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Ethnic Networks, Information, and International Trade: Revisiting the Evidence

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ETHNIC NETWORKS, INFORMATION, AND INTERNATIONAL TRADE: REVISITING THE EVIDENCE

NON-TECHNICAL SUMMARY

Deregulation and technological progress have decreased trade costs. There are many empirical studies dedicated to the analysis of the importance of these changes. In particular, studies of the border effect have shown that informal barriers are still important. According to Anderson and van Wincoop (2004), informal barriers altogether explain a large share of trade costs. Recent empirical works show that migration contributes to decrease informal trade barriers between countries and thus enhances their bilateral trade.

In an influential paper, Rauch and Trindade (2002) – henceforth R&T – use an empirical trade flow model to show that the network formed by the overseas Chinese population has a major trade creating effect. Quantitatively, they find that "*for trade between countries with ethnic Chinese population shares at the levels of prevailing in Southeast Asia, the smallest estimated average increase in bilateral trade in differentiated products attributable to ethnic Chinese networks is nearly 60%*" (p. 116). They argue that this effect is due to the reduced information costs and improved contracting conditions that networks may bring about, this is the trade cost channel or network effect.

As Combes et al. (2005) point out, ethnic networks may affect bilateral trade not only through their effect in trade costs (information and contracting costs), but also through preferences: members of ethnic minorities abroad may derive higher utility from goods imported from countries that host their ethnic majority. It is therefore difficult to clearly disentangle the trade cost from the preference effect. Separate identification, however, would be welcome, since trade-cost savings from networks free up resources and therefore represent welfare-improving efficiency improvements. The preference channel is not associated to such efficiency gains. The existence of a measurable and sizable trade-cost effect would be another – hitherto neglected – channel through which international migration leads to an improved allocation of resources worldwide.

The overall contribution of this paper is to revisit the findings of R&T. More precisely, we extend the literature in two main ways. First, we propose a theory-grounded gravity framework for the estimation of the network effects. This allows to discuss the identification of the trade-cost channel of networks. We argue that, excluding the links of ethnic minorities with the ethnic majority country, one may minimize the preference effect and come closer to the pure trade cost effect. Besides the identification issue, we use state-of-the-art econometric techniques to the data of R&T. We show that the large trade-creating effect of 60% estimated by R&T is probably two to four times too large. Most of the overestimation comes from the omission of the multilateral resistance terms; the preference channel seems to be less important.

The second part of our contribution is to extend the analysis beyond the Chinese network studied by R&T. Using data from the World Bank for the year of 2000, we proxy the networks of some ethnic group k by the stock of individuals born in k but residing in some foreign country i or j. This gives us a more narrow definition of ethnic networks than the one used by R&T, because it excludes descendants

of individuals who have migrated long ago or whose parents have always lived as ethnic minorities in those foreign countries. Moreover, the World Bank data allow to check for the existence of other ethnic (or better: migrant) networks. Besides the Chinese network, we document the existence of a Turkish, a Mexican, or a Pakistani network, to name only a few. Interestingly, in terms of trade-creating potential, the Chinese network is by far not the most important one. We also find substantial heterogeneity in the trade-creating potential of different networks which we can partly explain by characteristics of the migrants' countries of origin. For example, when the share of high-skilled individuals in the source country is larger, or the population less strongly ethnically fragmented, the network effects are smaller.

ABSTRACT

Influential empirical work by Rauch and Trindade (REStat, 2002) finds that Chinese ethnic networks of the magnitude observed in Southeast Asia increase bilateral trade by at least 60%. We argue that this estimate is upward biased due to omitted variable bias. Moreover, it is partly related to a preference effect rather than to enforcement and/or the availability of information. Applying a theory-based gravity model to ethnicity data for 1980 and 1990, and focusing on pure network effects, we find that the Chinese network leads to a more modest amount of trade creation of about 15%. Using new data on bilateral stocks of migrants from the World Bank for the year of 2000, we extend the analysis to all potential ethnic networks. We find, i.a., evidence for a Polish, a Turkish, a Mexican, or a Pakistani network. While confirming the existence of a Chinese network, its trade creating potential is dwarfed by other ethnic networks. The large heterogeneity in the trade-creating potential of different networks is, among other things, explained by the share of high-skilled immigrants, the degree of ethnic fragmentation, and GDP per capita.

JEL Classification: F12, F22.

Keywords: Gravity model. International trade. Network effects. International migration.

RÉSEAUX DE MIGRANTS, INFORMATION ET COMMERCE INTERNATIONAL

RÉSUME NON TECHNIQUE

Les dérégulations et le progrès technique ont font baisser les coûts de commerce et nombreux sont les économistes qui se sont appliqués à évaluer ces phénomènes. Cependant, nous savons depuis les études sur l'effet-frontière que les obstacles informels aux échanges sont importants. Selon Anderson et VanWincoop (2004), ils constituent une part substantielle des barrières aux échanges de biens manufacturés. Des travaux récents ont notamment indiqué que les migrations internationales qui diminuent ces barrières informelles, augmentent le commerce bilatéral.

Rauch et Trindade (Restat, 2002) - R&T - ont ainsi montré à partir d'un modèle de commerce bilatéral que la présence de populations chinoises à l'étranger a un important effet de création de commerce. Leurs résultats indiquent que "entre pays ayant une proportion de population chinoise de l'ordre de celle prévalant en Asie du Sud-Est, l'augmentation du commerce bilatéral de produits différenciés attribuable à l'existence de réseaux chinois est d'au moins 60% (p. 116). R&T considèrent que les migrants réduisent le coût de l'échange en véhiculant dans leur pays d'accueil de l'information sur les institutions légales et commerciales de leur pays d'origine ; c'est le canal du coût de transaction ou effet de réseau. Cependant, selon Combes et al. (2005), ce canal n'est pas le seul par lequel les migrants affectent le commerce bilatéral. Les membres d'une minorité ethnique peuvent aussi avoir une préférence marquée pour les produits provenant leur pays d'origine : c'est l'effet de préférence. Il est difficile de distinguer effets de réseau et effets de préférence, mais cette identification est utile dans la mesure où seuls les premiers, en diminuant les coûts de transaction, améliorent l'efficacité et augmentent le bien-être.

La contribution de cet article est de revisiter les résultats de R&T. Nous proposons une équation structurelle de gravité qui nous permet d'estimer les effets des réseaux chinois. Pour éliminer l'effet de préférence et isoler l'effet de réseau, nous nous concentrons sur les flux bilatéraux qui n'impliquent pas directement la Chine, mais concernent uniquement les pays où vivent des minorités chinoises. Nous appliquons aux données de R&T une méthodologie économétrique nouvelle et discutons des problèmes d'endogénéité. Nos résultats indiquent que la création de commerce estimée à 60% par R&T est, en réalité, probablement 2 à 4 fois moins élevée. Leur surestimation est essentiellement due à l'omission de certaines variables, dont celle relative au terme de résistance multilatérale des équations structurelles de gravité ; le fait de ne pas isoler l'effet de préférence est de moindre importance.

La seconde partie de notre contribution étend l'analyse de R&T à tous les réseaux ethniques. En utilisant les données de la Banque Mondiale portant sur l'année 2000, nous identifions les réseaux de groupes ethniques k par le stock d'individus nés dans le pays k mais résidant dans un pays étranger i ou j. Notre définition est ici plus restrictive que celle utilisée par R&T, puisqu'elle exclut les descendants des migrants ayant toujours vécu en minorité ethnique dans ces pays. Nous mesurons alors l'impact commercial de réseaux turcs, mexicains, pakistanais, pour n'en citer que quelques-uns. L'effet des réseaux chinois apparaît alors loin d'être le plus important. Nous montrons que la grande hétérogénéité des effets de réseaux peut être attribuée aux caractéristiques des pays d'origine des migrants : l'effet de réseau est plus faible lorsque les migrants proviennent de pays où le fractionnement ethnique est fort ou de pays où la part d'émigrants qualifiés est élevée.

RÉSUMÉ COURT

Le travail empirique influent de Rauch et Trindade (REStat, 2002) montre que la présence de fortes minorités chinoises dans certains pays accroît le commerce bilatéral entre ces pays d'au moins 60%. Cet effet nous paraît surestimé par l'existence d'un biais de variables omises ; par ailleurs, il s'explique davantage par un effet de préférence des migrants que par un effet de baisse des coûts de transaction. A partir d'une équation structurelle de gravité et de données de migration portant sur les années 1980 et 1990 et en nous centrant sur les seuls effets de réseaux, nous montrons que les réseaux chinois entraînent une création de commerce beaucoup plus modeste, d'environ 15%. Partant d'une base de données de la Banque mondiale, nous mesurons ensuite l'impact commercial de différents réseaux (turcs, mexicains, pakistanais...). L'effet des réseaux chinois est loin d'être le plus important. Nous montrons que la grande hétérogénéité des effets de réseaux s'explique par la part d'émigrants qualifiés, par le degré de fractionnement ethnique et par le niveau de développement du pays d'origine des migrants

Classification JEL : F12, F22.

Mots clés : Modèle de gravité. Commerce International. Effet de réseaux. Migration internationale.

ETHNIC NETWORKS, INFORMATION, AND INTERNATIONAL TRADE: REVISITING THE EVIDENCE[1]

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1. INTRODUCTION

Co-ethnic networks play an important role in shaping the volume and structure of international economic transactions. Rauch (2001) surveys a large economics literature that documents this fact for bilateral trade in goods. Networks ease the flow of information about trade opportunities and provide mutual trust that alleviates the problem of contract enforcement. Most authors focus on the trade-enhancing role of direct ethnic links between source and host countries. Sociological studies adopt a broader perspective that includes indirect links. Curtin (1984) defines a trade diaspora as *"the interrelated net of commercial communities forming a trade network"* (p. 4). Ethnic minorities are seed as middlemen who are active as cosmopolitan catalysts for economic transactions between global cities such as New York, London, or Singapore that form the backbone of the world economy. This view is confirmed in the empirical study of Peng and Ilinitch (1998) who find that immigrants make up as much as 40% of employees in international trade intermediaries.

Cowen (1997) reports historical examples: *"...the Spanish Jews were indispensable for international commerce in the Middle Ages. The Armenians controlled the overland route between between the Orient and Europe as late as the nineteenth century. Lebanese Christians developed trade between the various parts of the Ottoman empire"* (p. 170). The prototypical trade diaspora of the past is the one of the Phoenicians *"who exchanged products and knowledge as far afield as Spain, the British Isles, Greece, Babylon, Persepolis and Thebes"* (Cowen, 1997, p. 83). In modern times, the Chinese network is probably the most prominent. In all those examples, the trade-promoting role of ethnic minorities goes beyond the bilateral relationship between host and source country.

Until now, the only empirical paper that studies those indirect links between agents of the same ethnicity in different host countries is the one by Rauch and Trindade (2002) – henceforth R&T. Those authors use an empirical trade flow model to show that the network formed by the overseas Chinese population has a major trade creating effect not only with mainland China but

[1]We are grateful to Oded Stark and Michel Beine for suggesting this line of research, to Wilhelm Kohler, Davide Sala, and Sanne Hiller for stimulating discussions, participants at Workshops at the universities of Hohenheim, Lille II and Tübingen for comments. All remaining errors are ours.
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also between countries that host those Chinese ethnic minorities. Quantitatively, they find that "*for trade between countries with ethnic Chinese population shares at the levels of prevailing in Southeast Asia, the smallest estimated average increase in bilateral trade in differentiated products attributable to ethnic Chinese networks is nearly 60%*" (p. 116). Compared to other determinants of bilateral trade, this effect is large. In the present paper, we set out to discover other ethnic communities which may act as global trade facilitators and to revisit the validity of R&T's findings.

In their survey article, Anderson and van Wincoop (2004) devote substantial space to the results of R&T and argue that the ad valorem tariff equivalent of informational costs is about 6 percent. This is higher than the average tariff rate applied worldwide in recent years.[2] Using data for OECD countries, Evans (2003) argues that tariff equivalents implied by R&T are exaggerated. Existing empirical work connected to R&T makes use of a standard gravity framework. However, in the last years, the econometric modeling of bilateral trade flows has improved due to a sequence of major innovations. Most importantly, Anderson and van Wincoop (2003) have derived a testable gravity equation from the standard monopolistic competition trade model. They show that unbiased estimation of parameters requires to take the so called multilateral resistance terms into account: how strongly trade impediments between two countries reduce their bilateral trade depends crucially on the strength of impediments between each of these two countries with all the other countries that they trade with. This argument is clearly important when quantifying the importance of ethnic networks: how strongly such a network between two countries encourages bilateral trade depends on the costs of alternative trade routes that these two countries entertain.[3]

Econometric issues. Besides potential omitted variable bias, the results of R&T may also suffer from misspecification. Santos Silva and Tenreyro (2006) argue and show empirically that log-linear specifications of the gravity equation may lead to inconsistent estimates if the assumed error term does not enter multiplicatively into the relationship. Liu (2008) emphasizes that this critique also applies to Tobit estimation, the estimation technique used by R&T. One way to deal with this problem is to estimate the gravity model by Poisson pseudo maximum likelihood, which is robust to the type of misspecification mentioned above.[4]

As Combes *et al.* (2005) point out, ethnic networks may affect bilateral trade not only through their effect in trade costs (information and contracting costs), but also through preferences: members of ethnic minorities abroad may derive higher utility from goods imported from countries that host their ethnic majority. It is therefore difficult to clearly disentangle the trade cost from the preference effect.[5] Separate identification, however, would be welcome, since trade-

[2]The WTO World Trade Report (2007) documents that for the US, Canada, and the majority of European countries, the import-weighted average applied tariff rate was 4.1 percent in 2005.

[3]Controlling for multilateral resistance is crucial, e.g., for the correct estimation of border effects – see the discussion in Feenstra (2004) – and, hence, for dealing with the so called border puzzle (McCallum, 1995).

[4]Liu (2008) also shows that Poisson estimation helps addressing the puzzle raised by Rose (2004) that WTO membership does not create trade.

[5]Felbermayr and Toubal (2008) is a first attempt to disentangle the trade costs and preference effects of migrants

cost savings from networks free up resources and therefore represent welfare-improving efficiency improvements. The preference channel is not associated to such efficiency gains. The existence of a measurable and sizable trade-cost effect would be another – hitherto neglected – channel through which international migration leads to an improved allocation of resources worldwide.

We measure an ethnic network by the probability to pick an individual of ethnicity k simultaneously in some pair of countries i, j. Different to other papers, but in line with R&T, we allow k to differ from i or j. In the case where $k \neq i$ and $k \neq j$, we focus on indirect links. Different to R&T, we do not only focus on China as the only sending country and, hence, on the Chinese network alone, but allow for a much bigger set of ethnic networks.

Contribution. We extend the literature in two main ways. First, we propose a theory-grounded gravity framework for the estimation of the network effects. This allows to discuss the identification of the trade-cost channel of networks. We argue that, excluding the links of ethnic minorities with the ethnic majority country, one may minimize the preference effect and come closer to the pure trade cost effect. Besides the identification issue, we use state-of-the-art econometric techniques to the data of R&T. This avoids a number of problems related to the R&T approach; see Baldwin and Taglioni (2006) for a discussion of those issues.[6] We show that the large trade-creating effect of 60% estimated by R&T is probably two to four times too large. Most of the overestimation comes from the omission of the multilateral resistance terms; the preference channel seems to be less important.

