The Importance of Business Travel for Trade: Evidence from the Liberalization of the Soviet Airspace*

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Abstract

Despite decades of intense globalization, empirical research provides robust evidence that the distance elasticity of trade is significant, not declining and largely unaccounted for by conventional explanations such as transport costs. One hypothesis that has been put forward to explain the persistence of geographical trade frictions is that face-to-face interaction through business travel is important for trade, and that transporting people is costly. I use the liberalization of the Soviet airspace for civil aviation to test this hypothesis. The opening of the Soviet airspace radically reduced travel time between Europe and East Asia. I show that shorter travel time was associated with a rapid and substantial increase in trade volumes, equivalent to a tariff reduction of 9.1%. The magnitude of the effect suggests that travel distance for people is a key source of geographical friction that affects gravity. I also show that the increase in trade occurred for goods not typically transported by air, and that the impact was larger for differentiated goods.

Keywords: trade costs, air travel, face-to-face communication

JEL: F14, F15, R4

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1 Introduction

While the world becomes more globalized, geographical distance still has a remarkably strong negative impact on trade. Trade frictions generated by distance are also not well understood, despite being a key component of most empirical trade models. In a review of the literature, Head and Mayer (2013) conclude that the distance elasticity of trade is large, not declining, and largely unaccounted for by conventional explanations such as transport costs and tariffs. This conclusion stands in stark contrast to much of the popular writing on the current wave of globalization usually describing a shift to a global economy where physical distance does not matter.[1]

One hypothesis is that physical interaction is still important for trade and that transporting personnel comes at a significant cost (Baldwin, 2016). If travel costs are significant and increase with distance, it could provide an explanation for the large and persistent negative impact of physical distance on trade.[2] While the face-to-face explanation is plausible, it is hard to disentangle from other channels that also correlate with distance. For instance, unfamiliarity with remote business partners, differences in preferences, or uncertainty about foreign legal systems. Another issue is reverse causality, as trade creates an incentive to provide better transportation which may bring down the cost of face-to-face communication.

A number of papers, not explicitly studying trade, have used exogenous travel cost shocks to better isolate the impact of face-to-face communication.[3] Causal evidence on the impact of travel cost on trade, however, is surprisingly limited. One reason

[1] The book *The World is Flat* by Thomas Friedman (2005) is perhaps the most notable example popularizing the notion of a borderless global economy.

[2] Similar ideas have been put forward several scholars, see for instance Leamer and Storper (2001), and Storper and Venables (2004).

[3] For instance, Bernard et al. (2015) use an expansion of high-speed railway in Japan as a source of exogenous variation to study firm-to-firm linkages, Giroud (2013) uses the introduction of new flight routes between headquarters and plants in the United States to study plant investments, Bernstein et al. (2016) use a similar identification strategy to study venture capitalists' involvement with portfolio companies in the United States, Campante and Yanagizawa-Drott (2018) use a discontinuity in flight staffing requirements to examine air links on spatial allocation of economic activity, and Catalini et al. (2016) use the introduction of new low fare air routes to study the impact on scientific collaboration within the United States. In contrast, Hovhannisyan and Keller (2015) use an instrumental variable approach to examine the impact of business travel on patenting.

might be that direct flight connections changes travel costs between cities, while trade data is usually recorded between countries. Instead, a number of studies have focused on correlations, rather than establishing a pure causal relationship. Studies that find a positive link between travel and trade include for instance Kulendran and Wilson (2000), Shan and Wilson (2001), Cristea (2011), Alderighi and Gaggero (2017), and Yilmazkuday and Yilmazkuday (2017). A notable exception in this stream of literature is Startz (2016), who uses a structural estimation approach to establish a causal link between the cost of face-to-face interaction and trade, in a developing country context. Using transaction-level data from Nigerian traders, Startz shows that higher costs of travel to meet foreign suppliers lowers both trade and welfare.

The purpose of this paper is to establish a causal relationship between business travel cost and trade by introducing a new exogenous travel cost shock. The shock consists of the sudden liberalization of Soviet airspace at the end of the Cold War. During most of the Cold War, almost no airline had permission to overfly the Soviet Union. This added significant flight time to a large number of international routes, primarily between Europe and East Asia. Nearly every flight from Europe to East Asia was routed either through Anchorage, Alaska, or the Middle East. In 1985, however, Soviet leaders started to permit non-Soviet airlines to make non-stop overflights over its territory. This meant that the shortest flight from London to Tokyo, which would typically take 18 hours, now could be done non-stop in less than 12 hours. The liberalization partly had to do with a general reorientation of Soviet policy towards the West at the end of the Cold War. Another important motivation for granting overflight rights was that the air traffic control fees that the Soviets could charge airlines became a vital source of foreign currency. Between 1985 and 1995 the number of non-stop passengers, non-stop routes and airlines that received overflight rights increased rapidly.

I gather novel non-digitized timetable data from the British Library to map flight patterns during the 1980s. Using a theoretical gravity model, I then show that shorter flight routes between Europe and East Asia coincides with an immediate and substantial increase in trade volumes. The average reduction in travel time of 19 percent generated an increase in trade similar to a tariff cut of 9.1%. The magnitude of the effect suggests that travel distance for people is a key source of geographical friction that affects gravity.

Results hold up when restricting the analysis to trade in goods that are not typically transported by air. Hence, the impact on trade is not driven by lower transportation costs for goods shipped by air.[4] Furthermore, trade in differentiated goods, which plausibly requires more business travel, experience a larger increase compared to trade of homogeneous goods.

My paper is related to a vast literature that tries to explain the negative impact of distance on trade and other forms of economic exchange. While no consensus about the main causes of the persistent negative impact of distance on trade has been established, several hypothesis has been put forward. One competing hypothesis to the face-to-face explanation is that locally biased preferences, rather than actual trade barriers, might be an important factor for the negative distance effect (Trefler, 1995; Head and Mayer, 2013; Atkin, 2013; Bronnenberg et al., 2012; Ferreira and Waldfogel, 2013; and Blum and Goldfarb, 2006). Another hypothesis is that unfamiliarity with foreign countries and institutions increases with distance creating trade frictions (Coeurdacier and Martin, 2009; Peri, 2005; Griffith et al., 2011; Hortaçsu et al., 2009; Chaney, 2014; Lendle et al., 2016, Huang, 2007; Dixit, 2003; Anderson and Marcouiller, 2002, Ranjan and Lee, 2007; and Turrini and van Ypersele, 2010). As unfamiliarity at least partly can be overcome by business travel, the unfamiliarity hypothesis can be seen as both a complementary and a competing explanation to the face-to-face hypothesis. A third hypothesis is that changes in the composition of trade has been biased towards goods that are more sensitive to distance (Duranton

[4]The empirical literature suggests that transport costs generally account for a small share of total trade costs. For instance, Glaeser and Kohlhase (2003) find that for 80% of all shipments by value, transport costs make up less than 4% of the value of the good.

and Storper, 2008; Hummels and Schaur, 2013; and Evans and Harrigan, 2005).[5] Methodologically, this paper is also related to a large literature that uses shocks in travel and transport costs to study various economic outcomes (e.g., Pascali, 2016; Donaldson, 2010; Donaldson and Hornbeck, 2016; Feyrer, 2009*a*; and Feyrer, 2009*b*).

2 Data

To map changes in flight patterns due to the liberalization of the Soviet airspace, I obtain city-to-city flight data from the International Civil Aviation Organization (ICAO) between 1982 and 2000. A limitation of the ICAO data is that, before 1989, it only records the city of departure and destination for direct flights. A direct flight is a flight where the same flight number is maintained. A direct flight can either be a non-stop flight from city A to city B or a flight that departs from city A, makes a stopover in city X, and then continues to city B. Regardless of which route the flight might take, ICAO data prior to 1989 only record city A as the city of departure and B is the city of destination and leave out any information on stopovers. Consequently, before 1989, I am not able to distinguish non-stop flights between Europe and East Asia taking the shorter route over Soviet airspace from longer direct flights that avoided Soviet airspace and made stopovers in cities such as Anchorage. The Soviet Union started to liberalize its airspace in 1985, four years prior to when more detailed data is available. Flight data before 1989 is obtained from ICAO's On-Flight Origin and Destination data set (OFOD). The OFOD data comprise all scheduled international direct flights reported to the ICAO. The data include city of departure, city of arrival, airline, and number of passengers carried.

[5]The degree to which the composition hypothesis is a competing or complementary explanation to the face-to-face hypothesis depend on how one explains the cause of the sensitivity to distance. Hummels and Schaur (2013), and Evans and Harrigan (2005) focus on the idea that the share of goods where time to market is more important has been increasing. Increased importance of time to market is a competing explanation to the face-to-face hypothesis, as it has to do with the time cost of transporting goods rather than people. In contrast to this, Baldwin (2016) argues that the composition if trade has been biased towards goods where face-to-face interaction is vital. Baldwin's argument suggest that the negative impact of the cost of meeting face-to-face has been magnified over time by the changing composition of world trade.

To separate non-stop flights from flights taking a detour around the Soviet Union before 1989, I gather supplementary flight timetable data from the British Library. The archival data is truly novel as it is based on a vast set of non-digitized flight timetables called the *ABC World Airways Guide*.[6] Using the timetables, I obtain information on the frequency of non-stop flights and estimate the number of non-stop passengers on all routes between Europe and East Asia from 1980 to 1988.[7]

From 1989, ICAO records non-stop flight data.[8] For instance, the London-Anchorage-Tokyo flight is recorded as two separate legs, one from London to Anchorage and one from Anchorage to Tokyo. Thus, from 1989 I am able to distinguish flights that made detours around Soviet airspace from those that flew non-stop over Soviet airspace without using additional timetable data.[9] In sum, data from the ICAO and the *ABC World Airways Guide* allow me to identify all air traffic between Europe and East Asia that were routed over Soviet airspace between 1980 to 2000.[10]

I obtain the trade data from the UN COMTRADE database which include variables that identify the exporting and importing country, commodity on the 4-digit level based on the first revision of Standard International Classification codes (SITC), and the value of trade. I supplement the COMTRADE data with customs data from

[6]The *ABC World Airways Guide* was published monthly from 1950 until 1996. Timetables are typically updated in April and November, so I study every April issue from 1980 to 1989. While there exist no direct flight data from ICAO before 1982 it is evident from the timetable data alone that there existed no non-stop flights between Europe and East Asia prior to 1983.

[7]To be able to estimate the number of non-stop passengers flying between Europe and East Asia I also gather information airline and airplane types from the flight timetables. Using the archival timetable data, together with the ICAO non-stop flight data, I compute an estimated figure for the annual number of passengers flying non-stop between Europe and East Asia. See Section A.2 in the Appendix for a more detailed description of the procedure of estimating the number non-stop passengers.

[8]I obtain non-stop flight data between 1989 and 2000 from ICAO's Traffic by Flight Stage dataset (TFS). The TFS data contain information on city of departure and destination, airplane model, number of departures, passenger load factor, average distance over the number of passengers carried, and the number of seats available.

[9]Two non-stop routes avoided Soviet airspace. Section 3 describe the non-stop flights that avoided Soviet airspace in close detail.

[10]As the number of non-stop flights between 1980 to 1988 is based on different data compared to the period between 1989 and 2000 I also collect direct flight data from 1989. I then identify the non-stop flights from the direct flight data using the timetables from 1989 and compare it with the non-stop flight data from ICAO's TFS dataset for the same year.

Eurostat of all goods traded between the EU and East Asia by product and mode of shipment. I use this dataset to analyze the impact of Soviet airspace liberalization on goods not typically transported by air as a robustness check.

I also obtained a number of control variables commonly used in gravity regression from the CEPII Gravity Dataset (Mayer and Zignago, 2011). The CEPII data include information on country pair-year-level and contains variables related to geographical distance between country pairs, shared borders, common language, common colonizer, and free trade agreements. It also includes information on GDP and GDP per capita. I obtained product-level data on the degree of differentiation of goods from Rauch (1999) and U.S. consumer price index data from the World Bank to deflate trade values.

