# ETHNIC CHINESE NETWORKS IN INTERNATIONAL TRADE

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Ethnic Chinese networks, as proxied by the product of ethnic Chinese population shares, are found to have increased bilateral trade more for differentiated than for homogeneous products, the difference being economically significant in 1980 and both economically and statistically significant in 1990. These and other, complementary findings suggest that business and social networks have a considerable quantitative impact on international trade by helping to match buyers and sellers in characteristics space, in addition to their well-established effect through enforcement of community sanctions that deter opportunistic behavior. For trade between countries with ethnic Chinese population 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 percent, providing evidence that the informal trade barriers these networks help to overcome are economically important.

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## I. Introduction

The importance of business and social networks in overcoming informal barriers to international trade is being increasingly recognized, both in empirical work (Gould 1994, Belderbos and Sleuwaegen 1998) and theoretical work (Greif 1993, Rauch and Casella 1998). Informal trade barriers may consist of weak international legal institutions or inadequate information about international trading opportunities. Such barriers, in turn, are leading candidates to help explain "the mystery of the missing trade" (Trefler 1995) or the home bias in international trade found by McCallum (1995) and many others (e.g., Helliwell 1998).

Among the many types of business and social networks that exist, coethnic networks have the advantage for empirical research that it is much easier to identify network members.[1] Of coethnic networks active in international trade, the Overseas Chinese have received the most attention (see, e.g., Redding 1995). Studies show that not only the Overseas Chinese but also many other ethnic groups living outside their countries of origin create formal or informal associations to which coethnic businesspeople from both the host countries and the mother country have access.[2] These associations serve as nodes for information exchange. In this sense

[1]Census takers will not record the characteristic "former employee of IBM", yet the fact that many of the key decision makers in the hard disk drive industry shared this characteristic contributed to the rapid spread of popularity of Singapore as a site for FDI, according to industry observers (McKendrick 1998).

[2]The Overseas Chinese, however, have been exceptional in this regard. Freedman (1967, p. 17) states, "The society built up by the Overseas Chinese in Southeast Asia has always been remarkable for its wealth of voluntary associations." Lever-Tracy, Ip, and Tracy (1996) report (p. 104), "Chew Choo Keng of Singapore remembered how 'It was through my friends at the clubs that I was able to expand my businesses into Thailand, Malaya, Burma and Indonesia'." Unfortunately, the reasons why some ethnic groups form successful associations and others do not are still a mystery.

the ethnic Chinese are best seen as forming a set of interlinked national networks rather than a unified international network, though since 1991 the international links have become more formalized and perhaps strengthened through biennial meetings of the World Chinese Entrepreneurs Convention.[3]

We will mainly address two issues in this paper. First, by what mechanism(s) do coethnic networks overcome informal barriers to international trade? Provision of information regarding trading opportunities suggests different lessons for policy makers than does the mechanism of deterring opportunistic behavior through enforcement of community sanctions. Second, what is the quantitative importance for trade of what is probably the world's largest and most internationally dispersed set of interlinked business and social networks? The answer is of interest in its own right, and also because it implicitly provides a lower bound on the trade-reducing impact of informal barriers.

In the next section of this paper we present our strategy for identifying the means through which ethnic Chinese networks overcome informal barriers to international trade. In section III we specify our empirical model and describe our data. We present our results in section IV and check their robustness to some changes in sample and specification. In our concluding section we briefly discuss what guidance our results could furnish for the formulation of policy.

## II. Theoretical Framework

We study the impact of ethnic Chinese networks on bilateral trade. The work of Greif

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[3]Recently Singapore was chosen as the venue for the first permanent secretariat of the Convention (Leong 1999).

(1989, 1993) has firmly established in the literature the idea that coethnic networks can promote international trade by providing community enforcement of sanctions that deter violations of contracts in a weak international legal environment. This is consistent with descriptions of the operation of ethnic Chinese networks. For example, Weidenbaum and Hughes (1996, p. 51) report, "If a business owner violates an agreement, he is blacklisted. This is far worse than being sued, because the entire Chinese network will refrain from doing business with the guilty party."

More recent work by Gould (1994) and Rauch and Casella (1998) has emphasized that coethnic networks also promote bilateral trade by providing market information and by supplying matching and referral services, for example helping producers find the right distributors for their consumer goods or assemblers find the right suppliers for their components. This is also consistent with the descriptive literature on ethnic Chinese networks. Kotkin (1992, p. 169) states that "Chinese entrepreneurs remain, in essence, arbitrageurs, their widespread dispersion a critical means of identifying prime business opportunities." Weidenbaum and Hughes (1996, p. 55) write:

> the members of the bamboo network operate in the interstices of the trading world. They make components, manufacture for others, and perform subassembly work. They are also heavily involved in wholesaling, financing, sourcing, and transporting....The leading businessmen know each other personally and do deals together, with information spreading through an informal network rather than through more conventional channels.