The second part of our contribution is to extend the analysis beyond the Chinese network studied by R&T. Using data from the World Bank for the year of 2000, we proxy the networks of some ethnic group k by the stock of individuals born in k but residing in some foreign country i or j. This gives us a more narrow definition of ethnic networks than the one used by R&T, because it excludes descendants of individuals who have migrated long ago or whose parents have always lived as ethnic minorities in those foreign countries. Our definition is well in line with the *"continually reversible population flow"* that defines a trade diaspora in the sociological literature (Cohen, 1997, p. 98). Applying R&T's methodology, we find results that are qualitatively similar to those obtained for the years of 1980 and 1990 where the definition of ethnicity is broader. Moreover, the World Bank data allow to check for the existence of other ethnic (or better: migrant) networks. Besides the Chinese network, we document the existence of a Turkish, a Mexican, or a Pakistani network, to name only a few. Interestingly, in terms of trade-creating potential, the Chinese network is by far not the most important one. We also find substantial heterogeneity in the trade-creating potential of different networks which we can partly explain by characteristics of the migrants' countries of origin. For example, when the share of high-skilled individuals in the source country is larger, or the population less strongly ethnically fragmented, the network effects are smaller.

on OECD bilateral trade.

[6]Baldwin *et al.* (2008) document the quantitative importance of these problems in a study on the effect of the Euro on trade and investment.

Related literature. Our paper is related to the literature as follows. Besides the paper by R&T, which we take as our starting point, our analysis is very close to Combes *et al.* (2005). That paper studies the role of social and business networks constituted by inter-regional migrants in France. Using a theory-based gravity approach, they find that these regional networks are quantitatively important and that they may contribute toward an explanation of the border puzzle introduced by McCallum (1995). Our paper is also related to a large literature on the direct effect of migration on bilateral trade. Gould (1994), Head and Ries (1998), Girma and Yu (2000), and Wagner *et al.* (2002) study the trade promoting role of immigration into the U.S. or Canada. Dunlevy (2006) and Bandyopadhyay *et al.* (2008) document a pro-trade effect of migration on the exports of US states. While the older literature usually focuses on bilateral trade of one anchor country with many trade partners, Felbermayr and Jung (2009) extend the analysis to the full matrix of sending and receiving countries and identify a strong causal effect of bilateral migration on bilateral trade between Southern and Northern countries.

The remainder of this paper is structured as follows. Section 2 introduces the theoretical framework and discusses our econometric approach. Section 3 provides a detailed look at the data. Section 4 and 5 contain our results while section 6 offers concluding remarks. The Appendix further details regression results .[7]

2. Econometric specification

2.1. A theory-based gravity model

We assume the existence of representative household with CES preferences over domestic and imported varieties of some differentiated good. Different to the standard treatment, we use the utility function proposed in Combes *et al.* (2005) which introduces source-country specific weights a_{ij}. These weights capture the particular attachment of country $i's$ household to imports from country j. We may use this slightly modified utility function in the multi-country monopolistic competition model of international trade proposed by Anderson and van Wincoop (2003), henceforth A&vW. Utility maximization under the appropriate aggregate budget constraint, market clearing, and the assumption that iceberg trade costs T_{ij} and preference weights a_{ij} are symmetric $(T_{ij} = T_{ji}; a_{ij} = a_{ji})$, the (c.i.f.) value of bilateral imports M_{ij} can be written as

$$M_{ij} = \frac{Y_i Y_j}{Y_w} \left(\frac{T_{ij}}{a_{ij}} \right)^{1-\sigma} \left(\tilde{P}_i \tilde{P}_j \right)^{\sigma-1}, \tag{1}$$

where the price indices $\tilde{P}$ solve $\left(\tilde{P}_j\right)^{1-\sigma} = \sum_{i=1}^{C} (Y_i/Y_w)(T_{ij}/a_{ij})^{1-\sigma} \left(\tilde{P}_i\right)^{\sigma-1}$; see Feenstra (2004) for the details of the derivation. A&vW call $\tilde{P}_i$ indices of multilateral resistance because they depend on the trade costs of country i with all countries in the world, the number of which is given by C. The variables Y_i denote GDP of country i, the subindex w refers to the world. The elasticity of substitution in the underlying CES utility function is given by σ. We will be interested by the determinants of T_{ij} in general, and by the cost of obtaining

[7] Our data, program codes, and further results can be downloaded from `http://team.univ-paris1.fr/teamperso/toubal/papers/fjt08.7z`

information in particular. Following the literature, we assume that T_{ij} is a log-linear function of its determinants.

The central insight of A&vW is that the volume of trade between i and j depends not only on the trade costs between i and j but on the entire distribution of trade costs between i and j and *all other countries* of the world. How strongly T_{ij} restricts trade between i and j depends on the costs that affect trade with alternative partners. Hence, in the estimation we have to deal with the $\tilde{P}_i$ terms. We also have to decide about the appropriate econometric estimation technique. Finally, in order to make the role of networks explicit, we need to model T_{ij} and a_{ij}. We deal with the first two issues first and relegate the modeling of trade costs and preferences into section 2.2.

The multilateral resistance terms $\tilde{P}_i$ are essentially unobserved since they do not correspond to official CPI deflators. A&vW show how one can solve for the $\tilde{P}_i$ terms numerically and use them in an iterative estimation strategy. They demonstrate that the failure to control for multilateral resistance typically biases the absolute value of estimated trade cost variables upwards. R&T recognize the problem of multilateral resistance (without mentioning the issue) by adding an ad-hoc remoteness term to their regressions. Ex ante, it is unclear whether this is sufficient to deal with omitted variable bias. In our regressions, we follow Feenstra (2004) who argues that the use of importer and exporter specific fixed effects in a simple OLS model leads to very similar results than A&vW's strategy but is technically much less demanding. We opt for this strategy, which is now common in virtually all gravity applications. In order to save on degrees of freedom, we do not allow for separate role for importer and exporter fixed effects; rather, we will use country dummies which, to the extent that trade costs are symmetric, yields identical results; see Baier and Bergstrand (2007) for a similar strategy.

Traditionally, the gravity literature estimates a log-linear version of (1). In non-stochastic form, the relationship between the multiplicative constant-elasticity model (1) and its log-linear additive formulation is trivial. This does no longer hold if trade flows are measured with error. Santos Silva and Tenreyro (2006) warn that heteroskedastic residuals do not only lead to inefficiency of the log-linear estimator, but also cause inconsistency. This is because of Jensen's inequality which says that the expected value of the logarithm of a random variable is different from the logarithm of its expected value, i.e., $E(\ln M_{ij}) \neq \ln E(M_{ij})$. Then, $E(\ln M_{ij})$ not only depends on the mean of M_{ij}, but also on higher moments of the distribution. Thus, heteroskedasticity in the residuals, which on a first glance only affects efficiency of the estimator, feeds back into the conditional mean of the dependent variable, which, in general, violates the zero conditional mean assumption on the error term needed to guarantee consistency.

To be more precise, consider that the true model can be represented as $M_{ij} = \exp(\beta X_{ij}) + \epsilon_{ij}$. Then, estimating a log-linear model of the form $\ln(M_{ij}) = \beta X_{ij} + \ln(\eta_{ij})$ would imply that $\eta_{ij} = 1 + \epsilon_{ij}/\exp(\beta X_{ij})$. Hence, $E[\eta_{ij}|X_{ij}]$ can only be independent of X_{ij} for the special case $\epsilon_{ij} = \exp(\beta X_{ij})\nu_{ij}$, where ν_{ij} is a random variable statistically independent of X_{ij}. In general, this requirement is violated.

Santos Silva and Tenreyro (2006) solve these problems by estimating the gravity equation multiplicatively (without taking the logarithm of M_{ij}) and allowing for heteroskedasticity.

Their proposed estimator is equivalent to the Poisson pseudo-maximum likelihood estimator (PML), the most commonly used conditional mean specification of which is $E\left(M_{ij}\left|X_{ij}\right.\right) = \exp\left(\beta X_{ij}\right)$. Coefficients can be explained as elasticities if the dependent variable is in level and covariates X_{ij} are in logs. It is worthy to note that country fixed effects can be included in the PML model as a control for multilateral resistance terms.

Santos Silva and Tenreyro (2006) justify the hypothesis that conditional variance is proportional to the conditional mean for the Poisson model, although the Poisson regression is consistent even when the variance function is misspecified.[8]

Liu (2008) argues that the problem of inconsistency due to heteroskedasticity also applies to the Tobit estimator, which has been used by R&T. Moreover, they use the log of total bilateral trade $\ln\left[\left(M_{ij} + M_{ji}\right)/2\right]$ as the dependent variable, which would be correct only if the theoretical assumption of perfect symmetry in trade costs $\tau_{ij} = \tau_{ji}$ was to be taken literally and the error terms were symmetric, too.

2.2. The role of networks

We now need to formalize the role of ethnic (or: migrants') networks. While there is little doubt that such networks may play an important role in conveying important information about the trading opportunities between countries, there is no apparent consensus in the existing literature as to how such networks are to be defined and modeled.

We define as the k-ethnic network the set of bilateral links between all countries in the world maintained by members of the ethnicity k. In other words, there are as many ethnic networks as there are ethnicities in the world. In our empirical work, we will assume that every ethnicity is associated to exactly one country in the world.[9] Moreover, most of our analysis concentrates on the most sizable ethnic network studied by R&T: that of Chinese.

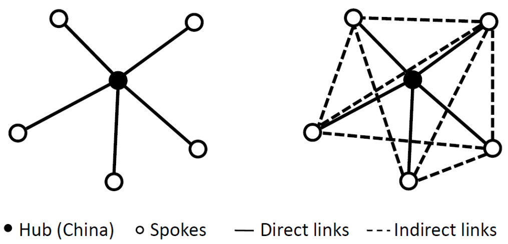

Figure 1 – Direct and indirect links in a network of countries.

Figure 1 illustrates a stylized network of six countries. The single star in the left panel depicts the Chinese ethnic network. It illustrates the links between the hub (China), illustrated by a

[8]Using nonparametric tests, Henderson and Millimet (2008) recommend estimation of the gravity model in levels. Wooldridge (2002, p.676) emphasizes "while the leading application is to count data, the fixed effect Poisson estimator works whenever the conditional mean assumption holds. Therefore, the dependent variables could be a nonnegative continuous variable, or even a binary response if we believe the unobserved effect is multiplicative...".

[9]Obviously, the number of ethnicities is much larger than the number of independent countries since there are many ethnicities without their own state, e.g., the Kurds. We abstract from this possibility.

full black circle, and its spokes (other countries), depicted by hollow circles. *Through the hub*, all spokes are linked with each other. The right-hand panel in Figure 1 depicts some of the bilateral trade links between the six countries. The solid lines coincide with the ethnic network which will affect trade relationships directly. We therefore use the term *direct* links. Bilateral trade flows between spokes are illustrated by dashed lines. Since the ethnic network affects those flows only through links to the same hub, we talk about *indirect* links. For simplicity, we assume that each ethnic (or migrant) network is associated to a single hub, but this need not be so in all cases.

We take a *search-theoretic* perspective on the trade-creating role of ethnic networks. Suppose that the total world-wide stock of individuals with ethnicity k is given by M_k. These individuals can be resident in any country in the world, hence $\sum_j M_{kj} = M_k$, where M_{kj} is the size of the ethnic group k in country j. Denote by L_i the total resident population in country i regardless of the ethnic group that residents may belong to. Then, $s_{ik} = M_{ki}/L_i$ denotes the probability that a randomly chosen individual residing in country i belongs to ethnicity k. Hence, $N_{ij}^k = s_{ik}s_{jk}$ denotes the likelihood that two simultaneously drawn individuals residing in countries i and j respectively have the same ethnicity. Hence, N_{ij}^k measures the probability of a co-ethnic contact and hence the strength of the link between i and j. In this concept, we regard k as the ethnic hub, and i, j as ethnic spokes. By construction, the hub is the country where the ethnicity k forms the majority, hence $N_{ij}^k \leq N_{kj}^k$, $j, i \neq k$. When k is different from i and j, N_{ij}^k refers to an indirect link; when k is either i or j, it refers to a direct link. Note that, on average, the strength of indirect and direct links are likely to be negatively correlated. Assume a reallocation of ethnicity-k individuals from a spoke i to the hub k such that s_{kk} goes up and s_{ik} falls. Then, all direct links (except possibly N_{ik}^k) grow stronger, *all* indirect links involving country i become weaker, and all indirect links that do not concern i remain as before.[10]

Our key hypothesis is that the strength of ethnic links is related to the trade-creating potential of an ethnic network. Clearly, those networks can foster trade along the direct links. They also, however, potentially affect trade between spokes i and j. This is the case, because migrants with ethnicity k residing in spoke i convey information on trading opportunities with migrants of the same ethnicity residing in spoke j, i.e., information about one country is made available through the k-network. Indirect k-ethnic links between spokes are measured by $N_{ij}^k = s_{ik}s_{jk}$, for all i, j, k. The k-ethnic network is then just the vector N^k that collects all elements N_{ij}^k for all i and j.

Following R&T, we assume that trade costs T_{ij} are a function of geographical measures related to transportation costs (distance, adjacency), of variables related to trade policy (membership in regional trade agreements), a variable measuring cultural proximity (common language), and one related to historical ties (joint colonial past). Central to our analysis, T_{ij} also depends on the network variable defined above. We assume that the trade cost function can be linearized. Collecting all variables other than the network into the (row) vector $\mathbf{X}_{ij}$, we may therefore posit $\ln T_{ij} = \xi_T' \mathbf{X}_{ij} - \sum_k \nu_T^k N_{ij}^k$, where ξ is a vector of coefficients, N_{ij}^k measures the strength of

[10]We do not make any statements here about whether a given distribution of M_{ki} across countries is efficient in a Pareto sense (i.e., whether it is possible to reallocate M_{ki} such that some N_{kj} grows stronger without any other link growing weaker).

the k-ethnic network (CHINSHARE in R&T), and ν_T^k is the associated coefficient measuring the effect of the k-ethnic network on trade costs (expected to be positive). Evidence in favor of $\nu_T^k > 0$ would suggest that the network of ethnicity k lowers informational or contractual costs, thereby encouraging trade through lower total trade costs. This is the *trade cost channel* of networks which R&T focus on in their paper. Note that most of the empirical literature focuses on direct links (see Combes *et al.* (2005) for an example), in which the our trade cost function would simply collapse to $\ln T_{ij} = \xi_T' \mathbf{X}_{ij} - \nu_T 2 N_{ij}^i$ since $N_{ij}^i = N_{ji}^j$ by construction. We will argue below that omitting indirect networks $k \neq i, j$ may bias estimates for direct network downwards because indirect and direct networks are negatively correlated.

Similarly, we may posit that country $i's$ cultural, political, or geographical proximity to country j increases the weight of goods imported from i, so that $\ln a_{ij} = \xi_a' \mathbf{X}_{ij} + \sum_k \nu_a^k N_{ij}^k$, where ν_a^k is expected positive. Evidence for $\nu_a^k > 0$ would be in line with the existence of a *preference effect* of ethnic networks.

