common in trade data. These findings can be informative to policymakers that are involved in regulating travel. Since tourism regulation by enforcing visa policies also overlooks business travel, the regressions here shed light on these indirect associations.

The gravity framework analysis indicates that travel costs have a significant impact on international trade. However, without additional data specifically related to business travel, it is difficult to determine how changes in travel costs, resulting from improved travel technology or relaxed visa policies, might influence trade flows. This limitation arises for two main reasons. Firstly, the gravity analysis focuses on the extensive margin of visa requirements, meaning that changes in visa policies targeting the intensive margin may not necessarily affect the extensive margin used in the analysis. Secondly, since the analysis does not directly incorporate travel prices, any changes in technologies that could potentially lead to variations in travel costs are not accounted for within the gravity framework.

4 Model

Motivated by the evidence presented, I incorporate business travel, tourism and visa restrictions in a model of international trade. The global economy consists of S countries indexed by n, i. Each country, n is endowed with labor L_n which is the only factor of production. The countries are populated by an exogenous measure of firms, N_n. Each firm produces a single unique good monopolistically. Goods can be traded internationally but are subject to iceberg costs. Additionally, firms that choose to export must incur a fixed cost. This fixed cost is incurred in the form of business travel to the importing country. Each country also acts as a destination for tourism services. Traveling to another country may require a visa document depending on the country-pair, and is also subject to iceberg costs reflecting the impact of distance on travel costs.

Table 1: Estimates from Gravity regressions

	OLS		PPML	
	(1)	(2)	(3)	(4)
Visa required		**-0.435*** **		**-0.153***
(Exporter to Importer)		(.031)		(.062)
Distance (km, log)	-1.548***	-1.442***	-0.746***	-0.659***
	(.020)	(.023)	(.032)	(.038)
Shared Border	0.774***	0.733***	0.310***	0.259**
	(.113)	(.121)	(.069)	(.079)
Shared Language	0.784***	0.650***	0.152*	0.223**
	(.039)	(.042)	(.068)	(.070)
Trade agreement	0.650***	0.770***	0.321***	0.539***
	(.040)	(.062)	(.059)	(.084)
Pair-FE	N	N	N	N
N	455,975	326,137	629,269	444,461
Adjusted-R2	0.729	0.722	0.946	0.948

Figure 2: This table presents the results of Gravity model regressions using both Ordinary Least Squares (OLS) and Poisson Pseudo-Maximum Likelihood (PPML) methods. The dependent variable is the volume of trade between country pairs. The independent variables include whether a visa is required for entry (Exporter to Importer), the logarithm of distance between countries, shared border, shared language, and existence of a trade agreement. Standard errors are reported in parentheses.

4.1 Household

Households in countries have preferences over traded goods and tourism that is represented as follows:

$$U_n = \left(\int_{\Omega_n} q^G_{ni}(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\left(\frac{\sigma}{\sigma-1}\right)\mu} \Pi_j \left(q^L_{in}\right)^{\mu_{in}} \tag{2}$$

where $q^G_{ni}(\omega)$ is the quantity of traded **G**oods variety ω consumed by the household that is sourced from a firm in j that produced ω. Ω_n is the set of varieties available to households in country n. q^L_{in} is the amount of tourism (or **L**eisure travel) services consumed by n from i[8]. I assume that $\mu + \sum_{j=1}^{S} \mu_{in} = 1$, and $\sigma > 1$. μ represents the expenditure share in tradable goods and services. μ_{in} is the expenditure share on tourism from country n in i. σ is the elasticity of substitution within tradable varieties.

The equilibrium expenditure share in n on variety ω from i is given by:

$$\frac{p^G_{ni}(\omega) q^G_{ni}(\omega)}{Y_n} = \mu \left(\frac{p^G_{ni}(\omega)}{P^G_n} \right)^{1-\sigma} \tag{3}$$

[8]Note the reversal in index between q^G and q^L. To clarify, the order of index always represents destination-origin pair for the underlying object being measured. For example, $q^G_{ni}(\omega)$ represents the flow of goods from i to n, and q^L_{ni} represents the flow of tourists from i to n.

where P_n^G denotes the price index for tradable varieties in country i. $p_{ni}^G(\omega)$ is the price of ω sourced from i by n. Y_n is the total income of households in n and is determined in the equilibrium as the sum of labor income and profits form traded goods production and tourism services.

The expenditure share on tourism service from country j is given by:

$$\mu_{in} = \frac{(p_{in}^V + \psi_{in})q_{in}^L}{Y_n} \tag{4}$$

ψ_{in} represents visa costs if there is a visa requirement to travel from n to i. I assume that if visa exists between countries, then $\psi_{in} = \psi$, and is 0 otherwise. p_{in}^V is the unit price of tourism/travel service from n to i, and includes the iceberg cost incurred to travel, τ_{in}^V, described in 4.4.

4.2 Tradable varieties

Tradable goods are produced using only labor by a monopolistically competitive firm and the total measure of firms in each country i is exogenously given by N_i. Firms draw labor productivity from a pareto distribution[9].