In order to quantify this second impact of ethnic Chinese networks on bilateral trade over and above their impact through deterrence of contract violations, we will estimate separately the effects of ethnic Chinese networks on bilateral trade in commodities that have "reference prices" and commodities that do not. Following Rauch (1999), a reference price is defined as a price that is quoted without mentioning a brand name or other producer identification. Commodities that possess reference prices are taken to be sufficiently homogeneous that if traders see the price differential between two countries' markets is large enough to cover customs and transport costs, they know it is profitable to ship the product. Commodities that do not possess reference prices are taken to be sufficiently differentiated that prices cannot convey all the information relevant for international trade: buyers and sellers must be matched in characteristics space, and hence the thicker information that can be provided by ethnic Chinese networks is much more important than for international trade in homogeneous commodities. Again following Rauch (1999), we will further divide homogeneous commodities into commodities whose reference prices are quoted on organized exchanges such as the London Metal Exchange and those whose reference prices are quoted only in trade publications such as *Chemical Marketing Reporter*. The reason to treat commodities traded on organized exchanges differently from other homogeneous commodities is that we know the former have specialized traders that can keep informed of their prices around the globe and perform international commodity arbitrage while the same is only potentially true for the latter.

In contrast, the threat of community sanctions should deter equally shipments of debased metals, rotting fruit, or stockings with runs. The same lack of distinction between commodities with and commodities without reference prices should hold for other forms of contract violation such as failure to pay for a shipment one has received. In short, the trade-promoting effect of ethnic Chinese networks through the mechanism of community enforcement of sanctions should be equal across commodity groups.[4] In this case, the difference between differentiated and homogeneous products in the effects of ethnic Chinese networks on bilateral trade could be used to measure their impact through the mechanism of market information, matching and referral, while the "baseline" effect of ethnic Chinese networks on bilateral trade in homogeneous products could measure their impact through the mechanism of community enforcement of sanctions. Within the class of homogeneous commodities we would use commodities whose reference prices are quoted on organized exchanges as the baseline because we are more confident that markets efficiently convey all the information needed to match buyers and sellers for these commodities.

There are a number of reasons, however, not to push this interpretation of our estimates too hard. First, note that our empirical proxies for the strength of ethnic Chinese networks in the next section will be functions of the ethnic Chinese populations in the trading partners. An immediate concern is that, if countries with similar tastes tend to trade differentiated products more with each other (as has been argued by Linder (1961), for example), one could interpret a finding of a greater effect of the ethnic Chinese variable on bilateral trade in differentiated products as indicating that the variable was a proxy for taste similarity rather than networks.

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[4]Certain private institutions have evolved to fill the void left by the weak international legal framework. Letters of credit allow the trading parties to shift some of their commercial credit risk to the issuing bank and allow the buyer to defer payment until the shipment passes quality inspection; for more information on their benefits see del Busto (1994). International commercial arbitration offers a private means of dispute resolution; Craig, Park, and Paulsson (1985) is the standard reference for International Chamber of Commerce arbitration. Since these private institutions are means of deterring opportunistic behavior in international trade that can substitute for community enforcement, it is important for our argument that they be equally effective across commodity groups. Unfortunately, we know of no systematic evidence on this point.

Second, the greater complexity of differentiated than homogeneous products may make more aspects of trading them inherently noncontractible. At first this point may seem irrelevant, since ethnic Chinese networks cannot promote trade by aiding contract enforcement if it cannot be determined that a violation of contract has occurred. However, it could be that agents who repeatedly exploit contractual ambiguities to their advantage will acquire a reputation within ethnic Chinese networks for being "difficult" and then be excluded from future trading opportunities. Ethnic Chinese networks could then deter this more subtle kind of opportunistic behavior and thus have a greater positive impact on trade in differentiated than homogeneous products to the extent that the scope for such behavior is greater for the former product group.[5] Finally, provision of market information, matching and referral services by ethnic Chinese networks may be relevant even for products whose reference prices are listed on organized exchanges, so that the effect of ethnic Chinese networks on this trade may not measure solely their impact through contract enforcement.

Two variables included in our empirical model mitigate this ambiguity in interpretation of our estimates to some extent. First, we argue that if the taste similarity interpretation of the impact of the ethnic Chinese variable is correct, common birth language across countries should also have a greater effect on bilateral trade in differentiated than homogeneous products: common Chinese ancestry should have effects on taste similarity roughly equal to those of

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[5]Though we did not find any description of this kind of operation of ethnic Chinese networks in the literature, Woodruff (1998) shows that domestic manufacturers' trade associations in the Mexican footwear industry were able to deter repeated opportunistic behavior by domestic retailers in noncontractible aspects of trading. Even in this purely domestic context, however, Woodruff reports (p. 986), "While the manufacturers' coalition helped overcome basic problems of trade in the industry, ... there were suggestions that the system functioned imperfectly, with the resulting market being characterized by considerable friction."