3 Historical Background

The emergence of non-stop air traffic between Europe and East Asia traversing Soviet airspace was an intricate process affected by international flight regulation, Cold War politics, geography, and technology.

Rights to fly over foreign countries are negotiated bilaterally and typically regulated in accordance with the Chicago Convention, first signed in 1944. Article 5 of the Convention stipulates that a signatory country allows other members to fly over its territory. The Soviet Union never signed the Chicago Convention and could restrict other countries from flying over its airspace. With very few exceptions, the Soviet Union did not allow non-Soviet airlines to fly over its territory during most of the Cold War era. A few airlines received rights to enter Soviet airspace beginning in early 1970s. However, all flights between Europe and East Asia that entered Soviet airspace was required to make a mandatory stop in Moscow. The number of such flights was limited and the share of passengers who flew between Europe and East Asia via Moscow was small. For instance, of all passengers flying directly from London to Tokyo, just above 10% made a stopover in Moscow prior to liberalization of the Soviet airspace, (see Figure A.1 in the Appendix).[11]

Instead of flying via Moscow, most air traffic was either rerouted north via Anchorage, Alaska, or south over the Middle East, which added significant flight time (Jaffe, 2016). The London-Anchorage-Tokyo route is shown in Figure 1.[12]

Figure 1: The London-Anchorage-Tokyo route

The Soviet Union lifted the strict restrictions on their airspace in 1985 when Japanese Airlines was granted rights to fly non-stop between London and Tokyo

[11]The share of passengers that flew via Moscow from London to Tokyo would be considerably smaller if one also would count the number of passengers that made a transfer and thereby switched flight number on this route. Due to the structure of the *ABC World Airways Guide* timetables it is hard to gather all flight traffic between Europe and East Asia via Moscow. The route between London and Tokyo is, however, likely to have been the direct flight that carried most passengers via Moscow.

[12]There were two exceptions where airlines operated non-stop flights between Europe and East Asia prior to 1985, that did not enter Soviet airspace. The first exception is Finnair, which introduced a weekly non-stop route between Helsinki and Tokyo in 1983 (*Aviation Week and Space Technology*, 1983). Due to Helsinki's proximity to Tokyo and the willingness of airplane manufactures to accommodate Finnair's need to increase its maximum operating distance, the non-stop flight to Tokyo was routed over the North Pole to avoid Soviet airspace (Wegg, 1983). While Helsinki-Tokyo was the only non-stop flight between Europe and East Asia at the time, it represented a negligible share of the total passenger traffic between Japan and Europe. The second exception was Cathay Pacific introduced a weekly non-stop route avoiding Soviet airspace between London and Hong Kong in 1984. Initially, Cathay Pacific only flew non-stop from London to Hong Kong, but added a weekly non-stop flight in the other direction in 1985. This service accounted for a very small share of passengers flying between Hong Kong and Europe.

(*Aviation Week and Space Technology*, 1985). Shortly after, the Soviet Union granted Japanese Airlines and Air France rights to fly between Paris and Tokyo. A second route over Soviet airspace became available in 1986 when a number of airlines were granted rights to fly non-stop between Europe and Hong Kong. Due to the strained relationship between the Soviet Union and China, however, airlines were not allowed to cross the border between the two countries. All airplanes had to pass through a neutral country first, which in practice meant that non-stop flights to Hong Kong still had to be routed south of the Himalayas instead of over central China (*Flight International*, 1986). Still, being able to traverse Soviet airspace on the way to Hong Kong represented a major reduction in flight distance.[13]

The sudden opening up of the Soviet airspace came after years of fruitless negotiations between Soviet leaders and various airlines.[14] The motivation for Soviet leaders to liberalize its airspace had partly to do with a general reorientation of policy towards the West at the end of the Cold War. Another important factor for granting overflight rights was that the air traffic control fees that the Soviets could charge airlines became a vital source of foreign currency. The influx of foreign currency was important as the economic situation deteriorated further during the 1980s (Gaidar, 2007).

The number of non-stop passengers flying over Soviet airspace expanded quickly after 1985, as shown in Figure 2.[15] Cities that obtained non-stop connections early include Amsterdam, Copenhagen, Frankfurt, Helsinki, Milan, and Paris in Europe and Tokyo and Hong Kong in East Asia. The possibility of flying over Soviet airspace represented a significant reduction in flight distance for all routes between Western Europe and East Asia. As non-stop flights between Europe and East Asia were initially limited, these flights were typically targeted at frequent business travelers

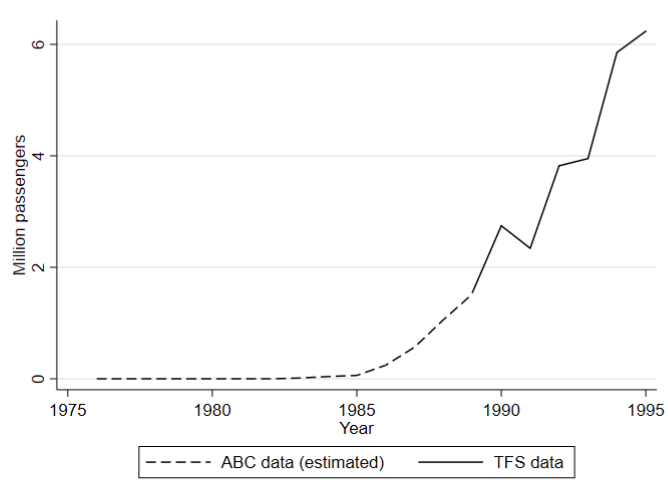
[13]At least for Cathay Pacific, the route south of the Himalayas represented the shortest route between Europe and Hong Kong until 1996 (*Flight International*, 1996).

[14]For instance, Wegg (1983) describes how Finnair failed to reach a deal for non-stop flights to Tokyo after negotiations that started in the mid-1970s, partly due to the large fees demanded by Soviet air traffic control.

[15]The estimated figures based on timetable data are validated by the fact that the estimated numbers of non-stop passengers almost exactly equals the number of observed non-stop passengers in the overlapping year in 1989.

while the transpolar service was targeted at the vacation traveler and the remaining business community (*Aviation Week and Space Technology*, 1986). As the number of permitted overflights increased rapidly, polar traffic via Anchorage declined and ended by 1993. Hong Kong and Japan came to dominate the non-stop traffic from Europe until the early 2000s when China surpassed Hong Kong in terms of non-stop passengers.[16]

Figure 2: Non-stop passenger traffic between Western Europe and East Asia



The number of non-stop passengers prior to 1989 is estimated based on data from the *ABC World Airways Guide* along with non-stop flight data from ICAO's TFS dataset. See Section A.2 in the Appendix for details on how the number of passengers is estimated. Data from 1989 to 1995 is based on actual non-stop traffic data from the TFS dataset.

[16]The signing of the Sino-British Joint Declaration in 1984 helped to establish Hong Kong as a key hub for intercontinental air traffic. The declaration stipulated that Hong Kong would return to Chinese rule in 1997 when Britain's lease of the territory ended. The declaration also contained administrative arrangements about how Hong Kong would be governed, including a section on civil aviation. The Chinese leaders decided that civil aviation in Hong Kong would not see any major changes after 1997, removing significant uncertainty about future operations for airlines in the region (Davies, 1997).

4 Impact of the Liberalization on the Cost of Travel

The liberalization of the Soviet airspace reduced the cost of business travel by primarily reducing the time cost of travel. As firms need to pay their workers while travelling, it makes it more costly to do business far away. The overflight fees charged by the Soviet Union, on the other hand, did generally not have an impact as it did not affect ticket prices. At the time of the Soviet airspace liberalization, ticket prices were negotiated between the airlines and the International Air Transport Association (IATA) and were typically based on the city of departure and arrival (Doganis, 1991). Thus, a trip from London to Tokyo was priced the same, regardless if it was routed via Anchorage or non-stop over the Soviet Union. These prices are also posted in the ABC World Airways Guide.

4.1 Identifying Affected Country Pairs and Controls

The first step to estimate the impact of travel time on trade is to exactly identify which country pairs that were affected by the liberalization of the Soviet airspace. I do this by mapping routes that pass through or close to Soviet airspace in the geoprocessing software ArcGIS. I then compare these routes to current flight routes using flight tracking imagery from uk.flightaware.com.[17] This method leaves me with a group of country pairs where I can safely verify a reduction in flight distance, between Western Europe and East Asia. The countries belonging to Western Europe and East Asia are listed in Section A.3 in the Appendix. In total, 126 country pairs were affected.[18]

There are a few uncertain cases where it is hard to determine if some country pairs might have experienced some marginal impact of the liberalization of the Soviet airspace. I address this by running robustness checks where I exclude country pairs

[17]This is arguably the most reliable way of verifying the impact of the Soviet airspace liberalization as I do not have access to a large enough set of flight maps from airlines that operated in or close to the Soviet airspace during the 1980s.

[18]Figure A.2 in the Appendix depicts an overview of how countries are divided into larger regions.

that are connected by routes that are close to Soviet airspace.[19]

To obtain enough variation to identify the impact of business travel on trade I need to include a suitable control group in the analysis. Technically all unaffected country pairs of the world could be included in the control group. However, I choose to exclude countries that are poorer than the group of affected countries as these countries are likely to be on different trends in terms of trade.[20] I also choose to exclude the Soviet Union and the Soviet satellite states from the control group. I will refer to country pairs affected by the liberalization as treated and the remaining country pairs in the datset as controls.

4.2 Computing the Change in Travel Time

The second step to estimate the impact of travel time on trade is to measure the reduction in travel time for the affected country pairs due to the liberalization of the Soviet airspace. Using the change in travel time based on time table data from before and after the liberalization is likely to be endogenous. Instead, I use ArcGIS to map the shortest routes between Western Europe and East Asia and then compute the change in travel time.

To compute the shortest routes between Western Europe and East Asia, I create

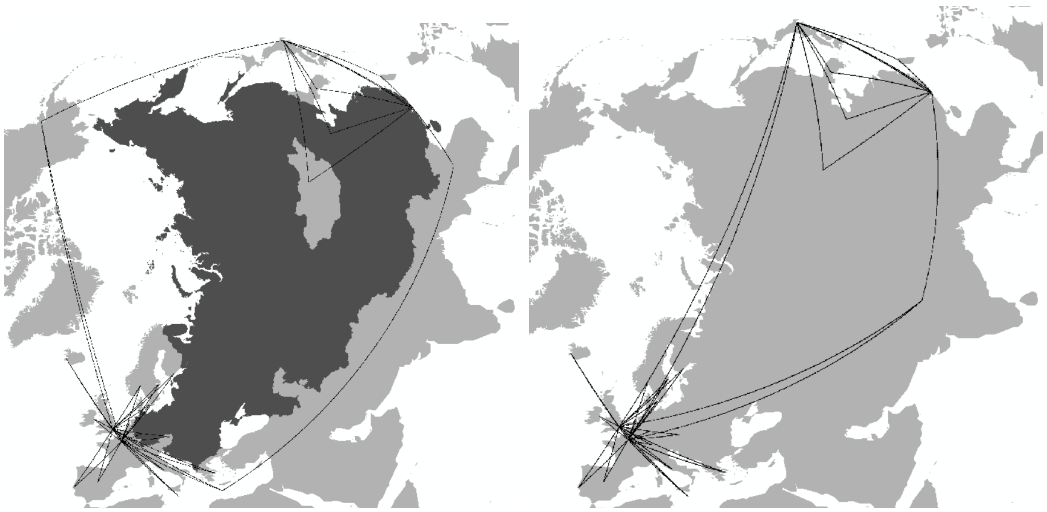
[19]Details about the excluded routes can be found in Section A.11 in the Appendix. There are also a number of routes where I lack enough information to determine if minor changes of routes potentially could have occurred as a consequence of the liberalization of the Soviet airspace. One example is the route Cairo-Tokyo which today passes over Chinese airspace. I have very limited information on routes over China and how these routes changed during the period of interest. Another example is Copenhagen-Istanbul which today is routed over Poland and Romania. I do not know how flights between Denmark and Turkey were routed during the 1980s and I do not know if they changed around the time of the Soviet airspace. Neither Poland or Romania were part of the Soviet Union, but it is plausible that Soviet satellite states were influenced by the decision of Soviet leaders also in terms of airspace policy. Common to all routes where I lack information is that they run close to the Soviet airspace and are excluded when running robustness checks.