The cost of producing $q_{ni}^G(\omega)$ units of good ω and exporting it to n for a firm with productivity φ is given by:

$$c_{ni}(q_{ni}^G(\omega), \varphi) = \frac{w_i \tau_{ni}^G}{\varphi} q_{ni}^G(\omega) + f_{ni} \tag{5}$$

where w_i is the wage in i, τ_{ni}^G is the iceberg trade cost (**for exporting from i to n**), and f_{ni} is the fixed cost incurred for a firm in i to sell in n. Note that each firm produces a specific variety.

To simplify notation, I identify the variety by the productivity level of the firm that produces it. So, the price faced in n for a variety with productivity φ from i is given by:

$$p_{ni}^G(\varphi) = \frac{\sigma}{\sigma - 1} \frac{w_i \tau_{ni}^G}{\varphi} \tag{6}$$

Firm productivity is drawn from a Pareto distribution with shape parameter, γ. Upon receiving their productivity draws firms decide whether to enter a market based on their profitability after paying the fixed costs. This results in a lower bound for productivity for firms in each country i to export to another country n. Assuming the distribution of productivity draws is Pareto allows

[9] The assumption of pareto distribution is important because it delivers a analytical expression for trade flows. However, it is not entirely dissociated from reality as argued by multiple studies in international trade that involve export choice by firms.

use to obtain closed form solutions for thresholds for productivity for exports, the aggregate price index in each country, and trade flows.

Let $\bar{\varphi}_{ni}$ denote the lowest productivity firm from i exporting to n, then the price index P_n^G is given by:

$$P_n^G = \left(\sum_{j=1}^{S} N_j \int_{\bar{\varphi}_{nj}}^{\infty} \left(\frac{\sigma}{\sigma-1} \frac{w_j \tau_{nj}^G}{\varphi} \right)^{1-\sigma} dF(\varphi) \right)^{\frac{1}{1-\sigma}} \tag{7}$$

where $F(\cdot)$ is the CDF of a Pareto distribution with shape parameter γ.

4.2.1 Firm's export choice

The profit for a firm in i exporting to n and productivity φ is given by:

$$\pi_{ni}(\varphi) = p_{ni}^G(\varphi) q_{ni}^G(\varphi) - c_{ni}(q_{ni}^G(\varphi), \varphi) = \frac{\sigma}{\sigma-1} \frac{w_i \tau_{ni}^G}{\varphi} q_{ni}^G(\varphi) - \frac{w_i \tau_{ni}^G}{\varphi} q_{ni}^G(\varphi) - f_{ni} \tag{8}$$

Only firms with non-negative profits export to a given country which determines the productivity threshold, $\bar{\varphi}_{ni}$ where the firm is indifferent between exporting and not. By equating the profits of the firm at the threshold to zero, we obtain:

$$\bar{\varphi}_{ni} = \left(\frac{\sigma}{\mu} \right)^{\frac{1}{\sigma-1}} \left(\frac{\sigma}{\sigma-1} \right) \frac{w_i \tau_{ni}^G}{P_n^G} \left(\frac{f_{ni}}{Y_n} \right)^{\frac{1}{\sigma-1}} \tag{9}$$

We can re-write the price index as follows:

$$P_n^G = \lambda Y_n^{\frac{1}{\gamma} - \frac{1}{\sigma-1}} \left[\sum_j N_j \left(w_j \tau_{nj}^G \right)^{-\gamma} \left(f_{nj} \right)^{\frac{\sigma-1-\gamma}{\sigma-1}} \right]^{-\frac{1}{\gamma}} \tag{10}$$

where $\lambda = \left(\frac{\sigma}{\sigma-1} \right) \left(\frac{\gamma}{\gamma+1-\sigma} \right)^{-\frac{1}{\gamma}} \left(\frac{\sigma}{\mu} \right)^{\frac{1}{\sigma-1} - \frac{1}{\gamma}}$.

$\left[\sum_j N_j \left(w_j \tau_{nj}^G \right)^{-\gamma} \left(f_{nj} \right)^{\frac{\sigma-1-\gamma}{\sigma-1}} \right]$ is the multilateral resistance, and is denoted by θ_n.

We are now ready to express the threshold productivity in-terms of the model parameters and equilibrium objects. The productivity threshold for exporting by a firm in i to a country n , $\bar{\varphi}_{ni}$ is given by

$$\bar{\varphi}_{ni} = \left(\frac{\sigma}{\mu}\right)^{\frac{1}{\gamma}} \left(\frac{\gamma}{\gamma+1-\sigma}\right)^{\frac{1}{\gamma}} (w_i \tau_{ni}^G) \theta_n^{\frac{1}{\gamma}} Y_n^{-\frac{1}{\gamma}} (f_{ni})^{\frac{1}{\sigma-1}} \tag{11}$$

This highlights that the threshold of productivity is an increasing function of the fixed cost to export, i.e, as the fixed costs increases the productivity of the least productive firm that exports increases. In section 4.3 I model this fixed cost explicitly as the cost of business travel, and so this is the mechanism through which travel costs affect international trade.