common mother tongue (most emigration from China occurred before World War I). With this in mind we will include a variable that measures the probability that, if we select an individual at random from each country, they will share a birth language. Second, we include a variable indicating direct and indirect colonial ties, where an indirect colonial tie exists between two countries that had the same colonial power. The integration of commercial interests that prevailed during colonial periods should have established a common business language or lingua franca and a set of business contacts, facilitating the search by producers for the right distributors, by assemblers for the right suppliers, and so on.[6] We thus expect even more strongly than we do for ethnic Chinese networks that direct and indirect colonial ties will increase bilateral trade in differentiated products more than homogeneous products, so if we find such a difference we are more confident that the mechanism of market information, matching and referral is driving the same difference in the impacts of ethnic Chinese networks.[7]

In summary, a conservative interpretation of a statistically and economically significantly greater impact of the ethnic Chinese variable on trade in differentiated than homogeneous products is that it establishes a presumption that provision of market information, matching and referral services is an additional quantitatively important mechanism through which ethnic Chinese networks promote international trade. This presumption is strengthened if common

[6]Of course our measure of common birth language and our indicator of direct and indirect colonial ties overlap considerably, so it is important to include both variables to avoid omitted variable bias in the coefficient estimate for either one.

[7]Direct and indirect colonial ties could be associated with some harmonization of legal systems, which could in turn promote bilateral trade by facilitating contract enforcement. Berkowitz et al. (2000) found that common legal systems promoted trade in homogeneous products but not in differentiated products, so it is unlikely that any larger impact of colonial ties on trade in differentiated products is due to their acting as a proxy for legal harmonization.

birth language does *not* promote trade in differentiated products more than homogeneous products and if direct and indirect colonial ties *do* promote trade in differentiated products more than homogeneous products.

## III. Empirical Model and Data

### *A. Gravity model specification*

We examine the effects of ethnic Chinese networks using a standard gravity model of bilateral trade. The gravity model takes its name from the prediction that the volume of trade between two countries will be directly related to the product of their economic masses (as measured by GDP or GNP) and inversely related to the distance between them. Helpman (1987) shows that proportionality of the bilateral volume of trade to the product of the trading partners' GDPs, $V_{ij} = \alpha GDP_i GDP_j$ , can be derived from the assumption that every country consumes its own output and that of every other country in proportion to its share of world demand. We follow Rauch (1999) in viewing this proportional relationship as a basic "null" or starting point for further analysis of trade rather than as something that itself needs to be explained.[8]

In line with the usual gravity model specification, we assume that factors that aid or resist trade cause deviations from the basic proportional relationship multiplicatively. In addition to distance, we will start with the other factors aiding or resisting trade that were used by Frankel and co-authors in a series of papers synthesized in Frankel (1997). Per capita income has become a standard covariate in gravity models (for example, it is used in the paper by Eaton and

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[8]Deardorff (1998, p. 12) states, "any plausible model of trade would yield something very like the gravity equation, whose empirical success is therefore not evidence of anything, but just a fact of life."

Tamura (1994) cited below), and Frankel included the product of the two countries' per capita GNPs. (He also used GNP rather than GDP as his measure of a country's economic mass.) He added a dummy variable indicating when two countries are adjacent, which is important since the distance between Chicago and Mexico City, say, is a much less complete measure of the physical separation between the United States and Mexico than is the distance between Chicago and London of the physical separation between the United States and the United Kingdom. Frankel completed his basic specification with a dummy variable indicating the presence of either a common language or past direct or indirect colonial relationship between two countries. To this set of five explanatory variables (product of GNPs, product of per capita GNPs, distance, adjacency, and common language/colonial tie), Frankel (1997, Chapter 4) added various lists of dummy variables indicating membership in existing and potential trading blocs.

For the reasons given in the previous section, we will modify the basic gravity model specification used by Frankel to include separate variables for common (birth) language and (direct and indirect) colonial ties. Following Deardorff (1998) and Wei (1996), we also include a variable for the geographical remoteness of the trading partners from the rest of the world. Their argument is that, all else equal, two countries that are very far away from most other large potential trading partners (such as Australia and New Zealand) will trade more with each other than two countries that are close to most other large potential trading partners (such as Denmark and Portugal). We include dummy variables indicating membership in the European Community (EEC) and the European Free Trade Association (EFTA), the two preferential trade areas that in the years covered by our data (1980 and 1990) were both the oldest post-World War II major regional trading arrangements (Frankel 1997, Table 1.1) and the ones most widely believed to have brought about genuine reductions in trade barriers between their members.

