Networks and Trade: evidence from the Jewish Diaspora *

Gabriel Felbermayr[†] Lisandra Flach [‡]

March 7, 2009

Abstract

Recent literature finds that informal networks are quantitatively important in explaining the cross-country patterns of trade. We check the robustness of this result by looking at the Jewish community. Analyzing the effect of the Jewish Diaspora on trade is particularly interesting: (i) we build and uncover the Jewish population data from publications of the American Jewish Committee from 1899 to 2005, what allows a rich analysis both in panel and cross-sections; (ii) the creation of the state of Israel is an interesting natural experiment that has not been empirically exploited yet. Our empirical strategy follows a micro founded gravity model of trade. We address the issue of heteroskedastic errors in log-linearized models and use the fixed effects pseudo-maximum likelihood estimation as our main econometric strategy. Our results confirm the social network effects found by earlier literature in cross-sections and reveal robust trade creation effects in a panel. We show that the omission of controls for multilateral resistance terms leads to overestimation of the network effect. Dividing networks between direct and indirect networks, we show that most of the network effect is captured by the direct links. Finally, we estimate the tariff equivalent, confirm the results of the network channel and find no evidence of a decrease of the network effect over time.

Key-words: networks, international trade, gravity model, pseudo-maximum likelihood.

JEL classification: F12, F22

* We thank Christina Gathmann, Wilhelm Kohler, Eckhard Janeba, Davide Sala, Benjamin Jung, Jennifer Abel-Koch, Gonzague Vannoorenberghe and the participants of ETSG 2007, THE Hohenheim Workshop 2008 and the Mannheim and Tübingen PhD seminars for insightful suggestions. Lisandra Flach gratefully acknowledges financial support from the German Research Foundation. All remaining errors are ours.

† University of Hohenheim. Corresponding address: g.felbermayr@uni-hohenheim.de

‡ University of Mannheim and CDSE. Corresponding address: l.flach@mail.uni-mannheim.de

1 Introduction

Social networks operating across national borders might help to overcome the informal barriers to trade and help to explain the "mystery of the missing trade " (Rauch, 2001). The effect of cultural proximity and networks on trade might be even higher due to the diffusion of preferences across borders, as, for instance, when a group has a home bias or particular preferences and disseminates their consumption habits overseas (Combes et al(2005)).

We study the effects of informal networks on trade in the Jewish community, a group that exhibits a deep and abiding commitment to life in community and is known by its high investment in human capital and high skills related to international exchange. The analysis of the Jewish Diaspora is particularly interesting since: (i) we build and uncover the Jewish population data from publications of the American Jewish Committee from 1899 to 2005, what allows a rich analysis both in panel and cross-sections. (ii) the creation of the State of Israel is an interesting natural experiment that has not been empirically exploited yet.

We follow the Dixit-Stiglitz monopolistic competition model to derive the standard gravity equation, using bilateral imports of country i from country j, GDP of i and j and the bilateral freeness [1]. We address theoretically two additional issues: **1.** the preference parameter a_{ij}, in order to account for home bias in consumers' preferences; **2.** along with the Anderson and van Wincoop(2003) model, we apply the Novy (2008) model, recently used in Jacks, Meissner and Novy(2008), which allows part of the goods to be *non-tradable* and also corrects for multilateral resistance terms in a tractable way.

As an outcome of the model, the proximity measure affects trade in two ways: through the reduction of trade costs, τ_{ij}, and the diffusion of preferences, a_{ij}. The proximity measure, the network among Jews, is measured by the product of the share of Jews in a country pair i j and is fully consistent with the state of the art gravity literature (e.g., Anderson and van Wincoop (2003), Combes et al (2005) and Novy (2008)).

Our benchmark empirical strategy follows the Pseudo Maximum Likelihood (PML) estimation suggested by Santos Silva and Tenreyro (2006). We also report results using ordinary least squares (OLS) and the Tobit model.

Our results show that the omission of controls for multilateral resistance terms in the Ander-

[1] As discussed in Eaton and Kortum(2002) and Anderson and van Wincoop(2003), trade costs are not restricted to trade barriers such as tariffs and transportation costs: language barriers, non-tariff barriers and communication costs comprise important trade frictions.

son and van Wincoop (2003) gravity equation leads to overestimation of the network effect. Moreover, our estimations using the OLS and the Tobit model lead to inconsistent estimators. Dividing the sample into direct and indirect networks reveals that the direct networks capture most of the trade creation effects. Finally, we find no evidence of a decreasing effect over time of networks on trade.

The paper is divided as follows. Section 2 presents some stylized facts on Jewish history and traditions and provides a closer look at the data. Section 3 discusses the gravity model and the econometric approach. Section 4 shows the results for world trade, for the creation of the State of Israel and results over time using the Novy(2008) model. Section 5 offers concluding remarks. Results for the robustness check to the Rauch and Trindade(2002) study with the Rauch(1999) classification of goods and further results are found in the Appendix.

2 Stylized facts and data

2.1 Jewish Networks and Trade

Among the literature on international trade, social interactions and informal barriers to trade have been recently used to explain trade flows (see Guiso et al, 2005 and Combes et al, 2005). Within informal barriers, ethnic proximity is one of the most tractable to be theoretically modeled and empirically tested: Rauch and Trindade (2002) showed that Chinese networks can be easily proxied by the share of the representative ethnic group.

We study networks within a religious and cultural group, which is particularly interesting due to its the characteristics. Jews exhibit a deep and abiding commitment to life in community and build strong networks. In one of the most cited Jewish texts, the "Pirkei Avot " [2], Rabbi Hillel set a one line dicta that has characterized Jewish community for the past 2000 years: "*Al tifrosh min hatzibur* - Do not separate yourself from the community " .

The value to life in community and the membership in the same cultural and religious group created a network externality and the possibility to impose sanctions, which, according to Greif (1993), made it profitable for the Jewish merchants not to leave their religious network. Jews also have a long tradition in high skilled activities and have long sought occupations

[2] The Pirkei Avot means literally "Ethics of Our Fathers " and is composed of ethical maxims of the Rabbis of the Mishnaic period. It is part of the Mishna, a major work of Rabbinic Judaism and the first major redaction into written form of Jewish oral traditions.

in crafts and trade (Botticini and Eckstein, 2006). Ayal and Chiswick (1983) raise the discussion concerning the overinvestment on human capital by the Jews in the Diaspora, what is ratified by Botticini and Eckstein (2007): as merchants, the Jews invested more in education, “a pre-condition for the extensive mailing network and common court system that endowed them with trading skills demanded all over the world ” . Cultural values within the Jewish community and international exchange are closely related (Temin(1997), Mokyr(2002) and Botticini and Eckstein(2006)).

Figure 1 shows the distribution of the Jewish population through the twentieth century for some countries, selected according to the (highest) number of the Jews in absolute numbers in 2006 [3]. Three structural breaks are worth mentioning: 1. the events of the Second World War, which caused a massive redistribution of the Jewish population in the world (and for which data for most countries is not available); 2. the event of the creation of the state of Israel in 1948 and its particular migration inflow, not observed in other countries in the world (see Figure 2, plotted in million of Jews, for the Jewish population in Israel since the creation of the state); and 3. the second wave of migration from developing countries to Israel at the beginning of the 1980's. The significant migration flows and the specific characteristics of the Jewish community make the analysis of Jews living in Diaspora and in Israel an interesting question in the trade literature.

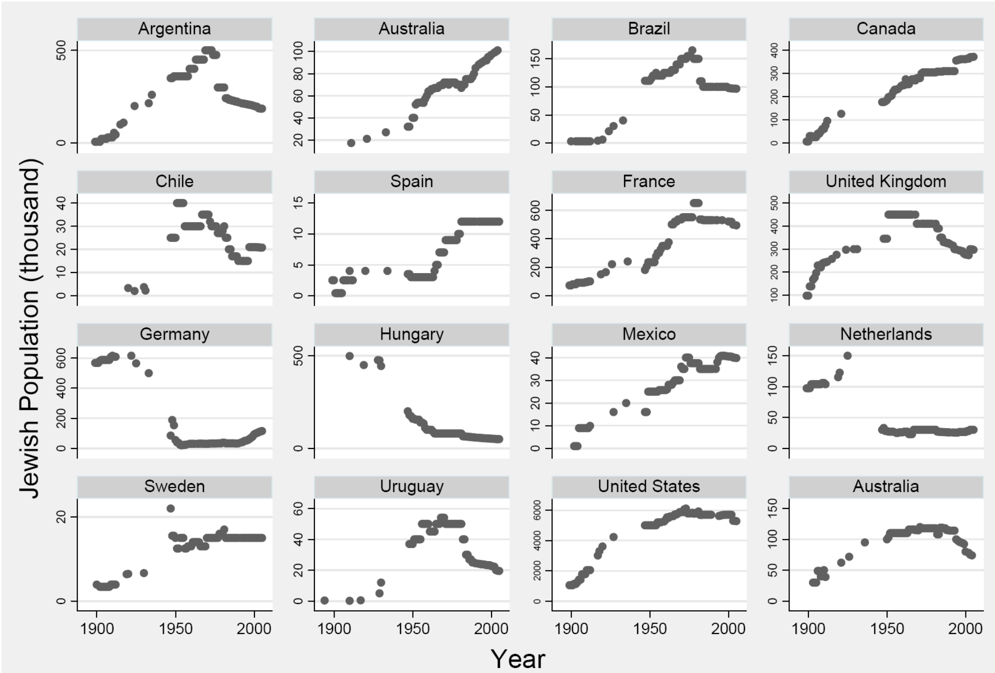
2.2 The creation of the State of Israel

The dreadful events of the Second World War and the creation of the State of Israel establish unique characteristics for the Jewish population in the years after War and provide us the opportunity to evaluate the effects of the redistribution of Jews on trade flows.

The creation of the State of Israel is an important event not expoited in the economics literature yet. There is no counterpart in the literature of such an abrupt and high inflow of an ethnic and religious group to a country as is the case of the Jews to Israel. Our dataset shows that, in the first decade after the creation of the State of Israel (1948-1958), the Jewish population in Israel rose from 750 thousand to almost two million Jews. The Jewish population

[3] The two countries with a large Jewish population missing in this figure are Israel and Russia. Both cases are plotted separately for their particular characteristics: Israel is plotted in Figure 2 and Russia and the Soviet Union in the Appendix for the Jewish population. There is data available for 110 countries, but many missing values before 1950 for most of the countries.

Figure 1: Jews in the World (1899-2005)



data in Israel is found in Figure 2 Appendix A.2 (s. also Appendix A.2 for further details on the data). Section 4.2 studies the effects of networks with Israel on trade.

2.3 The Jewish population data

Jewish population data comes from the publications of the American Jewish Committee - AJC (www.ajc.org). We build this dataset, available in the yearly volumes from the "American Jewish Year Book " from 1899 to 2005 for 110 countries, what allows to construct a rich panel data. What we observe in the data is the number of Jews in each country in each year, regardless the country of birth of the Jew.

The data renders an unbalanced panel: in each of the reports there are some missing values. For our subsample from 1951 to 2004 (the most used in the estimations), we observe for each year at least 75 countries, and on average 83 countries. When we take the share of the Jewish population, this average shrinks to 76, since for some countries we could not match the Jewish data with the total population data [4]. The complete table with yearly values of

[4]Countries (and cty code number) for which we could not match the Jewish population data with the available total population data from IMF: Yugoslavia (cty 188), Afghanistan (cty 512), Gibraltar (cty 823),

Jewish population mean, median and number of observations for the monadic data is found in Appendix A.

As a broad classification, the AJC considers as Jews in their data what they call the *core* Jewish population, which means, the numbers exclude non-Jewish members of Jewish households and other non-Jews of Jewish ancestry (s. Appendix A for a closer look on who is a Jew).

Historical estimates from AJC are based on several censuses and surveys, partly made available by the source country and in some cases with duplicated values. Always when feasible, the AJC provides a cross-matching of the different sources of data for the same Jewish population, what provides a check on the reliability of the data. The data for the period of intra-wars (First and Second World War) is imprecise and in most cases was not reported. Thus, we focus our analysis from 1948 on, when data was again reliable. Use use the data until 1948 only to perform simple tests on the gravity model with cross-sections for the period 1899-1948, since this is an interesting point to understand the migration flows and the links to social and cultural networks. [5].