4.2.2 Profits and dividends

The firms in the model generate positive profits. These profits are accumulated in a global fund, and distributed as dividends across households in each country. Each household in country n owns w_n shares of the global fund as in Chaney (2008). So, if π is the dividend per share issued by the global fund, the total profits accrued to country n is given by $L_n(\pi w_n)$.

The total profits in the global fund, Π are:

$$\Pi = \sum_n \sum_i N_i \int_{\bar{\varphi}_{ni}}^{\infty} \pi_{ni}(\varphi) dF(\varphi) \tag{12}$$

Since each household in country i holds w_i shares, and there are L_i households, the total outstanding shares of the global fund are $\sum_i w_i L_i$, and the dividend per share is:

$$\pi = \frac{\Pi}{\sum_i w_i L_i} = \frac{\frac{\sigma-1}{\sigma}\frac{\mu}{\gamma}}{1 - \frac{\sigma-1}{\sigma}\frac{\mu}{\gamma}} \tag{13}$$

4.3 Business travel

I interpret the fixed cost incurred to export, f_{ni} as travel costs. The firm in i must send managers to n to sell there and so incurs a business travel cost. I assume that it depends on the number of people/trips needed to trade, ϕ, the price paid per person which is denoted by P_{ni}^V, and whether there is a visa requirement between countries or not. I assume the following functional form, partly guided by recent empirical evidence discussed in section 4.3.1 :

$$f_{ni} = \phi(p_{ni}^V + \psi_{ni}) \tag{14}$$

p_{ni}^V is the price charged by the travel industry as discussed for tourism above. ϕ captures the degree of contractual or information frictions present. ψ_{ni} represents visa costs, where $\psi_{ni} = \psi$ if there is a visa requirement between i and j, 0 otherwise.

Aggregating individual firm-level demand generates the total business travel demand curve and is given by:

$$
\begin{aligned}
q_{ni}^{B} &= \int_{\bar{\varphi}_{ni}}^{\infty} N_i \phi dF(\varphi) = N_i \phi (1 - F(\bar{\varphi}_{ni})) = N_i \phi \bar{\varphi}_{ni}^{-\gamma} \\
&= \phi \underbrace{\frac{\mu}{\sigma} \frac{\gamma + 1 - \sigma}{\gamma}}_{\kappa} \frac{Y_n}{f_{ni}} \frac{N_i \left(w_i \tau_{ni}^{G}\right)^{-\gamma} \left(f_{ni}\right)^{\frac{\sigma - 1 - \gamma}{\sigma - 1}}}{\theta_n} \\
&= \kappa Y_n \frac{N_i \left(w_i \tau_{ni}^{G}\right)^{-\gamma} \left(p_{ni}^{V} + \psi_{ni}\right)^{-\frac{\gamma}{\sigma - 1}}}{\sum_j N_j \left(w_j \tau_{nj}^{G}\right)^{-\gamma} \left(p_{ni}^{V} + \psi_{ni}\right)^{1 - \frac{\gamma}{\sigma - 1}}}
\end{aligned} \tag{15}
$$

4.3.1 Structure for fixed cost

The structure of the fixed cost is motivated by the discussion in Startz (2021) where the author mentions[10]:

> Second, to be consistent with the reality of the empirical context, it must allow for there to be many small traders, who nonetheless deal in differentiated goods and earn profits that allow them to cover costs of travel – such as plane tickets and visas – that are **clearly fixed with respect to the value of goods purchased**. Third, in contrast to many trade models, it **must allow a role for the endogenous frequency of purchasing**. This is not only consistent with the empirical pattern that traveling involves buying less frequently in larger batches, but also the fundamental feature of the environment that desirable new products appear regularly and so the timing of sourcing matters to traders and consumers.

Startz (2021) highlights that travel costs are large and vary across countries. She find that Nigerian traders are more likely to travel to countries that are easier to access, and infrequently to countries where they must incur significant ticket and visa costs. She also find that products that are likely to suffer more from information friction require more travel. Thus the cost of travel is determined by the degree of frictions within an industry, ϕ, the price of travel, p^V, and the visa costs, ψ[11].

In the absence of visa costs, the managers in the firm only need to pay for transport and lodging, and so the total cost incurred is equal to the price per

[10] While in Startz (2021), traders travel to import, the same logic can be extended for exports.

[11] Additionally, social and news media often report visa rejection reports for business and conference travelers (Fractal. Nature).

manager or trip, scaled by the number of managers that need to travel or the number of trips that must occur for trade to take place, ϕp^V.

Visa costs are incurred in addition to transportation costs and are not related to the price of flights or lodging. So, to account for visa costs in travel costs, I incorporate them additively to the transportation costs rather than iceberg costs. While this additively separates visa costs ψ from p^V, we still need to consider the interaction of ϕ and visa costs as each trip or individual traveler incurs visa requirement.