We conclude our gravity model specification with the addition of a variable measuring the strength of ethnic Chinese network links between the trading partners. Unfortunately, theory gives us little guidance here as there exists no model that incorporates both the contract enforcement and matching functions of networks in a multi-country framework. We therefore try two different intuitively plausible variables. The first is the probability that, if we select an individual at random from each country, both will be ethnic Chinese. The second is the number of potential international connections between the ethnic Chinese populations of the trading partners. The two variables are related since the first equals the product of the two countries' ethnic Chinese population shares and the second equals the product of the two countries' ethnic Chinese populations. Nevertheless, each variable has distinct advantages. The probability measure ranges between zero and one and thus yields coefficient estimates that are readily comparable to those on the common language probability and the colonial ties dummy. The potential connections measure, specified as a quadratic, can conveniently capture the diminishing returns that are bound to set in as networks grow too large for everyone to keep in touch with everyone else (even through referral).

Following Rauch (1999) and the discussion in section II, we divide traded commodities into three groups and estimate our gravity model separately for each aggregated group. The three groups are commodities traded on organized exchanges, commodities possessing "reference prices" but not traded on organized exchanges, and all other commodities, which we label as differentiated.

We can now write our gravity model as follows:

$$V_{ijk} = \alpha_k (GNP_i GNP_j)^{\beta_k} (PGNP_i PGNP_j)^{\gamma_k} DISTANCE^{\delta_k} REMOTE^{\varepsilon_k}$$
$$\times \exp(\zeta_k ADJACENT + \eta_k EEC + \theta_k EFTA \quad \textbf{(1)}$$
$$+ \lambda_k LANGUAGE + \varphi_k COLOTIE + \psi_k CHINSHARE + u_{ijk}), \quad k{=}1,2,3,$$

where

$k = 1$ denotes the organized exchange commodity group, $k = 2$ denotes the reference priced commodity group, and $k = 3$ denotes the differentiated commodity group;

$V_{ijk}$ denotes bilateral nominal value of trade (exports plus imports) between countries *i* and *j* in commodity group *k*;

*GNP* denotes nominal GNP;

*PGNP* denotes per capita nominal GNP;

*DISTANCE* equals the great circle distance between the principal cities of countries *i* and *j*;

*REMOTE* equals the product of the weighted sum of country *i*'s distances from all other countries in the sample and the same weighted sum for country *j*, where the weights are the GNPs of the other countries;

*ADJACENT* equals one if countries *i* and *j* share a land border and zero otherwise;

*EEC* or *EFTA* equals one if countries *i* and *j* are members of the European Community or European Free Trade Association, respectively, and zero otherwise;

*LANGUAGE* is a measure, described in the next subsection, of the extent to which countries *i* and *j* share birth languages;

*COLOTIE* takes the value of one if countries *i* and *j* share a direct or indirect colonial tie and zero otherwise;

*CHINSHARE* equals the product of the ethnic Chinese population shares for countries *i* and *j*;

$u_{ijk}$ is a Gaussian white noise error term associated with the dependent variable $V_{ijk}$.[9] In section

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[9]The reader might note that it is possible to rewrite equation (1), replacing the product of per capita GNPs with the product of populations, in which case the exponent on the product of GNPs would equal $\beta_k + \gamma_k$ and the exponent on the product of populations would equal $-\gamma_k$.

IV we will allow for specifications other than *CHINSHARE* of the variable measuring the strength of ethnic Chinese network links between the trading partners

The dependent variable $V_{ijk}$ is bounded below by zero, and some observations achieve this bound. Following Eaton and Tamura (1994), we estimate a modified gravity model in which the right-hand side of equation (1) must achieve a minimum threshold value $a_k$ before strictly positive values of $V_{ijk}$ occur. In the iceberg transportation cost metaphor, we might think of $-a_k$ as an amount of "melting" that occurs as soon as the trip starts, independent of the distance traveled. The gravity model to be estimated in section IV below is then

$$\begin{aligned} V_{ijk} = \max[-a_k + \alpha_k (GNP_i GNP_j)^{\beta_k} (PGNP_i PGNP_j)^{\gamma_k} DISTANCE^{\delta_k} REMOTE^{\varepsilon_k} \\ \times \exp(\zeta_k ADJACENT + \eta_k EEC + \theta_k EFTA \\ + \lambda_k LANGUAGE + \varphi_k COLOTIE + \psi_k CHINSHARE + u_{ijk}),\ 0],\quad k=1,2,3. \end{aligned} \quad \textbf{(2)}$$

Rearranging and taking natural logarithms of both sides yields

$$\begin{aligned} \ln(a_k + V_{ijk}) = \max[\ln\alpha_k + \beta_k \ln(GNP_i GNP_j) + \gamma_k \ln(PGNP_i PGNP_j) + \delta_k \ln DISTANCE \\ + \varepsilon_k \ln REMOTE + \zeta_k ADJACENT + \eta_k EEC + \theta_k EFTA \\ + \lambda_k LANGUAGE + \varphi_k COLOTIE + \psi_k CHINSHARE + u_{ijk},\ \ln a_k],\quad k=1,2,3. \end{aligned} \quad \textbf{(3)}$$

Each of equations (3) will be estimated by maximum likelihood, where the likelihood function is constructed using what we call a threshold Tobit model. The details of the estimation procedure are given in Eaton and Tamura (1994, pp. 490-492).[10]

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[10]This method of estimating gravity models has been gaining popularity (see, e.g., Head and Ries 1998). For the sake of robustness, however, we also repeat all estimations using the log transform of equations (1) instead of equations (2), where we add one to the dependent variables before taking the log so that all zero observations can be retained (see, e.g., Eichengreen and Irwin 1998), and estimate using ordinary least squares (OLS). We report any instances in which this OLS estimation procedure yields qualitatively different results than the threshold Tobit estimation procedure.