See Appendix A for a complete description on the Jewish data and its collection.

2.4 Gravity data and descriptive statistics

We use trade data from the Direction of Trade Statistics - DOTS/IMF (www.imfstatistics.org/dot) for the period 1951-2005. In the Appendix we also do a robustness check to the Rauch and Trindade(2002) study using the NBER data recorded by Feenstra(2004) (s. Appendix C).

Data on GDP for the recent periods is taken from the World Development Indicators WDI/IMF; for the population, we use the IFS/IMF data. Our dummies proxies for information and trade costs come from CEPII - Centre d'Etudes Prospectives et d'Informations Internationales. Finally, data for the existance of FTA (Free Trade Agreement) is taken from the IMF's Direction of Trade Statistics for the years 1960, 1965, 1970,..., 2000 - the same data source used by Baier and Bergstrand (2007). Since in the panel data analysis we take 5 years average of the trade data, i.e. 1966-70, 71-75, ..., 1996-2000, we always include the FTA data from the

Turmekistan (cty 795), Uzbekistan (cty 927), Cuba (cty 928), Czechoslovakia (cty 934), Serbia and Montenegro (cty 965).

[5]The arquives from the AJC deliver yearly reports containing information on the Jewish population in the world. Although, the reports from the Second World War represent only estimates of the real data. It was possible to compute data on the Jewish population again by the end of the 1940's

former period, which means, 1965 for the period 66-70, 1970 for 71-75 and so on.

We report the summary statistics of the yearly data in Table 1 and the correlation matrix at 1% significance level in Table 2.

Table 1: DOTS trade data and regressors, yearly data (1951-2000)

Variable	Obs	Mean	Std.Dev.	Min	Max
$Imports_{ij}$	183,706	4,45 e+08	4,43 e+09	0	3,36 e+11
Jewish population i	183,706	189243	842388	20	6115000
Jewish population j	183,706	181886	823740.1	20	6115000
Total population i	183,706	4,21 e+07	1,26 e+08	231000	1,31 e+09
Total population i	183,706	4,62 e+07	1,38 e+08	223000	1,31 e+09
JSH_i	183,706	0,0165861	0,1077659	2,24e-08	0,9064885
JSH_j	183,706	0,0157032	0,104471	2,24e-08	0,9064885
$JSH_i * JSH_j$	183,706	0,0000737	0,0008457	1,75e-14	0,0278173
GDP_i	183,706	3,23 e+11	1,12 e+12	1,76 e+08	1,25 e+13
GDP_j	183,706	3,15 e+11	1,11 e+12	1,04 e+08	1,25 e+13
$CGDP_i$	183,706	8,944,461	12778,73	6,643,237	81003,84
$CGDP_j$	183,706	8,747,356	12653,03	6,643,237	81003,84
Distance	183,706	7,751,093	4,755,023	5,961,723	19772,34
Contiguity	183,706	0,0334908	0,1799149	0	1
Common Language	183,706	0,1575364	0,3643068	0	1
Former colony	183,706	0,0271841	0,1626199	0	1
FTA	103,234	0,0608520	0,2390599	0	1

Table 2: Correlation matrix at 1% significance level

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1. $Imports_{ij}$	1							
2. Jewpop1	0,1135*	1						
3. Jewpop2	0,1260*	-0,0171*	1					
4. $(GDP_i * GDP_j)$	0,5586*	0,1703*	0,1738*	1				
5. Distance	-0,0718*	-0,0261*	-0,0295*	-0,0085*	1			
6. Contiguity	0,1691*	-0,0082*	-0,0067*	0,0233*	-0,2602*	1		
7. Language	0,0285*	0,0551*	0,0461*	-0,0054	-0,1374*	0,1756*	1	
8. FTA	0,3234*	0,0131*	0,0148*	0,1077*	-0,3412*	0,2253*	0,0031	1

* Denotes significantly different from 0 at 1% level.

3 Model and Econometric Specification

3.1 Trade flows and trade costs: gravity revisited

We follow the Dixit-Stiglitz Krugman (Dixit and Stiglitz, 1977; Krugman, 1980) monopolistic competition model, particularly the Anderson and van Wincoop (2003) gravity equation, with a slightly modified utility function to account for home bias in consumers' preferences a_{ij} [6] [7]. We omit time subscripts for simplicity.

Market clearing condition and the solution for the scaled prices (s. complete derivation in Anderson and van Wincoop(2003) and Feenstra(2004)) yield the maximization problem:

$$c_{ij} = \frac{y_i y_j}{y_w} \left(\frac{1+\tau_{ij}}{a_{ij}} \right)^{1-\sigma} (P_i P_j)^{\sigma-1} \tag{1}$$

c_{ij} is the demand of country j of goods produced in country i (c.i.f. value of imports), σ the elasticity of substitution between varieties, a_{ij} the preference parameter, y_i and y_j income in countries i and j, y_w total world income, and τ_{ij} the standard ad valorem iceberg-type trade costs, with $\tau_{ij} > 0 \; \forall \; i \neq j$ [8]. Crucial assumptions for utility maximization are, besides the market clearing condition and the budget constraint, the assumption that τ_{ij} and a_{ij} are symmetric, i.e., $\tau_{ij} = \tau_{ji}$ and $a_{ij} = a_{ji}$ (s. Feenstra(2004)).

P_i and P_j account for importer and exporter country-specific effects, the multilateral resistance terms depicted by Anderson and van Winccop (2003). As the authors discuss, trade is determined by *relative* trade barriers. For a given bilateral barrier τ_{ij}, an increase in barriers from i and other trade partners causes a reduction in relative prices of goods from j and an increase in imports from j. Thus, P_i and P_j represent countries i and j resistance to trade with all other countries [9], such that $P_i^{1-\sigma} = \sum_j \frac{y_j}{y_w} a_{ij}^{\sigma-1} P_j^{\sigma-1} (1+\tau_{ij})^{1-\sigma}$.

[6] Due to the preference parameter a_{ij}, varieties do not enter symmetrically the CES-Utility function but are weighted by a_{ij}. Agents maximize $U_j = \left(\sum_{k=1}^{I} (a_{ij} c_{ij})^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$ subject to the budget constraint $\sum_{k=1}^{I} p_{ij} c_{ij} = y_j$, where I is the number of countries.

[7] We also test our hypothesis using the Novy(2008) model in section 4.3.

[8] This implies that only a fraction $\frac{1}{1+\tau_{ij}}$ arrives at the destination. Without information on trade within regions in a country, we also assume that $\tau_{ii} = 0$ and $\tau_{ij} > 0 \; \forall \; i \neq j$.

[9] In the monopolistic competition model, P_i represents a consumer index and depends on all bilateral resistances τ_{ij}. Although, as shown in Anderson and van Wincoop(2003), this is not a proper interpretation for P_i more generally. For instance, in the existance of different consumption preferences among countries, P_i no longer represents the consumer price index, since the border barrier includes a home bias. Thus, the authors refer to P_i as the "multilateral resistance terms " : bilateral trade, after controlling for size, depends on τ_{ij} relative to the product of P_i and P_j. Note that $P_j = (\sum_i a_{ji}^{\sigma-1} y_i p_{ji}^{1-\sigma})^{\frac{1}{1-\sigma}}$.

3.2 Trade costs and the proximity channel

Transportation costs τ_{ij} are composed of physical and political transport costs T_{ij} and of information costs $INFO_{ij}$ - the same structure was proposed by Combes et al (2005). The physical component of T_{ij} is composed of the distance between countries, D_{ij}, and their contiguity $CONT_{ij}$. As a political component of T_{ij} we use the existance of a free trade agreement (FTA) between countries i and j. Thus, T_{ij} assumes the structure $T_{ij} = e^{\bar{\delta}(1-FTA_{ij})+\gamma(1-CONT_{ij})}D_{ij}^{\bar{\lambda}}$. We use the network channel as a proxy for informal trade barriers, which is in our specification a component of the information cost $INFO_{ij}$. There is no consensus regarding the way through which networks could affect trade patterns; we follow Rauch and Trindade(2002) and use the product of the share of the Jewish population in a country pair i j, JSH_{ij}, as our proximity measure [10] [11].

Information costs have the structure $INFO_{ij} = e^{\bar{\vartheta}(1-LANG_{ij})}I(JSH_{ij})$, where the function $I(JSH_{ij})$ decreases the greater the magnitude of the network.

The preference parameter is specified for a representative agent as $a_{ij} = \varphi I(JSH)_{ij}$, $\varphi > 0$, which means, it depends on the share of jews in both countries [12]. Although, the literature on migration and network effects (e.g. Head and Ries, 2001, and Rauch and Trindade, 2002) shows that the effect of migrants is not consistently higher for imports than for exports, as also argued by Combes et al (2005), what implies that one should be cautious about the empirical relevance of the preference channel. Thus, we do not focus the analysis to disentanble the two effects (trade costs and preferences) on trade. Moreover, since our sample is large compared to the number of observations which include Israel as a trade partner, we can in some cases abstract from the preference channel [13]; the network effect through trade costs should in this case capture most of the effect. The preference channel might be especially interesting when we analyse trade only with Israel and the *direct* networks to Israel.

[10] We also perform the main results using $SJEW_{ij}$, the sum of the ethnic population in the country pair. The information cost in this case yields $INFO_{ij} = e^{\bar{\vartheta}(1-LANG_{ij})}SJEW_{ij}^{\mu}$. Even though results are mainly statistically significant controlling for fixed effects, the results using the sum of Jews in the country pair are less intuitive.

[11] We have tried to use the JSH_i and JSH_j separatelly to check whether results could be driven by the country of origin or destination of exports, but in these preliminary results there is no clear direction.

[12] We consider the fact that consumer might have a home bias and prefere locally produced goods, which happens specially due to persistance of consumption habits.

[13] It is less intuitive to think of preferences from Jews living in the US and in Germany, for instance. In those *indirect* networks, the information cost channel might be more relevant.

3.3 Pseudo-maximum likelihood estimation

Our gravity model follows equation (1). As we know from empirical applications, there exists no set of parameters which fits exactly the observations in the data. Thus, a stochastic version of equation (1), which accounts for deviations, can be written as:

$$c_{ij} = (y_i y_j)^{\bar{\psi}} a_{ij}^{\bar{\kappa}} e^{\bar{\delta}(1-FTA)+\gamma(1-CONT_{ij})} D_{ij}^{\bar{\lambda}} e^{\bar{\vartheta}(1-LANG_{ij})} I(JSH_{ij})^{\bar{\varsigma}} e^{\bar{\gamma_i} d_i + \bar{\gamma_j} d_j} \epsilon_{ij} \qquad (2)$$

where d_i and d_j are the dummies representing P_i and P_j that control for multilateral resistance terms, $\bar{\gamma_i}$ and $\bar{\gamma_j}$ the respective parameters and ϵ_{ij} an iid error term s.t. $E[\epsilon_{ij}|c, P, y, a, \tau] = 1$. Empirically, the omission of P_i and P_j in the gravity equation leads to biased estimates [14].
We use different ways to control for multilateral resistance terms both in cross-sections and in a panel and use the pseudo-maximum likelihood (PML) estimation suggested by Santos Silva and Tenreyro(2006) as our main econometric specification. We assume that the cost function can be linearized, as is shown in Henderson and Millimet(2008). The equation to be estimated using quasi-maximum likelihood follows:

$$c_{ij} = exp\left\{\bar{\psi} ln(y_i y_j) + \xi \mathbf{X}_{ij} + \bar{\varsigma} I(JSH_{ij}) + \bar{\gamma_i} d_i + \bar{\gamma_j} d_j\right\} + \epsilon_{ij} \qquad (3)$$

where $\mathbf{X}_{ij}$ is the vector of variables in τ_{ij} other than the network variable, ξ the vector of coefficients and $I(JSH_{ij})$ the measure of networks, which contains both the information and the preference channel. Note that $\bar{\varsigma} = (\sigma - 1)\varsigma$, for σ the elasticity of substitution [15].
The correct specification of the conditional mean, i.e., $E[c_{ij}|Z] = expz_i'\hat{\beta}$ for z a set of regressors, is the only assumption required for consistent estimation of equation (3) (a result shown in Gourieroux, Monfort and Trognon(1984) and Wooldridge, 2002b). Note that c_{ij} does not need to have a Poisson distribution: the estimator is a Poisson PML estimator which solves $max_\beta \sum_{i=1}^{n} l_i(\beta)$. The unique solution of $max_\beta E[l_i(\beta)]$ is ensured by rulling out perfect multicollinearity [16].