4.4 Travel services

Tourists travel to consume tourism and business travelers travel to conduct business. In this model, I treat tourism and air-travel to a specific destination from a specific origin jointly as a single good. I do this to avoid the problem of modeling two separate sectors that are complementary. A monopolistic firm uses labor from both origin and destination countries to provide these services to households from the origin. The production of travel services from i to n is given by a Cobb-Douglas aggregator for labor from origin and destination countries, as follows:

$$Q_{ni} = z\sqrt{L_n^{V,(ni)} L_i^{V,(ni)}} \tag{16}$$

where z is a travel service productivity parameter and is constant across routes. $L_n^{V,(ni)}$ is the labor from destination employed on route ni. $L_i^{V,(ni)}$ is similarly defined. So, the marginal cost of producing a unit of travel services is given by $\frac{\sqrt{w_n w_i}}{z}$.

To incorporate the impact of distance on prices I assume the presence of iceberg-like costs that scales price with distance. The iceberg costs reflect the price of fuel, and the impact of distance on labor hours. So, if $\tilde{p}_{ni}^V$ is the price set by the monopolist on route ni, the price incurred by the household is $p_{ni}^V = \tau_{ni}^V \tilde{p}_{ni}^V$, where τ_{ni}^V is the iceberg travel costs. We will assume a functional form for the these costs in the calibration that is in line with the gravity literature's modeling of iceberg trade costs.

The monopolist operating the route i to n chooses the price to maximize profits, accounting for the demand curves of tourism and business travel:

$$\max_{\tilde{p}_{ni}^V} \left(\tilde{p}_{ni}^V - \frac{\sqrt{w_n w_i}}{z}\right)\left(\frac{\mu_{ni} Y_i}{(\tau_{ni}^V \tilde{p}_{ni}^V + \psi_{ni})} + \kappa Y_n \frac{N_i \left(w_i \tau_{ni}^G\right)^{-\gamma} \left(\tau_{ni}^V \tilde{p}_{ni}^V + \psi_{ni}\right)^{-\frac{\gamma}{\sigma-1}}}{\theta_n}\right)$$

The price satisfies the first-order condition:

$$\kappa Y_n \frac{N_i \left(w_i \tau_{ni}^G\right)^{-\gamma} \left(\tau_{ni}^V \tilde{p}_{ni}^V + \psi_{ni}\right)^{-\frac{\gamma}{\sigma-1}}}{\theta_n} \left(1 - \frac{\gamma}{\sigma - 1} \frac{\tau_{ni}^V}{(\tau_{ni}^V \tilde{p}_{ni}^V + \psi_{ni})} \left(\tilde{p}_{ni}^V - \frac{\sqrt{w_n w_i}}{z}\right)\right)$$
$$+ \quad \frac{\mu_{ni} Y_i}{(\tau_{ni}^V \tilde{p}_{ni}^V + \psi_{ni})} \left(1 - \frac{\tau_{ni}^V}{(\tau_{ni}^V \tilde{p}_{ni}^V + \psi_{ni})} \left(\tilde{p}_{ni}^V - \frac{\sqrt{w_n w_i}}{z}\right)\right) = 0 \tag{17}$$

The profits generated from the travel industry on each route, Π_{ni}^V, are added to the global profit fund and distributed to each country according to their share of the fund [12].

4.4.1 Travel market discussion

The above travel production function abstracts from the network structure of travel flows where travelers often transit in an intermediate country while traveling to a destination. Unlike trade flows where the assumption regarding the triangle inequality is widely accepted, it is not clear if travel prices follow the triangle inequality given the ubiquity of layovers in international travel. The choice to retain a Cobb-Douglas production function with a monopoly pricing scheme is to simplify the travel process while (directly) delivering interdependence between business and tourism travel instead of through their impact on national income. And yet another assumption is the ad-hoc incorporation of iceberg travel costs. This structure allows me to ignore the presence of an intermediate sector that delivers fuel.

A valuable extension to the model is to embed a full travel network that can potentially deliver a non-triangle inequality satisfying price scheme. I plan to pursue this in another iteration of the paper or in a separate paper altogether.

4.5 National Income

The total income of country i, Y_i is given by:

$$Y_i = w_i L_i + L_i(\pi w_i) + \frac{w_i L_i}{\sum_j w_j L_j} \Pi^V \tag{18}$$

[12] I also considered other distribution schemes such as profits accruing to only the countries involved, or just the destination country, but it improved the fit of the model insubstantially.