We estimate equations (3) separately for the two years in which we have data on ethnic Chinese populations (1980 and 1990) in order to check that our results are not the artifact of a particular time period and to allow for changes in coefficients that might have taken place due (for example) to improvements in communication and transportation technology or in international legal institutions. In light of the theory presented so far, in each of the two years we expect to find $\psi_1, \psi_2, \psi_3 > 0$, $\psi_3 > \psi_2$, and $\psi_3 > \psi_1$. Though our main hypothesis concerns the distinction between differentiated and homogeneous commodities, we might also expect $\psi_2 > \psi_1$: the effects of *CHINSHARE* for reference priced commodities will be in between those for differentiated commodities and commodities traded on organized exchanges because, with regard to matching international buyers and sellers, their homogeneity makes them like organized exchange commodities but their lack of organized exchanges makes them like differentiated commodities. Suppose we do in fact observe the expected rankings of the coefficients $\psi_k$. Our interpretation that this indicates that the ethnic Chinese variable measures networks that provide market information and facilitate the matching of international buyers and sellers in characteristics space, as well as providing community enforcement of sanctions, is weakened if the same rankings across commodity groups are observed for the coefficients $\lambda_k$ on the common language variable (which argues for a taste similarity interpretation); our interpretation is reinforced if the same rankings are observed for the coefficients $\varphi_k$ on the colonial ties dummy (which argues for a business contact interpretation).[11]

[11]Since we are not interested in the differences across commodity groups in the coefficients on $\ln(GNP_i GNP_j)$, $\ln(PGNP_i PGNP_j)$, ln(*DISTANCE*), ln(*REMOTE*), *ADJACENT*, *EEC*, and *EFTA*, we could restrict the coefficients on these variables to be equal across the three groups. However, pooling tests always reject these joint restrictions (allowing for different constant terms) at the one percent level. Examination of Tables 3-6 below shows that the coefficients on

*B. Data*

The sample of countries used in the estimation below is listed in Table 1. They are the same 63 countries that were chosen by Frankel (1997). This allows us to use his data for GNP and per capita GNP (in current dollars), great circle distance between principal cities, and dummies for adjacency, European Community membership, and European Free Trade Association membership. Our measure of common birth language between countries *i* and *j* is $\sum_l s_{il}s_{jl}$, where $s_{il}$ is the share of the population in country *i* with mother tongue *l*. If everyone has only one birth language, our variable gives the probability that, if we select an individual at random from each country, they will have a common birth language.[12] We constructed a dummy variable indicating direct or indirect colonial ties by taking the Frankel common

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ln($PGNP_iPGNP_j$), ln(*DISTANCE*), ln(*REMOTE*), and *ADJACENT* in particular tend to differ substantially across commodity groups. By way of explanation, we first note that Frankel (1997) argues that the positive effect of the product of the trading partners' per capita incomes on bilateral trade partly reflects the tendency for richer countries to be more open. It is well known that this tendency is much weaker for agricultural products, and as one moves from organized exchange to reference priced to differentiated products the proportion of agricultural products falls, so the positive impact on trade of the product of per capita incomes could be expected to rise, as we in fact observe in Tables 3-6. Second, we note that distance, remoteness and adjacency all relate to the physical separation between countries, so we could expect their impacts on trade to differ across the three commodity groups if the groups differ substantially in transportability, for example. Rauch (1999) shows that the ratio of transport costs to value is much lower for differentiated than for homogeneous products.

[12]To construct our variable, for each country we started with estimates from *Ethnologue Index* (Grimes 1992) of the number of mother tongue speakers of each of the various languages. We then divided these estimates by the midyear population estimates for the corresponding years in the *United Nations Demographic Yearbook*. If the year for the estimates of native speakers was not specified in *Ethnologue Index*, we used the 1990 population estimates in the *Yearbook*. We thus obtained the language shares $s_{il}$. In section IV we consider other variables that measure common mother tongue.

language/colonial ties variable and changing its value from one to zero whenever the *Encyclopedia Britannica* did not indicate a past direct or indirect colonial relationship. Thanks to the efforts of Poston, Mao, and Yu (1994), ethnic Chinese population data for nearly all the countries in our sample is available circa 1980 and circa 1990.[13] Table 1 lists the number of ethnic Chinese (column CHIN) and the overall population (column POP) circa 1980 and circa 1990 for all countries in our sample for which ethnic Chinese data are available. The countries are listed in descending order by ethnic Chinese population shares.