Employing these specifications for T_{ij} and a_{ij} in (1), and using non-overlapping sets of country dummies μ_i and μ_j to control for all country-specific variables, we have

$$\begin{aligned} M_{ij} &= \exp\left\{ \ln\left(Y_i Y_j\right) + (\sigma - 1)\left(\xi_a' - \xi_T'\right)\mathbf{X}_{ij} + \sum_k (\sigma - 1)\left(\nu_a^k + \nu_T^k\right) N_{ij}^k + \mu_i + \mu_j \right\} + \epsilon_{ij}, \\ &= \exp\left\{ \ln\left(Y_i Y_j\right) + \bar{\xi}' \mathbf{X}_{ij} + \sum_k \bar{\nu}^k N_{ij}^k + \mu_i + \mu_j \right\} + \epsilon_{ij}. \end{aligned} \tag{2}$$

Clearly, the estimated coefficients $\bar{\xi}'$ and $\bar{\nu}^k$ will reflect the elasticity of substitution σ as well as the effect of X or the network on trade costs *and* preferences. In other words, there is a twofold identification problem. First, the identification of the *total* network effect is impossible without external information about σ. Second, the trade cost and the preference channels are typically confounded.

At this point, we want to make three observations. First, R&T run equation (2) on different dependent variables: First, they focus on trade in differentiated goods. These goods are highly heterogeneous with their characteristics typically depending on the producer who has monopoly on the production of a specific variant of the good. Most consumption goods such as apparel, appliances, or cars fall into this category. Second, there are goods for which either reference prices exist, or which are traded on organized exchanges. In both cases, the characteristics of the goods do not depend on the producer but are rather specific to the good itself. Standardized industrial inputs, or homogeneous products such as steel, wood, etc., fall into this category. Clearly, across those categories, the degree of product differentiation differs and so does the monopoly power of the producers. Hence, σ is probably low for differentiated goods, higher for reference-priced ones, and highest for exchange-priced ones. Also, the informational needs for trade in differentiated goods are likely to be much higher than for homogeneous goods, so that ethnic networks should matter more for the former than for the latter. However, there are no clear predictions concerning the comparison between parameter estimates $\bar{\xi}'$ and $\bar{\nu}^k$ obtained from these different regressions. For example, even if the trade cost and the preference channel could be separated, for a given strength of the network effect ν_T^k, the estimated coefficient $(\sigma - 1)\,\nu_T^k$ would be large for homogeneous goods since the degree of substitutability is high and low for differentiated goods. The opposite may be true if, for given σ, ν_T^k varies across the groups of goods. However, neither σ nor ν_T^k can be assumed constant over those subaggregates of goods so that the naive comparison of coefficients obtained from different regressions is problematic.

Second, in general, any estimate of $\bar{\nu}^k$ reflects the preference and trade cost effect of the k-ethnic network.[11] However, the following observation may help in the separate identification of the channels. Any ethnic (or migrant) network consists of direct and indirect links. Direct links are those that relate an individual of ethnicity k residing in country i to another individual of the same ethnicity *at the hub*, namely country k. Indirect links, in turn, relate the individual to another one of the same ethnicity in country $j \neq k$. If migrants (or their offspring) have special preferences for goods produced in country k, then direct links will reflect the preference channel along with information channel. The preference channel should, however, not be so important in indirect links, since these do not relate to the country of origin. Rather, indirect links should only reflect the information channel.[12] There is another advantage of looking at indirect links: it may well be that citizens of country k move to country i (and vice versa) as a response to some positive shock to the trading potential between the two countries. Then, the direct ethnic link $s_{ik}s_{ki}$ would be endogenous to the volume of bilateral trade. In contrast, the indirect links $s_{ik}s_{kj}$ would not be affected.[13]

Third, there may be an endogeneity issue. Migration and trade flows between two countries could be driven by the same (unobserved) factors. Or, there may be reverse causation in that flows of people are actually induced by flows of goods. In related work using the same definition of migrant networks (but focusing on direct links only, using a smaller country sample, and exploiting the time variance of the data), we show that there is no empirical evidence for endogeneity bias.[14] The reason may be that migration follows wage differentials between countries, and those are determined by multilateral trade openness rather than bilateral one.

Summarizing, our econometric approach differs from R&T in the following ways:

1. In all of our specifications, the dependent variable is the log (or level, depending on the model) of *imports* rather than the log (or level) of the arithmetic average over imports and

[11] R&T conceptually decompose the trade cost channel into an 'contractual enforcement' and an 'informational' component. They try to isolate the informational part by distinguishing between differentiated, reference-priced and exchange-traded goods. Their identifying assumption is that network improve contractual enforcement for all categories of goods, but information is only relevant for differentiated goods. Hence, the difference between the network estimates for differentiated and exchange-traded goods reflects information; see also Anderson and van Wincoop (2004). We do not wish to push this interpretation, since equation (2) shows that estimated coefficients would also reflect systematic differences in elasticities of substitution across categories of goods, which are essentially unobserved. Rather, we subsume both effects under 'trade costs'.

[12] R&T propose a similar strategy in a section where they measure the strength of networks in levels rather Chinese ethnic population shares.

[13] Clearly, any combinations of $s_{ik}, s_{jk}, s_{ki}, s_{kj}$ would satisfy this criterion.

[14] See Felbermayr and Jung (2009). More precisely, we follow Baier and Bergstrand (2007) and estimate in first-differences. In that setup, the Wooldridge test for exogeneity is satisfied.

exports. This implies that we have two observations per country pair instead of only one. This increases the degrees of freedom, but requires to control for correlation of error terms within each pair.

2. We control for the multilateral resistance terms and all other country-specific determinants of trade costs, policy, history, etc., by including a complete set of *country fixed-effects*. This strategy also mitigates spurious correlation concerns driven, e.g., by language etc..
3. Our preferred specification is a *Poisson (pseudo) maximum likelihood* approach with country fixed-effects.
4. Since the comparison of results by commodity group is complicated by a (potentially) varying degree of substitutability, we also show results for aggregate trade,
5. Besides computing the total network effect, as R&T do, we present *direct* and *indirect* effects for the case of measuring the strength of network in shares, where the latter are supposed to be more informative about the pure trade cost channel.

3. Data

3.1. Trade data

R&T estimate the effect of Chinese ethnic networks on different dependent variables: trade in differentiated goods, trade in reference-priced goods, and trade in exchange-traded goods. This classification requires trade data at the level of the four-digit Standard Industrial Trade Classification (SITC) Revision 2, which can be downloaded from the United Nations Commodity Trade Statistics Database (UN Comtrade).

Since the raw data are incomplete in time, country, and commodity coverage, several attempts have been made to recompile the data, thereby allocating exports to unspecified regions, and correcting for entrepôt trade. The correct identification of trading partners seems to be an important issue, which is also recognized by R&T.

Statistics Canada has constructed the World Trade Database (WTDB), covering the years 1970-1997. Feenstra (2000) concludes that the "method of dealing with entrepôt trade seems to be adaptable to the situation of an entrepôt country as the Netherlands. [...]. It does not seem to cover the case of entrepôt trade countries such as Hong Kong or Singapore" (p. 4). In order to assess the severity of the problem, Feenstra (2000) compares the total value of U.S. imports from China and Hong Kong, respectively, from Statistics Canada and U.S. Census data, and finds these values to be "reasonably close" (p. 7) up until 1983.

R&T have made use of an early version of the WTDB. Unfortunately, this data is no longer distributed by the NBER. A slightly revised version covering the years 1980-1997 is made available by Robert Feenstra, and can be downloaded as UCD-Statistics Canada Trade Data. Robert Feenstra also provides a newer dataset (NBER-UN World Trade Data), covering the years 1962-2000. Data for early years (1962-1983) are taken from UN Comtrade, making adjustments for country codes only. For the latter years (1984-2000), data only cover 72 countries, and are adjusted in several ways. Most importantly, Feenstra *et al.* (2005) revise Chinese exports shipped through Hong Kong.[15]

In order to take advantage of all the corrections made, we utilize the UCD-Statistics Canada Trade Data for 1980, and the NBER-UN World Trade Data for 1990 and 2000. We restrict our sample to the 63 countries used by R&T. Unfortunately, the 72 reporting countries in the NBER-UN World Trade Data do not completely overlap the 63 countries of interest, such that we do not have the full trade flow matrix.[16] Note that the trade data does not contain zero trade flows. Rather, trade flows below 1,000 thousand U.S. dollar are coded as missing. Hence, log-log OLS models do not present the extra problem that the log of a zero trade flow is not defined.

3.2. Migration data

Data on Chinese ethnic networks for 1980 and 1990 is taken from R&T. In order to check the existence of migrant networks, we utilize the World Bank international bilateral migration stock database which is available for 226 countries and territories and is described in detail by Parsons *et al.* (2007). Rather than including all persons with any Chinese ancestry, the World Bank data comprise migrants which have been born in China and now reside in a foreign country. While the migration data are broken down by receiving country, the data make no reference to the time at which migration has taken place (Parsons *et al.*, 2007, p. 4). It allocates the total outstanding stock of 175.7 million international migrants over sending and receiving countries.

Both the Chinese ethnic and the migration network cover Chinese citizens residing abroad and naturalized citizens of Chinese descent. Whereas the Chinese ethnic network also captures descendants of Chinese parents, people born who have just been born in China without being of Chinese ancestry add to the Chinese migrant network. In any case, the focus of the migrant network is on people who have moved during their lifetime.[17]

The World Bank matrix also allows for examining the role of other networks in a similar way. In absolute values, Mexico is the top sending country with more than 10.1 million of its natives living abroad. However, 92.6% of emigrants go to neighboring countries. This ratio is 18.4% for India, the second largest sending country with about 9.0 million of its natives abroad, 42.2% for China (fourth largest expatriate population, 5.8 million), 6.2% for Turkey (10th largest expatriate population, 3.0 million), or 13.2% for Morocco (12th largest expatriate population,

[15]Feenstra *et al.* (2005) estimate the value-added in Hong Kong on re-exports, and reduce the value of imports from China and increase the value of imports from Hong Kong by this amount. The markup calculation is described in detail in Feenstra *et al.* (1999), and discussed in Feenstra *et al.* (2005).

[16]Countries and data availability are listed in the Appendix. In order to come from trade data on four-digit SITC level to trade by commodity group, we make use of the Rauch (1999) classification. In order to save space, we focus on the 'liberal' aggregation which maximizes the number of SITC categories classified as either exchange-trade or reference-priced goods in case of ambiguities. R&T compare results for 'liberal' and 'conservative' aggregation rules and find no qualitative and quantitative difference.

[17]This criterion is often not met in case of the Former Soviet Union, Yugoslavia, and Czechoslovakia, where the break-ups of former states have "produced" migrants. However, our analysis does not cover these countries. Moreover, Parsons et. al (2007) states that "the return of Hong Kong to Chinese sovereignty in 1997 did not reduce the number of migrants" (p. 9).

2.6 million).[18] Unfortunately, since the data for 2000 is conceptually different from the one used by R&T, we cannot pool different years and use panel econometrics.

3.3. Other data

Data on population in 2000 and GDP come from the World Development Indicators (WDI).[19] Data on geographical and cultural proximity like distance, use of a common official language, colonial ties, and common colonizer are taken from the CEPII. Following R&T, we include dummies for common membership in the EEC and EFTA for 1980 and 1990. In 2000, we additionally control for common membership in NAFTA, ASEAN, and MERCOSUR, which seem to be the most important regional free trade agreements at that time.

4. Results

In this section, we present results for the effect of Chinese networks on trade. The discussion of other potential networks is relegated to the next section. Following R&T, we start with looking at the effect of country pairs trading along the direct *and* indirect links. While this strategy disallows to distinguish between preference and trade cost channel, we proceed with a decomposition of the average effect. In order to make transparent how our estimation strategy impacts on the trade creation of Chinese ethnic networks in Southeast Asia (where the network is quantitatively strong), we also decompose the average effect along the lines of strong and weak networks.

We do not only present the estimated coefficients, but also compute implied trade creation and associated ad valorem tariff equivalents. We do this in order to make our results comparable to the results presented by R&T and A&vW, respectively.

4.1. The direct and indirect effect of the Chinese network on aggregate bilateral trade

We start the discussion of our results by looking at aggregate bilateral trade. Hence, the dependent variable records the total value of imports of country i from country j. In later tables, we will disaggregate bilateral trade flows into the groups of exchange-trade, reference-priced, and differentiated goods, as proposed by R&T.

The first three columns in Table 1, (A1) to (A3), show the effect of the Chinese ethnic network on the value of bilateral trade, without distinguishing between direct and indirect network links. The list of controls is identical to R&T with the exception that we do not include the product of *per capita* GDPs, for which there is no role in the standard theoretical derivations of the gravity equation. Column (A1) replicates R&T for the case of aggregate trade and the year of 1980. The coefficients on standard gravity covariates appear with signs and magnitudes comparable to those found by R&T and other studies: the coefficients on the product of GDPs and distance

[18] This collection reflects the largest sending countries for which we find network effects in our empirical analysis below.

[19] Unfortunately, WDI do not cover Taiwan which is therefore excluded from our analysis. It turns out that the replication of R&T's results does not hinge on the inclusion of Taiwan.

are close to -1 and 1, respectively. The dummies controlling for common membership in regional trade agreements (EEC, EFTA) yield implausible results (this is common, see Baier and Bergstrand, 2007). Common language and colonial ties have large and significant effects, and the adjacency dummy is not statistically significant.