4.6 International trade flows

To compute the aggregate trade flow between countries, we integrate the revenues of all exporting firms. So, the total exports from country i to country n is given by:

$$\begin{aligned} X_{ni} &= N_i \int_{\bar{\varphi}_{ni}}^{\infty} p_{ni}^G(\varphi) q_{ni}^G(\varphi) dF(\varphi) \\ &= \mu Y_n \left[\frac{N_i \big(w_i \tau_{ni}^G\big)^{-\gamma} \big(p_{ni}^V + \psi_{ni}\big)^{\frac{\sigma-1-\gamma}{\sigma-1}}}{\sum_j N_j \big(w_j \tau_{nj}^G\big)^{-\gamma} \big(p_{ni}^V + \psi_{ni}\big)^{\frac{\sigma-1-\gamma}{\sigma-1}}} \right] \end{aligned} \tag{19}$$

4.7 Welfare

I follow the literature on international trade and use real GDP per worker as my measure of welfare[13]:

$$W_n = \left(\frac{Y_n}{L_n}\right)\left(\frac{1}{(P_n^G)^{\mu} \Pi_i (p_{in}^v)^{\mu_{in}}}\right) \tag{21}$$

4.8 Equilibrium properties

Given the parameters of the economy $(\sigma, \gamma, \mu, \mu_{ni}, \tau^V, \tau^G, \psi, \phi, N, L, z)$, an equilibrium in this economy is the collection of $(w, Y, q^L, q^B, q^G, \tilde{p}^V, p^G, L^V)$ that satisfies the equations: 4, 15, 17, 18, and 19.

In equilibrium, the impact of visas on welfare is felt through three channels. First, a reduction in Visa increases the demand for tourism and business travel, thereby allowing the monopolist to charge a higher price and obtain greater profits. Since these profits accrue to Y through Π^V, removal of Visa's increases national income through travel and tourism profits. Second, since the composite price index in the denominator of the welfare expression includes travel prices, changes in visa policy effects welfare through tourism prices. To argue that this effect is positive, note that while the monopolist increases the price of travel services, it never increases it to the point that the distance-adjusted price $\tau^V \tilde{p}^V$ is higher than the sum of the original equilibrium and visa costs. This is because if the new price increase were over the original equilibrium price, then the original equilibrium would not have been the optimal choice. So in

[13] An alternative measure of welfare that I consider is the real income for traded goods given by:

$$W_n = \frac{\mu Y_n}{L_n} \frac{1}{P_n^G} \tag{20}$$

Results from this measure will be included in a future draft.

the new equilibrium, travel costs are lower than they would be in the presence of Visas.

Finally, we arrive at the third channel that pertains to the aggregate price index of traded goods in each country, P^G. I argue that in the absence of Visa, the price index can either increase of decreases thereby leaving the impact of visas on the household welfare ambiguous. First, from 10, we see that the index decreases as national income increases. However, in the absence of visa costs, $\theta^{-\frac{1}{\gamma}}$, the multilateral resistance term increases as can been seen by computing $\frac{d\theta^{-\frac{1}{\gamma}}}{d\psi}$[14]. Thus the impact of visas on welfare remains ambiguous and is driven by the reallocation of global trade under a visa-free world.

A second, more nuanced effect of visas is felt through the magnitude of price change in travel services. The joint modeling of tourism and business travel allows use to see the impact of one type of demand on the other. In the absence of tourism, the increase in price due to the removal of visas would be higher for business travel on account of their relative inelasticity, which is here governed by the shape of the Pareto distriction, γ, and the elasticity of substitution between traded goods, σ. Similarly, in the absence of business travel, removing visa would increase the price less for the tourists. The latter point has been echoed by Aryal et al. (2021) who state that the presence of business travelers leads to lower consumer welfare.

5 Calibration

I calibrate the parameters of the model to reproduce observed trade flows. The model consists of the following parameters: $(\sigma, \gamma, \mu, \mu_{ni}, \tau^V, \tau^G, \psi, \phi, N, L, z)$. Following literature, I parameterize the iceberg costs, τ^V, τ^G, as a linear combination of gravity variables. For iceberg trade costs to export from i to n, τ^G_{ni}, I include distance (D_{ni}), border dummy (B_{ni}), and trade agreement dummy (A_{ni}), so:

$$\tau^G_{ni} = 1 + \beta^G_d D_{ni} + \beta^G_b B_{ni} + \beta^G_a A_{ni}$$

For travel iceberg cost, I restrict myself to distance. , so:

[14]
$$\frac{d\theta_n^{-\frac{1}{\gamma}}}{d\psi} = -\frac{1}{\gamma}\frac{\sigma-1-\gamma}{\sigma-1}\left(\sum_j N_j (w_j \tau^G_{ni})^{-\gamma}(p^V_{ni}+\psi)^{-\frac{\gamma}{\sigma-1}}\right)\theta_n^{-\frac{1}{\gamma}-1}$$

The first two terms interact to generate a positive derivative. Note I assume a constant ψ for all countries here. This simplification doesn't alter the nature of the intuition.

$$\tau^V_{ni} = 1 + \beta^V_d D_{ni}$$

This parameterization shrinks the model parameter space to: $\sigma, \gamma, \mu, \mu_{ni}, \psi, \phi, N, L, z, \beta^G_d, \beta^G_b, \beta^G_a, \beta^V_d$. I take $\sigma, \gamma, \mu, \mu_{ni}, \phi, N, L$ directly from either data or previous studies that attempted to measure them. Below is the table for these variables and their sources:

Parameter	Value	Source
σ	2	Standard values meeting $\gamma + 1 > \sigma$
γ	1.31	Chaney (2018) (uses 1.068 for full French sample)
μ_{ni}	–	USITC data (2014)
μ	0.97	Adjusted median μ_{ni}
ϕ	1.1	Computed using Eaton et al. (2011)
N	–	Statista website
L	–	Proxied using population (in 2014) from Penn World Tables

Table 1: Externally calibrated parameter values to operationalize the model in section 4.