Ethnic Chinese population data are not available for six countries in 1980 and four countries in 1990, reducing the maximum number of country-pair observations from (63)(62)/2 = 1953 to (57)(56)/2 = 1596 and (59)(58)/2 = 1711, respectively. In section 4 we will check the robustness of our results to inclusion of the omitted countries on the assumption that their ethnic Chinese populations are zero. We also omitted trade between China and Taiwan because of the special barriers to trade that exist between them,[14] reducing the number of observations to 1595 in 1980 and 1710 in 1990. Because some trade between China and Taiwan that passes through Hong Kong may be incorrectly counted as China-Hong Kong or Hong Kong-Taiwan trade, in section 4 we will consider the robustness of our results to omission of these two country pairs. Table 2 gives descriptive statistics for the variables of interest, *LANGUAGE*, *COLOTIE*, and *CHINSHARE*. We see that about 14 percent of the country pairs in our 1980 and 1990 samples

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[13]We draw on an unpublished version of Table 1 in Poston et al. (1994) that reports data for countries with small ethnic Chinese populations separately rather than aggregating. We thank Dudley Poston for kindly supplying this table.

[14]Direct trade between China and Taiwan is illegal. The WTDB does not report any trade between China and Taiwan in 1980 but reports positive trade between them in 1990, reflecting the relaxation of restrictions on indirect trade through Hong Kong that began in the mid-1980s.

have direct or indirect colonial ties. We also see that for the average country pair in our 1980 and 1990 samples there is roughly a four percent probability that, if we select an individual at random from each country, they will share a birth language, whereas the probability that both will be ethnic Chinese is an order of magnitude lower.

Unlike Frankel (1997), we use the World Trade Database (WTDB) of Statistics Canada as our source for bilateral trade (see Feenstra, Lipsey, and Bowen 1997 for a description of the WTDB). The WTDB is derived from the United Nations COMTRADE data used by Frankel. Aside from cost and convenience (the NBER has made the WTDB available on CD-ROM), the importance of which should not be underestimated given that data at the four-digit SITC level are being used, the main advantage of the WTDB over the COMTRADE data is that special care was taken to insure that trading partners were correctly identified (as opposed to listing an entrepôt as the trading partner), mainly by making careful efforts to insure that exports of country $i$ to country $j$ of commodity $x$ equal imports of country $j$ from country $i$ of commodity $x$.

As discussed in the previous subsection, traded commodities are classified into three categories: organized exchange, reference priced, and differentiated, at the three- and four-digit SITC level. Trade reported at a less disaggregated level was omitted. Fortunately, this accounted for only 0.1 percent of the total value of trade in our sample in each of the two years. Commodities were classified in the following manner. All commodities at the five-digit SITC level were classified by looking them up in *International Commodity Markets Handbook* and *The Knight-Ridder CRB Commodity Yearbook* (to check for organized exchanges) and *Commodity Prices* (to check for reference prices, e.g., price quotations published in industry journals). Classification of the next higher level of aggregation was then done according to which of the three categories accounted for the largest share (almost always more than half) of the value of its world trade. Since the WTDB does not report world trade by five-digit SITC, the sum of 1980 U.S. General Imports and Exports from the U.S. Department of Commerce was used for this purpose.[15] Because ambiguities arose that were sometimes sufficiently important to affect the classification at the three- or four-digit level, both "conservative" and "liberal" classifications were made, with the former minimizing the number of three- and four-digit commodities that are classified as either organized exchange or reference priced and the latter maximizing those numbers.[16] An appendix listing all of the commodities used in the estimation below and their conservative and liberal classifications is available on request.

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[15]One thus expects that industries will be most accurately classified for the bilateral trade of the United States. For this reason we estimated equations (3) using only this trade as a check on our main results. In 1980 and 1990 this reduces the number of country-pair observations from 1595 to 56 and from 1710 to 58, respectively, so we pooled across years to get 114 observations which proved adequate for the threshold Tobit estimation routine. We found that the rankings of coefficient sizes across commodity groups reported in Tables 3-6 below were preserved for the variables of interest, with the "conservative" aggregation conforming to the 1980 results and the "liberal" aggregation conforming to the 1990 results. Moreover, for *CHINSHARE* the relative sizes of the coefficients across commodity groups were usually in between those for 1980 and 1990 in Tables 3-6.