Table 1 – The Chinese network in aggregate trade

Dependent variable: Aggregate trade

	1980					1990					2000				
	(A1) OLS	(A2) FE-OLS	(A3) FE-PML	(A4) FE-OLS	(A5) FE-PML	(B1) OLS	(B2) FE-OLS	(B3) FE-PML	(B4) FE-OLS	(B5) FE-PML	(C1) OLS	(C2) FE-OLS	(C3) FE-PML	(C4) FE-OLS	(C5) FE-PML
CHIN	4.488***	0.893***	0.881***			4.471***	1.262***	1.758***			5.460***	1.725**	2.975***		
	(4.77)	(2.63)	(3.40)			(6.96)	(2.64)	(5.35)			(3.80)	(2.17)	(6.00)		
CHIN*(1-DIR)				1.137***	0.457				0.979***	0.369				92.590**	42.490***
				(2.62)	(0.95)				(2.64)	(0.92)				(2.34)	(3.29)
CHIN*DIR				0.769*	1.000***				1.402**	1.986***				1.790**	3.148***
				(1.89)	(4.24)				(2.21)	(7.16)				(2.23)	(6.14)
ln(GDP_i GDP_j)	1.047***	1.110***	0.857***	1.110***	0.833***	0.979***	0.962***	0.888***	0.962***	0.888***	1.070***	1.029***	0.930***	1.029***	0.930***
	(49.40)	(25.63)	(25.54)	(25.62)	(19.84)	(65.48)	(32.11)	(22.29)	(32.10)	(22.09)	(80.79)	(39.38)	(32.32)	(39.35)	(32.32)
ln(DISTANCE)	-1.084***	-1.117***	-0.708***	-1.116***	-0.711***	-0.949***	-0.984***	-0.589***	-0.986***	-0.607***	-1.134***	-1.205***	-0.598***	-1.200***	-0.596***
	(-16.01)	(-18.46)	(-16.31)	(-18.30)	(-16.10)	(-20.03)	(-23.16)	(-13.54)	(-23.06)	(-13.63)	(-25.42)	(-27.03)	(-17.30)	(-26.81)	(-17.23)
ADJACENT	-0.069	0.130	0.571***	0.133	0.567***	0.226	0.452**	0.705***	0.449**	0.663***	-0.072	-0.103	0.395***	-0.091	0.401***
	(-0.30)	(0.61)	(5.40)	(0.62)	(5.31)	(1.23)	(2.36)	(7.09)	(2.34)	(6.38)	(-0.41)	(-0.55)	(3.96)	(-0.48)	(4.02)
EEC	-0.226	-1.569***	0.086	-1.568***	0.084	0.154	-0.353**	0.489***	-0.354**	0.469***	0.101	-0.572***	0.569***	-0.569***	0.569***
	(-1.35)	(-8.93)	(0.62)	(-8.92)	(0.60)	(1.33)	(-2.37)	(3.65)	(-2.37)	(3.49)	(1.07)	(-5.21)	(5.43)	(-5.18)	(5.43)
EFTA	0.656***	0.012	0.389**	0.012	0.390**	0.288**	-0.021	0.377**	-0.021	0.389**	1.025	0.955	-0.700	0.956	-0.701
	(3.90)	(0.06)	(2.14)	(0.07)	(2.15)	(2.04)	(-0.13)	(2.08)	(-0.13)	(2.15)	(1.29)	(1.13)	(-1.63)	(1.14)	(-1.63)
NAFTA											0.077	0.596	0.629***	0.602	0.632***
											(0.19)	(1.06)	(3.78)	(1.07)	(3.81)
MERCOSUR											0.447	1.071*	1.985***	1.072*	1.981***
											(0.85)	(1.83)	(10.75)	(1.84)	(10.76)
ASEAN											1.464***	0.038	0.200	0.059	0.224
											(4.24)	(0.13)	(1.22)	(0.20)	(1.36)
LANGUAGE	0.557***	0.513***	0.231**	0.514***	0.231**	0.645***	0.549***	0.232**	0.549***	0.234**	0.632***	0.652***	0.258***	0.643***	0.253***
	(4.48)	(4.12)	(2.44)	(4.12)	(2.44)	(7.03)	(5.92)	(2.38)	(5.90)	(2.40)	(7.59)	(7.34)	(3.16)	(7.23)	(3.09)
COLOTIE	0.601***	0.690***	0.221*	0.690***	0.221*	0.408**	0.448***	0.040	0.449***	0.034	0.419***	0.436***	0.047	0.441***	0.048
	(2.65)	(3.34)	(1.66)	(3.34)	(1.66)	(2.37)	(3.01)	(0.30)	(3.01)	(0.25)	(2.65)	(2.78)	(0.36)	(2.81)	(0.37)
ln(REMOTE)	0.433***					0.461***					0.923***				
	(3.29)					(4.53)					(10.20)				
R2	0.609	0.722	0.887	0.722	0.887	0.702	0.794	0.907	0.794	0.907	0.750	0.819	0.900	0.819	0.900
RESET (p-value)	0.010	0.000	0.017	0.000	0.017	0.000	0.000	0.685	0.000	0.642	0.000	0.000	0.241	0.000	0.241
Trade creation (%)															
CHIN	1.413	0.280	0.276			1.290	0.363	0.505			0.167	0.053	0.091		
CHIN*(1-DIR)				0.171	0.069				0.136	0.051				0.275	0.126
CHIN*DIR				3.607	4.716				5.705	8.173				1.356	2.397
Tariff equivalent (%)															
CHIN	0.201	0.040	0.039			0.183	0.052	0.072			0.024	0.008	0.013		
CHIN*(1-DIR)				0.024	0.010				0.020	0.007				0.039	0.018
CHIN*DIR				0.518	0.674				0.809	1.145				0.193	0.340

N=2520 in 1980, N=2795 in 1990, and N=3259 in 2000. All regressions include a constant. FE-OLS and FE-PML include country dummies. Observations clustered by (undirectional) country-pair. Robust t statistics in parenthesis. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.
Trade creation (%) and ad valorem tariff equivalents (%) evaluated at the respective sample means. Elasticity of substitution is eight.

The variable of interest is $CHIN$. The coefficient obtained under OLS without fixed effects in column (A1) yields a point estimate of 4.488 and a robust, cluster-corrected, t-value of about 5, which is comparable to results for trade by commodity group reported by R&T.[20] That effect amounts to total trade creation of about 1.4%, if assuming that $CHIN$ moves from zero to the sample average.[21] In terms of ad valorem tariff equivalents, the estimated network effect is equivalent to a hypothetical tariff reduction of about 0.2 percentage points.[22] This is much smaller than the headline result of 60% trade creation or, equivalently, 6% tariff equivalent, discussed by Anderson and van Wincoop (2004), which focus on differentiated goods, and relate to the effect of the network when both concerned countries have *large* (i.e., larger than 1%) ethnic chinese populations. Table B.5 columns (A1) and (B1) replicate the findings by R&T.

Column (A2) includes country-specific fixed effects to deal with multilateral resistance. This changes the usual gravity covariates only modestly, with the exception of EEC and EFTA membership. However, the network effect drops to 0.893 and is only about 20% as big as the one obtained without fixed effects. Statistical significance, however, is maintained, with a t-value of 2.63. The amount of trade creation or the tariff equivalents are scaled downwards to 0.28% and 0.04 percentage points, respectively.[23] Finally, column (A3) replaces OLS estimation with Poisson (pseudo) maximum likelihood (PML). Compared to (A2), the heteroskedasticity-robust approach does not lead to important further changes and has only minor effects on the accuracy of the estimate.

Columns (A4) and (A5) decompose the total network into direct (involving mainland China) and indirect links (not involving China as a trade partner). The dummy variable DIR takes the value of one if the bilateral relationship involves China and zero otherwise. Using fixed-effects in an OLS model, the direct effect comes with an estimate of 0.769 and the indirect one with 1.137, both estimated at satisfactory (though not excellent) statistical precision. Using the fixed-effects PML model, we do not find any evidence for the indirect effect any more while the direct one is now very precisely estimated. This finding suggests that the preference channel is probably quantitatively more important than the information channel. Evaluated at the respective sample means, the effect of direct links is associated to substantial trade-creation (4.7%). This equivalent to a reduction of an ad valorem tariff by 0.67 percentage points. Even in the OLS model with fixed effects (FE-OLS), indirect links matter less by at least one order of magnitude. This evidence points towards the importance of the preference relative to the information channel.

Columns entitled (B1) to (B5) repeat the exercise for the year of 1990. The sample composition and the total number of observations is different, but the estimated coefficients are mostly

[20] As R&T point out, the Tobit and OLS without fixed effects yield qualitatively and quantitatively comparable results.

[21] The formula employed is $100 \times \left[\exp\left(\bar{\nu} \times \overline{CHIN}\right) - 1\right]$, where $\bar{\nu}$ is the obtained coefficient and $\overline{CHIN}$ the sample mean; see R&T. Summary statistics are shown in the Appendix.

[22] The formula employed is $100 \times \bar{\nu} \times \left[\exp\left(\overline{CHIN}\right) - 1\right] / (\sigma - 1)$. We use the same assumption on σ as Anderson and van Wincoop (2004), i.e. $\sigma = 8$.

[23] This is less than 19% smaller due to the non-linearity of the trade cost function.

qualitatively and quantitatively similar to those obtained for 1980. However, looking at our preferred specifications (B3) and (B5), we find a larger role for the Chinese network. The total effect now amounts to trade creation of 0.5% and to a tariff equivalent of 0.07 percentage points (both about 70% larger than in 1980). This effect is virtually entirely driven by the direct effect. The overall conclusions from 1980 remain robust: the network effect is dramatically reduced when using fixed effects, its economic significance is small, and the total effect is mostly driven by the direct effect. Note that the Ramsey RESET test strongly indicates that OLS models are misspecified while the PML models pass the test with p-values beyond 60%.

The remainder of the table turns to the year 2000 where we use data on bilateral stocks of foreign born individuals rather than on ethnic populations. The network variable, constructed as the product of shares in each of the two trading countries' populations, is smaller than for ethnic populations since the concept of foreign-born status is more narrow than that of ethnicity. It is therefore not surprising that the estimated network coefficients are larger. However, when evaluated at the sample mean, the associated amounts of trade creation or the tariff equivalents are again small. The total effect yields trade creation of 0.1% (column C3).

There is evidence for the existence of a direct and an indirect effect in columns (C4) and (C5), where both are estimated at fair statistical accuracy. While, the RESET test strongly indicates that the OLS model is invalid, both models indicate that the trade-creating potential for direct links is by an order of magnitude larger than that of indirect effects. In the PML model, for example, the direct links amount to a an ad valorem tariff reduction of about 0.34 percentage points, while indirect links amount only to about 0.02 percentage points.

4.2. The Chinese network by commodity group

In Table 2, we present the trade creation and tariff equivalent results and the significance level of the associated coefficients for different product categories. In order to do this, we need external information on the elasticities of substitution. Following Anderson and van Wincoop (2004), we assume σ to be 20, 15, and 5 for exchange-traded, reference-priced, and differentiated goods, respectively. The upper third of the table refers to the group of exchange-traded goods; the second to the group of reference-priced goods; and the third to differentiated goods. We only report the estimation results from the FE-OLS and FE-PML specifications.[24]

According to R&T, one may expect that the network effect should be largest for commodity goods, smaller for reference-priced goods, and minimum for goods traded on organized exchanges. Total trade creation confounds differences of the pure network effect with the elasticity of substitution. Hence, it is most informative to look at the computed tariff equivalents. Comparing exchange-traded and reference-priced goods, estimates do not differ much. This

[24]Trade creation effects and tariff equivalents correspond to columns (A2)-(A5), (B2)-(B5) and (C2)-(C5) of Table B.3 in Appendix B. Notice that the results in Table B.3 confirms the pattern that OLS without fixed effects typically overestimates the size of the network effect. Interestingly, this problem is particularly severe in the case of differentiated goods where the mere inclusion of these effects cuts the estimate by at least the factor 5 (and makes it disappear in the year 1990); compare columns (A1) and (A2) of Table B.3 in Appendix B. Using Poisson has little quantitative effect on the obtained estimates but can have a strong effect on the precision. Similar observations can be made regarding the years 1990 and 2000.

Table 2 – The tariff equivalents of Chinese network in different commodity groups

Dependent variable: Trade by commodity group												
	1980				1990				2000			
	(A1)	(A2)	(A3)	(A4)	(B1)	(B2)	(B3)	(B4)	(C1)	(C2)	(C3)	(C4)
	FE-OLS	FE-PML	FE-OLS	FE-PML	FE-OLS	FE-PML	FE-OLS	FE-PML	FE-OLS	FE-PML	FE-OLS	FE-PML
Exchange-traded goods												
CHIN	0.050***	0.046***			0.045***	0.036***			0.005**	0.003*		
CHIN*(1-DIR)			0.028***	0.033***			0.025***	0.029***			0.011	0.016**
CHIN*DIR			0.820***	0.683***			0.818***	0.565***			0.114**	0.090*
RESET (p-value)	0.467	0.681	0.479	0.682	0.135	0.831	0.134	0.824	0.048	0.0633	0.049	0.072
Reference-priced goods												
CHIN	0.051***	0.024***			0.039***	0.023***			0.005**	0.003***		
CHIN*(1-DIR)			0.048***	0.005			0.033***	0.012			0.027**	0.011***
CHIN*DIR			0.632***	0.386***			0.607***	0.480***			0.117***	0.082***
RESET (p-value)	0.000	0.087	0.000	0.085	0.036	0.197	0.036	0.198	0.0129	0.46	0.011	0.468
Differentiated goods												
CHIN	0.061**	0.060**			0.079	0.145***			0.018***	0.029***		
CHIN*(1-DIR)			0.073**	0.003			0.062***	0.016			0.037	0.026*
CHIN*DIR			0.772	1.289***			1.372	2.756***			0.427***	0.692***
RESET (p-value)	0.000	0.606	0.000	0.608	0.000	0.437	0.000	0.528	0.000	0.946	0.000	0.949

Ad valorem tariff equivalents in percentage points. Evaluated at the respective sample means. N=2114, N=2127, N=2377 in 1980 for exchange-traded goods, referenced-priced goods, and differentiated goods, N=2378, N=2453, N=2533 in 1990, and N=2745, N=2914, N=3025 in 2000, respectively. All regressions include the full set of covariates as shown in Table 1, and a set of country dummies. Observations clustered by (undirectional) country-pair. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. Elasticity of substitution is twenty, fiveteen, and five for exchange-traded, reference-priced, and differentiated goods, respectively.

may be due to the fact that these categories are conceptually difficult to separate and that they both refer to homogeneous goods and the underlying elasticities of substitutions are likely to be similar (we assume 20 and 15, respectively). However, contrasting either exchange-traded or reference-priced goods, we do see the expected pattern: the tariff equivalents associated to differentiated goods are always larger for differentiated goods. For example, in 1980 and focusing on FE-PML regressions (A2) which pass the RESET test (OLS regressions fail to pass), increasing the size of the Chinese *direct network links* from zero to the sample mean is equivalent to an ad valorem tariff reduction of about 0.06 percentage points for differentiated goods, 0.046 percentage points for exchange-traded and 0.024 percentage points for reference-priced goods. For 1990, a similar ranking emerges with somewhat larger tariff equivalents. In 2000, using stocks of migrants rather than ethnic data for the calculation of the network, tariff equivalents are again smaller, but the ranking still prevails.

Next, we look at the difference between direct and indirect links. Again, the RESET test suggests to work with the PML model rather than OLS. Hence, we focus on columns (A4), (B4) and (C4). Interestingly, on average, we have stronger evidence for the existence of indirect links in trade of homogeneous goods rather than in trade of differentiated goods, the only tentative exception being the year 2000. However, in terms of the associated tariff equivalent, indirect links have smaller effects than direct ones by at least one order of magnitude. In line with expectations, direct links are more important for differentiated than for homogeneous goods. Tariff equivalents can be fairly sizable, e.g., between 1.3 and 2.8 percentage points when looking at the ethnic Chinese network (years 1980 and 1990) and about 0.7 percentage points when considering the migrant network (year 2000).

Table 3 – Tariff equivalents of strong and weak Chinese network links in aggregate trade

Dependent variable: Aggregate trade												
	1980				1990				2000			
	(A1)	(A2)	(A3)	(A4)	(B1)	(B2)	(B3)	(B4)	(C1)	(C2)	(C3)	(C4)
	FE-OLS	FE-PML	FE-OLS	FE-PML	FE-OLS	FE-PML	FE-OLS	FE-PML	FE-OLS	FE-PML	FE-OLS	FE-PML
CHIN*(1-L)	0.017	0.136*			0.135***	0.181***			-0.095**	-0.039		
CHIN*L	1.463**	1.975***			2.375***	3.673***			0.170	0.377***		
CHIN*(1-L)*(1-DIR)			0.121*	0.158**			0.148***	0.121***			0.178**	0.014
CHIN*(1-L)*DIR			-2.383	-0.548			0.080	1.597***			-3.312***	-0.838
CHIN*L*(1-DIR)			1.273***	1.048***			1.230***	0.862***			1.664***	0.649**
CHIN*L*DIR			2.838	5.204***			6.569**	10.460***			1.271**	2.015***
RESET (p-value)	0.000	0.025	0.000	0.024	0.000	0.783	0.000	0.735	0.000	0.285	0.000	0.291

Ad valorem tariff equivalents in percentage points. Evaluated at the respective sample means. N=2520 in 1980, N=2795 in 1990, and N=3259 in 2000. All regressions include the full set of covariates as shown in Table 1, and a set of country dummies. Observations clustered by (undirectional) country-pair. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. Elasticity of substitution is twenty, fiveteen, and five for exchange-traded, reference-priced, and differentiated goods, respectively.