[20]To determine which countries are poor, I rank all countries in the sample based on per capita income in 1985. I choose to exclude all countries that are poorer than Mongolia, except China and India. China is the poorest affected country and Mongolia is the second poorest. India was not affected by the liberalization of the Soviet airspace. The reason for excluding all countries poorer than Mongolia except China and India is that the regions in China and India that are most engaged in international trade are significantly richer than their respective country averages.

two networks of routes that connect these regions. The first network captures the period before the liberalization and contains routes that avoid Soviet airspace. The second network reflects the period after the liberalization and contains routes that cross Soviet airspace. All routes after the liberalization avoid the parts of the Chinese airspace that was still restricted. Both networks consist of points that represent the city in each country with the most departing passengers in 1985.

The networks also reflect the fact that some cities have better flight connections than others and that only few countries obtained a non-stop connection during the years after the Soviet airspace opened up. I categorize every point as either a hub or a spoke. I assume that hubs are the only points in the network that have intercontinental connection. Thus, to reach East Asia when flying from a spoke in Western Europe, the flight has to be routed through a European hub. If the destination is an East Asian spoke, the flight also needs to be routed through an East Asian hub. Using actual hubs that connected Western Europe and East Asia is likely to be endogenious. Instead, I choose the two cities with the most departing passengers in each region in 1985 to be hubs and the remaining points to be spokes. The busiest cities turned out to be London, Paris, Tokyo, and Hong Kong. Based on the set of hubs, spokes and the available airspace Figure 3 depicts the flight route network that connects Western Europe and East Asia before and after the liberalization of the Soviet airspace.

Figure 3: Flight route networks before and after the liberalization



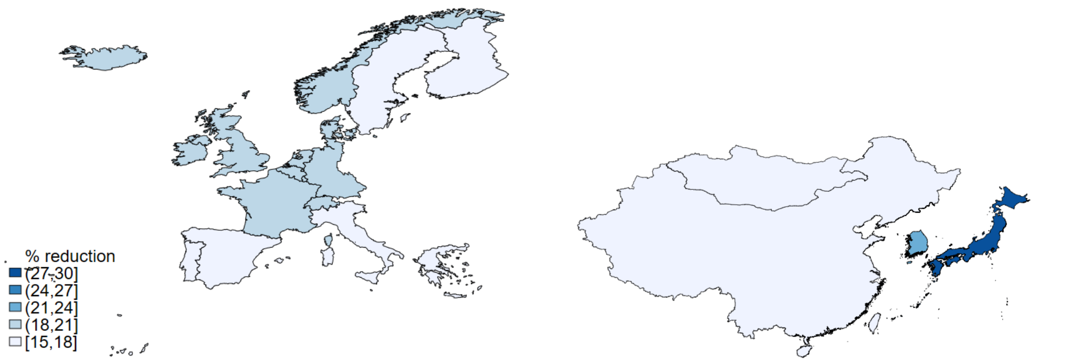
The left map depict the network before the liberalization. The dark area depict the Eastern Bloc including China. The right map depict the network after the liberalization.

Using the constructed networks, I simulate the shortest distance between all affected country pairs before and after the liberalization. To translate distances into travel time, I assume an average flight speed of 850 km/h and that flying through a hub adds 1.5 hours of travel time.[21] The average computed reduction in flight time among the 126 affected country pairs was 3.9 hours or 19 percent. To illustrate how the intensity of treatment varies across countries, I present the average percentage travel time reduction for every affected country in Figure 4. We see that Northwestern and Central Europe along with Japan and South Korea experienced the largest average reduction in in travel time.[22]

[21]The flight speed is based on the cruising speed of a typical wide-body aircraft that were operating routes between Western Europe and East Asia during the 1980s. The results of the main analysis are not very sensitive to assumptions regarding stop-over time and average flight speed. See Section A.5 in the Appendix for a more comprehensive description on how the travel time is computed using ArcGIS.

[22]The distribution of the reduction in distance among the affected country pairs is shown in Figure A.7 in the Appendix.

Figure 4: Average percentage reduction in distance across treated countries



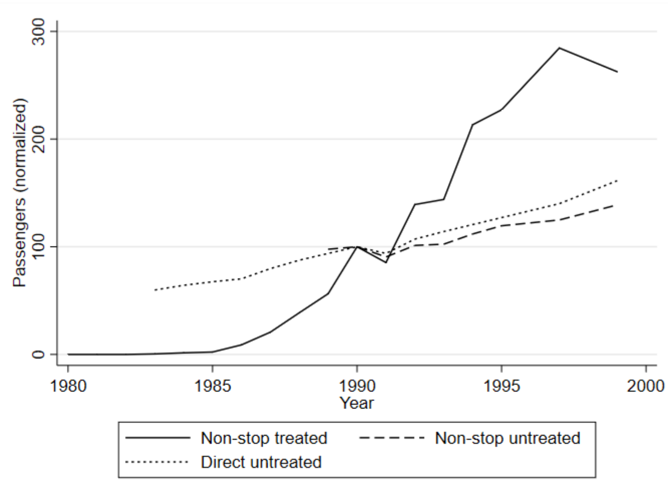
The average percentage reduction is computed as the average reduction in travel time between a country being affected by the Soviet airspace liberalization and all countries to which the travel time was reduced. For instance, the average value for France is the average reduction in travel time between France and all countries in East Asia. Hong Kong and Macao are hard to see due to their small size. The average reduction for Hong Kong is 17% and the average reduction for Macao is 16%.

4.3 Changes in Flight Patterns

The flight data show substantial differences in flight patterns among the treated country pairs compared to the control group. Figure 5 compares passenger traffic among treated country pairs and controls. Values are normalized and the base year is set to 1990. As I do not observe non-stop flights before 1989 for the control group, I also display the normalized number of direct flight passengers flying between the country pairs in the control group. We see that the control group experienced a gradual increase of passengers. The treatment group, on the other hand, goes from practically having no passengers before 1985 to several millions just a few years after the liberalization.[23]

[23]The growth in non-stop passenger traffic between Western Europe and East Asia also stand out when breaking down air traffic to a more disaggregate levels, see Figure A.3 in the Appendix.

Figure 5: Passenger traffic among treated and untreated country pairs



The number of non-stop passengers flying between Western Europe and East Asia was approximately 2.7 million in 1990, five years after the liberalization of the Soviet Airspace.

While the data show a rapid increase in the number of non-stop passengers, few treated country pairs actually received a non-stop connection. In 1990 only about 15% of the country pairs had a non-stop connection and about 25% had a direct connection, see Figure A.4 in the Appendix.[24] Thus, while many passengers travelling between Western Europe and East Asia could enjoy shorter flight routes, most passengers still needed to transfer flights in major hubs.[25]

To conclude, the liberalization of the Soviet airspace had a substantial impact on the time cost of travel between Europe and East Asia. The liberalization was largely unanticipated and was primarily driven by domestic factors within the Soviet Union. The data show that the liberalization was associated with a substantial increase in non-stop air traffic between the affected regions. Yet, only a minority of the treated country pairs obtained a non-stop connection.

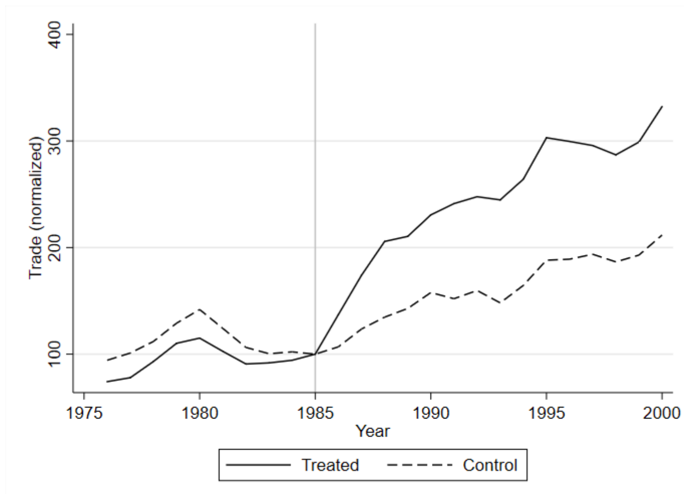
[24]Revisit Section 2 for an explanation of the difference between non-stop and direct flights.

[25]For further descriptive statistics see Figure A.5 in the Appendix which shows the number of country pairs in the treatment group that had at least a weekly non-stop connection. Figure A.6 in the Appendix shows the number of weekly departures between the busiest non-stop routes among the treated country pairs.

5 Empirical Analysis

Before proceeding to the main analysis, I provide a descriptive overview of the evolution of trade among the treated and untreated country pairs. Figure 6 shows that the treatment and control group follow similar trends prior to 1985. After the liberalization, however, trade among the treated country pairs experience a sudden boom in 1986 and 1987. From 1988, growth in trade in the treatment group returns to comparable levels as in the control group.

Figure 6: Normalized trade among treated and untreated country pairs

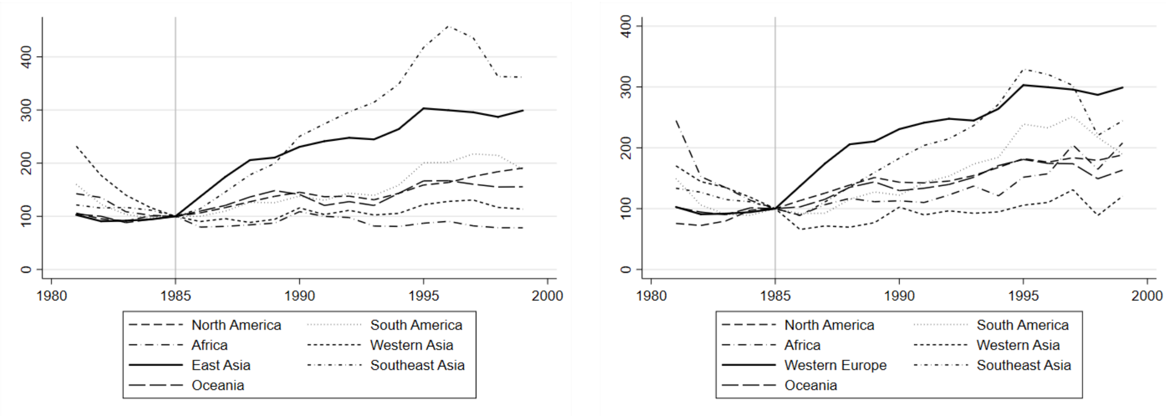


The growth in trade among the group of treated country pairs also stand out when solely focusing on the trade of Western Europe and East Asia. Figure 7 compares normalized trade flows between Western Europe as well as East Asia and the rest of the world by region. We see that trade between Western Europe and East Asia grows the fastest for both regions after the liberalization of the Soviet airspace in 1985.[26]

[26]Figure 7 also show that normalized trade with Southeast Asia surpasses trade between East Asia and Western Europe around 1990. The growth in trade with Southeast Asia coincides with the boom in offshoring to this region. While the growth in trade is remarkable, it is not unique for Western Europe and East Asia. For instance, trade between North America and Southeast Asia experience similar growth from the late 1980s and onward.

Figure 7: Normalized trade between Western Europe/East Asia and the rest of the world by region

(a) Western Europe (b) East Asia



Trade between Western Europe and East Asia is captured by the solid line in both figures.