[14] In the study of Chinese networks, Rauch and Trindade(2002) omit the multilateral resistance terms.

[15] This makes harder the interpretation of $I(JSH_{ij})$ using the Rauch(1999) classification of goods. Rauch and Trindade(2002) use this classification of goods dividing trade in differentiated, homogeneous and reference priced goods. Although, the interpretation of their coefficients strongly relies on the elasticities σ, what is omitted in their analysis. We discuss their results in Appendix C.

[16] Note that the Hessian $H(\beta) = -\sum_{i=1}^{n} exp(x_i'\beta)x_i x_i'$ is negative definite for all x and β, what ensures the uniqueness of the maximum. Some of the parameters might be not identified, as discussed in Santos Silva and Tenreyro (2008). Thus, the parameters which cause perfect multicollinearities and complete separation are dropped to insure identification of β.

We also estimate equation (2) using OLS and Tobit and check the adequacy of the results (s. results in Appendix B and C). The Tobit model has an important advantage over OLS for trade data: if there exists many observations on the threshold b, OLS would lead to inconsistent estimators. For X the set of regressors and $P(.)$ the conditional probability, OLS estimates only $E[c|X, c > b]$, while the Tobit model estimates $E[c_{ij}|X] = P(c_{ij} = b|c_{ij})b + P(c_{ij} > b|c_{ij})E[c_{ij}|X, c_{ij} > b]$. Thus, OLS estimates only the expected value of observations above the threshold b. Moreover, inconsistency of OLS might result from a $E[c_{ij}|X]$ non linear in X.

Despite this advantage over OLS for trade data, the Tobit model, used by Rauch and Trindade (2002) among others, has been highly criticized in the most recent literature dealing with the gravity model. In the presence of heteroskedasticity and nonnormal residuals, Tobit leads to inconsistent estimators of the parameters, what we can suspect to be the case of trade data (s. Santos Silva and Tenreyro (2006)) [17].

Consider equation (2): the validity of the specification depends whether ϵ_{ij} is statistically independent on all regressors. Thus, under heteroskedasticity, the Jensen's Inequality, i.e. $E(\log c_{ij}) \neq \log E(c_{ij})$, implies that the interpretation of the elasticities of the log-linearized model is incorrect and the model should be estimated using the multiplicative form (Santos Silva and Tenreyro(2006), Handerson and Millimet (2008)) [18]. This is true since the nonlinear transformation of the dependent variable by log-linearization changes the properties of the error term: for X the set of regressors, $E[ln(\epsilon_{ij})|X]$ depends on the shape of $E[\epsilon_{ij}|X]$. Results of the log-linearized version using OLS are consistent estimates of $E[ln(c_{ij})|X]$ only if $E[ln(c_{ij})|X]$ is a linear function of the regressors.

To make our results in line with this important critic on the heteroskedastic errors raised by Santos Silva and Tenreyro (2006), we use the pseudo-maximum-likelihood estimation as our main econometric strategy. We check whether the OLS and the Tobit model are correctly specified using the RESET test from Ramsey(1969), as in Santos Silva and Tenreyro(2006) (s. estimations for OLS and Tobit in the Appendix).

[17] For trade flows c and a set of regressors x, as $E[c|x]$ reaches its lower bound, dispersion around the mean tends to be small. The variance $V[c_i|x]$ tends to vanish as $c \to 0$, while $V[c_i|x]$ is higher for higher values of c ($E[c|x]$ has greater dispersion). But there is also no reason to assume that $V[c_i|x]$ is proportional to c_i. Therefore, errors in trade data are generally heteroskedastic, as extensivelly discussed in Santos Silva and Tenreyro(2006).

[18] The Tobit model proposed by Eaton and Tamura(1994) and applied in Rauch and Trindade(2002) solves the problem of observations on the threshold b. But, as in the OLS model, under heteroskedasticity it also leads to inconsistent estimates of the parameters.

3.4 Trade Creation

More important than to evaluate the outcome coefficient of the JSH_{ij} variable is to measure the magnitude of the trade creation effects of the Jewish population. In the Rauch and Trindade (2002) study, a minority of countries capture most of the network effects. They divide the sample and estimate the coefficients separately. We follow their strategy and divide our observations in two samples, corresponding to the country pairs with the "relatively large " share of Jews in both countries and the "relatively small " share of Jews. We take the median of the JSH_{ij} for the period in question using the monadic data.

The next step is to create a dummy, called $DCORE$, that equals 1 in case both trading countries are above the median and 0 otherwise. Instead of estimating with the variable JSH_{ij}, the model is estimated using two different groups: $JSHSmall_{ij} = JSH_{ij} * (1 - DCORE)$ and $JSHLarge_{ij} = JSH_{ij} * (DCORE)$, corresponding, respectively, to the countries with a large and a small shares of Jews in both countries, which gives us new coefficients. [19]

The trade creation effect is measured by: $100\left[\exp(\overline{JEWSHARE} * \varpi_m) - 1\right]$, where $\overline{JEWSHARE}$ is the mean of the JSH_{ij} in the two different groups and ϖ is the corresponding coefficient estimated from the two variables $JSHSmall$ and $JSHlarge$. When we use the complete sample, we use the mean of JSH_{ij} to calculate the trade creation effects.

[19] Observations for the countries with small share of Jews are treated as an undifferentiated mass of zeroes. Thus, the coefficient from the regressor JSH_{ij} should be similar to the coefficient from $JSHLarge_{ij}$, as argued by Rauch and Trindade (2002).

4 The effects of social networks on trade: preliminary results

4.1 Effects of JSH_{ij} on total trade flows

Results for world trade flows using the DOTS trade data and the PML estimations are reported on Table 3 [20]. We take 5 years average from the data to control for missing values and data heterogeneity, which yields 10 periods: 1951-1955, ..., 1996-2000. It is computationaly cumbersome to estimate a panel over 50 years for 110 countries using PML: if we control for time-varying importer and exporter fixed effects, this would yield 50*2*110 dummies. Thus, besides missing values and data heterogeneity, there is also a computational advantage of taking five years average of the data [21].

The dependent variable in this model follows equation (3). We estimate a pooled PML but use the fixed effects PML with time dummies as our preferred specification. Results are reported with the robust standard errors in all cases.

Results are reported in Table 3. Column (1) shows the results for the pooled PML model, which yields non significant results for the network channel JSH_{ij}. Although, the pooled PML model relies on the assumption that the unobserved effect is independent from the regressors and treat the data as a long cross-section. For z_{ijt} a set of regressors and n_{ij} an unobserved effect, the pooled model assumes that $E[c_{ijt}|z_{ijt}, n_{ij}] = n_{ij} exp z'_{ijt}\hat{\beta}$, which is the strict exogeneity assumption, and that $E[n_{ij}|z_{ijt}] = E[n_{ij}] = 1$. Since our main interest lies on the time-varying regressors, we use the fixed effects PML estimator as our benchmark strategy, which allows for arbitrary dependence between n_{ij} and z_{ijt}.

Columns (2) to (5) report the results for the fixed effects PML. z_{ijt} contains time dummies in columns (2) and (4). In columns (2) and (3) we report results for the proximity channel JSH_{ij}. We use the mean of the whole sample JSH_{ij} to calculate the trade creation effects attributable to the Jews (a comparison between the mean and the median for each year is available in Table 6 in Appendix A). For the complete panel, the mean is 0,000068. We use the FTA for comparison, given the relevance of this variable for total trade flows: in Table 3, the first three columns reveal a trade creation effect from the FTA of, respectively, 32.9%,

[20] We also allow GDP per capita to enter our final model. With non-homothetic preferences, there would be a natual role for per capita income in gravity equations.

[21] As reported by the data source, the AJC, for some particular countries it would be better to report a range (with maximum and minimum value) of the Jewish population in the country, since it is for some cases difficult to estimate the exact measure. Thus, taking 5 years average smooths some possible under or overestimations of the Jewish population.

23.6% and 23.6%.

FTA is always positive and significant, which is the expected effect. Distance, GDP, language and contiguity have the expected signs and magnitudes similar to the usually reported in the gravity models of trade. Period dummies are in most cases significant.

In columns (4) and (5), the countries are divided according to the criteria described in section 3.4. Even though the coefficient is smaller for the $JSHLarge_{ij}$, this group capture most of the trade creation effects.

The estimations with the fixed effects specification and period dummies reported in columns (2) and (4) represent our benchmark results. Trade creation for JSH_{ij} amounts 0.84%. One could argue that this is a rather small result comparing to the at least 60% trade creation found in the Rauch and Trindade (2002) for the Chinese group. Although, we argue that the values of trade creation in Table 3 are plausible for the relatively smaller group under study. Moreover, the results reported in Rauch and Trindade (2002) are subject to two concerns: 1. the estimators might be biased due to the omission of the multilateral resistance terms, what we account for in our model [22]; 2. their Tobit gravity equation might have heteroskedastic errors, what is a problem not only of efficiency, but also of model misspecification (s. discussion in Santos Silva and Tenreyro(2006)). For the PML estimation results, we only report results controlling in some way for multilateral resistance terms - if we do not control for those terms, omitted in Rauch and Trindade(2002), the trade creation effects of the Jewish networks approximately doubles.

For comparison, we report results for the log-linearized version of equation (2) in Table 8 (Appendix B) as well as for the Tobit model in Table 9 (Appendix B). Both models confirm the results from Table 3. The effect of networks on trade is higher with the log-linearized model and the Tobit model, in comparison to the PML estimation. Although, the RESET test reveals that the OLS and the Tobit model suffer from misspecification.

One important concern of our model is sequential moment restrictions: past values of JSH_{ij} might help to predict trade. If this is the case [23], we could solve the exogeneity problem including lags in the model. Results show that JSH_{ijt-1} has a smaller effect on trade then JSH_{ijt}, but the significance of the results do not change.

[22] We also estimate the model with time-varying country-fixed effect. Although, besides the fact that we loose many degrees of freedom, the time varying country effects are mainly not significant and yield similar trade creation effects comparing to the results reported in Table 3.

[23] z_{ijt} would be correlated with ϵ_{ijt}.

Table 3: Panel using PML. Period 1951-2000 (five years average).

Dep. variable: c_{ij}	(1)	(2)	(3)	(4)	(5)
JSH_{ij}	-12.66	122.2**	207.5***		
	(18.20)	(55.66)			
$JSHLarge_{ij}$				86.06**	144.6***
				(42.74)	(0.00621)
$JSHSmall_{ij}$				483.1**	772.0***
				(190.8)	(258.1)
Distance	-0.616***				
	(0.0246)				
Log $(GDP_i * GDP_j)$	0.761***	1.103***	1.990***	0.940***	0.940***
	(0.0125)	(0.118)	(0.0442)	(0.0156)	(0.0156)
Log $(CGDP_i * CGDP_j)$	0.0271***	0.393***	1.233***	0.396***	
	(0.0176)	(0.113)	(4.46e-06)	(0.113)	
Language	0.411***				
	(0.0585)				
Contiguity	0.140***				
	(0.0546)				
FTA	0.193***	0.236***	0.329***	0.239***	0.371***
	(0.0546)	(0.0506)	(0.0205)	(0.0505)	(0.0588)
period 3	-1.236***	-0.186		-0.188	
	(0.0921)	(0.271)		(0.271)	
period 4	-1.774***	-0.696***		-0.698***	
	(0.100)	(0.189)		(0.189)	
period 5	-1.127***	-0.0736		-0.0752	
	(0.102)	(0.170)		(0.170)	
period 6	-1.224***	-0.0938		-0.0949	
	(0.108)	(0.111)		(0.110)	
period 7	-1.559***	-0.408***		-0.409***	
	(0.114)	(0.0745)		(0.0745)	
period 8	-1.156***	-0.00861		-0.00900	
	(0.116)	(0.0577)		(0.0576)	
period 9	-1.080***	0.0655**		0.0644**	
	(0.120)	(0.0291)		(0.0291)	
period 11	-0.777***	0.331***		0.331***	
	(0.122)	(0.0197)		(0.0197)	
Constant	-16.07***				
	(0.566)				
Country effects	yes	no	no	no	yes
Period dummies (P)	yes	yes	no	yes	no
option fixed effects	no	yes	yes	yes	yes
Trade creation (JSH_{ij})		0.84%	1.42%		
Trade creation ($JSHLarge_{ij}$)				3.16%	1.87%
Trade creation ($JSHSmall_{ij}$)				0.23%	0.14%
Trade creation FTA	19.30%	23.60%	23.60%	23.90%	37.10%
Observations	26188	22159	22804	22159	22159
Country pairs		3175	3175	3175	3175
Log likelihood	-1.876e+12	-3.644e+11	-5.248e+11	-3.602e+11	-5.247e+11

The trade creation effect in columns (2) and (3) are calculated with median (s. section 3.5.)
(ii) Mean of $JSHLarge_{ij}$ and $JSHSmall_{ij}$, respectively: 2.16e-04 and 2.95e-06.