[16]Ambiguities could arise because, for example, the organized exchange on which a commodity was traded was a very obscure one, or the reference priced commodities accounted for about half the value of a SITC rather than a clear majority. Out of 642 3- and 4-digit SITCs classified, 70 switch from differentiated to reference priced or from reference priced to organized exchange when moving from the conservative to the liberal classification. Note that by construction the conservatively aggregated organized exchange products and the liberally aggregated differentiated products contain no SITCs that switch classifications. We can thus create a trade data set that is purged of SITCs that switch classifications by using these two commodity aggregations and dropping all the "switching" SITCs from the reference priced aggregation. Using these dependent variables does not qualitatively change any of the results we obtain below.

**IV. Results of Estimation**

The first three columns in Tables 3-6 give estimates of equations (3): Tables 3 and 4 respectively show the conservative and liberal commodity aggregations for 1980 and Tables 5 and 6 respectively show the conservative and liberal commodity aggregations for 1990. It should be noted that no attempt was made to adjust for changes in classification of commodities by the three categories organized exchange, reference priced, and differentiated that may have occurred during the period 1980-1990.

We see that for both years and all commodity classifications the coefficients on the logarithm of the product of GNPs are close to one, and we cannot reject (at the five percent level) the hypothesis that this coefficient equals one for any commodity classification in 1990 or for the organized exchange commodity groups or the liberally aggregated reference priced commodity group in 1980. This result is consistent with the proportionality between bilateral trade and the product of GNPs predicted by the gravity model.[17] The coefficients on the logarithms of the product of per capita GNPs, *DISTANCE*, and *REMOTE* always have the expected signs and are always significant, usually highly so. The estimated thresholds are always positive and highly significant. The coefficients on *ADJACENT* are always positive, but not significant for the organized exchange commodity groups in 1980 or the liberally aggregated reference price commodity group in 1980. The coefficients on *EEC* are positive and significant for the reference priced and differentiated commodity groups for both aggregations in 1990, but are insignificant

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[17]In contrast, for the OLS estimates the coefficients on the logarithm of the product of GNPs are significantly greater than one for all commodity classifications in 1990 and for the organized exchange commodity groups and the liberally aggregated reference priced commodity group in 1980. This is another reason to prefer the threshold Tobit estimates.

otherwise except for a negative and significant coefficient for the liberally aggregated organized exchange commodities in 1980. The coefficients on EFTA are positive and significant for the differentiated commodity group for all years and aggregations and for the liberally aggregated reference priced commodity group in 1990, but are otherwise insignificant.[18]

Turning to the coefficients of interest, we first note that the coefficients on *CHINSHARE* are positive and significant for all years and commodity classifications. Second, we observe that the coefficients on *CHINSHARE* are largest for the differentiated commodity group and smallest for the organized exchange commodity group for both years and for both the conservative and liberal aggregations. (We will address the statistical significance of the differences across commodity groups below.) Third, we note that the coefficients on *LANGUAGE* are not significant for the differentiated commodity group in any year and in any aggregation (and the point estimates of these coefficients are smallest for this group in both years for both aggregations), whereas they are positive and significant for the organized exchange and reference priced commodity groups in 1990 for the conservative aggregation (and for the reference priced commodity group for the liberal aggregation). Finally, we observe that the coefficients on *COLOTIE* are always largest for the differentiated commodity group and smallest for the organized exchange commodity group except for the liberal aggregation in 1990, where the

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[18]In general, the OLS coefficient estimates are less precise than the threshold Tobit estimates. The only qualitative difference between the two sets of estimates for the logarithms of the product of per capita GNPs, *DISTANCE*, and *REMOTE*, and for *ADJACENT*, *EEC*, and *EFTA* is that many coefficients that are significant using the threshold Tobit estimation are insignificant using OLS: ln(*REMOTE*) for the differentiated commodity group for all years and aggregations, *ADJACENT* for the conservatively aggregated reference priced commodities in 1980, *EEC* for all cases, and *EFTA* for all cases.

coefficient on *COLOTIE* is smallest for the reference priced commodity group.[19] (We will discuss the statistical significance of the differences across commodity groups below.) The results reported in the first three columns of Tables 3-6 thus appear very supportive of our hypothesis that ethnic Chinese networks promote bilateral trade by providing market information and facilitating matching of international buyers and sellers in characteristics space, in addition to providing community enforcement of sanctions. The results for *LANGUAGE* and *COLOTIE* support our interpretation of the product of ethnic Chinese population shares as a measure of networks of business contacts rather than taste similarity.

It turns out that the coefficients on *CHINSHARE* reported in the first three columns of Tables 3-6 are essentially estimated using only the information contained in the observations covering trade between the minority of countries with relatively large ethnic Chinese population shares, i.e., at least one percent (the lowest share in Southeast Asia).[20] To bring out the information contained in the observations on all other country pairs we first create two dummy variables, *TWO80ONE* and *TWO90ONE*, that equal one when the populations of both trading partners are at least one percent ethnic Chinese in 1980 and 1990, respectively, and zero otherwise. We then reestimate equations (3) in the last three columns of Tables 3-6, substituting the variables *CHINSHARE*∗(1-*TWO80ONE*) and *CHINSHARE*∗*TWO80ONE* or

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[19]The OLS coefficient estimates are insignificant for *CHINSHARE* for the conservatively aggregated organized exchange commodities in 1990 and for *LANGUAGE* for the liberally aggregated organized exchange commodities in 1990.