4.3. Strong versus weak network links: Ethnic Chinese and aggregate trade

Next, Table 3 replicates the key findings of R&T for aggregate trade; results for different categories follow in Table 4. To do so, we distinguish between strong and weak network links. Strong links are defined as those for which both trading partners belong to the top ten countries that have the highest shares of ethnic Chinese in total population.[25] Weak links are made up by the complementary set. We define by L a dummy that takes the value of 1 in the former case and zero in the latter. The idea that the marginal trade-creating effect of weak networks may be systematically different from the one of strong networks captures the possible existence of non-linearities. If a network is to make a visible difference, it must be large enough. In terms of our search-theoretic interpretation, such non-linearities would be introduced by the existence of search costs: an individual in country i of ethnicity k searches for a counter-part in country j only if the probability of success is large enough to warrant the investment of fixed search costs. Additionally, we may further distinguish between direct and indirect effects as in Tables 1 and 2.[26]

In Table 3, we augment the R&T standard specification by country specific fixed-effects. Again, it turns out that the RESET test recommends to prefer the PML models over the OLS specifications. Columns (A2), (B2), and (C2) suggest that large network links (direct and indirect) are indeed equivalent to tariff reductions that are of an order of magnitude larger than those implied by weak links. Hence, there is evidence for the non-linear impact of networks on trade. Note that the tariff equivalents computed for the ethnic networks (1980, 1990), 1.98 and 3.67 percentage points, respectively, are substantially bigger than that for the migrant network (2000), where we find 0.38 percentage points.

When the effect of the network is broken up further into direct and indirect links, large direct links appear to be most important. There is mixed evidence about weak indirect effects (which matter only in 1990). There is strong and robust evidence that indirect links are important when they are only strong enough. The estimated tariff equivalents range between 1.05 to 0.65

[25]For 1980 and 1990, this rule corresponds the definition in R&T, where strong links are defined as those for which in both trading countries the share of ethnic Chinese exceeds 1% of population.

[26]The estimated coefficients are presented in columns (A2)-(A5), (B2)-(B5) and (C2)-(C5) of Table B.4 in Appendix B.

percentage points and are therefore certainly sizable enough to matter. Strong direct links have the largest impact on bilateral trade flows. They are on average equivalent to an ad valorem tariff reduction from 2.02 to about 10.46 percentage points.

4.4. Strong versus weak network links: Ethnic Chinese in different commodity groups

The final step, presented in Table 4, looks separately at different categories of goods, but otherwise replicates Table 3.[27]

A fairly complex picture emerges. Focusing on even-numbered columns, as suggested by the RESET test, we find robust evidence for direct links. Typically, the tariff equivalents are larger for differentiated than for homogeneous goods, but also differ a lot across years. Large links are associated to an ad valorem tariff of about 4.23 percentage points in 1990 and to only 0.41 percentage points in 2000. Weak links have much smaller effects, and are estimated with very low statistical precision for the year 2000. Turning to the difference between large direct and large indirect effects (columns (A4), (B4), and (C4)), we find that large direct network links have strongest effects for differentiated goods (ranging from 11.23 to 2.04 percentage points in terms of tariff equivalents). Evidence for strong indirect links is not as robust, but we can still conclude that they appear to matter, albeit at a much lower level than direct links.

We may now summarize the main results obtained from a theory-consistent view on the trade flow implications of the *Chinese ethnic network*.

1. **Controlling for multilateral resistance is important.** Without doing so, the quantitative importance of the Chinese ethnic network is overestimated, at least by a factor of two and often by much more. The omitted variable bias is therefore positive, which signals a positive correlation between the degree of multilateral remoteness of both the importer and the exporter and the size of the Chinese network. Besides controlling for the unobserved resistance terms, our fixed-effects estimation also deals with other country-specific and time-invariant determinants of bilateral trade that may correlate with the size of the network. The overall stance of policies toward the rest of the world (e.g., overall trade policy, overall restrictions to migration, etc.) is such a candidate determinant.
2. Poisson estimation (PML) is immune to misspecification of the error term in the empirical form of the gravity equation. The Ramsey RESET test usually recommends PML over OLS. It turns out that point estimators of the network coefficients are usually not strongly affected by misspecification bias. However, in several cases the PML affects the estimated standard errors. Usually, **PML makes results more plausible**; however, it also makes it more difficult to find robust network effects.

[27] The estimated coefficients are presented in columns (A3)-(A5), (B3)-(B5) and (C3)-(C5) of Table B.5 in Appendix B. Notice that the results presented in columns (A1), (B1) of Table B.5 in Appendix B are comparable with R&T. In the OLS specification, we find the intuitive ranking of coefficients across differentiated, exchange-traded, and reference-priced goods. For differentiated goods, we find the headline trade creation of about 60% that R&T report in the abstract of their paper. The associated tariff equivalent is higher (7.3 percentage points) than the one computed by Anderson van Wincoop (2004) using the results and data of R&T because we are using a lower elasticity of substitution (5 instead of 8).

Table 4 – Tariff equivalents of strong and weak Chinese network links in different commodity groups

Dependent variable: Trade by commodity group	1980				1990				2000			
	(A1)	(A2)	(A3)	(A4)	(B1)	(B2)	(B3)	(B4)	(C1)	(C2)	(C3)	(C4)
	FE-OLS	FE-PML	FE-OLS	FE-PML	FE-OLS	FE-PML	FE-OLS	FE-PML	FE-OLS	FE-PML	FE-OLS	FE-PML
Exchange-traded goods												
CHIN*(1-L)	0.087	-0.041			0.099	-0.064			-0.029	-0.171***		
CHIN*L	4.302***	3.601***			4.618***	3.256***			0.377**	0.067		
CHIN*(1-L)*(1-DIR)			0.104	0.141			0.059	-0.089			0.144	0.002
CHIN*(1-L)*DIR			-0.145	-4.364*			1.013*	0.125			-1.333	-3.417***
CHIN*L*(1-DIR)			2.064***	2.803***			1.966***	1.853***			1.252	1.287
CHIN*L*DIR			12.250***	8.806***			14.760***	9.245***			2.166**	0.758
RESET (p-value)	0.479	0.434	0.499	0.434	0.124	0.868	0.125	0.851	0.0526	0.0665	0.0592	0.0766
Reference-priced goods												
CHIN*(1-L)	0.313***	0.057			0.151**	0.153**			-0.026	0.080***		
CHIN*L	3.761***	1.601***			3.286***	2.344***			0.266**	0.314***		
CHIN*(1-L)*(1-DIR)			0.313***	0.070			0.185***	0.118**			0.250***	0.128***
CHIN*(1-L)*DIR			0.916	-0.018			-0.266	0.652			-1.971**	1.592***
CHIN*L*(1-DIR)			2.903***	0.439			2.303***	-0.110			2.245***	1.298***
CHIN*L*DIR			8.180**	4.557***			7.338***	6.549***			1.891***	2.277***
RESET (p-value)	0.000	0.094	0.000	0.089	0.041	0.232	0.039	0.221	0.014	0.407	0.008	0.532
Differentiated goods												
CHIN*(1-L)	0.085	0.204***			0.125*	0.211***			0.012	-0.074*		
CHIN*L	1.384**	1.954***			2.075*	4.226***			0.337***	0.407***		
CHIN*(1-L)*(1-DIR)			0.116*	0.183***			0.168***	0.126***			0.148**	-0.002
CHIN*(1-L)*DIR			-0.444	0.118			-0.620	2.299***			-0.599	-1.554*
CHIN*L*(1-DIR)			1.227**	0.676*			1.378***	0.814**			1.002*	0.439
CHIN*L*DIR			2.607	5.333***			4.766	11.230***			1.876***	2.036***
RESET (p-value)	0.000	0.719	0.000	0.716	0.000	0.350	0.000	0.411	0.000	0.801	0.000	0.798

Ad valorem tariff equivalents in percentage points. Evaluated at the respective sample means. N=2114, N=2127, N=2377 in 1980 for exchange-traded goods, referenced-priced goods, and differentiated goods, N=2378, N=2453, N=2533 in 1990, and N=2745, N=2916, N=3025 in 2000, respectively. All regressions include the full set of covariates as shown in Table 1, and a set of country dummies. Observations clustered by (undirectional) country-pair. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. Elasticity of substitution is twenty, fiveteen, and five for exchange-traded, reference-priced, and differentiated goods, respectively.

3. **Direct network links are more important than indirect links**. One way to interpret this result is that the preference channel of ethnic networks dominates the trade cost channel. There is also evidence that ethnic networks have a **non-linear effect on bilateral trade**, since the marginal effects of strong networks and of weak network links differ substantially. This is in line with a search-theoretic interpretation of networks, where agents engage only in search if the probabilities of success are above a threshold beyond which search is economically worthwhile.
4. We do find that networks matter more for trade in differentiated goods than for homogeneous ones. However, estimated effects vary across specifications and periods of time. Moreover, there is no intuitive ranking between exchange-traded and reference-priced goods. This sheds **doubts on the overall usefulness of R&Ts identification strategy** which distinguishes between the contract enforcement and the information channel of ethnic networks.

5. OTHER MIGRANT NETWORKS

R&T have studied the quantitative implications of the Chinese ethnic network in a traditional gravity framework. We have qualified the picture using more recent econometric techniques. One of the underlying assumptions of this work is that the Chinese network is the most influential amongst the large number of potential other ethnic (or migrant) networks. In this section, we look at a large number of potential networks and, using the same econometric setup than for the Chinese network, test for their existence. In particular we carry out two separate exer-

Table 5 – Tariff equivalents of average migrant network links

Dependent variable: Aggregate trade	All links	Direct and indirect links			Strong and weak links	
	(1)	(2)	(3)	(4)	(5)	(6)
MIG	0.084***					
MIG*(1-DIR)			0.0791***	0.0839**		
MIG*DIR		-0.022		0.0494***		
MIG*(1-L)					-0.145	
MIG*L					0.0589***	
MIG*(1-L)*(1-DIR)						0.020
MIG*(1-L)*DIR						-0.127
MIG*L*(1-DIR)						0.0239*
MIG*L*DIR						0.0606***
RESET (p-value)	0.219	0.361	0.220	0.219	0.292	0.289

Estimation method: Fixed-effect PML. Ad valorem tariff equivalents in percentage points. Evaluated at the respective sample means. N=3259 in all regressions. All regressions include the full set of covariates as shown in Table 1, and a set of country dummies. Observations clustered by (undirectional) country-pair. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. Elasticity of substitution is eight.

cises: First, we study the trade-creating effect of the *average* migrant network; second, we run separate regressions for all networks and try to make sense of the observed heterogeneity.

5.1. The average migrant network

In this section, we assume that different migrant networks are perfect substitutes. In other words, we measure the strength of network effects between country i and j by $N_{ij} = \sum_k \theta^k N_{ij}^k$. This is consistent with the search-theoretic interpretation that we have used above: N_{ij} measures the likelihood that two individuals residing in countries i and j share the same ethnicity. In that sense, different ethnic networks are necessarily perfect substitutes; however, this does not rule out that networks differ in their effectiveness θ^k. For the time being, we set $\theta^k = \theta$ and differentiate between different networks in the next subsection.

Table 5 reports the findings, showing only estimates based on fixed-effects PML as supported by the RESET test. All regressions contain the full list of covariates introduced in Table 1. Data refers to the year of 2000 for which information on bilateral stocks of migrants exists. We focus on aggregate trade and restrict ourselves to the 63 migrant networks that correspond to the 63 countries used in our gravity equations.

Column (1) shows the average effect of the average network. The effect is positive and accurately estimated, but the associated tariff equivalent is very low (0.08 percentage points). The reason is that the size of the average network, which is used in the calculation of the tariff equivalent, is very low. Columns (2) to (4) differentiate between direct and indirect effects. Interestingly, indirect links turn out significant only when direct links are controlled for. Also, the effect of direct links appears somewhat larger when indirect links are also present in the equation. This pattern may be explained by the fact that direct and indirect links in the same network are likely to be negatively correlated due to the adding up condition by which the number of migrants in different countries must add up to the total stock of migrants of some origin k. However, when direct and indirect links are negatively correlated and their individual effects are both positive, omitting one of them from the specification leads to omitted variable bias. This bias would be negative, which is exactly what we see when considering column (4).

Columns (5) and (6) further decompose the effect of the average migrant network into weak and strong links. We do not find any evidence for weak links. The effect of strong links is very much comparable with the average effect. When further distinguishing between direct and indirect links, we find evidence for both of them when links are strong. Hence, the evidence supports the view that the effect of networks on trade is non-linear.

5.2. Heterogeneity of network effects

In this subsection, for any network k, we compute the tariff equivalent of increasing the size of the network (the product of population shares $s_{ik}s_{jk}$ of migrants in i and j coming from country k) from zero to the sample mean for network k. We focus on aggregate trade and on the total effect (without differentiating between strong and weak and between direct and indirect links). For each network k, we run a separate regression. Since we have information about the location of individuals born in country k only for the year of 2000, all regressions refer to this year. Detailed results are found in Appendix C.[28]

The upper part of Figure 2 represents the point estimates obtained for each network from separate regressions as dark circles. It also plots the 1.96 standard deviations band around those coefficients as dashed lines. All estimates shown are statistically significant at least at the 10% level. The figure shows that the Chinese network is not at all the most important one in terms of the trade cost reduction that it entails. The lower part of the figure, which records the total sizes of emigrant networks in million individuals, shows that the Chinese network is also not the largest one in terms of the emigrant population.

The most powerful network seems to be that of Moroccans, of whom about 2 million live abroad. The associated tariff equivalent is close to 0.1 percentage points, which is, of course, small compared to real-life tariffs, or to other estimated trade barriers (compare, e.g., to the border effect identified in Anderson and van Wincoop, 2003). The second and the third most powerful networks are those of the Ghanaese and the Danish, respectively. The largest emigrant stock in the world is the Mexican one, with almost 10 million individuals. That network seems to be relevant for trade creation, albeit at a tariff equivalent inferior to 0.05 percentage points. The second largest sending country, India, is associated to an even weaker network whose effect is indistinguishable from zero. The Chinese effect is at the lower end of the spectrum and amounts to trade costs savings of 0.013 percentage points; see column (C3) in Table 1. Countries not shown in Figure 2 do not have measurable network effects.

The heterogeneity in estimates across networks requires explanation. We cannot offer a conclusive answer in this paper. However, one can think about a number of possible reasons why

[28]We have also run regressions with all 63 networks present in the same regressions and allowing for $k-$ specific coefficients. Results are very similar to the exercise reported in the paper, probably to the low degree of correlation between different ethnic networks. Results are available upon request.