4.2 Direct vs. indirect networks and the creation of the State of Israel

We create an additional measure of *direct* and *indirect* links to check the relevance of networks with Israel. Direct links are defined as networks in which Israel is either country i or j [24]. The hypothesis is that direct links have a higher effect on trade, through both the preference channel and the information channel. The measure of *direct* networks is created in a similar fashion to the two groups of countries shown in 3.4. $JSHdir_{ij} = JSH_{ij} * (dir)$, for dir a dummy equal to 1 if i or j are Israel and $JSHindir_{ij} = JSH_{ij} * (1 - dir)$ otherwise.

Results for the direct and indirect links are reported in columns (1) and (2) in Table 5. In column (2) we control for multilateral resistance terms and results for the direct networks with Israel yield a trade creation effect of 24%. Column (1) reproduces the same regression model but with period dummies. In this case, the effect of the indirect networks vanishes: one possible way to interpret this last result is to think that direct vs. indirect links could help in a very crude way to disentangle the preference and the trade cost channels, and that the preference channel of the Jewish networks dominates the trade cost channel.

In columns (3), (4) and (5), we look only at the *direct links* to Israel. Thus, we keep only the observations for which one of the countries is Israel. Looking only at the links to Israel is particularly interesting given the characteristics of this country: as already mentioned in subsection 2.2., the creation of the State of Israel offers an interesting experiment and, after its creation, the high inflow of Jews (shown in Appendix A) might be responsible for the high effects of the direct links found in columns (1) and (2).

Column (3) shows the trade creation effects of networks JSH_{ij} on trade with Israel. In column (4), the sample is divided between *strong* ($JSHLarge_{ij}$) and *weak* ($JSHSmall_{ij}$) networks. Even though the coefficient for $JSHSmall_{ij}$ is higher, its mean is much smaller and, thus, the trade creation effect of the group $JSHLarge_{ij}$ is higher, as expected.

Finally, in column (5) we add a dummy to control for political relations with Israel. A closer look at the first two decades after the creation of the State of Israel reveals that results from columns (4) and (5) might be biased due to omitted variables: specially in the first two decades after the creation of the State of Israel, many countries participated in a boycott to Israelian products. Thus, we include country votes at the United Nations as a proxy

[24] As a robustness check, we also include the United States in the direct links, given the magnitude and importance of the Jewish population in this country. The coefficients are slightly higher, but the trade creation effect remains close to previous results.

for political relations with Israel. This dataset from the United Nations is available for all countries in our sample and covers the complete period under study [25]. Results for the UN votes (5) are significant and positive, as expected, and the effect of the JSH_{ij} reduces with the inclusion of the dummy.

For the specification similar to the ones reported in (1) and (2), we have also included $[JSH_{ij} * (1 - dir)]^2$ as a quadratic term, along with $JSHdir_{ij}$ and $JSHindir_{ij}$, to capture diminishing returns (s. Rauch and Trindade(2002)). Although, we found no evidence of the significance of the coefficient.

Table 4: Direct and indirect links and trade with Israel. Dep. variable: c_{ij}.

Dep. Variable: c_{ij}	World Trade		Trade with Israel		
	(1)	(2)	(3)	(4)	(5)
Log $(GDP_i * GDP_j)$	1.109***	2.009***	3.5721***	2.917***	2.881***
	(0.119)	(0.0441)	(0.118)	(0.131)	(0.118)
Log $(CGDP_i * CGDP_j)$	0.401***	1.252***	2.5794***	2.421***	2.310***
	(0.114)	(0.0511)	(0.113)	(0.132)	(0.113)
FTA	0.237***	0.330***	-0.1051***	-0.206***	-0.190***
	(0.0506)	(0.0172)	(5.74e-05)	(5.74e-05)	(5.74e-05)
Period 3	-0.190		-0.186	-1.574***	-0.188
	(0.271)		(0.271)	(0.334)	(0.271)
Period 4	-0.699***		-0.696***	-1.603***	-0.698***
	(0.189)		(0.189)	(0.234)	(0.189)
Period 5	-0.0763		-0.0736	-0.895***	-0.0752
	(0.171)		(0.170)	(0.205)	(0.170)
Period 6	-0.0955		-0.0938	-0.588***	-0.0949
	(0.111)		(0.111)	(0.133)	(0.110)
Period 7	-0.408***		-0.408***	-0.651***	-0.409***
	(0.0745)		(0.0745)	(0.0830)	(0.0745)
Period 8	-0.00798		-0.00861	-0.234***	-0.00900
	(0.0577)		(0.0577)	(0.0621)	(0.0576)
Period 9	0.0659**		0.0655**	-0.108***	0.0644**
	(0.0292)		(0.0291)	(0.0283)	(0.0291)
UN votes					0.395***
					(0.0952)
$JSHdir_{ij}$	119.3**	195.1***			
	(56.41)	(35.40)			
$JSHindir_{ij}$	1437	5065***			
	(1622)	(1540)			
JSH_{ij}			104.34***		74.18***
			(55.66)		(46.43)
$JSHLarge_{ij}$				87.49***	
				(42.74)	
$JSHSmall_{ij}$				519.6***	
				(258.1)	
Obs.	22159	22159	723	723	723
Number of pairs	3175	3175	102	102	102
Log-likelihood	-3.604e+11	-4.775e+11	-1.703e+09	-1.646e+09	-1.703e+09

[25] We have also created a dummy for the Arab Liga, the countries which leaded the trade boycott with Israel. Although, using the UN votes offers a more complete analysis.

4.3 The Novy(2008) model and trade costs over time

Novy(2008) proposes a tractable way to correct for time-varying multilateral resistance terms in a model that allows part of the goods to be non-tradable. The model was recently applied in Jacks, Meissner and Novy (2008). We use it as an alternative specification to Anderson and van Wincoop (2003).

Instead of the theoretical constructs P_i and P_j as in Anderson and van Wincoop (2003), Novy(2008) uses the tractable measure $y_i - x_i$ (output minus exports) for countries i and j to control for multilateral resistance terms, which is captured directly from the data. As a drawback of the model, we need to use export data instead of import data because of the measure $y_i - x_i$.

Details on the model are found in Appendix D.

We represent the Novy(2008) gravity equation (s. equation 9 in Appendix D) in terms of the tariff equivalent, ψ, such that $\psi_{ij} = \frac{1}{1-\tau_{ij}} - 1$. Under symmetry, $\tau_{ij} = \tau_{ji} = \left(\frac{x_{ij}x_{ji}}{\theta_i(y_i-x_i)\theta_j(y_j-x_j)}\right)^{\frac{1}{2\sigma-2}}$, where θ_i is the share of tradable goods in country i.

We set the values for the parameters θ and σ suggested in Jacks, Meissner and Novy(2008) and write the tariff equivalent ψ_{ij} as a function of all trade costs τ_{ij} :

$$\psi_{ijt} = exp\{\beta_0 + \beta_1 JSH_{ijt} + \beta_2 LANG_{ij} + \beta_3 CONT_{ij} + \beta_4 COL_{ij} + \beta_5 FTA_{ijt} + \beta_6 lnD_{ij}\} + \epsilon_{ijt} \quad (4)$$

where language $LANG_{ij}$, contiguity $CONT_{ij}$, colonial relationship COL_{ij} and distance D_{ij} are time-invariant regressors and ϵ_{ijt} an error term.

In our data, a check for the correlation between ψ_{ij} and τ_{ij} showed that, at 1% significance level, correlation is nearly 0.95. Thus, using ψ_{ij} or τ_{ij} should leave the regressors unaffected, as is the case in Jacks, Meissner and Novy(2008). Moreover, ψ_{ij} is more intuitive to interpret than τ_{ij}: the coefficients are percentage point changes in the tariff equivalent in response to changes in regressors. We show the results for the tariff equivalent following equation (4). The hypothesis is that, the higher the proximity channel JSH_{ij}, the lower the tariff equivalent ψ_{ij}.

Results using cross-sections over time yield richer results than time effects in a panel, since we can capture, with the robust standard erros, the effects over time of the time invariant gravity regressors.

We report results for World trade and trade with Israel over time in Tables (5) and (6), respectively. P1-P10 refers to the 10 cross-sections for the 5 years averaged data: P1=1951-55, P2= 1956-60, ..., P10= 1996-2000. All results are reported with the robust standard erros. We find significant results for the JSH_{ij} on trade over time, and find no evidence of a decreasing effect of the network on trade over time. The effect of JSH_{ij} on ψ_{ij} seems to increase over time for World trade. For trade with Israel there is no clear pattern once we control for political relations with the country.

Table 5 shows that the effects of the network channel persists over time and has always a negative and significant effect on the tariff equivalent, what confirms our hypothesis. The other variables mainly confirm the hypothesis of the gravity model: higher distance increases the tariff equivalent, while contiguity, colony and FTA decreases the tariff equivalent. The only exception is language, which is positive in the period 1950-1970 and in two cases significant. From 1970 to 2000, the effect of language on trade costs is as expected.

Table 6 reports the results for the fixed effects PML model for trade with Israel. Not controlling for political relations with Israel could lead to biased results, as already argued for Table 4, column 5. Thus, besides the standard gravity model with the network channel, we also use the UN votes to evaluate the effects of networks with Israel over time. The pattern is similar to World trade without controlling for political relations. Once we control for political relations, the pattern over time is unclear, even though one could argue that it follows an inverted u-shape effect over time.

Rauch and Trindade(2002) have already speculated on the effects of networks over time: they argued that better communication technology, the spread of English as the common business language and stronger international institutions could be a reason for a smaller effect of the Chinese networks on trade over time - although, with only two cross-sections they were not able to check the validity of the hypothesis.

Table 5: PML estimation for 10 periods (1951-2000). Dependent variable: ψ_{ij}. WORLD TRADE

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Dist	0.293***	0.313***	0.377***	0.378***	0.375***	0.359***	0.340***	0.288***	0.205***	0.229***
	(0.0195)	(0.0175)	(0.0203)	(0.0212)	(0.0191)	(0.0203)	(0.0207)	(0.0239)	(0.0274)	(0.0190)
Cont	-0.533***	-0.317***	-0.266***	-0.138**	-0.0359	0.0998	-0.222**	-0.269***	-0.400***	-0.211***
	(0.113)	(0.0919)	(0.0900)	(0.0676)	(0.102)	(0.122)	(0.0863)	(0.0587)	(0.0600)	(0.0455)
Lang	0.107***	0.0196	0.150***	0.00708	-0.106**	-0.0950*	-0.0175	-0.104*	-0.200***	-0.0849**
	(0.0406)	(0.0392)	(0.0455)	(0.0450)	(0.0467)	(0.0531)	(0.0544)	(0.0606)	(0.0511)	(0.0421)
Col	-0.803***	-0.763***	-0.838***	-0.683***	-0.619***	-0.485***	-0.618***	-0.489***	-0.403***	-0.298***
	(0.114)	(0.109)	(0.0756)	(0.0637)	(0.0551)	(0.104)	(0.0971)	(0.0606)	(0.0552)	(0.0479)
JSH	-35.32***	-28.91*	-53.39**	-69.02***	-69.20***	-93.78***	-102.9***	-88.65***	-120.6***	-77.65***
	(10.70)	(17.18)	(24.77)	(15.58)	(12.54)	(15.37)	(15.49)	(12.65)	(19.59)	(14.18)
FTA			-0.550***	-0.465***	-0.206	-0.400***	-0.478***	-0.497***	-0.687***	-0.298***
			(0.0485)	(0.0458)	(0.185)	(0.0932)	(0.0572)	(0.0546)	(0.0461)	(0.0387)
Const	-1.387***	-1.520***	-2.113***	-2.231***	-2.329***	-2.233***	-2.040***	-1.780***	-1.062***	-1.631***
	(0.174)	(0.158)	(0.183)	(0.189)	(0.167)	(0.178)	(0.184)	(0.211)	(0.243)	(0.164)
Obs	2277	2832	2522	2334	2516	2620	2908	2158	2332	2350

Estimations with robust standard errors. Cross-sections for the 5 years averaged data.