In addition to these calibrated paramters, I also take the wage rate in the countries in my sample from penn world tables, and normalize wages in the US as numeraire. I do this to create a scale for value in the model, in the absence of this, all scaling transformations of the endogenous variables are admitted as valid equilibria.

This leaves us with $(\psi, z, \beta^G_d, \beta^G_b, \beta^G_a, \beta^V_d)$ to find. I follow Fieler (2011) in finding values for these parameters by simulating trade flows that best fit observed trade flows. I implement the following steps to obtain my value of the other parameters.

1. I initiate the program with a guess for $(\psi, z, \beta^G_d, \beta^G_b, \beta^G_a, \beta^V_d)$, and national income Y.
2. I then find p^v, and Y by looping over equations 17, and 18.
    - I first obtain p^v from 17, and compute profits for each route, π^V_{ni}, and add them to obtain total profits.
    - I update profits using 18, and repeat the above step until the process converges.
    - I also compute business travel demand to be used in step 4 for comparison.
3. Upon obtaining Y, and p^v, I optimize over $(\psi, \beta^G_d, \beta^G_b, \beta^G_a, \beta^V_d)$ to minimize the mean squared error between predicted trade flows (using 19), and trade flows observed in the data.

4. Using these updated values, I predict business travel (using equation 15) and compare it to business travel demand under the previous iteration. If the demand generated under the updated parameter scheme is high, I increase the price by reducing z, and vice versa.
5. Now I return to step 1 with a full updated vector of $(\psi, z, \beta_d^G, \beta_b^G, \beta_a^G, \beta_d^V)$, and repeat the process.[15]

5.1 Calibration results

The values of the parameter that I obtain from implementing the above algorithm are:

Parameter	Value
β_d^G	0.850
β_b^G	-0.665
β_a^G	-0.0459
β_d^V	0.0175
ψ	125.004
z	0.012

Table 2: Externally calibrated parameter values to operationalize the model in section 4.

And the corresponding difference in predicted and observed trade flows is:

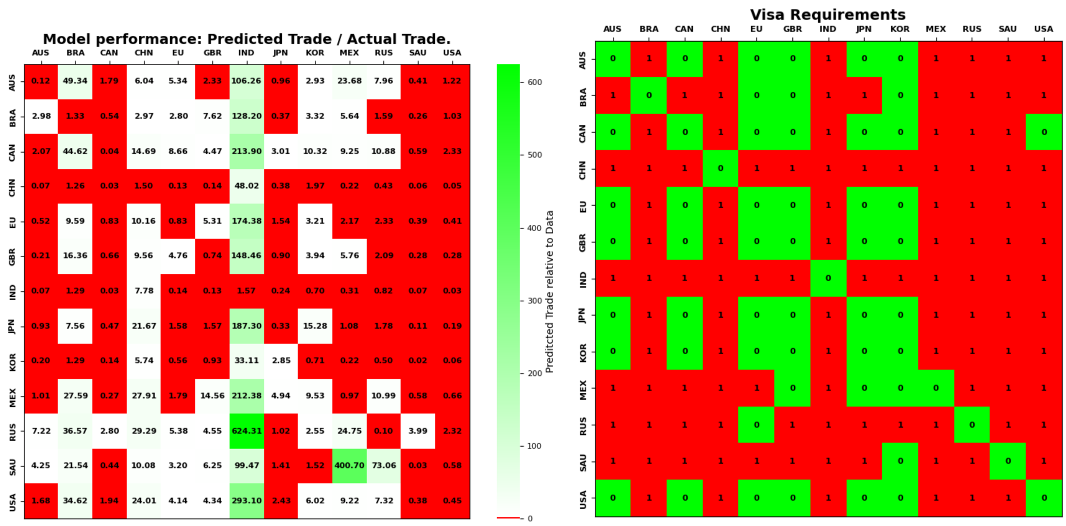

Figure 3: The figure reports the ratio of predicted trade flows to observed trade flows from the column labeled exporting country to the row labeled importing country. Intensity of green represents the degree of over prediction while shades of red represent the degree of underprediction. The right panel shows the presence of visa restrictions across country pairs with red highlighting presence of visa requirements, and green highlighting absence.

[15] The convergence of the program is not guaranteed, but the program converges to a steady state. However, as is reflected in the fit of the model, the convergence on yeilds a moderately good fit.