5.1 Empirical Framework

The general framework of the empirical analysis is based on gravity model of trade. The gravity model stipulates that bilateral trade increases with a countries economic size and decreases with the distance to its trading partners. I use the following theoretical gravity model derived by Anderson and van Wincoop (2003):

$$Trade_{ijt} = \frac{y_{it}y_{jt}}{y_{wt}} \left(\frac{\tau_{ijt}}{P_i P_j} \right)^{1-\sigma} \tag{1}$$

where $Trade_{ijt}$ is bilateral trade between country i and j, y_{it} and y_{jt} is the respective income of the two countries, y_{wt} is world income, τ_{ijt} captures bilateral trade frictions, P_i and P_j represent multilateral resistance terms, and σ denotes the elasticity of substitution across products. A log transformation yield the following expression:

$$ln(Trade_{ijt}) = ln(y_{it}) + ln(y_{jt}) - ln(y_{wt}) - (1-\sigma)(ln(\tau_{ijt}) + ln(P_i) + ln(P_j)) \tag{2}$$

where τ_{ijt} represent all bilateral barriers to trade including the time cost of travel between country i and j. Most of the trade frictions are time-invariant and can be controlled for by using country pair dummies. The country pair dummies will also control for income and multilateral trade resistance.[27] Therefore, I estimate the impact of the cost of travel on trade using the following reduced form regression:

$$ln(Trade_{ijt}) = \alpha + \beta ln(Time_{ijt}) + \varphi_t + \gamma_{ij} + \varepsilon_{ijt} \tag{3}$$

where $ln(Time_{ijt})$ denotes the log business travel time between country i and j. β captures both the effect of the cost of business travel time and the price elasticity of demand. To illustrate this, lets assume that $ln(\tau_{ijt})$ can be expressed through the following log-linear function:

$$ln(\tau_{ijt}) = \varphi ln(Time_{ijt}) + \zeta ln(Dist_{ij}) + \delta Z_{ijt} \tag{4}$$

where $ln(Dist_{ij})$ is the log of geographical distance, and Z_{ijt} represent a vector that contains other determinants of trade frictions such as common language, colonial linkages, and trade agreements. By substituting Equation (4) into (2), I obtain the following estimating equation after adding country pair and time dummies:

$$ln(Trade_{ijt}) = \alpha + (1-\sigma)\varphi ln(Time_{ijt}) + \varphi_t + \gamma_{ij} + \varepsilon_{ijt} \tag{5}$$

Thus, we see that as $\beta = (1-\sigma)\varphi$, which represents the ad-valorem tariff equivalent of business travel. Based on the results from the main analysis, I compute φ separately by using estimates of σ from the trade literature.

5.2 Baseline Results

To asses the causal impact of shorter business travel time on trade on trade, I estimate a modified version of Equation (3) that captures the effect of the liberalization of the

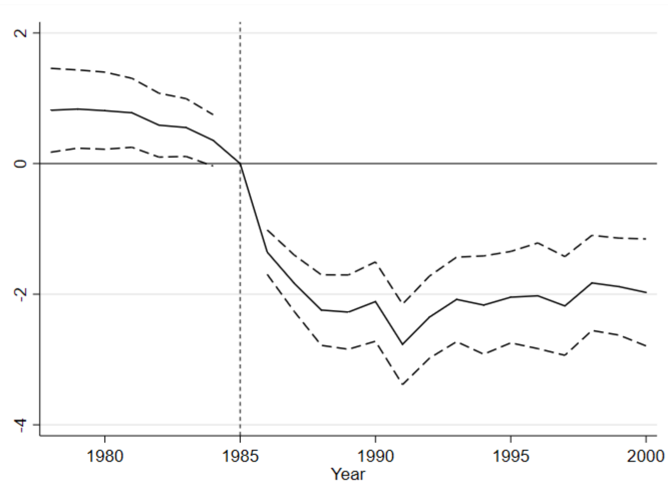
[27] Income and potentially time-varying trade friction variables will not be perfectly controlled for by country pair dummies. However, since the liberalization of the Soviet airspace was plausibly exogenous to income and time-varying trade frictions outside the Eastern Bloc, which is excluded from the analysis, this should not bias the results.

Soviet airspace year-by-year. The regression takes the following form:

$$ln(Trade)_{ijt} = \alpha + \sum_{t=1978}^{2000} \beta_t \Delta Time_{ij} \times \varphi_t + \gamma_{ij} + \varphi_t + \varepsilon_{ijt} \tag{6}$$

where $\Delta Time_{ij}$ represent the log-difference between the business travel time after and before the liberalization of the Soviet airspace. We expect $\beta < 0$, as a greater reduction in travel time should be associated with more trade. 1985 constitute the base year. I estimate the impact using standard OLS.[28]

Figure 8: Impact of Soviet airspace liberalization on trade



The figure depicts the beta estimates of Equation 6 with a 95% confidence interval. SE are clustered at the country pair level. Country pair and year fixed effects are included. 1985 = base year.

Figure 8 show a sudden and large impact of shorter travel time on trade after the decision of the Soviet's to allow non-stop flights over its territory. The estimated coefficients of around -2, post treatment, indicates that the increase in travel time leads to a twice a big drop in trade. The magnitude of the impact suggests that the

[28]Mathematically the right hand side variable can be expressed as follows: $\Delta Time_{ij} = ln(Time^{Post85})_{ij} - ln(Time^{Pre85})_{ij}$. I use OLS as the trade data contains very few zero trade flows and I consequently do not have to deal selection into trade. Figure A.8 in the Appendix show the normalized number of country pairs with positive trade flows for treated country pairs and controls.

travel cost explanation could potentially account for a major share of the unobserved trade frictions affecting global trade.

The fact that most of the effect occur within just a few years after treatment might seem surprising. One could expect more time for the impact on trade to materialize if shorter flight routes reduced search costs for customers and firms gradually discover trading opportunities between Europe and East Asia. However, the rapid increase in trade can be explained by the large concentration of firms that traded goods between Europe and East Asia. Figure A.9, in the Appendix, depict the concentration of Swedish firms that trade goods between Sweden and East Asia in 1997.[29] Figure A.9 shows that the top 15 out of 5,382 exporters account for over half of all exports to East Asia and the top 50 out of 7,510 importers accounted for over half of all imports from East Asia. The large concentration of trade suggests that changing trade behaviour of a small number of the highest ranked firms could have a large aggregate impact. The heavy concentration of trade to a few firms also suggests that it is plausible that firms that already traded goods between Western Europe and East Asia accounted for most of the increase in trade volume, rather than new firms entering into trade.

The concentration of trade also provides an explanation for why the impact of the liberalization was so sudden, despite the fact that the number of non-stop flights over Soviet airspace was initially limited. The Soviet Union gradually increased the number of permitted non-stop flights over its territory after 1985. Figure 2 shows that about a million passengers travelled between Western Europe and East Asia in 1987, compared to over six million in 1995. When capacity was limited, airlines targeted frequent business travellers for their non-stop flights, while other passengers had to fly the detour routes (*Aviation Week and Space Technology*, 1986). The strategy to target frequent business flyers suggests that even if capacity over the Soviet Union initially was limited, the available non-stop seats was likely to have been channeled to the travellers that generated a big fraction of trade between Western Europe and East Asia.

[29] 1997 is the first year where Swedish firm level trade data is available.

5.3 Robustness Checks

The baseline results are robust to a number of alternative specifications. To be able to display results in a more condensed way, I estimate the treatment effect using the regression specification from Equation (3), which compares the average impact before and after the liberalization:

$$ln(Trade_{ijt}) = \alpha + \beta ln(Time_{ijt}) + \varphi_t + \gamma_{ij} + \varepsilon_{ijt} \tag{7}$$

I set the pre-treatment period to be 1980 to 1985 and the post-treatment period to be 1986 to 1990. All results are presented in Table 1. Regression 1 use the standard specification as a point of reference. I also carry out most of the robustness checks in Table 1 using the specification of Equation 6, which produces a treatment effect for every year. These results are presented in Section A.10 in the Appendix.

5.3.1 Alternative Treatment and Trade Variables

One cause of concern is whether travel time and trade is measured correctly or not. I use alternative dependent and independent variables in Panel A to address this. In Regression 2 I use route distance instead of time. The route distance variable is based on the simulations of ArcGIS but does not rely on assumptions on average flight speed and stop-over time. The estimates based on distance show to be larger than the baseline specification. This is because of lower variation in the distance variable as it does not take into account that the liberalization meant that airplanes could start to fly non-stop between hubs in Western Europe and East Asia instead of making a half-way stopover. In Regression 3, I use a binary treatment variable which does not rely on any specific assumptions about the change in travel cost. The binary variable simply takes the value one if the country pair is treated. The estimated effect implies that average trade increased 51% more for the treated country pairs compared to the control group.

In regression 4, I turn to the measurement of the trade variable. A key concern is that the strong growth in trade between the affected country pairs might have been driven by lower costs of transporting goods by air rather than lower time cost of transporting people. A control for transport cost channel by estimating Equation 7 using trade in goods not typically transported by air as the dependent variable. I use data from Eurostat from 2002-2004 to identify product codes not typically transported by air. The data cover all trade between EU and East Asia divided on 6 digit HS product codes and the mode of shipment. The Eurostat data cover a period over a decade and a half after the liberalization of the Soviet airspace. However, Hummels (2007) documents a monotonic decline in the air-to-sea freight price ratio which implies that goods not shipped by air in the early 2000s are even less likely to be shipped by air in the mid-1980s. I define a good as not typically transported by air if less than 20 percent of the value of trade between the EU and East Asia of a good cross the EU border by air. The share of non-air goods is approximately 65 percent of total trade around the period of treatment. Regression 4 show a similar effect compared to the baseline regression which implies that it is unlikely that the baseline results are driven by lower costs of air transports.

5.3.2 Altering Sample and Adding Controls

The first three columns of Panel B addresses the concern that differences in underlying trends between the treatment group and the control group are driving the baseline results. For instance, a possible reason for for the strong growth in trade among the group of treated country pairs could stem from higher levels of growth or liberal trade reforms. I account for such channels in Regression 5, where I add GDP per capita and free trade agreement status to the baseline specification. The estimate of Regression 5 show that the inclusion of gravity controls increases the effect by roughly 8%.

While it is reassuring that results are robust to growth and trade policy, there might be other unobserved trends driving the growth in trade between the pool of treated countries after the liberalization of the Soviet airspace. To control for all country specific time trends I run a regression with country-sprecific time trends and also a regression with a complete set of country-time fixed effects. Adding time-trends and country-time fixed effects reduces the estimates significantly. However, when estimating the effect year-by-year, results are only slightly smaller compared to the baseline specification, see Figure A.14 and A.15.

The last column of Panel B addresses the concern that the baseline results might be driven by small countries that do not trade much. In the baseline specification trade between Malta and Iceland is given the same weights as trade between Japan and the United States. In Regression 8 I drop all country pairs that have trade flows that are below average in 1985, which slightly increases the estimated effect.

5.3.3 Altering Treatment and Control Group

Finally, in Panel C, I test if results are sensitive to altering the the treatment and control group. I first, extend the control group with all poor countries that I excluded in the baseline regression. I also add the Soviet Union along with the Soviet satellites states to the control group in a second specification. Adding the group of poor countries reduces the effect somewhat while adding the group of Soviet countries practically has no impact on the results.

Another concern is that there are a number of country pairs where it is hard to verify if they might have experienced a marginal impact due to the liberalization of the Soviet airspace. Common to the pool of potentially treated country pairs is that they would have been connected by routes that would have passed directly over, or close, to the Soviet Bloc or China.[30] To address this issue, I drop all potentially treated country pairs from the control group.[31] Regression 11 shows that excluding the pool of potentially treated country pairs slightly increases the baseline effect. As an alternative to control for parallel trends, I choose to reduce the control group by only keeping country pairs where at least one country belongs to Western Europe or East Asia. Regression 12 shows that the estimated effect actually increases

[30] See Section 4 for a more detailed discussion of potentially treated country pairs.