*, **, ***, indicate significance of the coefficient at the 1%, 5% and 10% level, respectively.

Table 6: PML estimation for 10 periods (1951-2000). Dependent variable: ψ_{ij}. TRADE WITH ISRAEL

	P1		P2		P3		P4	
JSH_{ij}	-56.85***	-91.33***	-35.87*	-38.84**	-52.03**	-44.25*	-65.24***	-60.55***
	(15.43)	(12.81)	(19.36)	(16.38)	(26.23)	(25.38)	(18.86)	(17.87)
UN votes		-1.238***		-2.107***		-0.570		-1.189**
		(0.376)		(0.449)		(0.590)		(0.604)
Obs	91	63	102	86	96	88	92	88

	P5		P6		P7		P8	
JSH_{ij}	-72.03***	-59.11***	-127.8***	-89.58***	-151.4***	-82.28***	-117.3***	-42.79***
	(20.95)	(18.29)	(33.08)	(22.86)	(33.24)	(20.17)	(27.93)	(13.61)
UN votes		-3.103***		-2.337***		-2.023***		-1.744***
		(0.663)		(0.266)		(0.247)		(0.320)
Obs	96	94	98	96	106	104	90	88

	P9		P10	
JSH_{ij}	-122.7***	-25.32	-102.6***	-13.18
	(28.06)	(20.88)	(39.04)	(22.77)
UN votes		-1.571***		-1.719**
		(0.278)		(0.744)
Obs	94	92	96	92

Estimations with robust standard errors. Cross-sections for the 5 years averaged data.

*, **, ***, indicate significance of the coefficient at the 1%, 5% and 10% level, respectively.

5 Final Remarks

In this paper we have shown the effects of a religious group on trade through the diffusion of preferences and the reduction of trade costs using a micro-founded gravity model.

We confirm the results found by the earlier literature on the trade-enhancing role of networks. We show that, even though computationally cumbersome in a panel, the PML estimation with the robust standard errors is immune to misspecification (Tables 3-6), while the estimation using OLS and Tobit might lead to inconsistent estimators (Tables 8 and 9). Thus, we follow the new empirical gravity literature (s. Santos Silva and Tenreyro(2006), Handerson and Millimet (2008), Santos Silva and Tenreyro(2008)), which argues that the gravity model should be estimated in levels. Moreover, we also show that the omission of controls for multilateral resistance terms leads to overestimation of the network effect (s. results for the Tobit and the OLS models).

We also conduct a robustness check to the results from Rauch and Trindade(2002) with the Rauch(1999) classification of goods (s. appendix C). Controlling for multilateral resistance terms and using the PML estimation, we do not find empirical support to rank the network effects across different types of goods and focus the analysis on total trade and on a subsample of direct links to Israel.

With our measure of direct and indirect links, we show that the direct networks capture almost all the trade creation effect. As mentioned along the paper, the distinction between direct and indirect links might help in a crude way to disentangle the preference channel from the trade costs channel. Although, as a drawback of the model, we are not able to confirm which channel is more relevant in terms of trade creation.

In the sample of direct links with Israel, we use the UN votes dataset to control for political relations with the country, once the omission of this variable could bias the results, specially in the first two decades after the creation of the state of Israel. We show that, including this variable, the effect of networks is smaller but remains robust.

The analysis of networks with cross-sections over time (Tables 5 and 6) allows to evaluate the effect of all trade costs regressors over the decades. Despite better communication technology and stronger international institutions, we can not find a decreasing effect over time of the Jewish network on the tariff equivalent.

For World trade, our panel reveals a trade creation effect of the Jewish community of 0,84%

with our preferred specification [Table 3], what confirms the importance of this group to the integration of the world economy and show, in a robust way, that networks are generalized to the cultural and religious ties that exist within the Jewish population.

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A Jewish Population Data and Statistics

A.1 Who is a Jew in our dataset?

Despite ideologies, this is a crucial question in our study. As mentioned in the archives of the AJC [26], the clear definition of the Jewish group is an important concept to provide serious comparative foundations to the study of the Jewish demography. The three major concepts of a Jew are: (i) the *core* Jewish population; (ii) the *enlarged* Jewish population; and (iii) the *Law of Return* Jewish population.

The data from the American Jewish Committee considers in their numbers for the Jewish population in each country only the *core* Jewish population, what does not include non-Jewish members of Jewish households and other non-Jews of Jewish ancestry [27]. In what follows, we give a closer look at the definitions:

(i) the *core* Jewish population:

In most of the countries, the concept of the core Jewish population includes "all persons who, when asked, identify themselves as Jews; or, if the respondant is a different person in the same household, are identified by him/her as Jews" [28]. "The core Jewish population includes all converts to Judaism by any procedure, as well as other people who declare they are Jew". "Persons of Jewish parentage who adopted another religion are usually excluded, as are other individuals who in censuses or surveys explicitly identify with a non-Jewish group without having converted out of Judaism".

Until 2001, Jews who had other religious corporate identities were excluded from the definition of the *core*. Since 2001, Jews with multiple religious identities are, under certain circumstances, included as Jews [29].

(ii) the *enlarged* Jewish population:

The enlarged Jewish population includes the core population and: a. all other persons of Jewish parentage who are not Jewish at the date of the investigation; b. all of the respective

[26] We refer here mainly to the notes on the most current book release on the Jewish data and methods: American Jewish Year Book Vol. 107 (2007) and the chapter World Jewish Population and Clarifications (2007)

[27] For instance, statistics from the AJC show that in 1980 there were 196 thousand Jews in Brazil, while in 2006 this number decreased to 96 thousand. The break out in the numbers from the census suggest considerable intermarriage with non-Jews, as suggests the AJC.

[28] This definition of a person as a Jew broadly overlaps with the Halakhah (the rabbinic law), but not necessarily coincide. Although, in Israel, the personal status is subject to the rulings of the Ministry of the Interior, which relies on the rabbinical authorities and thus relies on legal rules of the Halakhah.

[29] This change in the definition does not represent a problem to our sample, since we mainly use data from 1950 until 2000.

non-Jews with Jewish backgroud.

(iii) the *Law of Return* Jewish population:

According to this rule, a Jew is any person born to a Jewish mother or converted to Judaism, who does not have another religious identity. The Law of Return is significantly larger definition than (i) and (ii) and represents the distinctive legal framework for the acceptance and absorption of new immigrants; awards Jewish new immmigrants immediate citizenship and other civil rights.

The data collection for the definition (i) benefits from scholars and institutions in many countries. Some of the countries that have delivered national censuses information on Jewish population in the recent years are: Ireland, Czech Republic, India, Romania, Bulgaria, the Russian Republic, Macedonia, Israel, Canada, South Africa, Australia, New Zealand, Belarus, Azerbaijan, Kazakhstan, Kyrgyzstan, Brazil, Mexico, Switzerland, Estonia, Latvia, Tajikistan, United Kingdom, Hungary, Croatia, Lithuania, Ukraine, Georgia, Poland, Moldova. For some countries, for instance, the United States, the censuses do not provide infromation on religion. Although, other sociodemographic studies have provided the AJC information on the Jewish demography, as for instance in the countries: South Africa, Mexico, Lithuania, United Kingdom, Chile, Venezuela, Israel, Hungary, Netherlands, Guatemala, Moldova, Sweden, France, Turkey, Argentina and United States [30].

It is important to note that the AJC provides a cross-matching of the different sources of data for the same Jewish population always when feasible, what provides a check on the reliability of the data.

As we have already mentioned in the data description, the total population data comes from the IMF. We use this data along with the AJC data in order to create our proximity channel, the product of the share of Jews in the country pair i j, JSH_{ij}. A closer look on the monadic data follows:

[30] For the United States, current information was provided by the National Jewish Population Survey and the American Jewish Identity Survey.

Table 7: Mean values and median of the variable JSH_i (monadic data)

	Observations	**Mean**	**Std. Dev.**	**Min**	**Max**	**Median**
1951	70	.0163063	.0972918	8.79e-06	.8162518	.0013453
1952	72	.0167620	.1062832	6.89e-06	.9041469	.0013941
1953	71	.0168085	.1073130	6.77e-06	.9064885	.0014178
1954	76	.0153116	.1006274	6.67e-06	.8792067	.0013658
1955	76	.0148763	.0974630	6.57e-06	.8515275	.0009280
1956	76	.0148020	.0973268	1.62e-06	.8503059	.0009036
1957	75	.0146855	.0985630	1.60e-06	.855409	.0008604
1958	70	.0152756	.1043689	8.16e-06	.8751267	.0010100
1959	76	.0150118	.1000505	6.19e-07	.8742632	.0011368
1960	77	.0144498	.0988162	6.08e-07	.8689687	.0010555
1961	77	.0141523	.0971825	3.73e-07	.8545454	.0007930
1962	77	.0139416	.0960317	3.66e-07	.8444396	.0007710
1963	74	.0141892	.0988747	2.87e-07	.8521776	.0007937
1964	78	.0136506	.0976660	2.81e-07	.8641129	.0007425
1965	77	.0137998	.0986647	2.74e-07	.867304	.0006986
1966	77	.0137982	.0992608	2.67e-07	.8724858	.0006765
1967	76	.0137779	.0994817	1.30e-07	.8686551	.0006008
1968	76	.0136351	.0981350	1.27e-07	.8568841	.0005839
1969	76	.0136717	.0987637	2.47e-08	.8623009	.0005675
1970	76	.0136308	.0986880	2.41e-08	.8616287	.0004849
1971	76	.0134450	.0983716	2.35e-08	.8587722	.0004279
1972	76	.0134636	.0981087	2.29e-08	.856492	.0004147
1973	76	.0134616	.0984294	2.24e-08	.8592616	.0004241
1974	74	.0137462	.0997310	3.30e-08	.8591549	.0004187
1975	74	.0134064	.0969983	3.23e-08	.8356164	.0004135
1976	76	.0130885	.0959711	3.18e-08	.83783	.0004241
1977	76	.0129544	.0957970	3.13e-08	.836307	.0004221
1978	77	.0129268	.0963544	3.09e-08	.8466648	.0004107
1979	77	.0127422	.0948677	3.04e-08	.8336043	.0003976
1980	75	.0129392	.0960488	3.00e-08	.8328906	.0003854
1981	78	.0127110	.0959517	2.96e-08	.8485007	.0003051
1982	69	.0140821	.1010704	3.96e-06	.8408555	.0004648
1983	69	.0138582	.0993647	3.87e-06	.8266684	.0004474
1984	67	.0143060	.1019554	2.83e-06	.8358434	.0005055
1985	67	.0140873	.1003149	2.76e-06	.8223982	.0005033
1986	67	.0141917	.1016309	1.80e-06	.8331414	.0004502
1987	67	.0139805	.1000699	1.76e-06	.820345	.0004410
1988	66	.0142216	.1017126	1.72e-06	.8275262	.0004133
1989	66	.0139457	.0995832	1.68e-06	.8102115	.0004063
1990	67	.0137183	.0988885	1.64e-06	.8105893	.0003556
1991	67	.0135094	.0973296	1.60e-06	.7978321	.0003790
1992	77	.0124185	.0929673	1.56e-06	.8171222	.0004975
1993	79	.0122993	.0928278	1.53e-06	.8264407	.0005254
1994	84	.0113922	.0888870	1.49e-06	.8158654	.0004940
1995	87	.0108263	.0863713	9.62e-07	.8066989	.0004399
1996	87	.0107456	.0859414	9.38e-07	.8026568	.0003760
1997	87	.0106827	.0857637	9.14e-07	.8009683	.0003921
1998	87	.0104533	.0840670	7.98e-07	.7850980	.0003825
1999	87	.0104584	.0846017	7.91e-07	.7900521	.0003478
2000	87	.0105674	.0859308	7.85e-07	.8024326	.0003251
2001	74	.0122113	.0924907	7.79e-07	.7966859	.0004037
2002	87	.0104079	.0847981	7.74e-07	.7918373	.0002885
2003	86	.0100516	.0811707	7.69e-07	.7536454	.0003303
2004	85	.0100884	.0810761	7.65e-07	.7483866	.0003744