We can see that the model performs moderately well in matching trade flows. The model consistently under-estimates exports from US, Saudi Arabia, Canada and Australia, and over estimates exports from India. This is largely driven by the wage rates in these countries. The model generate low trade exports for countries with high wages as is the case with the above countries, and India is the cheapest country in my data by a large margin (9% of US wages) which relfects in its exports. In addition to trade flows, I also compare the values with travel flows using data from the World Tourism Organization. Since travel flows were not targeted in the calibration, this comparison acts as a check on the performance and interpretation of the model variables.

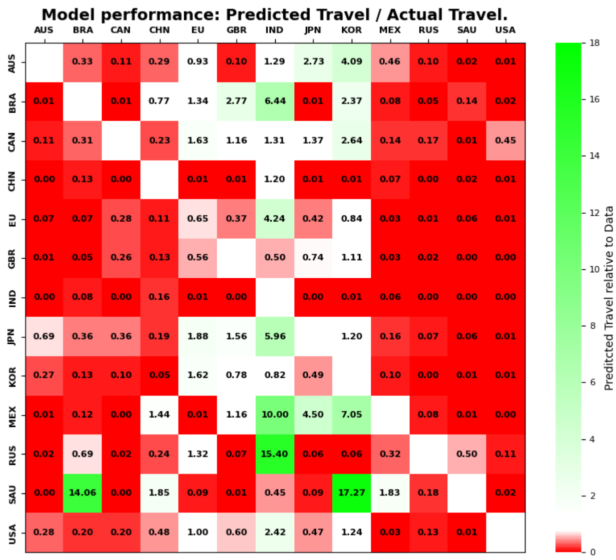

Figure 4: The figure reports the ratio of predicted trade flows to observed travel flows from the column labeled origin country to the row labeled destination country. Intensity of green represents the degree of over prediction while shades of red represent the degree of undeprediction. Travel is computer by adding the demand form tourism and business travel using equations 4 and 15 respectively. Observed travel flows were obtained from World Tourism Organization that reports non-permanent immigration.

On predicting the travel flows, the model severely underperforms, predicting significantly lower travel flows across the board. This is possibly driven by conservative tourism shares, and price of travel that is determined by β_d^V, z, ψ.

A brief note on the magnitude of ψ: Since ψ is measure on the same scale as travel prices, compare φ travel prices to understand the relative magnitude of visa costs. When compared to the price of travel between EU and US, $p^v_{US,EU}$, I get $\frac{\psi}{p^v_{US,EU}} = 1.14$. So the presence of a visa requirement is equivalent to purchasing a ticket between EU and US according to my calibration.

6 Counterfactual analysis

The model's incorporation of tourism, business travel, visas and international trade renders it versatile to study a number of counterfactual policies. I use it as a setup to study three realistic counterfactual policies. First, I measure the impact of visas on international trade and welfare by completely abolishing visa requirements between countries. Second, I study the case of specifically eliminating the visa requirements between EU and China. The model's rich inclusion of heterogeneous visa requirements allows me explore individual relationships between country pairs. Finally, I study the possibility of more efficient air-planes. Since the model includes the impact of distance on travel prices through β_d^V, I am able to compare the observed patterns with the counterfactual world with more efficient airplanes.

6.1 Absence of Visa cost.

I set $\varphi = 0$ and simulate a new trade equilibrium. I the compute the welfare using 20 and trade flows using 19.

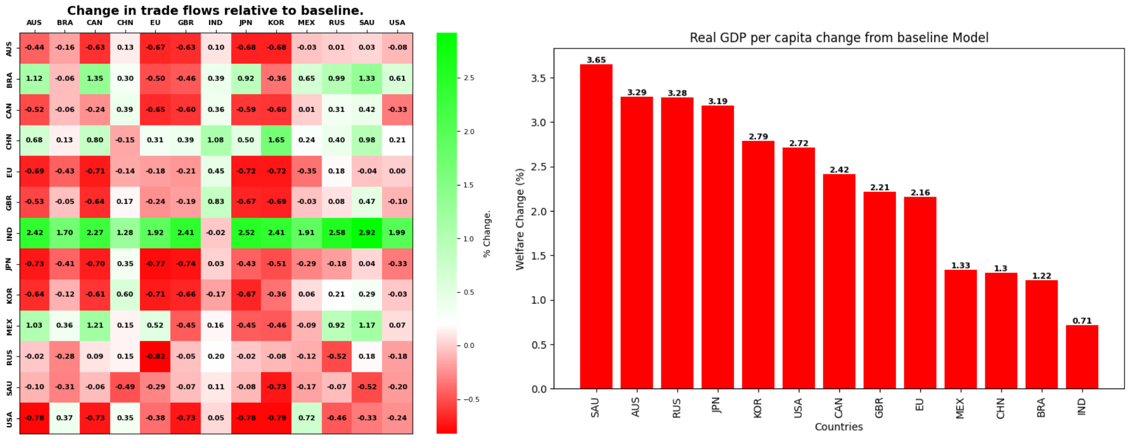

Figure 5: In the left panel, I compute the change in export from the column labeled country to the row labeled country relative to the baseline model. On the right panel, I compute the change in real GDP per capital relative to the baseline model.