[31] A detailed description of which country pairs that are dropped can be found in Section A.11 in the Appendix.

marginally when reducing the control group.[32]

In addition to manually dropping observations to balance the pool of treated and control subjects, I also implement a Coarsened Exact Matching Method (CEM) procedure (Iacus et al., 2012). CEM is a nonparametric procedure that matches treated subjects with similar controls based on a selected set of observables. Nonparametric matching seems preferable to methods using propensity scores, as I do not observe covariates that predict a similar trading relationship to the group of treated country pairs.[33] After selecting a set of appropriate variables to obtain balance between the pool of treated and control subjects, each variable is coarsened so that substantively indistinguishable values are grouped and assigned the same numerical value. Then, treated subjects are matched to one control subject or discarded from the dataset. Finally, the uncoarnsed data are retained for the matched subjects.

I identify controls based on the following characteristics: average GDP of the country pair, relative GDP of the country pair, average GDP per capita of the country pair, relative per capita income, volume of trade, geographic distance, along with a number of dummy variables indicating if the country pair has a common language status, a free trade agreement and if the country pair share a border.[34] Regression 13 shows that the estimated effect, using the matched subsample, is approximately 16 percent larger compared to the baseline specification.

[32]Another pool of subjects that plausibly would have been affected by similar trends to the treatment group are all country pairs that can be formed between the United States along with Canada and East Asia. Instead of running a regression, as this control group only consists of 14 country pairs, I compare normalized aggregate trade flows between these regions. Figure A.22 in the Appendix show that trade between the United States along with Canada and East Asia exhibit a fairly constant growth between 1980 and 1995, while for the treated country pairs, trade is declining between 1980 and 1985 and then increases rapidly after the Soviet Union liberalized its airspace.

[33]See Azoulay et al. (2010) for an application of CEM similar to this study.

[34]See Section A.10 in the Appendix for a detailed description of how the matching variables are defined and how the CEM procedure is carried out.

Table 1: Robustness checks

Panel A. Alternative treatment and trade variables				
	(1)	(2)	(3)	(4)
	Baseline	Distance	Binary treatment	Non-air trade
Effect	-2.401***	-2.989***	0.510***	-2.208***
	(0.208)	(0.278)	(0.044)	(0.231)
Observations	21,341	21,341	21,341	20,761

Panel B. Altering sample and adding controls				
	(5)	(6)	(7)	(8)
	Gravity controls	Linear Trends	Time-Country FE	Large obs
Effect	-2.625***	-1.408***	-1.408***	-2.521***
	(0.203)	(0.242)	(0.278)	(0.192)
Observations	21,242	21,341	21,341	13,157

Panel C. Altering treatment and control group					
	(9)	(10)	(11)	(12)	(13)
	Poor countries	Eastern Bloc	Close routes	Few controls	CEM
Effect	-2.115***	-2.468***	-2.477***	-2.485***	-2.832***
	(0.190)	(0.204)	(0.229)	(0.209)	(0.486)
Observations	57,865	26,474	12,942	14,062	1,643

Robust standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All regressions are based on Equation 7. Standard errors are clustered at the country pair level.

5.4 Distribution of Effect

While all treated country pairs experienced a change in air routes, some country pairs received non-stop connections while others required multiple transfers. To analyze how the aggregate impact is distributed across individual countries, I run separate regression with individual countries in the treatment group. I use the same pool of control subjects and include one treated country at a time. For instance, the first regression include all untreated country pairs along with all treated country pairs where Austria is included. I use the same regression specification as in Equation 7. I plot the estimates in a frequency table in Figure 9.

Figure 9: Distribution of impact for individual countries

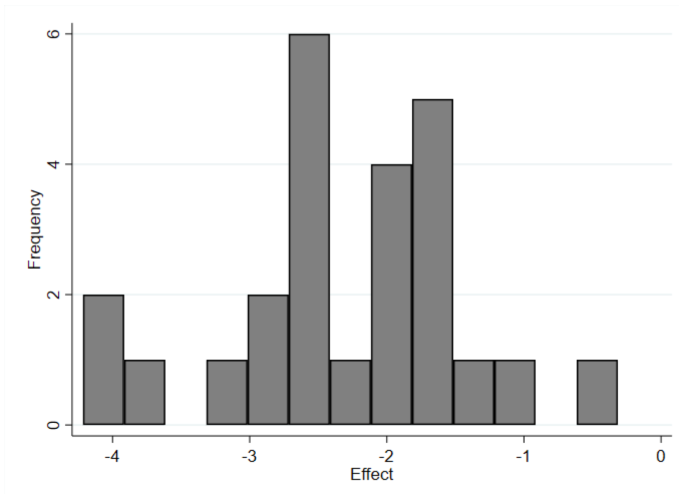


Figure 9 shows a negative impact for all treated countries. All estimates also show the be significant. These results indicate that baseline results are not driven by a few country pairs but rather that the positive impact on trade is seen in all countries in the treatment group.

5.5 Tariff Equivalent of Business Travel Costs

As mentioned previously, the time elasticity of trade represents both the effect of the cost of business travel time and the price elasticity of demand, $\beta = (1 - \sigma)\varphi$. The effect of the cost of travel can be obtained indirectly by using the estimated results along with estimates of elasticities of substitution from the trade literature. Head and Mayer (2013) review the literature and conclude that $\sigma = 6$ is a reasonable estimate. Using $\sigma = 6$ along with $\beta = -2.4$ of the first specification in Table 1, I obtain $\varphi = 0.48$, which represents ad-valorem tariff equivalent cost of business travel on trade. Given that the average reduction of business travel time was 19%, the implied reduction on tariffs was approximately 9.1%.

5.6 Product Level Analysis

While the baseline results suggest that shorter travel distance causes trade to increase, it is not self evident that lower costs of meeting face-to-face is what drives these results. To examine the face-to-face channel, I compare goods that are likely to rely on business travel to different degrees. If trade increased due to lower costs of business travel, goods that rely more intensively on business travel should also experience a larger impact of the treatment. Empirical evidence show that trade in differentiated goods is subject to more informational frictions and consequently require closer cooperation between the transacting parties, compared to homogeneous goods, (see Rauch, 1999; and Nunn, 2007). If differentiated goods require more communication between buyers and sellers, lower business travel cost should impact this category of goods to a larger extent.

To identify homogeneous and differentiated goods I use the classification from Rauch (1999), which distinguishes between goods that are traded in organized exchanges, goods that are reference priced, and all other goods. The two former categories are considered homogeneous while the last category is considered differentiated. I then estimate the following triple difference-in-difference model:

$$\begin{aligned} ln(Trade)_{ijnt} =& \alpha + \beta_1 D_{ij}^{Tr} \times D_t^{Post} \times D_n^{Diff} \\ &+ \beta_2 D_{ij}^{Tr} \times D_t^{Post} + \beta_3 D_{ij}^{Tr} \times D_n^{Diff} + \beta_4 D_t^{Post} \times D_n^{Diff} \\ &+ \varphi_t + \gamma_{ij} + \theta_n + \varepsilon_{ijnt} \end{aligned} \tag{8}$$

where D_{ij}^{Tr} is a treatment dummy, D_t^{Post} is a post-treatment time dummy and D_n^{Diff} is a product dummy that takes the value one if the product is differentiated. Products are defined by 4-digit SITC product codes. β_1, the coefficient of interest, captures the differential impact of treatment across differentiated and homogeneous goods within the treatment group when the Soviet airspace is liberalized.

Table 2 show that goods that are differentiated experienced 29.6% larger impact compared to homogeneous goods. The fact that trade increased more for goods that are likely to require more business travel provides further evidence that lower cost of face-to-face meetings is the channel driving the main results.

Table 2: Triple difference-in-difference analysis

Treated × Diff × Post	0.296***
	(0.0573)
Treated × Diff	0.735***
	(0.0959)
Treated × Post	0.278***
	(0.0545)
Diff × Post	0.100***
	(0.0107)
Observations	5,280,885
R-squared	0.467

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Fixed effects at year, country pair and product level. SE clustered at the country pair level.

6 Conclusion

Robust evidence shows that standard barriers to trade, including tariffs and transport, cannot account for the negative impact of geographical distance on trade. One hypothesis is that the business travel is a necessary but costly input to trade. Hence, the cost of business travel makes firms want to trade with partners that are geographically closer. I examine the causal impact of the cost of business travel on trade using the liberalization of the airspace in the Soviet Union as a source of exogenous variation. The liberalization meant that non-Soviet airlines could fly non-stop over the Eastern Bloc, radically reducing the travel time between Europe and East Asia. I show that this reform was associated with a rapid and substantial increase in bilateral trade between the affected country pairs, equivalent to a tariff reduction of 9.1%. The magnitude of the effect suggests that travel distance for people is a key source of geographical friction that affects gravity.

Results hold for trade in goods not typically transported by air, which indicates that results are not driven by a reduction in air shipping costs. The analysis also shows that the liberalization of Soviet airspace had a significant positive impact on almost all affected country pairs, despite the fact that a fairly small share of country pairs had direct or non-stop connections. Finally, I show that trade in differentiated goods, which typically requires more business travel, experienced a larger impact compared to trade in homogeneous goods.

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A Appendix

A.1 Passenger traffic from London to Tokyo 1982-1989

Figure A.1: Passenger traffic from London to Tokyo

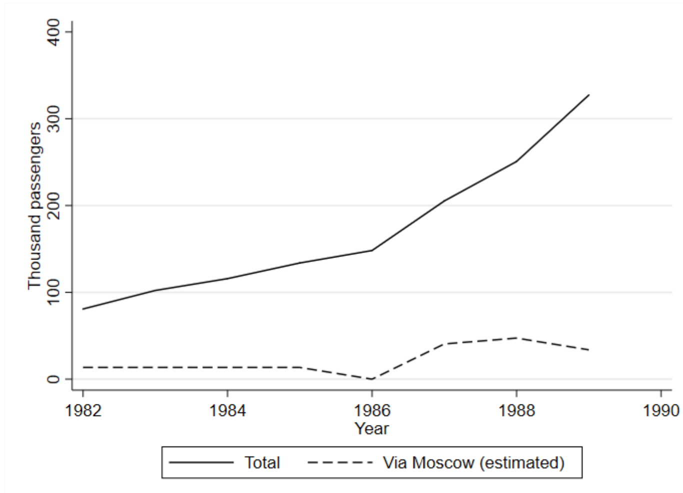


Figure A.1 is based on the number of weekly departures obtained from the *ABC World Airways Guide*. I estimate the number of passenger by using additional data from ICAO's TFS data set. See Section A.2 in the Appendix for a detailed description how the number of non-stop passengers is estimated. If one would also count the passengers that had to make at least one transfer between London and Tokyo, the fraction of flights that made stopovers in Moscow would be even smaller. The Soviet air carrier Aeroflot did not report statistics to ICAO. Hence, all passenger traffic from London to Tokyo via Moscow by Aeroflot is excluded. The timetable data, however, indicated that Aerflot's capacity was typically limited to only one or two weekly flights. Moreover, Aeroflot had a notoriously bad reputation due to inferior quality and flight safety concerns and was generally not popular in the business community.

A.2 Computing Non-Stop Passengers Prior to 1989

The number of annual non-stop passengers between East Asia and Western Europe prior to 1989 is computed using data from the *ABC World Airways Guide* timetables and the TFS dataset as follows:

$$non\text{-}stop\, passengers_{ijamt} = weekly\; departures^{ABC}_{ijamt} \times passengers\; per\; flight^{TFS}_{m} \times 52$$

i = city of departure, j = city of arrival, a = airline, m = airplane type, t = year

where $weekly\, departures$ is the average number of weekly non-stop departures obtained from the timetables and $passengers\, per\; flight^{TFS}_{m}$ is the average number of passengers per departure by airplane type taken from the TFS dataset. To compute the average number of passengers by airplane type, I use all non-stop flights between Europe and East Asia in 1989, the first year of observation, and divide the number of travelling passenger by the number of departures for each airplane type. During this time the Boeing 747 dominated the non-stop traffic between Europe and East Asia, but a few airlines also used the McDonnell Douglas DC-10. I then aggregate the number of estimated number of non-stop passengers by year.

A.3 Treated Country Pairs

The pool of treated subjects in the analysis consist of all country pairs that can be formed between Western Europe and East Asia. The control group consists of the remaining country pairs of the world. In total there are 126 country pairs in the treatment group and 2,271 country pairs in the control group.