A.2 Jews in Israel - Migration Stock

Figure 2: Jewish Population (million) in Israel since the creation of the State (1948)

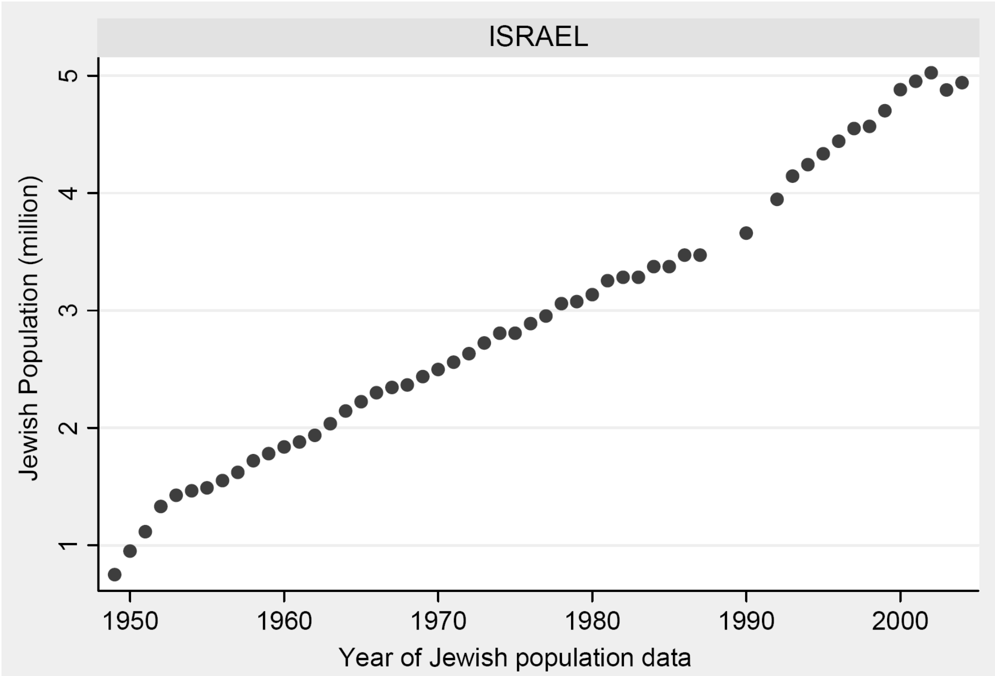

Figure 2 shows the increase in the Jewish population after the creation of the State of Israel. The increase in the number of Jews in Israel shown in the figure might be due to migration flows, population growth or Jews converted into Judaism (the dataset refers to the Jewish population in Israel regardless place of birth). We compare the total population in Israel (Jews and non-Jews) to the Jewish population and find that, with exception of the years 2000-2005 (for which the difference is higher), in the other years the increase in the Jewish population growth was appoximately proportional to the total population growth. This can also be confirmed in the column called Max in the table of means, which represents Israel (which is the country with the maximum value of the JSH_i); the share of Jews in Israel does not change drastically. Thus, this confirms the litetarure, which argues that most of the Jewish population growth in Israel can be attributed to Jewish migration [31].

[31] The AJC also raises the concern on the decrease of the Jewish population growth due to low birthrates among Jews - they argue that the fertility rate of Jews is lower with respect to other religious groups (AJ-Carchives, World Jewish Population, 2007).

B Results using OLS and the Tobit model

For the log-linearized OLS with fixed effects it follows:

$$lnc_{ij} = \gamma_i d_i + \gamma_j d_j + \varphi X + \eta_{ij} \quad (5)$$

for d_i and d_j the multilateral resistance terms, X the vector of regressors and η_{ij} is the log-linearized error term ϵ_{ij}, $ln\epsilon_{ij}$. We conduct the RESET test proposed by Ramsey(1969) [s. Silva and Tenreyro(2006)] in order to check whether the OLS model is misspecified. In all cases reported in Table 8, the p-values of the RESET test are zero, what rejects the hypothesis that the coefficient is zero. The trade creation effect found using OLS at least doubles in comparison to the results using PML (compare OLS results with Table 3).

Table 8: Results using the OLS model. 5 years averaged data. World Trade)

dependent variable: log c_{ij}	(1)	(2)	(3)	(4)	(5)	(6)
JSH_{ij}	303.8***	434.3***	156.9*	173.1	19.54	224.3***
	(42.61)	(51.81)	(87.77)	(108.0)	(79.18)	(40.58)
Log $(GDP_i * GDP_j)$	1.438***	3.627***	1.370***	3.944***	28.27***	1.372***
	(0.0182)	(0.109)	(0.0348)	(0.203)	(4.755)	(0.0213)
Log $(CGDP_i * CGDP_j)$	-0.300***	-2.819***	-0.0761*	-2.857***	-28.62***	0.0406
	(0.0237)	(0.0910)	(0.0457)	(0.173)	(4.805)	(0.0304)
Log distance	-1.857***	0	-1.610***	0	-1.759***	-1.956***
	(0.0498)	(0)	(0.0985)	(0)	(0.101)	(0.0483)
contiguity	0.0711	0	0.360	0	0.752**	-0.164
	(0.273)	(0)	(0.479)	(0)	(0.377)	(0.243)
language	1.272***	0	1.041***	0	1.451***	0.967***
	(0.139)	(0)	(0.252)	(0)	(0.223)	(0.129)
colony	1.318***	0	0.612	0	-0.0338	1.467***
	(0.305)	(0)	(0.595)	(0)	(0.470)	(0.273)
common colony	1.025***	0	0.202	0	0.667	1.888***
	(0.246)	(0)	(0.511)	(0)	(0.463)	(0.229)
FTA			-0.533***	0.222	-0.162	
			(0.174)	(0.186)	(0.231)	
Constant	-36.33***	-115.7***	-38.39***	-131.9***	-1009***	-35.94***
	(0.655)	(3.769)	(1.340)	(7.216)	(177.1)	(0.823)
Option fixed effects	*no*	*yes*	*no*	*yes*	*no*	*no*
Country fixed effects interacted with year	*no*	*no*	*no*	*no*	*no*	*yes*
Importer and exporter fixed effects interacted (i*year and j*year)	*no*	*no*	*no*	*no*	*yes*	*no*
Observations	40590	40590	11045	11045	11045	40590
Number of pairs	6714	6714	1665	1665	1665	6714

The Tobit model for equation (2) for a minimum threshold b follows:

$$\ln(\mathrm{b}+\mathrm{c}_{ij}) = [\psi_l n(c_i * y_j) + \varpi JSH_{ij} + \vartheta LANG_{ij} + \gamma CONT_{ij} + \delta FTA_{ij} + \lambda lnD_{ij} + \pi_i + \nu_j + \eta_{ij}, lnb] \quad (6)$$

Results using the Tobit model are reported in Table 9. We report results with [columns (1) and (2)] and without [columns (3) and (4)] FTA, since data for FTA is missing for some countries and is available only from 1960 on. Clearly, the omission of the multilateral resistance terms overestimates the effect of networks on trade (compare columns (1) and (2)). This is also the case of the OLS model: compare columns (1) and (6) from Table 8. P-values of the RESET test are zero, which implies that the Tobit model is misspecified.

Table 9: Results using the Tobit model. 5 years averaged data. World Trade)

dependent variable: log $b + c_{ij}$	(1)	(2)	(3)	(4)
JSHij	345.4***	296.4***	239.6***	205.2***
	(40.21)	(38.98)	(64.02)	(63.47)
Log $(GDP_i * GDP_j)$	1.426***	1.331***	1.351***	1.411***
	(0.0184)	(0.0238)	(0.0256)	(0.0281)
Log $(CGDP_i * CGDP_j)$	0.279***	0.0948***	-0.0795**	-0.179***
	(0.0244)	(0.0321)	(0.0345)	(0.0353)
Log distance	-1.891***	-1.844***	-1.672***	-1.639***
	(0.0507)	(0.0507)	(0.0716)	(0.0704)
contiguity	-0.0174	-0.214	0.244	0.273
	(0.277)	(0.248)	(0.348)	(0.341)
language	1.172***	1.223***	1.299***	1.380***
	(0.137)	(0.131)	(0.182)	(0.179)
colony	1.350***	1.303***	0.659	0.484
	(0.308)	(0.279)	(0.432)	(0.423)
common colony	0.785***	1.902***	0.249	0.483
	(0.242)	(0.229)	(0.373)	(0.366)
FTA			-0.825***	-1.042***
			(0.131)	(0.132)
Period dummies	*no*	*yes*	*no*	*yes*
Country fixed effects	*no*	*yes*	*no*	*no*
Constant	-35.78***	-33.00***	-39.64***	-44.62***
	(0.663)	(1.063)	(0.977)	(1.289)
Log-likelihood	-111960.75	-110852.08	-59731.687	-59574.08
Observations	41207	41207	22804	22804
Country pairs	6618	6618	3344	3344

Period dummies were omitted in columns (2) and (4) for simplicity.
Except periods 6 and 10, they are significant at 1% level.

C A robustness check to Rauch and Trindade (2002)

In a very influential paper, Rauch and Trindade(2002) study the effects of the Chinese networks on trade. The authors estimate a Tobit model in cross-sections for the years 1980 and 1990 and reveal a trade creation effect of the Chinese networks of at least 60%. We conduct the same analysis for the Jewish population as a robustness check of their results and take the same gravity regressors as well as the same trade data divided according to the Rauch (1999) classification of goods: homogeneous goods, differentiated goods and reference priced goods. As in Rauch and Trindade (2002), we expect that, more than the effect on trade costs, the existence of taste similarity within an ethnic group should lead to a higher effect of networks on differentiated goods in comparison to the effect on homogeneous goods. The trade data, as our dependent variable, is bounded below by zero, as in Eaton and Tamura (1994). The same methodology is used by Rauch and Trindade (2002) in a modified gravity model where the dependent variables must achieve a minimum threshold value b for trade flows to be positive. The empirical specification follows:

$$\ln(\mathrm{b}_m+c_{ijm}) = [\psi_m ln(c_i * y_j)+\varpi_m JSH_{ij}+\vartheta_m LANG_{ij}+\gamma_m CONT_{ij}+\delta_m FTA_{ij}+\lambda_m lnD_{ij}+ \pi_i + \nu_j + \eta_{ijm}, lnb_m] \quad (7)$$

where $m = w, r, n$:
w represents the homogeneous goods group;
n represents the differentiated goods group;
r represents the reference priced goods group.
As already mentioned in section 3.3, the Tobit model has an important advantage over OLS for trade data. Although, the Tobit model, used by Rauch and Trindade (2002) among others, is also subject to heteroskedastic errors, which leads to inconsistent estimators (s. discussion on Silva and Tenreyro(2006) in section 3.6.). As a further drawback, Rauch and Trindade (2002) do not control for multilateral resistance terms, extensively discussed in Anderson and

van Wincoop(2003).

Therefore, we address two important concerns in our analysis of the Rauch and Trindade(2002) results: 1. we control for multilateral resistance terms using the country-fixed effects from Anderson and van Wincoop (2003); 2. we address the concern on heteroskedastic errors raised in Santos Silva and Tenreyro(2006).