The model generates the large trade gains for countries that were directly impacted by visas but also welfare gains for the rest of the world. This is largely driven by the fact that in the model, the profits from travel services are distributed by the economic size of the countries which is determined by wages and labor, both exogeneously set.

6.2 Eliminating visa requirements from EU to China

In December 2023, the Chinese government eliminated visa requirements for short term travel from several European countries to China. Since the model does not differentiate between EU countries, I assume that travel from EU to China was visa-free. I do this by eliminating visa requirement between the regions in my model. I focus my attention on the impact on China and present the changes in trade flows between EU and China.

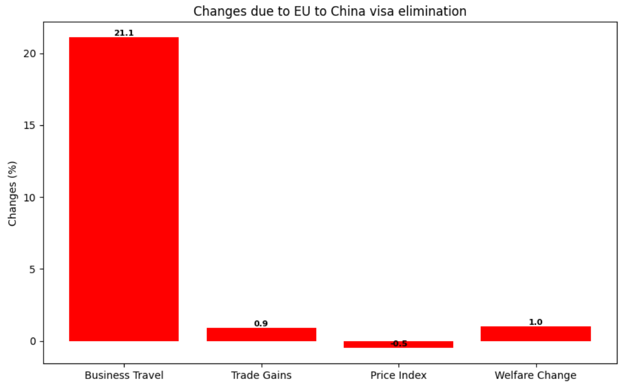

Figure 6: Business travel represents the change in business travel from EU to China when visa requirements to travel from EU to China are eliminated. Price index is the change in price of the composite traded good. Welfare is the real GDP per capita as in equation 20.

The model predicts that eliminating visas between EU and China would increase welfare by 1%. Part of this gain comes form a decrease in the price index in China, as a result of increased trade between EU and China.

6.3 Decrease in travel costs

I conduct a counterfactual analysis exploring changes in the impact of geographical distance on travel prices. Aircraft like the Boeing 787 Dreamliner, the Airbus A350 and the Bombardier CSeries were 20% more fuel efficient than previous generation aircraft[16]. I consider a scenario where the next generation of aircrafts are 20% more fuel efficient. To do so, I reduce the value of β_d^V by 20%. We observe that trade flows increases across the board.

7 Conclusion

This paper is a first attempt to quantify the impact of visa requirements on international trade and jointly models business and tourism travel. I find that Visa barriers are substantial and estimate them to be close to the travel price between the EU and the US. The paper also measures the gains from eliminating visas around the world as well as specifically from country pairs, and highlights significant gains from global trade. And finally, the paper also measures the impact of better travel technology on welfare through trade and tourism.

[16] Fuel efficiency is measured per passenger kilometer.

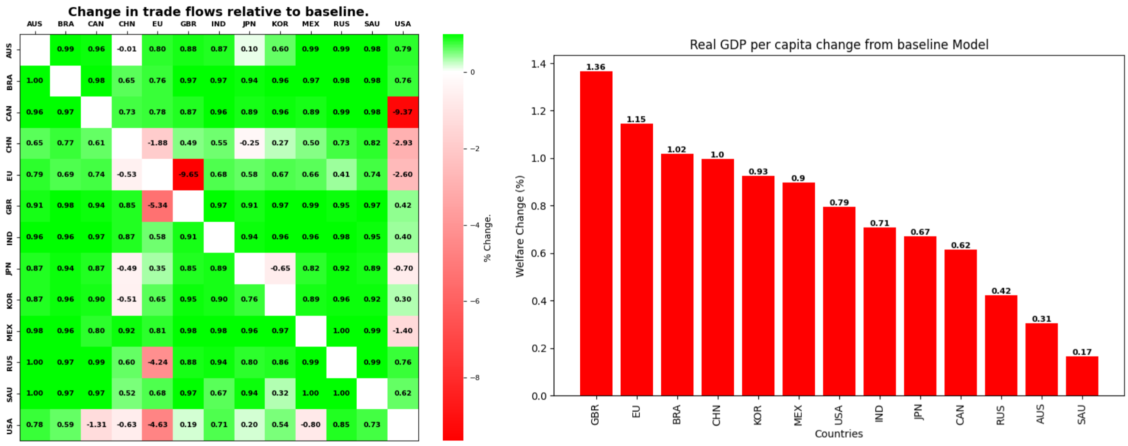

Figure 7: In the left panel, I compute the change in export from the column labeled country to the row labeled country relative to the baseline model. On the right panel, I compute the change in real GDP per capital relative to the baseline model.

A key intuition in the paper is the relation between business travel and tourism. Relatively elastic tourism reduces the increase in price that accompanies elimination of visas in the presence of inelastic business travel alone. This affect allows for indirect gains from eliminating visas in addition to the direct decreases in travel costs.

The model developed in the paper abstracts away from the network structure of travel in favor of an aggregate travel production function. Future research in including the network structure of trade will be a useful step towards resolving the impact of connecting flights on easing travel restrictions.

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