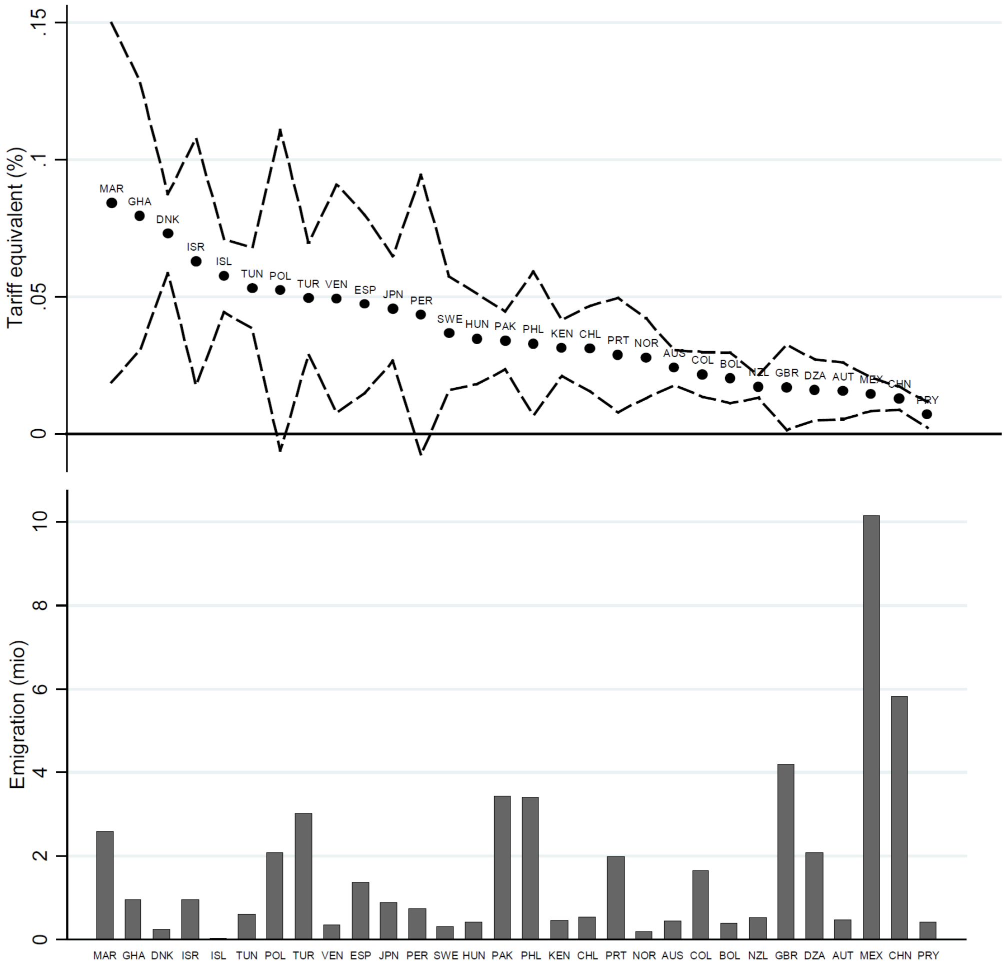

Figure 2 – Tariff equivalents of different migrant networks (aggregate trade, total effects).

the trade-creating potential of networks differs. First, it is likely that more highly educated individuals will be more informed about trading opportunities in their host countries. Their diaspora should therefore contribute more strongly towards the reduction of trade costs. We use data from the World Development Indicators to measure the share of skilled emigrants in the total population of emigrants for each network (i.e., sending country k). Taking our search-theoretic interpretation of networks, the network is of higher quality, when the likelihood that two individuals with high-skills from countries i and j share the same ethnic background k. Accordingly, we regress the estimated trade-cost savings from different networks on the squared fraction of skilled emigrants. The results are shown in column (1) of Table 6. Indeed, a more highly skilled diaspora is associated to more cost savings.[29]

Second, we hypothesize that English speaking diasporas are less useful in creating trade because English is the lingua franca of international commerce so that having access to an English speaking diaspora does not offer much additional advantage. This argument, of course, applies

[29] Since the dependent variable is generated from regressions, we bootstrap the standard errors.

Table 6 – Explaining heterogeneity in network effects

Dependent variable: Tariff equivalent (%)	(1)	(2)	(3)	(4)
(Rate of skilled emigrants)^2	0.264*	0.426***	0.439***	0.381**
	(1.70)	(2.61)	(2.71)	(2.54)
English		-0.0280**	-0.0264**	-0.0223**
		(-2.39)	(-2.31)	(-2.29)
(Ethnic fractionalization)^2			-0.0234	-0.0514***
			(-1.53)	(-2.94)
GDP per capita				-0.0101**
				(-2.43)
R2	0.0816	0.183	0.208	0.266

Estimation method: OLS. N=61. All regressions include a constant (not shown). Bootstapped t statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

mostly to direct links. Column (2) shows that this idea may be borne out by the data. Column (3) uses the degree of ethnic fractionalization in the source country. That measure is provided by Alesina *et al.* (2003) The reason for using this variable is the following: when a source country is ethnically fragmented, the likelihood that two agents in countries i and j come from the same ethnic group k is reduced. Hence, the likelihood of two agents in k having the same ethnic roots should enter as a squared term in our regressions. The associated coefficient has the right sign, but comes with a t-value of only 1.53. However, including GDP per capita into column (4), ethnic fractionalization turns significant. Since fractionalization is strongly negatively related to GDP per capita that result may come as no surprise. We have experimented with a large number of other potential explanatory variables, but without identifying any additional statistically significant determinants of network strength. However, in total, we are able to explain about a quarter of the overall variation in estimated network effects across source countries.

6. Conclusions

In this paper we have revisited the important work by Rauch and Trindade (R&T, 2002) on the trade-enhancing role of Chinese ethnic networks. Those authors have found that for countries with ethnic Chinese populations shares at the levels prevailing in Southeast Asia, the smallest estimated average increase in bilateral trade in differentiated products attributable to ethnic Chinese networks is nearly 60%. This estimate is obtained by the authors using a traditional gravity model. Recent advances by Anderson and van Wincoop (2003) and Santos Silva and Tenreyro (2006) allow to estimate the network effect in a more theory-consistent and robust way.

Using the econometric techniques proposed in the modern literature, we confirm the existence of a Chinese network effect. However, in terms of magnitudes, the trade creation associated to the network is at most half as big as the one computed by R&T. Moreover, we fail to find the intuitive size ranking of network coefficients across differentiated, reference-priced, and exchange-traded categories of goods. This is not overly surprising since the theory-based gravity model signals that the estimated coefficients confound the elasticity of substitution with the trade-cost elasticity of networks, so that comparing across categories of goods is not an ideal identification strategy. Focusing on indirect network links (i.e., links that relate two trading partners other than China) in order to mitigate endogeneity concerns and to reduce the role of preferences as compared to information, we find that the average network effect is very small (and, indeed, often indistinguishable from zero).

We also investigate other ethnic networks than the Chinese one. To do so, we use recent data on bilateral stocks of foreign-born individuals provided by the World Bank for the year of 2000 and a total of 63 countries. Using this data, which implies a more narrow definition of an ethnic network, we conduct a comprehensive quest for the existence of network effects in trade data. Focusing on average effects, we document the existence of a large number of networks. Judging by the obtained size of coefficients and the size of the involved emigrant population, the most relevant are the Moroccan, the Polish, the Turkish, the Pakistan, the Philippino, the Mexican, the British, and the Chinese networks. Different networks differ strongly with respect to their trade-cost reducing potential, but on average the trade creation effects are small. We are able to explain about 27% of the observed heterogeneity by characteristics of the source countries of emigrants.

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APPENDIX

Appendix

A. List of countries and summary statistics

Table A.1 – List of countries included in the regressions

Country	ISO-Code	Reporter (1990, 2000)	Country	ISO-Code	Reporter (1990, 2000)
Algeria	DZA	YES	Kuwait	KWT	YES
Argentina	ARG	YES	Libyan Arab Jamahiriya	LBY	YES
Australia	AUS	YES	Malaysia	MYS	YES
Austria	AUT	YES	Mexico	MEX	YES
Belgium-Luxembourg	BEL	YES	Morocco	MAR	YES
Bolivia	BOL	NO	Netherlands	NLD	YES
Brazil	BRA	YES	New Zealand	NZL	YES
Canada	CAN	YES	Nigeria	NGA	YES
Chile	CHL	YES	Norway	NOR	YES
China	CHN	YES	Pakistan	PAK	YES
Colombia	COL	YES	Paraguay	PRY	NO
Denmark	DNK	YES	Peru	PER	YES
Ecuador	ECU	YES	Philippines	PHL	YES
Egypt	EGY	NO	Poland	POL	YES
Ethiopia	ETH	NO	Portugal	PRT	YES
Finland	FIN	YES	Saudi Arabia	SAU	YES
France	FRA	YES	Singapore	SGP	YES
Germany	DEU	YES	South Africa	ZAF	YES
Ghana	GHA	NO	Spain	ESP	YES
Greece	GRC	YES	Sudan	SDN	NO
Hong Kong	HKG	YES	Sweden	SWE	YES
Hungary	HUN	YES	Switzerland	CHE	YES
Iceland	ISL	NO	Taiwan	TWN	NO
India	IND	YES	Thailand	THA	YES
Indonesia	IDN	YES	Tunisia	TUN	YES
Iran, Islamic Republic of	IRN	YES	Turkey	TUR	YES
Ireland	IRL	YES	United Kingdom	GBR	YES
Israel	ISR	YES	United States of America	USA	YES
Italy	ITA	YES	Uruguay	URY	NO
Japan	JPN	YES	Venezuela	VEN	YES
Kenya	KEN	NO	Yugoslavia	YUG	YES
Korea, Republic of	KOR	YES			

Note: In 1990 and 2000, bilateral tade flows are only available if at least one of the trading partners is a trade data reporting country. The restriction comes from the NBER-UN World Trade Data.

Table A.2 – Summary statistics

	1980		1990		2000	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Aggregate trade						
Trade	10.550080	2.835352	10.974960	2.553509	11.440580	2.764433
CHIN	0.003126	0.041500	0.002868	0.038930	0.000306	0.008225
CHIN*(1-DIR)	0.001444	0.024569	0.001339	0.022852	0.000029	0.000359
CHIN*DIR	0.001682	0.033518	0.001529	0.031582	0.000277	0.008219
CHIN*(1-L)	0.000097	0.000511	0.000137	0.000816	0.000022	0.000140
CHIN*L	0.003029	0.041504	0.002731	0.038931	0.000284	0.008225
CHIN*(1-L)*(1	0.000071	0.000420	0.000098	0.000665	0.000007	0.000044
CHIN*L*(1-DII	0.000027	0.000298	0.000039	0.000480	0.000016	0.000134
CHIN*(1-L)*DI	0.001374	0.024569	0.001241	0.022848	0.000022	0.000357
CHIN*L*DIR	0.001655	0.033518	0.001490	0.031580	0.000262	0.008218
N	2520		2795		3259	
Exhange-traded goods						
Trade	9.176285	2.882749	9.667008	2.360433	9.827834	2.519341
CHIN	0.003705	0.045284	0.003334	0.042182	0.000360	0.008961
CHIN*(1-DIR)	0.001702	0.026809	0.001556	0.024765	0.000032	0.000386
CHIN*DIR	0.002003	0.036588	0.001778	0.034228	0.000328	0.008954
CHIN*(1-L)	0.000109	0.000551	0.000154	0.000879	0.000025	0.000151
CHIN*L	0.003596	0.045289	0.003180	0.042185	0.000335	0.008961
CHIN*(1-L)*(1	0.000079	0.000454	0.000110	0.000718	0.000007	0.000046
CHIN*L*(1-DII	0.000030	0.000319	0.000045	0.000518	0.000018	0.000145
CHIN*(1-L)*DI	0.001623	0.026810	0.001447	0.024761	0.000025	0.000383
CHIN*L*DIR	0.001973	0.036589	0.001733	0.034227	0.000311	0.008954
N	2114		2378		2745	
Reference-priced goods						
Trade	8.849660	2.600528	9.709237	2.335736	10.192980	2.496710
CHIN	0.003691	0.045150	0.003242	0.041538	0.000341	0.008695
CHIN*(1-DIR)	0.001700	0.026735	0.001501	0.024382	0.000031	0.000379
CHIN*DIR	0.001991	0.036477	0.001741	0.033707	0.000310	0.008688
CHIN*(1-L)	0.000103	0.000535	0.000151	0.000867	0.000024	0.000148
CHIN*L	0.003589	0.045155	0.003090	0.041540	0.000317	0.008695
CHIN*(1-L)*(1	0.000073	0.000434	0.000108	0.000708	0.000007	0.000045
CHIN*L*(1-DII	0.000030	0.000319	0.000044	0.000511	0.000017	0.000142
CHIN*(1-L)*DI	0.001628	0.026736	0.001393	0.024378	0.000025	0.000377
CHIN*L*DIR	0.001961	0.036477	0.001697	0.033705	0.000292	0.008688
N	2127		2453		2916	
Differentiated goods						
Trade	9.249129	2.943961	9.978731	2.700432	10.593380	2.855413
CHIN	0.003299	0.042720	0.003148	0.040882	0.000329	0.008537
CHIN*(1-DIR)	0.001517	0.025288	0.001462	0.023999	0.000030	0.000372
CHIN*DIR	0.001782	0.034510	0.001686	0.033171	0.000298	0.008530
CHIN*(1-L)	0.000101	0.000523	0.000147	0.000854	0.000023	0.000144
CHIN*L	0.003198	0.042724	0.003001	0.040884	0.000305	0.008537
CHIN*(1-L)*(1	0.000073	0.000431	0.000105	0.000697	0.000007	0.000045
CHIN*L*(1-DII	0.000027	0.000302	0.000042	0.000502	0.000016	0.000138
CHIN*(1-L)*DI	0.001444	0.025288	0.001358	0.023995	0.000024	0.000370
CHIN*L*DIR	0.001755	0.034510	0.001644	0.033170	0.000282	0.008530
N	2377		2533		3025	

B. Details to Chinese networks (Tables 2 to 4)

Table B.3 – The Chinese network in different commodity groups (Details to Table 2)