Table 3: Treated Country Pairs

Western Europe		**East Asia**
Austria	Italy	China
Belgium-Luxembourg	Malta	Hong Kong
Denmark	Netherlands	Japan
France	Norway	South Korea
Finland	Portugal	Mongolia
West Germany	Spain	Taiwan
Greece	Sweden	Macao
Iceland	Switzerland	
Ireland	United Kingdom	

A.4 Flight and Trade Patterns

Figure A.2: World regions

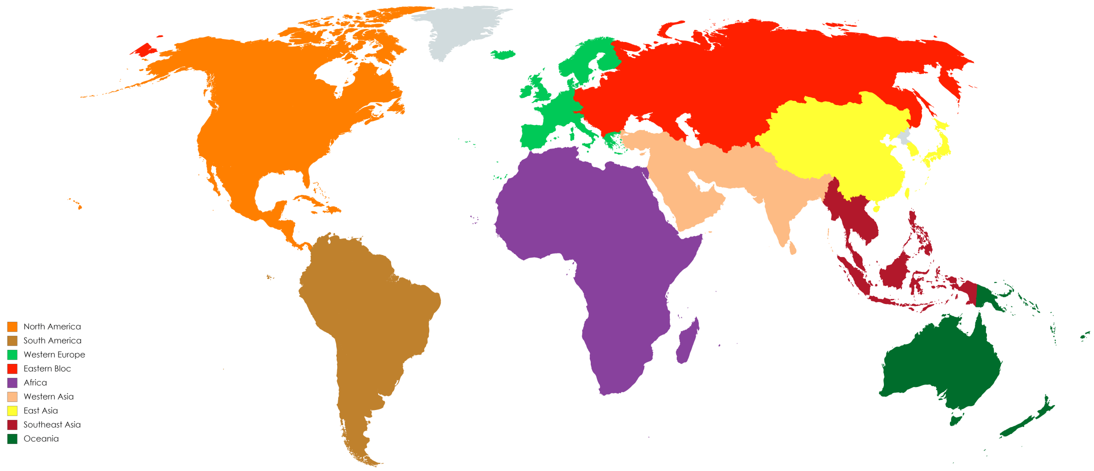
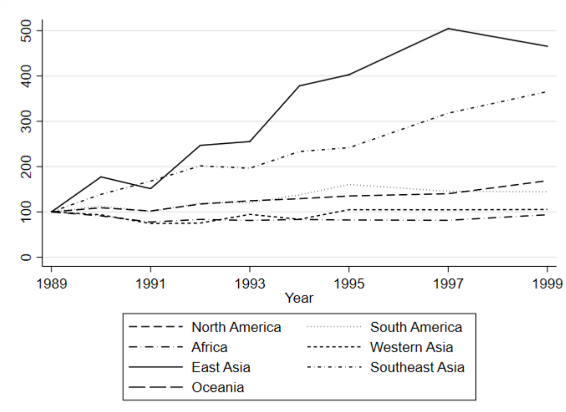
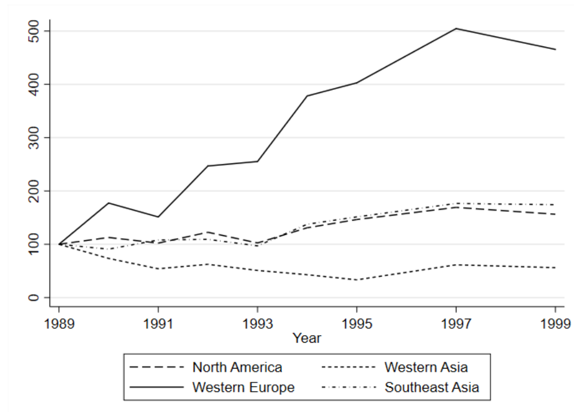


Figure A.3: Normalized air traffic from Western Europe and East Asia to the rest of the world

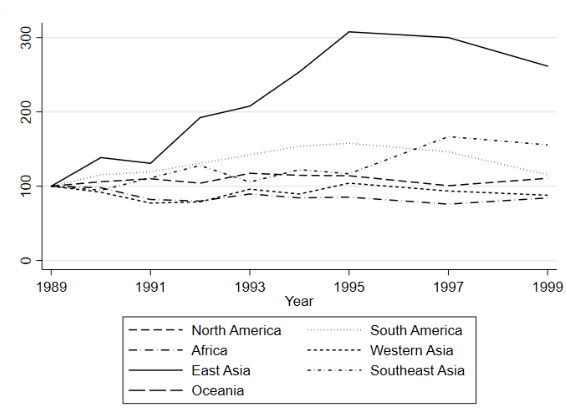
(a) Non-stop passenger traffic between Western Europe and the rest of the world



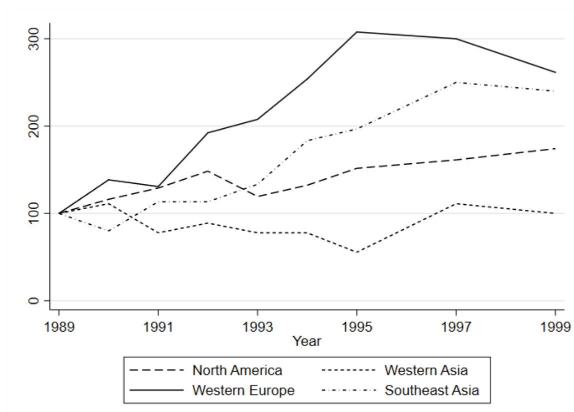
(b) Non-stop passenger traffic between East Asia and the Rest of the World



(c) Non-stop routes between Western Europe and the rest of the world

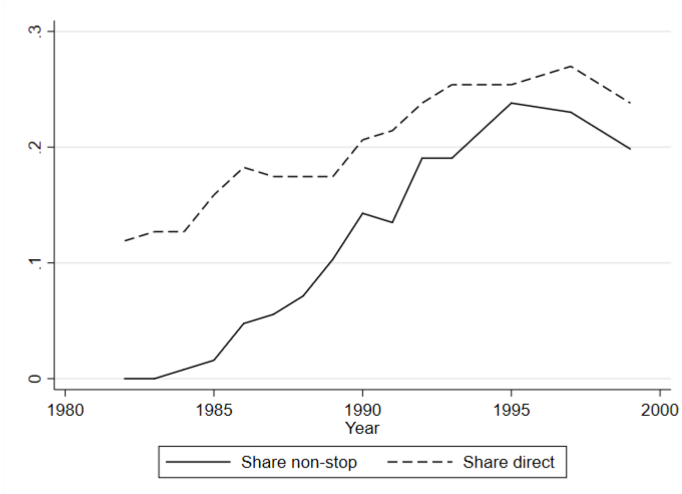


(d) Non-stop routes between East Asia and the rest of the world



A route is defined as a city pair with at least 20,000 annual non-stop passengers. For East Asia, Africa, South America, and Oceania are excluded due to negligible levels of air traffic.

Figure A.4: Share of treated country pairs with direct and non-stop connections



A non-stop connection is defined as a city pair with at least 20,000 annual non-stop passengers.

Figure A.5: Number treated country pairs with at least a weekly non-stop connection

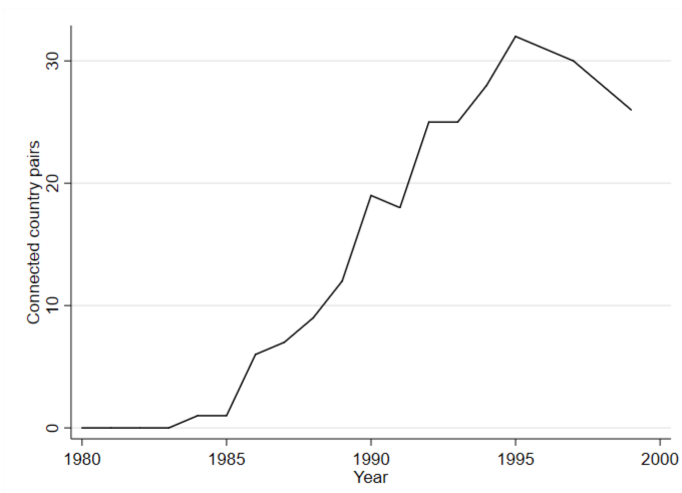
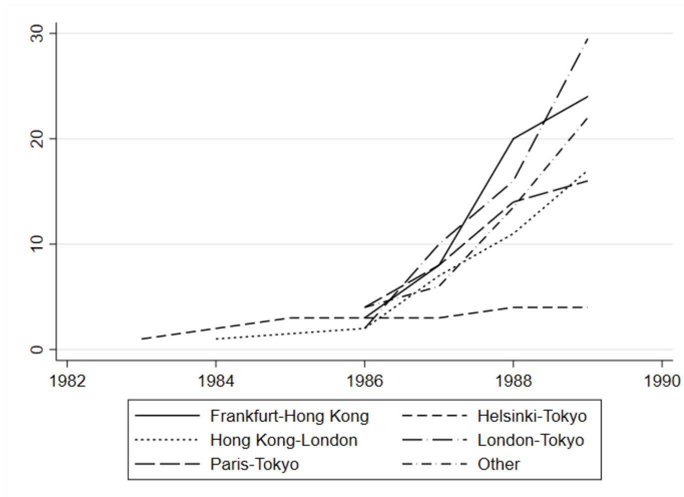


Figure A.6: Number of weekly non-stop departures on busiest routes between Western Europe and East Asia



Other city pairs include Amsterdam-Tokyo, Copenhagen-Tokyo, Frankfurt-Tokyo, Rome-Hong Kong, Milan-Tokyo, and Zurich-Tokyo.

A.5 Computing Travel Time

I use the geoprocessing software ArcGIS to compute travel time between the country pairs that were affected by the liberalization of the Soviet airspace. I start by creating two networks of routes that connect countries in Western Europe with countries in East Asia. The first network captures the period before the liberalization and contains routes that avoid Soviet airspace. The second network reflects the period after the liberalization and contains routes that cross Soviet airspace but still avoids the parts of the Chinese airspace that were still prohibited.[35] Both networks consist of points that represent the city in each country in Western Europe and East Asia with the most departing passengers in 1985 according to the OFOD dataset.

The first step to set up the networks is to determine which countries have airports with intercontinental air traffic between Western Europe and East Asia. I am not able to use the actual hubs that channeled passenger between Western Europe and East Asia as that is endogenous. Instead I choose the two cities with the most departing passengers during the 1980s in Western Europe and East Asia. These cities are London, Paris, Tokyo, and Hong Kong. I refer to London, Paris, Tokyo and Hong Kong as hubs, while the remaining points are referred to as spokes.

The network are then set up in the following way: Each spoke receives a non-stop connection to both hubs in its respective region. For instance, Copenhagen is the city with most departing passengers in Denmark in 1985. Hence, Copenhagen receives a non-stop connection to both Paris and London. Then, each hub receives an intercontinental connection to hubs in the other region. Hence, London and Paris each receives connections to Tokyo and Hong Kong.

The difference between the networks I create is that intercontinental routes between the hubs prior to the liberalization completely avoid Soviet airspace. The intercontinental routes that avoid Soviet airspace are routed both over the Middle East and Anchorage, Alaska.[36] The intercontinental routes in the network after the liberalization represent the shortest routes between the hubs that still avoided the

[35] The reason why parts of the Chinese airspace was prohibited is explained in Section 3.

[36] These routes both represent the shortest detour routes between Western Europe and East Asia prior to 1985 depending on the point of departure and destination.