C.1 Data and Descriptive statisticss: the Rauch(1999) classification of goods

Table 8 presents the summary statistics for the 5 years averaged data pos-1960. We use the NBER-UN yearly bilateral trade data (www.nber.org/data), documented by Feenstra et al (2005), in order to compare our results to the ones found in Rauch and Trindade(2003). We aggregate the trade data in three groups of commodities according to the Rauch(1999) liberal classification of goods: (i.) w, homogeneous (organized exchange) goods: goods traded in an organized exchange; (ii.) r, reference priced: goods not traded in an organized exchange, but which have some quoted reference price, as industry publications; and (iii.) n differentiated: goods without any quoted price. The NBER-UN trade data gives a more accurate measure of trade flows, since the values are mainly reported by the importing country - which is a better measure due to the differences between c.i.f. and f.o.b. prices (s. Feenstra, 2005).

Data on GDP for the recent periods is taken from the World Development Indicators WDI/IMF; for the population, we use the IFS/IMF data. Our dummies proxies for information and trade costs come from CEPII - Centre d'Etudes Prospectives et d'Informations Internationales. Finally, data for the existance of FTA (Free Trade Agreement) is taken from the IMF's Direction of Trade Statistics for the years 1960, 1965, 1970,..., 2000 - the same data source used by Baier and Bergstrand (2007). Since in the panel data analysis we take 5 years average of the trade data, i.e. 1966-70, 71-75, ..., 1996-2000, we always include the FTA data from the former period, which means, 1965 for the period 66-70, 1970 for 71-75 and so on.

Table 9 presents a simple correlation matrix among the 5 years averaged core variables of the model in the logarithmic form. Even if merely ilustrative, it is interesting to notice that our network channel is positively correlated to the trade variables in the three groups of commodities. GDP, GDP per capita, countries contiguity and existence of a free trade agreement between i and j are positively correlated to trade, as expected. Common language is negatively correlated to the product of GDP's and GDP's per capita. FTA and contiguity are not correlated at 1% significance level to the proximity measure $JSH_i * JSH_j$.

Table 10: NBER trade data and regressors, yearly data (1962-2000)

Variable	**Obs**	**Mean**	**Std.Dev.**	**Min**	**Max**
Reference priced goods	84.859	90661.73	543301.6	1	3.13e+07
Differentiated goods	96.023	289457.3	2496726	0	1.41e+08
Homogeneous goods	74.231	71267.17	433458.1	1	2.92e+07
Jewish population i	103.149	238277.4	949708.9	20	6115000
Jewish population j	103.149	228620.5	937812.8	20	6115000
Total population i	103.149	5.19 e+07	1.42 e+08	232000	1.27 e+09
Total population j	103.149	4.72 e+07	1.31 e+08	232000	1.27 e+09
JSH_i	103.149	.0190686	.1159091	2.24e-08	.8724858
JSH_j	103.149	.0167838	.1080378	2.24e-08	.8724858
$JSH_i * JSH_j$	103.149	.0000858	.0008809	1.75e-14	.0246964
GDP_i	103.149	4.16 e+11	1.25 e+12	2.33 e+08	1.25 e+13
GDP_j	103.149	4.13 e+11	1.26 e+12	2.33 e+08	1.25 e+13
$CGDP_i$	103.149	11178.1	12871.48	1.160.914	65134.23
$CGDP_j$	103.149	10849.05	12707.47	1.160.914	65134.23

Table 11: Correlation matrix at 1% significance level

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Ln (c_{ijR})	1								
2. Ln (c_{ijN})	0.8440*	1							
3. Ln (c_{ijW})	0.5913*	0.5321*	1						
4. $JSH_i * JSH_j$	0.0180*	0.0246*	0.0196*	1					
5. FTA	0.3139*	0.3109*	0.2720*	-0.0194	1				
6. Ln ($GDP_i * GDP_j$)	0.7403*	0.7639*	0.6322*	0.0142	0.2308*	1			
7. Ln ($CGDP_i * CGDP_j$)	0.5233*	0.6088*	0.4156*	0.1513*	0.3374*	0.6003*	1		
8. contiguity	0.1733*	0.1581*	0.1596*	-0.0138	0.1917*	0.0296*	-0.0089	1	
9. language	-0.0062	0.0043	0.0374*	0.0679*	0.0026	-0.1596*	-0.1212*	0.1478*	1

C.2 Results using the Rauch(1999) classification of goods: cross-section and panel data

First we show the results with the Tobit model used by Rauch and Trindade (2002) for the cross-section 1980 and 1990, even though we are aware of the econometric concerns. Although, we already use in this first results a micro founded gravity equation to control for multilateral resistance terms, omitted in the Rauch and Trindade (2002) gravity equation - many of our results that are not significant at 10% level turn to significant if we omit the multilateral resistance terms (P_i P_j), what reinforces the discussion from Anderson and van Wincoop (2003) on the bias caused by the omission of these terms. Table 10, 11 and 12 show the results for three cross sections using the proximity channel JSH_{ij}. The years for cross-sections (1980, 1990), the data sources and the classification of goods are the same used in Rauch and Trindade (2002).

The hypothesis raised for the three groups of goods was that the proximity channel JSH_{ij} would have a higher effect on trade for the group of differentiated goods, followed by the reference priced goods. Effects on the group of homogeneous goods would be smaller.

Surprisingly, in these cross-sections presented, the greater effect on the groups of differentiated goods can not be confirmed: except for the year 1970, we do not find significant results for this group once we add the FTA dummy. Even though the variable FTA is not significant in half of the cases, once we add it to control for the existence of free trade agreements, the effect of the JSH_{ij} on trade vanishes in some cases which were significant before. Again, results are more frequently significant (but misspecified) if we do not include the importer and exporter fixed effects. Once we add these controls and add the FTA dummy, there is no effect of JSH_{ij} on trade in most of the cases for the cross-sections shown [32]. Adding all controls, results are once significant for homogeneous goods, and once for the other two classifications. Thus, results with these cross-sections are inconclusive in what refers to JSH_{ij}.

Concerning the other regressors, most of them confirm the expected signs: language and distance are always, respectively, positive and negative, significant and assume the elasticities expected in the trade literature; $GDP_i * GDP_j$, as the measure of the mass of both countries,

[32] We also check these same results for the cross sections 1962 (first year of our dataset), for which we find significant results if we do not control for multilateral resistance terms. We also check for the cross section 2000, for which there is no effect. As we will see later on, and what is by now only speculation, it seems that the effect of Jews on trade is higher in the first two decades, what is stronger if we keep only observations for trade with Israel.

is, with only one exception, positive and significant. $CGDP_i * CGDP_j$ is surprisingly not significant in most of the cases; although, given the importance of low income countries on trade flows (specially in homogeneous goods), it becomes difficult to see a pattern for the GDP per capita - interestingly, $CGDP_i * CGDP_j$ is usually significant and positive in the cases of differentiated goods, what is intuitive: countries with higher GDP per capita trade more in differentiated goods.

Table 12: Tobit model for 1970. Anderson an van Wincoop (2003) equation.

	Homogeneous		Refer. Priced		Differentiated	
JSH_{ij}	116.1***	105.8*	42.34	33.15	74.24**	79.58**
	(40.25)	(55.72)	(31.67)	(41.30)	(30.19)	(39.09)
Log $(GDP_i * GDP_j)$	1.108***	0.910***	1.125***	0.722***	1.184***	1.129***
	(0.115)	(0.0981)	(0.0815)	(0.0927)	(0.0580)	(0.0777)
Log $(CGDP_i * CGDP_j)$	0.0917	0.191	-0.0970	0.142	0.271***	0.631***
	(0.125)	(0.137)	(0.117)	(0.0872)	(0.0814)	(0.116)
log Distance	-1.080***	-0.931***	-1.143***	-1.085***	-1.104***	-1.093***
	(0.0661)	(0.0795)	(0.0517)	(0.0614)	(0.0470)	(0.0557)
Contiguity	0.0153	0.0258	0.331*	0.212	0.494***	0.447**
	(0.237)	(0.265)	(0.194)	(0.213)	(0.181)	(0.198)
Language	0.660***	0.757***	0.869***	1.039***	0.940***	0.946***
	(0.150)	(0.175)	(0.114)	(0.131)	(0.102)	(0.118)
Colony	0.605***	0.380	0.710***	0.327	0.817***	0.764***
	(0.231)	(0.311)	(0.191)	(0.252)	(0.180)	(0.237)
Common Colony	0.279		0.765***		0.286	
	(0.320)		(0.239)		(0.212)	
FTA		0.805***		0.753***		0.494**
		(0.309)		(0.252)		(0.240)
Constant	-43.11***	-34.65***	-39.31***	-25.32***	-48.26***	-50.06***
	(5.471)	(5.008)	(3.560)	(4.143)	(2.949)	(3.181)
Importer fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Exporter fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Observations	1978	1549	2219	1731	2528	1960

Table 13: Tobit model for 1980. Anderson an van Wincoop (2003) equation.

	Homogeneous		Refer. Priced		Differentiated	
JSH_{ij}	65.74	42.37	68.39*	55.01	28.04	-10.48
	(48.09)	(94.21)	(40.77)	(68.70)	(37.95)	(68.71)
Log $(GDP_i * GDP_j)$	1.022***	1.208***	0.946***	0.863***	0.992***	1.296***
	(0.0870)	(0.222)	(0.0926)	(0.269)	(0.0568)	(0.289)
Log $(CGDP_i * CGDP_j)$	-0.187	-0.0961	-0.229*	0.290	0.0729	-1.216**
	(0.125)	(0.386)	(0.126)	(0.548)	(0.0864)	(0.567)
log Distance	-1.258***	-1.113***	-1.487***	-1.438***	-1.328***	-1.360***
	(0.0658)	(0.111)	(0.0524)	(0.0818)	(0.0460)	(0.0793)
Contiguity	0.285	0.629*	0.240	0.265	0.196	-0.178
	(0.237)	(0.355)	(0.203)	(0.263)	(0.187)	(0.272)
Language	0.292*	0.471*	0.549***	0.551***	0.863***	0.883***
	(0.152)	(0.251)	(0.120)	(0.174)	(0.103)	(0.172)
Colony	0.539**	0.170	0.274	0.172	0.614***	0.421
	(0.256)	(0.422)	(0.221)	(0.307)	(0.206)	(0.318)
Common Colony	0.0993		0.525**		-0.356	
	(0.339)		(0.258)		(0.221)	
FTA		-0.0711		0.376		0.169
		(0.725)		(0.552)		(0.588)
Constant	-29.27***	-43.77***	-22.49***	-27.84***	-31.18***	-25.76***
	(3.916)	(6.274)	(3.848)	(5.892)	(2.627)	(6.771)
Importer fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Exporter fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Log-likelihood	-3874.69	-3170.31	-4275.30	-3301.86	-4795.15	-3591.34
Observations	1957	799	2329	936	2690	1021

Table 14: Tobit model for 1990. Anderson an van Wincoop (2003) equation.

	Homogeneous		Refer. Priced		Differentiated	
JSH_{ij}	97.62**	89.43	100.4***	131.1**	30.64	2.569
	(47.65)	(77.77)	(33.64)	(53.42)	(35.33)	(56.19)
Log $(GDP_i * GDP_j)$	0.268***	-0.0105	0.738***	0.877***	0.994***	1.077***
	(0.0763)	(0.106)	(0.0482)	(0.0519)	(0.106)	(0.0663)
Log $(CGDP_i * CGDP_j)$	0.447***	-0.222**	-0.0545	-0.0440	0.262***	0.258***
	(0.0978)	(0.105)	(0.0650)	(0.0618)	(0.0988)	(0.0625)
log Distance	-1.096***	-0.993***	-1.185***	-1.121***	-1.012***	-1.000***
	(0.0596)	(0.0748)	(0.0395)	(0.0489)	(0.0408)	(0.0515)
Contiguity	0.209	0.227	0.398***	0.452***	0.646***	0.673***
	(0.202)	(0.223)	(0.140)	(0.149)	(0.148)	(0.162)
Language	0.324***	0.259*	0.516***	0.529***	0.788***	0.753***
	(0.125)	(0.145)	(0.0855)	(0.0957)	(0.0877)	(0.102)
Colony	0.351*	0.373	0.236*	0.0732	0.314**	0.173
	(0.194)	(0.270)	(0.134)	(0.178)	(0.142)	(0.194)
Common Colony	0.175		0.294		-0.238	
	(0.364)		(0.251)		(0.267)	
FTA		0.457**		0.418***		0.0415
		(0.190)		(0.126)		(0.135)
Constant	-0.580	18.87***	-17.36***	-27.92***	-38.92***	-42.09***
	(3.511)	(4.603)	(2.231)	(2.336)	(4.705)	(3.400)
Importer fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Exporter fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Log-likelihood	-2797.99	-2286.30	-2514.56	-1997.35	-2874.95	-2305.68
Observations	1609	1301	1797	1444	1957	1559

Even though we do not find satisfactory results for these cross sections, we look at a broader picture: the NBER-UN trade data with the Rauch(1999) classification of goods is available since 1962, what allows a rich panel data analysis.