Dependent variable: Trade by commodity group

	1980					1990					2000				
	(A1)	(A2)	(A3)	(A4)	(A5)	(B1)	(B2)	(B3)	(B4)	(B5)	(C1)	(C2)	(C3)	(C4)	(C5)
	OLS	FE-OLS	FE-PML	FE-OLS	FE-PML	OLS	FE-OLS	FE-PML	FE-OLS	FE-PML	OLS	FE-OLS	FE-PML	FE-OLS	FE-PML
Exchange-traded goods															
CHIN	3.512***	2.542***	2.351***			3.403***	2.567***	2.040***			1.981*	2.649**	1.755*		
	(5.56)	(4.12)	(4.05)			(4.34)	(5.78)	(5.59)			(1.87)	(2.35)	(1.73)		
CHIN*(1-DIR)				2.016***	2.389***				1.914***	2.211***				63.710	93.630**
				(2.96)	(3.04)				(3.05)	(3.42)				(0.69)	(2.11)
CHIN*DIR				2.808***	2.338***				2.887***	1.997***				2.729**	2.163*
				(3.77)	(3.63)				(6.29)	(6.02)				(2.40)	(1.93)
Trade creation (%)															
CHIN	1.310	0.946	0.875			1.141	0.859	0.682			0.071	0.095	0.063		
CHIN(1-DIR)				0.536	0.636				0.482	0.557				0.210	0.309
CHINDIR				16.370	13.460				16.33	11.03				2.181	1.725
Tariff equivalent (percentage points)															
CHIN	0.069	0.050	0.046			0.06	0.045	0.036			0.004	0.005	0.003		
CHIN(1-DIR)				0.028	0.033				0.025	0.029				0.011	0.016
CHINDIR				0.820	0.683				0.818	0.565				0.114	0.090
RESET (p-value)	0.030	0.467	0.681	0.479	0.682	0.009	0.135	0.831	0.134	0.824	0.002	0.048	0.0633	0.049	0.072
Reference-priced goods															
CHIN	3.166***	1.913***	0.891***			3.819***	1.671***	0.979***			4.734***	1.943**	1.210***		
	(5.91)	(3.63)	(3.51)			(7.15)	(3.85)	(2.75)			(3.35)	(2.55)	(2.64)		
CHIN*(1-DIR)				2.538***	0.240				1.856***	-0.646				116.600**	47.610***
				(4.23)	(0.45)				(3.69)	(-0.64)				(2.43)	(3.31)
CHIN*DIR				1.596**	0.975***				1.579***	1.250***				2.060***	1.438***
				(2.13)	(4.33)				(2.68)	(5.12)				(2.87)	(2.94)
Trade creation (%)															
CHIN	1.175	0.709	0.329			1.246	0.543	0.318			0.162	0.066	0.041		
CHIN*(1-DIR)				0.676	0.064				0.467	-0.162				0.381	0.156
CHIN*DIR				9.000	5.407				8.627	6.771				1.645	1.145
Tariff equivalent (percentage points)															
CHIN	0.084	0.051	0.024			0.089	0.039	0.023			0.012	0.005	0.003		
CHIN*(1-DIR)				0.048	0.005				0.033	0.012				0.027	0.011
CHIN*DIR				0.632	0.386				0.607	0.48				0.117	0.082
RESET (p-value)	0.269	0.000	0.087	0.000	0.085	0.255	0.036	0.197	0.036	0.198	0.750	0.013	0.46	0.011	0.468
Differentiated goods															
CHIN	4.474***	0.738**	0.722**			5.177***	1.007	1.834***			8.906***	2.172***	3.465***		
	(5.09)	(2.24)	(2.46)			(6.75)	(1.47)	(5.54)			(5.22)	(2.90)	(5.70)		
CHIN*(1-DIR)				1.093**	0.0464				0.980***	0.253				47.050	32.330*
				(2.08)	(0.11)				(2.91)	(0.72)				(1.21)	(1.83)
CHIN*DIR				0.557	0.929***				1.020	2.049***				2.210***	3.578***
				(1.28)	(3.75)				(1.03)	(6.66)				(2.92)	(5.71)
Trade creation (%)															
CHIN	1.487	0.244	0.239			1.643	0.317	0.579			0.293	0.071	0.114		
CHIN*(1-DIR)				0.29	0.012				0.246	0.064				0.149	0.102
CHIN*DIR				3.052	5.146				5,489	11.340				1.718	2.796
Tariff equivalent (percentage points)															
CHIN	0.37	0.061	0.06			0.408	0.079	0.145			0.073	0.018	0.029		
CHIN*(1-DIR)				0.073	0.003				0.062	0.016				0.037	0.026
CHIN*DIR				0.772	1.289				1,372	2.756				0.427	0.692
RESET (p-value)	0.046	0.000	0.606	0.000	0.608	0.027	0.000	0.437	0.000	0.528	0.182	0.013	0.46	0.011	0.468

N=2114, N=2127, N=2377 in 1980 for exchange-traded goods, referenced-priced goods, and differentiated goods, N=2378, N=2453, N=2533 in 1990, and N=2745, N=2916, N=3025 in 2000, respectively. All regressions include the full list of covariates as shown in Table 1, and a constant (all omitted). FE-OLS and FE-PML include country dummies. Observations clustered by (undirectional) country-pair. Robust t statistics in parenthesis. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. Trade creation (%) and ad valorem tariff equivalents (%) evaluated at the respective sample means. Elasticity of substitution is twenty, fiveteen, and five for exchange-traded, reference-priced, and differentiated goods, respectively.

Table B.4 – Strong versus weak network link in aggregate trade (Details to Table 3)

Dependent variable: Aggregate trade															
			1980					**1990**					**2000**		
	(A1)	(A2)	(A3)	(A4)	(A5)	(B1)	(B2)	(B3)	(B4)	(B5)	(C1)	(C2)	(C3)	(C4)	(C5)
	OLS	FE-OLS	FE-PML	FE-OLS	FE-PML	OLS	FE-OLS	FE-PML	FE-OLS	FE-PML	OLS	FE-OLS	FE-PML	FE-OLS	FE-PML
CHIN*(1-L)	508.4***	11.61	94.71*			254.0***	67.27***	90.25***			490.6***	-290.8**	-119.1		
	(5.31)	(0.19)	(1.73)			(4.13)	(2.63)	(3.82)			(2.97)	(-2.06)	(-1.05)		
CHIN*L	4.521***	0.916**	1.236***			4.526***	1.465***	2.265***			5.41***	1.152	2.559***		
	(4.82)	(2.50)	(4.48)			(7.09)	(3.04)	(7.00)			(4.03)	(1.30)	(3.70)		
CHIN*(1-L)*(1-DIR)				113.4*	147.8**				99.77***	81.96***				1773.3**	136.3
				(1.66)	(2.43)				(2.72)	(3.05)				(2.32)	(0.39)
CHIN*(1-L)*DIR				-186.9	-42.98				4.691	93.35***				-467.0***	-118.2
				(-1.42)	(-0.47)				(0.17)	(2.95)				(-3.51)	(-1.04)
CHIN*L*(1-DIR)				1.397***	1.151***				1.323***	0.927***				117.1***	45.69**
				(2.98)	(2.66)				(3.39)	(2.79)				(2.88)	(2.48)
CHIN*L*DIR				0.667	1.223***				1.547**	2.464***				1.836**	2.908***
				(1.51)	(5.00)				(2.43)	(9.26)				(1.97)	(3.73)
Trade creation (%)															
CHIN*(1-L)	5.229	0.117	0.954			3.636	0.950	1.277			1.124	-0.660	-0.271		
CHIN*L	61.490	10.190	14.000			62.670	17.050	27.570			5.711	1.189	2.661		
CHIN*(1-L)*(1-DIR)				0.853	1.113				1.040	0.853				1.255	0.096
CHIN*(1-L)*DIR				-15.360	-3.761				0.563	11.820				-20.690	-5.699
CHIN*L*(1-DIR)				9.024	7.372				8.702	6.020				12.340	4.645
CHIN*L*DIR				19.000	37.560				49.570	89.850				9.080	14.760
Tariff equivalent (percentage points)															
CHIN*(1-L)	0.728	0.017	0.136			0.510	0.135	0.181			0.160	-0.095	-0.039		
CHIN*L	7.223	1.463	1.975			7.338	2.375	3.673			0.797	0.170	0.377		
CHIN*(1-L)*(1-DIR)				0.121	0.158				0.148	0.121				0.178	0.014
CHIN*(1-L)*DIR				-2.383	-0.548				0.080	1.597				-3.312	-0.838
CHIN*L*(1-DIR)				1.273	1.048				1.230	0.862				1.664	0.649
CHIN*L*DIR				2.838	5.204				6.569	10.460				1.271	2.015
RESET (p-value)	0.001	0.000	0.025	0.000	0.024	0.000	0.000	0.783	0.000	0.735	0.000	0.000	0.285	0.000	0.291

N=2520 in 1980, N=2795 in 1990, and N=3259 in 2000. All regressions include the full list of covariates as shown in Table 1, and a constant (all omitted). FE-OLS and FE-PML include country dummies. Observations clustered by (undirectional) country-pair. Robust t statistics in parenthesis. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. Trade creation (%) and ad valorem tariff equivalents (percentage points) evaluated at the respective sample means. Elasticity of substitution is twenty, fifteen, and five for exchange-traded, reference-priced, and differentiated goods, respectively.

Table B.5 – Strong versus weak network link in different commodity groups (Details to Table 4)

Dependent variable: Trade by commodity group			1980					1990					2000		
	(A1)	(A2)	(A3)	(A4)	(A5)	(B1)	(B2)	(B3)	(B4)	(B5)	(C1)	(C2)	(C3)	(C4)	(C5)
	OLS	FE-OLS	FE-PML	FE-OLS	FE-PML	OLS	FE-OLS	FE-PML	FE-OLS	FE-PML	OLS	FE-OLS	FE-PML	FE-OLS	FE-PML
Exchange-traded goods															
CHIN*(1-L)	303.5***	53.98	-25.16			111.2***	43.52	-28.12			55.37	-78.64	-470.3***		
	(3.10)	(0.63)	(-0.19)			(2.73)	(1.55)	(-0.68)			(0.30)	(-0.49)	(-2.93)		
CHIN*L	3.555***	2.665***	2.230***			3.439***	2.706***	1.907***			1.976*	2.481**	0.443		
	(5.60)	(4.03)	(3.38)			(4.36)	(5.64)	(4.43)			(1.88)	(2.05)	(0.41)		
CHIN*(1-L)*(1-DIR)				85.72	116.3				35.34	-53.20				1372.8	17.26
				(0.86)	(0.92)				(0.97)	(-0.96)				(1.30)	(0.02)
CHIN*(1-L)*DIR				-10.55	-316.8*				56.22*	6.945				-183.4	-470.3***
				(-0.07)	(-1.90)				(1.65)	(0.16)				(-1.23)	(-2.98)
CHIN*L*(1-DIR)				2.244***	3.049***				2.052***	1.934***				88.90	91.36
				(3.02)	(4.09)				(3.03)	(2.83)				(0.97)	(1.57)
CHIN*L*DIR				2.881***	2.070***				3.019***	1.891***				3.126**	1.095
				(3.65)	(2.92)				(6.09)	(4.62)				(2.32)	(0.73)
Trade creation (%)															
CHIN*(1-L)	3.480	0.610	-0.283			1.778	0.692	-0.445			0.141	-0.200	-1.188		
CHIN*L	46.330	33.020	26.970			47.410	35.710	24.020			2.112	2.659	0.469		
CHIN*(1-L)*(1-DIR)				0.729	0.990				0.414	-0.620				1.010	0.013
CHIN*(1-L)*DIR				-1.011	-26.310				7.340	0.879				-8.904	-21.270
CHIN*L*(1-DIR)				15.030	20.950				14.240	13.380				9.158	9.424
CHIN*L*DIR				111.900	71.520				143.200	74.470				15.960	5.321
Tariff equivalent (percentage points)															
CHIN*(1-L)	0.489	0.087	-0.041			0.252	0.099	-0.064			0.020	-0.029	-0.171		
CHIN*L	5.740	4.302	3.601			5.869	4.618	3.256			0.300	0.377	0.067		
CHIN*(1-L)*(1-DIR)				0.104	0.141				0.059	-0.089				0.144	0.002
CHIN*(1-L)*DIR				-0.145	-4.364				1.013	0.125				-1.333	-3.417
CHIN*L*(1-DIR)				2.064	2.803				1.966	1.853				1.252	1.287
CHIN*L*DIR				12.250	8.806				14.760	9.245				2.166	0.758
RESET (p-value)	0.043	0.479	0.434	0.499	0.434	0.012	0.124	0.868	0.125	0.851	0.002	0.053	0.067	0.059	0.077
Reference-priced goods															
CHIN*(1-L)	382.2***	206.2***	37.93			204.8***	67.91**	68.66**			481.9***	-72.23	224.3***		
	(5.24)	(3.81)	(0.92)			(3.93)	(2.41)	(2.29)			(3.40)	(-0.62)	(2.96)		
CHIN*L	3.215***	2.354***	1.002***			3.879***	1.890***	1.348***			4.688***	1.788**	2.106***		
	(6.06)	(4.39)	(3.09)			(7.27)	(4.29)	(3.48)			(3.55)	(2.15)	(4.39)		
CHIN*(1-L)*(1-DIR)				282.9***	63.37				112.8***	72.23**				2375.0***	1217.8***
				(3.93)	(1.12)				(2.98)	(2.01)				(3.88)	(5.30)
CHIN*(1-L)*DIR				65.05	-1.259				-14.91	36.62				-263.0**	212.4***
				(0.78)	(-0.03)				(-0.48)	(1.18)				(-2.05)	(2.99)
CHIN*L*(1-DIR)				3.186***	0.482				2.279***	-0.109				156.2***	90.34***
				(4.59)	(0.74)				(4.10)	(-0.12)				(3.28)	(7.00)
CHIN*L*DIR				1.923**	1.071***				1.728***	1.542***				2.730***	3.286***
				(2.54)	(3.62)				(2.90)	(5.32)				(3.29)	(6.99)
Trade creation (%)															
CHIN*(1-L)	4.143	2.214	0.404			3.236	1.062	1.073			1.209	-0.180	0.561		
CHIN*L	40.610	28.340	11.210			56.140	24.240	16.740			4.986	1.873	2.210		
CHIN*(1-L)*(1-DIR)				2.217	0.492				1.303	0.832				1.766	0.902
CHIN*(1-L)*DIR				6.616	-0.124				-1.841	4.670				-12.890	11.780
CHIN*L*(1-DIR)				21.770	3.027				16.850	-0.742				17.010	9.508
CHIN*L*DIR				65.070	32.210				56.780	49.390				13.800	16.840
Tariff equivalent (percentage points)															
CHIN*(1-L)	0.580	0.313	0.057			0.455	0.151	0.153			0.172	-0.026	0.080		
CHIN*L	5.137	3.761	1.601			6.746	3.286	2.344			0.699	0.266	0.314		
CHIN*(1-L)*(1-DIR)				0.313	0.070				0.185	0.118				0.250	0.128
CHIN*(1-L)*DIR				0.916	-0.018				-0.266	0.652				-1.971	1.592
CHIN*L*(1-DIR)				2.903	0.439				2.303	-0.110				2.245	1.298
CHIN*L*DIR				8.180	4.557				7.338	6.549				1.891	2.277
RESET (p-value)	0.346	0.000	0.094	0.000	0.089	0.417	0.041	0.232	0.039	0.221	0.984	0.014	0.407	0.008	0.532
Differentiated goods															
CHIN*(1-L)	521.8***	57.12	138.1***			292.7***	57.95*	98.05***			1038.8***	34.52	-217.6*		
	(5.03)	(1.14)	(2.88)			(3.88)	(1.88)	(4.03)			(4.61)	(0.25)	(-1.69)		
CHIN*L	4.508***	0.858**	1.210***			5.259***	1.190*	2.423***			8.813***	2.236***	2.702***		
	(5.14)	(2.40)	(3.73)			(6.97)	(1.72)	(7.26)			(5.80)	(2.72)	(3.40)		
CHIN*(1-L)*(1-DIR)				103.6*	164.4***				105.9***	79.08***				1426.3**	-22.98
				(1.91)	(3.16)				(2.99)	(2.98)				(2.17)	(-0.07)
CHIN*(1-L)*DIR				-34.19	9.063				-33.52	124.3***				-84.03	-218.0*
				(-0.33)	(0.18)				(-0.81)	(3.52)				(-0.66)	(-1.68)
CHIN*L*(1-DIR)				1.335**	0.735*				1.355***	0.800**				68.89*	30.18
				(2.36)	(1.70)				(3.55)	(2.31)				(1.75)	(1.48)
CHIN*L*DIR				0.613	1.254***				1.122	2.646***				2.708***	2.939***
				(1.29)	(4.67)				(1.13)	(9.34)				(3.18)	(3.60)
Trade creation (%)															
CHIN*(1-L)	5.556	0.594	1.441			4.507	0.877	1.488			2.509	0.082	-0.518		
CHIN*L	62.040	9.616	13.840			83.260	14.680	32.190			9.691	2.375	2.876		
CHIN*(1-L)*(1-DIR)				0.812	1.292				1.186	0.884				1.044	-0.0167
CHIN*(1-L)*DIR				-3.055	0.826				-4.243	17.440				-4.106	-10.310
CHIN*L*(1-DIR)				8.682	4.690				9.767	5.659				7.262	3.119
CHIN*L*DIR				17.320	38.650				33.920	99.060				13.680	14.930
Tariff equivalent (percentage points)															
CHIN*(1-L)	0.772	0.085	0.204			0.630	0.125	0.211			0.354	0.012	-0.074		
CHIN*L	7.278	1.384	1.954			9.172	2.075	4.226			1.328	0.337	0.407		
CHIN*(1-L)*(1-DIR)				0.116	0.183				0.168	0.126				0.148	-0.002
CHIN*(1-L)*DIR				-0.444	0.118				-0.620	2.299				-0.599	-1.554
CHIN*L*(1-DIR)				1.227	0.676				1.378	0.814				1.002	0.439
CHIN*L*DIR				2.607	5.333				4.766	11.230				1.876	2.036
RESET (p-value)	0.158	0.000	0.719	0.000	0.716	0.091	0.000	0.350	0.000	0.411	0.719	0.000	0.801	0.000	0.798

N=2114, N=2127, N=2377 in 1980 for exchange-traded goods, referenced-priced goods, and differentiated goods, N=2372, N=2377, N=2533 in 1990, and N=2741, N=2914, N=3025 in 2000, respectively. All regressions include the full list of covariates as shown in Table 1, and a constant (all omitted). FE-OLS and FE-PML include country dummies. Observations clustered by (undirectional) country-pair. Robust t statistics in parenthesis. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. Trade creation (%) and ad valorem tariff equivalents (%) evaluated at the respective sample means. Elasticity of substitution is twenty, fiveteen, and five for exchange-traded, reference-priced, and differentiated goods, respectively.