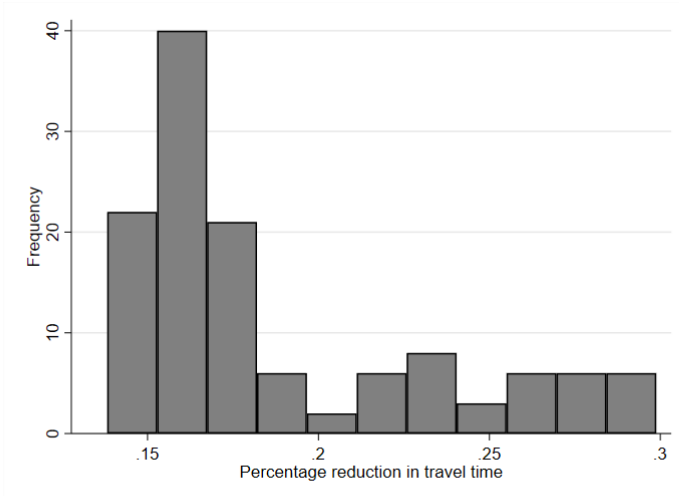
parts of the Chinese airspace that were not available. Using these networks I compute the shortest distance between all country pairs before and after the liberalization of the Soviet airspace.

To translate distances into flight time I need to make assumptions with regards to the number of stopovers on each route, stopover time, and average flight speed. I assume that a passenger need to make a stopovers whenever they pass through a hub. I also assume that every intercontinental flight prior to the liberalization need to make a stopover. For instance, a flight from Sweden to South Korea prior to the liberalization would consist of four legs. It would start in Stockholm and end end in Seoul. As neither Stockholm or Seoul are hubs, the flight would be routed Stockholm-London-Anchorage-Tokyo-Seoul. The same flight after the liberalization of the Soviet airspace would be routed Stockholm-London-Tokyo-Seoul.[37] I assume that a stopover adds 1.5 hours of flight time and that the average flight speed between any two points is 850 km/h. 850 km/h is slightly below the average cruising speed of a typical Boeing 747 or a McDonnell Douglas DC-10, which were the most common airplane models to operate routes between Western Europe and East Asia during the 1980s.

[37]All routes are assumed to be symmetric, which implies that the route from Seoul to Stockholm would be routed Seoul-Tokyo-Anchorage-London-Stockholm.

A.6 Distribution of the Continuous Treatment Variable

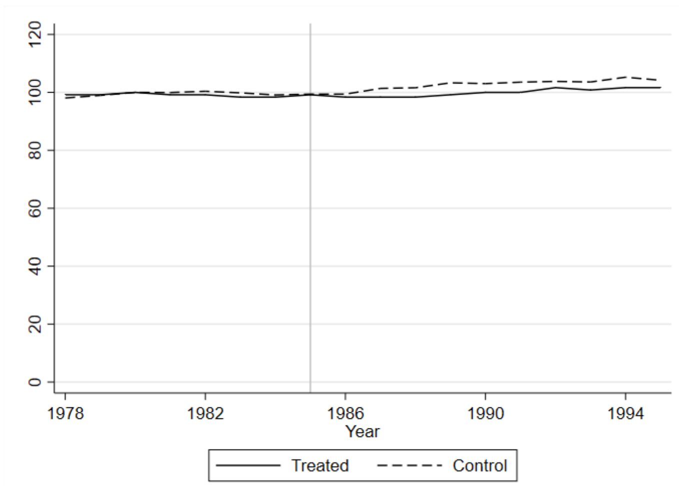
Figure A.7: Percentage reduction in travel time between affected country pairs



The figure illustrates the distribution of the percentage reduction in travel time between all 126 affected country pairs.

A.7 Positive Trade Flows

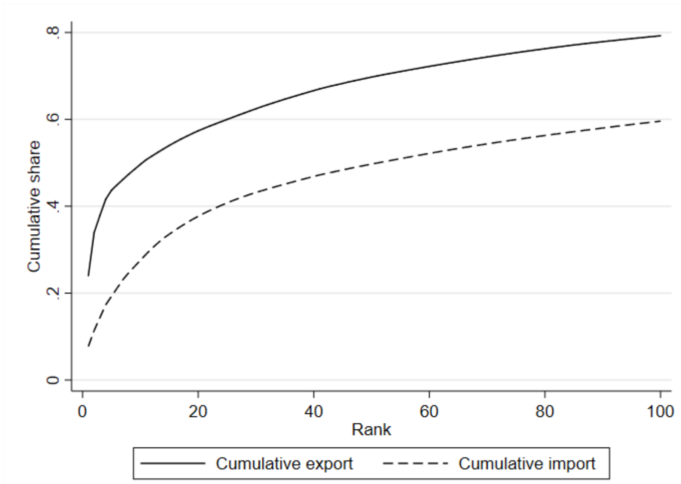
Figure A.8: Normalized number of country pairs with positive trade flows



The figure separates the normalized number of positive trade flows between the group of treated country pairs and controls. The base year is 1985.

A.8 Firm Concentration of Trade

Figure A.9: Cumulative share of trade between Sweden and East Asia by Sweden's 100 largest importers and exporters in 1997



The figure show that the 10 largest exporters of goods from Sweden to East Asia account for approximately 50% of total exports. The 10 largest importers account for about 30% of total imports. In total, there are 7510 firms that imports goods from East Asia and there are 5382 firms exporting goods to East Asia.

A.9 Coarsened Exact Matching

A.9.1 Definition of Matching Variables

I use nine covarites to carry out the Coarsneed Exact Matching procedure. All matching variables capture characteristics of treated country pairs and controls either before treatment or characteristics that are time invariant. For notation, let GDP_n^{80-85} denote the average GDP of country n between 1980 and 1985 and $GDPcap_n^{80-85}$ the average GDP per capita of country n over the same period of time. Then, the first four matching variables for country pair ij are defined as follows:

Average GDP: $\frac{GDP_i^{80-85}+GDP_j^{80-85}}{2}$

Relative GDP: $\frac{max(GDP_i^{80-85},GDP_j^{80-85})}{min(GDP_i^{80-85},GDP_j^{80-85})}$

Average GDP/capita: $\frac{GDPcap_i^{80-85}+GDPcap_j^{80-85}}{2}$

Relative GDP/capita: $\frac{max(GDPcap_i^{80-85},GDPcap_j^{80-85})}{min(GDPcap_i^{80-85},GDPcap_j^{80-85})}$

The fifth matching covariate capture average trade between country pair ij between 1980 and 1985 and the sixth matching variables captures the geographical distance between them. The distance variable is obtained from the CEPII Gravity Dataset and captures the population weighted great circle distance between countries.[38] The remaining matching variables are a set of dummy variables, also obtained from the CEPII Gravity Dataset, capturing common official language status, if the country pair share a border and if the country pair had a free trade agreement in 1985.

A.9.2 Matching Procedure

The exactness of matching between treated subjects and controls are determined by the bin sizes of each matching variable. Matching treated and controls on a narrow

[38] See Mayer and Zignago (2011) for a detailed description of the CEPII dataset.

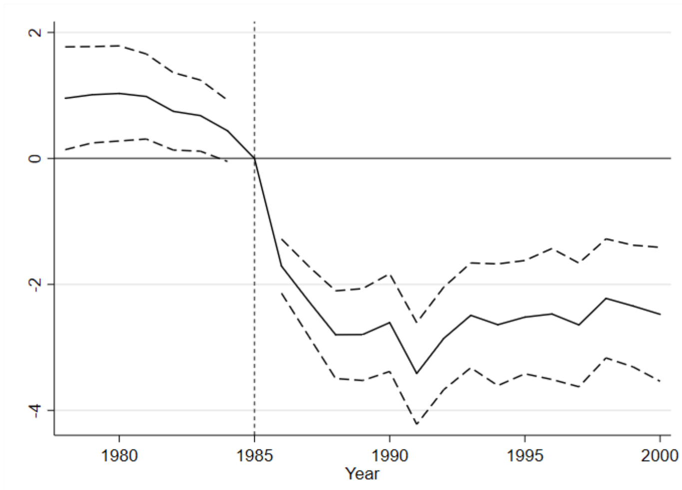
support will generate a closer match, but also a bias, as less treated country pairs will have a control country pair that it matches with.

To obtain a close proximity of matches while at the same time minimize the bias due to unmatched subjects, I proceed as follows: First, I remove observations of controls that have values of matching variables that lie significantly outside the support of the group of treated country pairs.[39] I then create as many bins as possible while still maintaining an acceptable level of matched treated subjects. I generate nine bins for the continuous variables and two bins for the dummy variables. The chosen set of bins leave me with 99 matched treated country pairs out of the total pool of 126 treated country pairs. The treatment effect is not particularly sensitive to slightly increasing or decreasing the number of bins.

[39] In practice, I remove observations where the value of a matching covariate is 20 percent lower than the smallest value among the group of treated country pairs or 20 percent larger than the largest value observed in the treatment group.

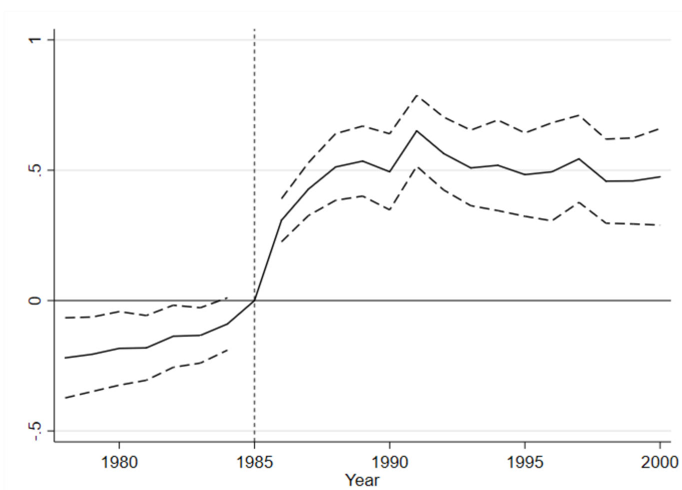
A.10 Robustness Results

Figure A.10: Route distance



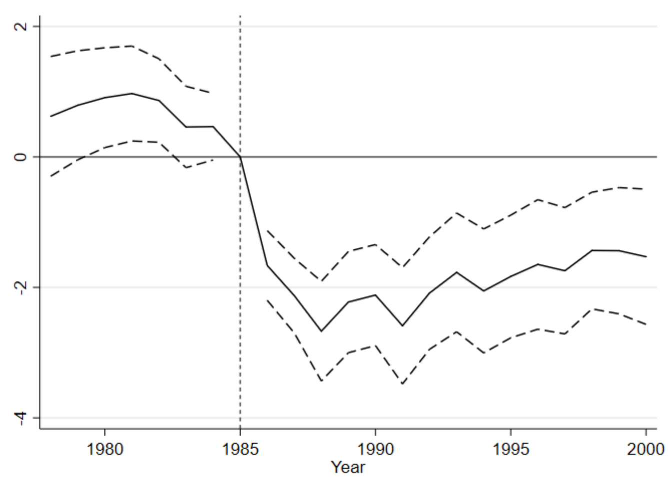
Effect with 95% confidence interval. SE clustered at country pair level. Fixed effects at country pair and year level. 1985 = base year. Route distance is measured as the geographical distance between treated country pairs. This measurement include the distance needed to fly through hubs.

Figure A.11: Binary treatment



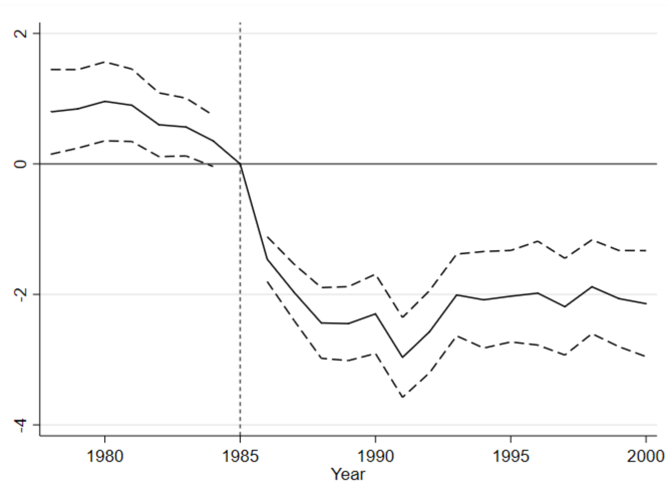
Effect with 95% confidence interval. SE clustered at country pair level. Fixed effects at country pair and year level. 1985 = base year.