Moreover, we are aware of the consistency, not only efficiency, problems in the Tobit and OLS models resulted from log-linearization of the gravity equation in the presence of heteroskedastic terms. Therefore, we show results for a panel data analysis for a specification that is not subject to this concern: the Anderson and van Wincoop(2003) equation estimated using Pseudo Maximum Likelihood.

Table 13 reports results using PML. It is computationaly cumbersome to include importer and expoter country-specific effects interacted with time in a PML regression, and even worse using the normal distribution. Note that, for a sample of 60 country and 5 periods, this implies 60*2*5 dummies. Therefore, we prefer to estimate it using the fixed effects specification, what also controls for country specific effects. The two specifications shown in Table 13 are: fixed effects specification with year dummies as well as random effects specification using time-varying country-specific fixed effects.

In both specifications shown in Table 13 (fixed and random effects with different controls), results reveal a positive and significant at 1% level results for the group of differentiated and reference priced goods. Although, it is also important to note that we find negative and significant results for trade in homogeneous goods - which goes against the hypothesis of trade creation effects of Jews (results are also negative using other controls not added in Table 13). Period dummies are always significant and distance, GDP and language have the expected signs. [33]. In the case of contiguity, results are significant but the sign is the opposite of what is expected - in this result, contiguos countries trade less.

Language has the highest elasticity for trade in differentiated goods and the lowest elasticity for trade in homogeneous goods, what is in line with the argument that language skills lower information costs (which is a more important concern for trade in differentiated goods) and facilitate matches of buyers.

An important concern with the interpretation of the results using the Rauch(1999) classification of goods refers to the elasticity of substitution σ: once this classification of goods

[33] We performed the same results using the log-linearized equation (5). In this case, results are significant only for homogeneous goods (the opposite of what we found using the PML). Although, under heteroskedasticity, the log-linearization violates the consistency of the OLS estimator. We use the RESET test to check whether log-linearized model estimated with OLS was misspecified and we reject the Ho hypothesis that the additional regressor included was not significant. Thus, OLS is misspecified and we opt out this specification.

is directly related to the degree of substitutability σ, there is no clear interpretation of the coefficients in JSH for the different types of goods. For $(\sigma - 1) * JSH_{ij}$ the effect estimated, the coefficient would be smaller for differentiated goods, once these have a low degree of substitutability in comparison to homogenegous goods. Thus, unless one set values for the elasticity of substitution, what is not present in the Rauch and Trindade(2002) study, it is difficult to interpret the results for the different types of goods. In this case, the analysis should be conducted for total world trade.

As a last argument, the classification on differentiated vs. homogeneous goods might be stronger for the case of the Chinese population in Rauch and Trindade (2002), comparing to the case of Jews. In the case of the Jewish population, it is not as clear that the effect on differentiated goods should be higher, since this is a religious and cultural network, and not a migration group. Thus, it is more intuitive to study total trade flows, regardless the type of good: following the argument that Jews are known for working in activities related to international exchange and for building and keeping strong networks, which also reflects in business networks, we might expect that the effects of this group on trade can be better explained with total trade flows.

Table 15: Panel using Gamma-PML for JSH_{ij}, NBER-UN Data. Period 1965-2000 (five years average)

Dep. Variable: c_{ij}	Org.		Reg.		Dif.	
JSH_{ij}	-127.6***	-626.6***	12.12***	99.13***	102.2***	124.6***
	(0.170)	(1.084)	(0.252)	(0.968)	(0.131)	(0.759)
Log $(GDP_i * GDP_j)$	1.077***	1.513***	1.560***	0.812***	2.510***	0.261***
	(0.000260)	(0.000949)	(0.000306)	(0.000721)	(0.000185)	(0.000184)
Log $(CGDP_i * CGDP_j)$	-0.547***		-0.947***		-1.753***	
	(0.000311)		(0.000355)		(0.000217)	
Log distance	-0.453***		-1.472***		-1.629***	
	(0.0286)		(0.0328)		(0.0520)	
contiguity	0.0963		-1.511***		-4.411***	
	(0.161)		(0.177)		(0.303)	
language	0.575***		0.916***		1.336***	
	(0.0803)		(0.0840)		(0.140)	
colony	0.141		-0.592***		-2.559***	
	(0.172)		(0.182)		(0.302)	
FTA		0.324***		0.326***		0.650***
		(0.000491)		(0.000292)		(0.000344)
period 2		0.618***		0.788***		
		(0.000742)		(0.000464)		
period 3		0.949***		1.039***		0.769***
		(0.000820)		(0.000565)		(0.000405)
period 4		0.733***		0.923***		0.586***
		(0.000970)		(0.000698)		(0.000492)
period 5		0.867***		1.280***		1.130***
		(0.00106)		(0.000762)		(0.000531)
period 6		0.854***		1.448***		1.337***
		(0.00118)		(0.000852)		(0.000587)
period 7		0.803***		1.464***		1.361***
		(0.00131)		(0.000949)		(0.000648)
Constant	-30.95***		-39.03***		-65.55***	
	(0.249)		(0.283)		(0.445)	
Country fixed effects interacted $i*$ year	yes	no	yes	no	yes	no
Period dummies (P)	no	yes	no	yes	no	yes
option fixed effects	no	yes	no	yes	no	yes
Observations	17936	6276	19698	7055	21679	7530
Number of pairs	4463	1261	4776	1325	5129	1407

D The Novy(2008) model and further results

D.1 The Novy(2008) gravity model

In Novy(2008), trade flows are decomposed into tradable and non-tradable goods. Country i comprises the consumer range $[n_{i-1}, n_i]$ and firms in country i optimize in this range. The continuum $[0,1]$ comprise all consumers and goods. $[n_{i-1}, n_{i-1} + \theta(n_i - n_{i-1})]$ is the range of tradable goods and $[n_{i-1} + \theta(n_i - n_{i-1}), n_i]$ of nontradable goods. θ is the exogenously given fraction of tradable goods. Consumption in country i follows:

$$c_i = \left[\sum_{k=1}^{I} \int_{n_{k-1}}^{n_{k-1}+\theta_k(n_k-n_{k-1})} \left(c_{im}^{\frac{\sigma-1}{\sigma}} \right) dm + \int_{n_{i-1}+\theta(n_i-n_{i-1})}^{n_i} \left(c_{im}^{\frac{\sigma-1}{\sigma}} \right) dm \right]^{\frac{\sigma}{\sigma-1}} \quad (8)$$

c_{im} denotes consumption of good m in country i. Note that c_i is total consumption in country i from all countries $j \neq i$ including goods produced and consumed in country i, as was assumed in c_i in equation (1). Thus, we can write c_{ij} from equation (1), for $i \neq j$, as: $\int_{n_{j-1}}^{n_{j-1}+\theta_j(n_j-n_{j-1})} \left(c_{im}^{\frac{\sigma-1}{\sigma}} \right) dm$, where θ_j is the share of tradable goods in county j - in equation (1) it is assumed that $\theta_j = 1$.

Prices are denoted as $p_{ij}^T = (1+\tau_{ij})p_j$ for tradable goods and $p_{ij}^{NT} = p_j$ for non-tradable goods, i.e., the c.i.f. (cost, insurance and fright) price is $(1+\tau_{ij})$ times the f.o.b. (free on board) price. Optimal firms' behavior implies that $p_{im}^T = p_{im}^{NT} = \frac{\sigma}{\sigma-1} = lw_i = p_i$. Thus, the mill price of a variety produced in region i is identical for all varieties.

In equation (1) we write trade flows in terms of consumption c_{ij}. In terms of exports from i to j (x_{ij}), we can write c_{ji} (consumption in j from goods produced in i) as $c_{ji} = (1+\tau_{ij})x_{ij}$, i.e., the difference between c.i.f. and f.o.b. prices [34].

Assuming symmetry among tradable goods produced in county-j over the range $\theta_j(n_j - n_{j-1})$, consumption in country i of goods produced in country j yields, for a country pair $i \neq j$: $x_{ij} = \theta_j(n_j - n_{j-1})q_{ji}^T$, where q_{ji}^T is the range of tradable goods produced in country j for county i such that: $q_j^T = \sum_{k=1}^{J} q_{jk}^T$ (tradable output for each country k).

Firms produce a differentiated good m with output q_{im}^T for tradable goods and q_{im}^{NT} for non-

[34] The choice to write equation (1) in terms of consumption c_{ij} was due to data concerns: we use equation (1) to estimate trade flows using the NBER-UN yearly bilateral trade data, for which most of the values are reported by the importing country (s. Feenstra et al(2005)). In the Novy(2008) model, although, we represent it in terms of exports instead of imports. The reason is the measure $(y_i - x_i)$ in equation 11, which must be represented in terms of exports.

tradable goods. $q_{im}^T = \sum_{j=1}^I q_{ijm}^T$ for all tradable goods. Equilibrium conditions imply that $q_j = \theta_j q_j^T + (1-\theta_j) q_j^{NT}$ and $q_j^{NT} = q_{ii}^{NT} = q_{ii}^T$, where q_{ii} is total output produced and consumed in country i. Country i GDP is $y_i = (n_i - n_{i-1})q_i$ and the number of consumers in country i is given by $pop_i = q_i(n_i - n_{i-1})$.

Intra-country total output yields: $(n_i - n_{i-1})q_{ii}^T = (n_i - n_{i-1})q_i - \theta_i(n_i - n_{i-1})\sum_{k\neq i} q_{ik}^T = y_i - x_i$, where $x_i = \sum_{k\neq i} x_{i,k}$ is the sum of goods produced in country i and exported to $k \neq i$. Thus, the equilibrium solution of the model, imposing trade cost symmetry $\tau_{ij} = \tau_{ji}$ gives rise to the following gravity equation:

$$x_{ij}x_{ji} = \theta_i(y_i - x_i)\theta_j(y_j - x_j)(1+\tau_{ij})^{2-2\sigma} \quad (9)$$

This specification has some advantages for panel data analysis, once it is possible to compute bilateral trade over time: instead of measuring multilateral resistance terms using theoretical constructs P_i and P_j as in Anderson and van Wincoop (2003), Novy(2008) uses the tractable measure $y_i - x_i$ to control for multilateral resistance terms, which is captured directly from the data [35]. Moreover, in the Novy(2008) model the assumption that all goods are tradable can be relaxed.

As before, the Jewish population share in both countries enters our model as a part of information costs, such that $INFO_{ij} = e^{\bar{\vartheta}(1-LANG_{ij})} I(JSH_{ij})$. The information costs $I(JSH_{ij})$ decreases the greater the magnitude of the network, i.e., the higher the dyadic share of Jews in the country pair.

The interpretation of equation (9) using the $I(JSH_{ij})$ follows. A decrease in information costs $I(JSH_{ij})$ between countries i and $k \neq j$ causes an increase in trade between i and k. It is relatively less costly to trade with country k than with country j; thus, $x_{ij}x_{ji}$ must decrease.

[35] Imagine exports of country i with other countries but j increase, then x_i increases and, ceteris paribus, $x_{ij}x_{ji}$ must decrease. In this cenario, trade costs from i with countries $k \neq j$ must have decreased: this implies that it is *relatively* more costly to trade with country j.