C. Details to other migrant networks (Figure 2)

	ARG		AUS		AUT		BEL		BOL		BRA	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MIG	40.72		129.2***		115.4***		-154.6*		255.3***		10.42	
	(0.80)		(7.43)		(2.98)		(-1.81)		(4.34)		(0.39)	
MIG*(1-DIR)		-41313.5		33036.5**		25604.6***		-96348.7***		121927.8		-12998.8
		(-0.72)		(2.41)		(2.59)		(-2.86)		(0.89)		(-0.19)
MIG*DIR		29.56		140.9***		134.1***		-228.1**		272.4***		2.111
		(0.58)		(7.16)		(3.30)		(-2.47)		(4.52)		(0.05)
Trade creation (%)												
MIG	0.0996		0.169		0.110		-0.122		0.142		0.0262	
MIG*(1-DIR)		-1.162		0.494		0.203		-0.533		0.265		-0.437
MIG*DIR		0.0714		0.182		0.127		-0.179		0.151		0.00524
Tariff equivalent (%)												
MIG	0.0142		0.0241		0.0157		-0.0175		0.0203		0.00374	
MIG*(1-DIR)		-0.167		0.0703		0.0290		-0.0764		0.0378		-0.0625
MIG*DIR		0.0102		0.0260		0.0181		-0.0256		0.0216		0.000749

	CAN		CHE		CHL		COL		DEU		DNK	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MIG	-361.5***		-85.66		181.5***		54.37***		5.193		382.6***	
	(-8.63)		(-0.33)		(3.91)		(5.22)		(0.58)		(9.88)	
MIG*(1-DIR)		-74140.8**		334704.9**		18983.3		1146.0		-973.0		55265.1***
		(-2.08)		(2.40)		(0.30)		(0.14)		(-0.71)		(5.69)
MIG*DIR		-371.9***		73.89		186.7***		55.50***		1.394		409.8***
		(-8.52)		(0.27)		(3.81)		(5.41)		(0.14)		(10.90)
Trade creation (%)												
MIG	-0.413		-0.0576		0.218		0.152		0.0455		0.512	
MIG*(1-DIR)		-1.013		1.835		0.202		0.0447		-0.600		0.681
MIG*DIR		-0.420		0.0493		0.222		0.153		0.0114		0.544
Tariff equivalent (%)												
MIG	-0.0591		-0.00822		0.0311		0.0217		0.00650		0.0730	
MIG*(1-DIR)		-0.145		0.260		0.0289		0.00638		-0.0860		0.0970
MIG*DIR		-0.0601		0.00704		0.0317		0.0219		0.00162		0.0774

	DZA		ECU		EGY		ESP		ETH		FIN	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MIG	36.55***		21.32		-13.28*		112.3***		37.23		9.193	
	(2.82)		(0.25)		(-1.92)		(2.86)		(1.13)		(0.91)	
MIG*(1-DIR)		-3662.8**		-221895.4***		-5318.3*		-13835.1***		68216.5		30906.1***
		(-1.98)		(-3.52)		(-1.77)		(-2.96)		(1.38)		(3.45)
MIG*DIR		34.76***		-38.67		-13.85**		90.39**		39.34		19.34*
		(2.71)		(-0.44)		(-2.23)		(2.24)		(1.29)		(1.96)
Trade creation (%)												
MIG	0.112		0.0148		-0.0373		0.332		0.0336		0.0158	
MIG*(1-DIR)		-0.229		-0.898		-0.510		-0.901		0.312		0.363
MIG*DIR		0.104		-0.0267		-0.0375		0.261		0.0354		0.0331
Tariff equivalent (%)												
MIG	0.0160		0.00212		-0.00532		0.0473		0.00480		0.00226	
MIG*(1-DIR)		-0.0327		-0.129		-0.0731		-0.129		0.0445		0.0518
MIG*DIR		0.0149		-0.00382		-0.00536		0.0372		0.00505		0.00473

	FRA		GBR		GHA		GRC		HKG		HUN	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MIG	-29.04***		7.546**		1653.8***		19.29		7.690		239.3***	
	(-2.80)		(2.13)		(3.19)		(0.28)		(0.07)		(4.14)	
MIG*(1-DIR)		1093.2		203.8		-260071.4		-39862.9*		-22895.9		51454.2
		(0.58)		(1.12)		(-1.00)		(-1.91)		(-0.57)		(1.40)
MIG*DIR		-26.63**		8.167**		1609.9***		0.845		-9.305		263.0***
		(-2.42)		(2.27)		(3.10)		(0.01)		(-0.08)		(4.61)
Trade creation (%)												
MIG	-0.118		0.119		0.558		0.0271		0.00595		0.242	
MIG*(1-DIR)		0.149		0.323		-0.443		-0.664		-0.244		0.413
MIG*DIR		-0.104		0.115		0.540		0.00117		-0.00711		0.264
Tariff equivalent (%)												
MIG	-0.0168		0.0169		0.0794		0.00386		0.000851		0.0346	
MIG*(1-DIR)		0.0213		0.0461		-0.0635		-0.0952		-0.0350		0.0588
MIG*DIR		-0.0149		0.0165		0.0769		0.000167		-0.00102		0.0377

	IDN		IND		IRL		IRN		ISL		ISR	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MIG	-35.93***		6.715		33.14		-598.8		2581.9***		1888.3***	
	(-3.68)		(1.24)		(1.45)		(-1.24)		(8.56)		(2.73)	
MIG*(1-DIR)		-966.7		-376.0**		8430.4		10613.9		2234258.9***		-1489755.5**
		(-0.96)		(-2.16)		(0.74)		(0.71)		(4.69)		(-2.29)
MIG*DIR		-37.99***		7.082		37.16		-596.4		2727.7***		1583.7**
		(-3.60)		(1.35)		(1.58)		(-1.23)		(9.74)		(2.26)
Trade creation (%)												
MIG	-0.180		0.0567		0.0399		-1.057		0.404		0.440	
MIG*(1-DIR)		-0.144		-0.451		0.0942		0.406		0.401		-2.439
MIG*DIR		-0.185		0.0513		0.0443		-1.030		0.426		0.366
Tariff equivalent (%)												
MIG	-0.0258		0.00810		0.00570		-0.152		0.0576		0.0628	
MIG*(1-DIR)		-0.0206		-0.0646		0.0135		0.0579		0.0572		-0.353
MIG*DIR		-0.0264		0.00733		0.00633		-0.148		0.0608		0.0523

Dependent variable: Aggregate trade. Estimation method: Fixed-effect PML. N=3259 in all regressions. All regressions include the full list of covariates as shown in Table 1. Observations clustered by (undirectional) country-pair. Robust t statistics in parenthesis. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. Trade creation (%) and ad valorem tariff equivalents (%) evaluated at the respective sample means. Elasticity of substitution is eight.

	ITA		JPN		KEN		KOR		KWT		LBY	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MIG	1.624		315.9***		653.7***		-42.72		-753.6***		-1379.5	
	(0.18)		(4.69)		(6.01)		(-0.42)		(-4.53)		(-0.32)	
MIG*(1-DIR)		-1977.2*		-187249.8**		310723.6		22047.2		-782379.5**		1063035.4*
		(-1.91)		(-2.18)		(1.53)		(0.85)		(-2.29)		(1.95)
MIG*DIR		-6.722		250.2***		692.2***		-22.05		-816.8***		-1366.4
		(-0.67)		(3.30)		(6.05)		(-0.22)		(-4.83)		(-0.31)
Trade creation (%)												
MIG	0.0121		0.320		0.219		-0.0736		-0.167		-0.0905	
MIG*(1-DIR)		-0.740		-1.369		0.401		0.471		-1.047		0.342
MIG*DIR		-0.0478		0.252		0.231		-0.0375		-0.180		-0.0892
Tariff equivalent (%)												
MIG	0.00174		0.0457		0.0312		-0.0105		-0.0239		-0.0129	
MIG*(1-DIR)		-0.106		-0.197		0.0571		0.0672		-0.150		0.0488
MIG*DIR		-0.00682		0.0359		0.0329		-0.00536		-0.0258		-0.0127

	MAR		MEX		MYS		NGA		NLD		NOR	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MIG	89.16**		24.65***		-4.598		154.6		-5.935		232.0***	
	(2.52)		(4.67)		(-1.49)		(0.72)		(-0.36)		(3.72)	
MIG*(1-DIR)		505.4		-256.2		423.5		-38797.9		-7334.0		114963.9***
		(0.37)		(-0.49)		(0.50)		(-0.47)		(-0.51)		(11.46)
MIG*DIR		89.61**		24.26***		-4.440		139.3		-12.22		261.4***
		(2.52)		(4.49)		(-1.41)		(0.64)		(-0.60)		(4.23)
Trade creation (%)												
MIG	0.591		0.101		-0.0238		0.158		-0.0126		0.194	
MIG*(1-DIR)		0.126		-0.0290		0.0304		-0.330		-0.283		0.574
MIG*DIR		0.572		0.0969		-0.0226		0.142		-0.0255		0.217
Tariff equivalent (%)												
MIG	0.0843		0.0145		-0.00339		0.0226		-0.00180		0.0276	
MIG*(1-DIR)		0.0180		-0.00415		0.00434		-0.0473		-0.0404		0.0818
MIG*DIR		0.0815		0.0138		-0.00323		0.0202		-0.00365		0.0309

	NZL		PAK		PER		PHL		POL		PRT	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MIG	98.11***		56.33***		310.4*		45.80**		93.20*		67.15***	
	(8.36)		(6.29)		(1.66)		(2.46)		(1.75)		(2.71)	
MIG*(1-DIR)		4204.8		-4034.3		-372287.8**		-2724.1		-11190.0*		-4223.3***
		(0.19)		(-1.62)		(-2.27)		(-0.81)		(-1.70)		(-2.97)
MIG*DIR		98.68***		53.20***		133.6		41.77**		77.57		61.96**
		(7.78)		(5.64)		(0.76)		(2.21)		(1.46)		(2.44)
Trade creation (%)												
MIG	0.121		0.239		0.304		0.231		0.366		0.201	
MIG*(1-DIR)		0.0310		-0.451		-3.034		-0.483		-1.263		-0.279
MIG*DIR		0.121		0.219		0.129		0.203		0.296		0.182
Tariff equivalent (%)												
MIG	0.0172		0.0340		0.0433		0.0329		0.0523		0.0287	
MIG*(1-DIR)		0.00443		-0.0646		-0.440		-0.0692		-0.182		-0.0399
MIG*DIR		0.0172		0.0313		0.0185		0.0289		0.0422		0.0259

	PRY		SAU		SDN		SGP		SWE		THA	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MIG	82.91***		-4449.5**		40.10		-90.00		162.2***		-86.55	
	(2.94)		(-2.37)		(0.83)		(-1.41)		(3.46)		(-1.29)	
MIG*(1-DIR)		-110769.7		-11509278.7**		-128203.8**		100242.5*		38735.5***		131887.2**
		(-1.02)		(-2.29)		(-2.30)		(1.79)		(2.92)		(2.04)
MIG*DIR		70.63**		-5218.2***		35.23		-74.25		187.4***		-43.22
		(2.48)		(-2.75)		(0.75)		(-1.07)		(3.93)		(-0.64)
Trade creation (%)												
MIG	0.0490		-0.629		0.0176		-0.0475		0.257		-0.120	
MIG*(1-DIR)		-0.213		-3.291		-0.635		0.239		0.817		1.809
MIG*DIR		0.0416		-0.736		0.0153		-0.0390		0.293		-0.0595
Tariff equivalent (%)												
MIG	0.00700		-0.0901		0.00251		-0.00679		0.0366		-0.0172	
MIG*(1-DIR)		-0.0305		-0.478		-0.0909		0.0342		0.116		0.256
MIG*DIR		0.00594		-0.105		0.00218		-0.00557		0.0418		-0.00850

	TUN		TUR		URY		USA		VEN		ZAF	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MIG	362.6***		52.06***		-269.9***		-146.3***		715.8**		149.9	
	(7.03)		(4.78)		(-4.40)		(-4.73)		(2.32)		(1.24)	
MIG*(1-DIR)		-71146.3***		-1022.5		-131960.2		2745.0		-67704.5		55832.6***
		(-2.85)		(-1.12)		(-0.27)		(0.35)		(-0.23)		(5.26)
MIG*DIR		346.9***		50.38***		-284.9***		-140.5***		697.2**		179.7
		(6.72)		(4.54)		(-3.66)		(-3.79)		(2.29)		(1.47)
Trade creation (%)												
MIG	0.372		0.346		-0.0978		-0.548		0.346		0.218	
MIG*(1-DIR)		-0.483		-0.321		-0.167		0.382		-0.145		0.842
MIG*DIR		0.354		0.319		-0.103		-0.507		0.335		0.258
Tariff equivalent (%)												
MIG	0.0531		0.0494		-0.0140		-0.0785		0.0493		0.0310	
MIG*(1-DIR)		-0.0692		-0.0460		-0.0239		0.0545		-0.0208		0.120
MIG*DIR		0.0505		0.0455		-0.0147		-0.0726		0.0478		0.0368

Dependent variable: Aggregate trade. Estimation method: Fixed-effect PML. N=3259 in all regressions. All regressions include the full list of covariates as shown in Table 1. Observations clustered by (undirectional) country-pair. Robust t statistics in parenthesis. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. Trade creation (%) and ad valorem tariff equivalents (%) evaluated at the respective sample means. Elasticity of substitution is eight.

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