Figure A.12: Goods not typically transported by air



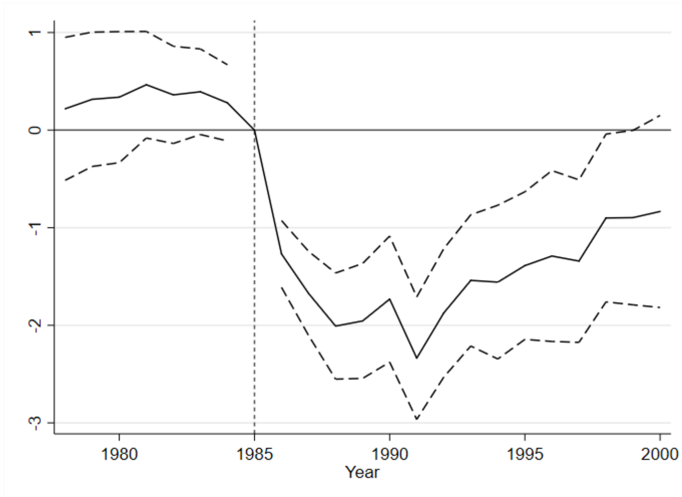
Effect with 95% confidence interval. SE clustered at country pair level. Fixed effects at country pair and year level. 1985 = base year. A good is defined not typically transported by air if less than 20 percent of the value of trade of that good between the EU and East Asia crosses the EU border by air.

Figure A.13: Gravity controls



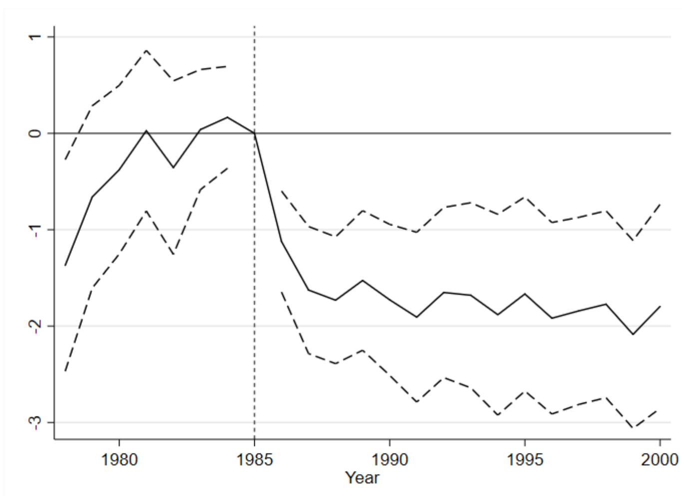
Effect with 95% confidence interval. SE clustered at country pair level. Fixed effects at country pair and year level. 1985 = base year. Gravity controls include GDP and free trade agreement status.

Figure A.14: Linear country-specific time trends



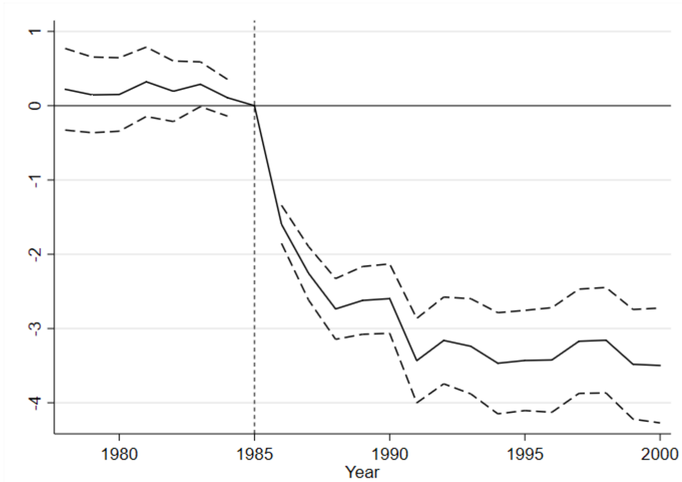
Effect with 95% confidence interval. SE clustered at country pair level. Fixed effects at country pair and year level. 1985 = base year.

Figure A.15: Country-time fixed effects



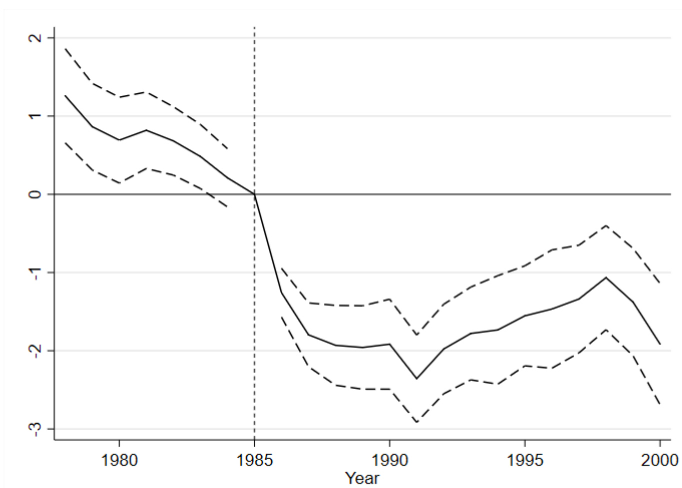
Effect with 95% confidence interval. SE clustered at country pair level. Fixed effects at country pair and year level. 1985 = base year.

Figure A.16: Small trade flows dropped



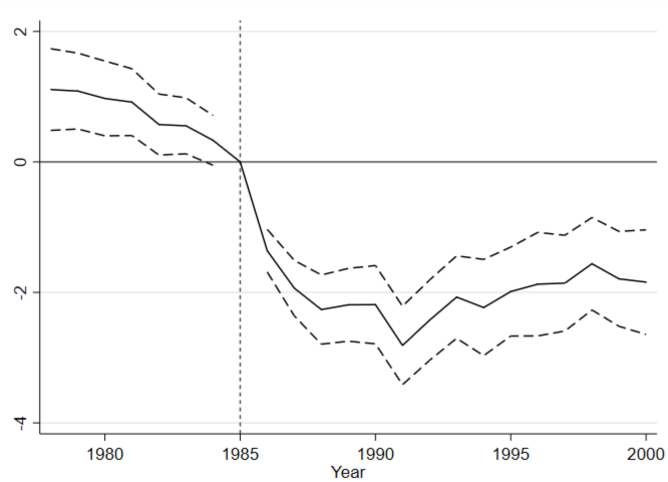
Effect with 95% confidence interval. SE clustered at country pair level. Fixed effects at country pair and year level. 1985 = base year. Country pairs with below average trade in 1985 are dropped from the sample.

Figure A.17: Poor countries included



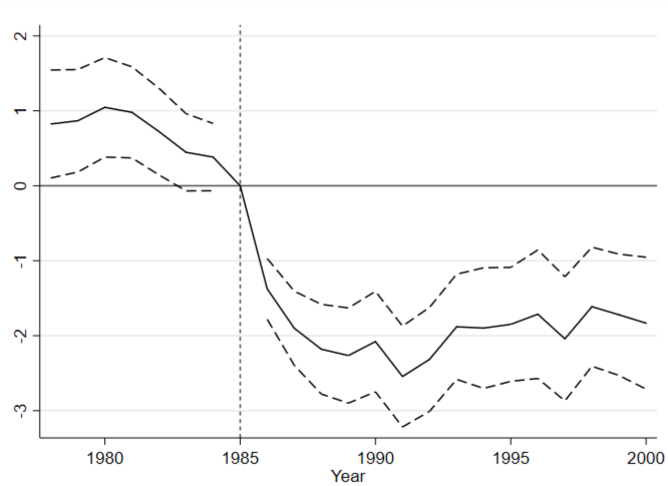
Effect with 95% confidence interval. SE clustered at country pair level. Fixed effects at country pair and year level. 1985 = base year. Sample includes all countries in the world instead of only countries that are richer than Mongolia in 1985.

Figure A.18: Including the Eastern Bloc



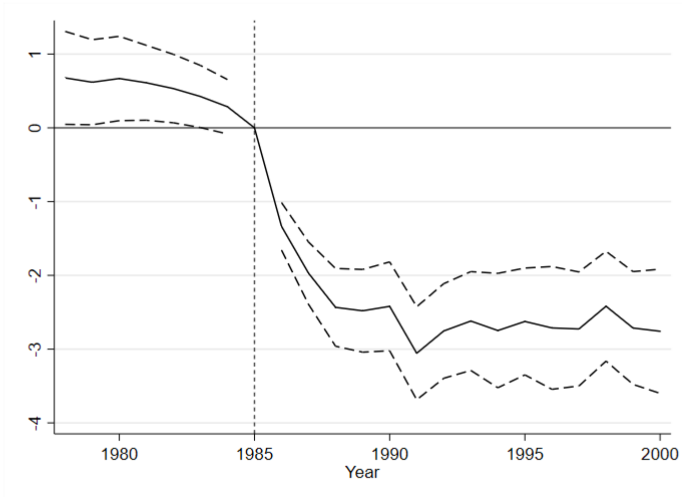
Effect with 95% confidence interval. SE clustered at country pair level. Fixed effects at country pair and year level. 1985 = base year. The Soviet Union and the Soviet satellite states are added to the sample.

Figure A.19: Dropping routes that cross or pass close to the Eastern Bloc



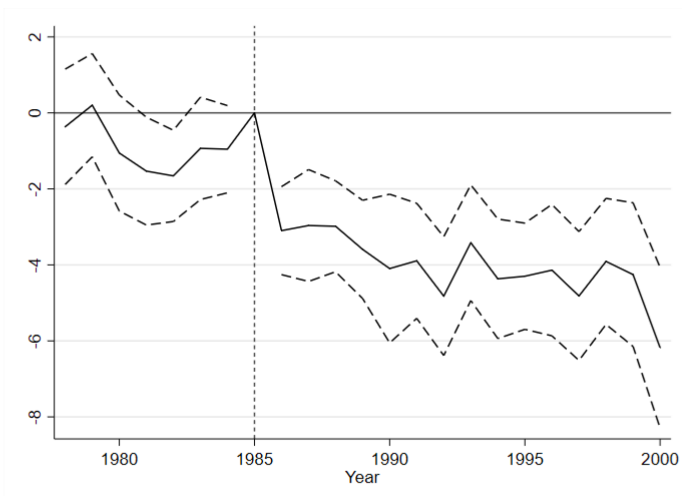
Effect with 95% confidence interval. SE clustered at country pair level. Fixed effects at country pair and year level. 1985 = base year. See Section A.11 in the Appendix for details on which routes that are dropped from the sample.

Figure A.20: Only trade between country pairs where at least one country belong to East Asia or Western Europe



Effect with 95% confidence interval. SE clustered at country pair level. Fixed effects at country pair and year level. 1985 = base year.

Figure A.21: Coarsened Exact Matching



Effect with 95% confidence interval. SE clustered at country pair level. Fixed effects at country pair and year level. 1985 = base year.

A.11 Routes Potentially Crossing the Eastern Bloc or China

As I lack information about the exact flight routes of airlines during the 1980s and 1990s I do robustness checks where I exclude a large set of country pairs that could have been connected by flights that were routed over or close to the Eastern Bloc or China. I group all countries into nine regions and exclude region pairs that contain country pairs that could have been connected by a flight that potentially would have crossed the airspace over the Eastern Bloc or China. Regions are shown in Figure A.2. The list of excluded region pairs are listed below.

Table 4: Routes Potentially Crossing the Eastern Bloc or China

East Asia	Western Asia
Southeast Asia	Western Asia
Africa	East Asia
Africa	Southeast Asia
Western Europe	Western Europe
Africa	Western Europe
Western Asia	Western Europe
East Asia	North America
North America	Western Asia
North America	Southeast Asia
Southeast Asia	Western Europe

These region pairs contain 913 country pairs which is approximately two fifths of the total number of country pairs in the data.

A.12 Trade between US/Canada and East Asia

Figure A.22: Trade between Treatment Group vs. US/Canada and East Asia