[20]The average probability that, if we select an individual at random from each country, both will be ethnic Chinese is three orders of magnitude greater when both countries belong to this minority than for all other country pairs in both 1980 and 1990. Given this difference, the estimation routine basically treats the observations on *CHINSHARE* for all other country pairs as an undifferentiated mass of zeroes.

*CHINSHARE*∗(1-*TWO90ONE*) and *CHINSHARE*∗*TWO90ONE* for *CHINSHARE*.[21]

We see that the coefficients on *CHINSHARE*∗*TWO80ONE* and *CHINSHARE*∗*TWO90ONE* are essentially the same (though slightly smaller in all cases) as the coefficients on *CHINSHARE* for all years and commodity classifications. All the other results from the first three columns of Tables 3-6 are unchanged, except that the coefficients on ln(*REMOTE*) for the differentiated commodity group in both aggregations in 1980 become insignificant and the coefficient on *LANGUAGE* for the liberally aggregated organized exchange commodities in 1990 becomes significant. The big difference between the first and last three columns of Tables 3-6, however, is the additional variable *CHINSHARE*∗(1-*TWO80ONE*) or *CHINSHARE*∗(1-*TWO90ONE*), which is always significant except for the organized exchange commodity group in both aggregations in 1990.[22] As for *CHINSHARE*∗*TWO80ONE* or *CHINSHARE*∗*TWO90ONE*, the coefficients on this variable are largest for the differentiated commodity group and smallest for the organized exchange commodity group for both years and both aggregations. The change in the specification of the ethnic Chinese network variable between the first and last three columns of Tables 3-6 thus leaves the support for our various hypotheses unchanged. It also raises a new issue of diminishing returns: the marginal effect of *CHINSHARE* on trade between countries with ethnic Chinese population shares at the levels

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[21]Countries with at least one percent ethnic Chinese population in 1990 are the top twelve in Table 1; in 1980 they are the same group less Australia, New Zealand, and Peru. For the country-pair subsets defined by *TWO80ONE* = 0, *TWO80ONE* = 1, *TWO90ONE* = 0, and *TWO90ONE* = 1, the means of *CHINSHARE* are, respectively, 0.000132, 0.172, 0.0000943, and 0.0944.

[22]The OLS coefficient estimates are insignificant for *CHINSHARE*∗*TWO90ONE* for the conservatively aggregated organized exchange commodities and for *CHINSHARE*∗(1-*TWO90ONE*) for the conservatively aggregated reference priced commodities.

prevailing in Southeast Asia is less than two (three) percent of that on trade for other country pairs in all cases in 1980 (1990). It is possible that this diminishing marginal effect arises because ethnic Chinese communities become less cohesive as their population shares increase, but more likely it reflects the fact that countries with large ethnic Chinese population shares also have large ethnic Chinese populations, diminishing the thoroughness with which any ethnic Chinese population increment is connected to the existing ethnic Chinese populations. The issue of diminishing returns is thus more appropriately addressed using the alternative measure of the strength of ethnic Chinese networks discussed in subsection III.A: the product of the trading partners' ethnic Chinese populations or total number of potential international connections, which we shall denote by *CHINPOP*.

As we suggested in subsection III.A, we will enter *CHINPOP* as a quadratic to capture the possibility of diminishing returns.[23] We also separate out country pairs including China because its ethnic Chinese population is more than 50 times larger than that of any other country. We thus create a dummy variable, *CHINA*, that takes on the value one if a country pair includes China and zero otherwise, and replace *CHINSHARE* in equations (3) with the variables $CHINPOP*(1-CHINA)$, $[CHINPOP*(1-CHINA)]^2$, and $CHINPOP*CHINA$. An added benefit of this specification is that it checks on the possibility that what we are calling an ethnic Chinese network effect on bilateral trade is really only an emigrant effect rather than the effect of a set of multilaterally linked national networks. In other words, it could be that our results are driven

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[23]Entering *CHINSHARE* as a quadratic leads to nonsensical estimates: negative coefficients on the squared terms that are roughly equal in absolute value to the positive coefficients on the corresponding linear terms. Estimating separate slopes for trade between countries with at least one percent ethnic Chinese populations and all other country pairs, as is done in the last three columns of Tables 3-6, yields clearly better fits indicated by higher log likelihood values.

entirely by the connections that emigrants established between China and their destination countries, just as immigrants connected the United States to their source countries in the study by Gould (1994) (although the immigrants in his study were much more recent than the typical emigrant from China).[24]

Table 7 shows the results for the new specification, where ethnic Chinese populations have been measured in millions so that *CHINPOP* measures trillions of potential ethnic Chinese international connections.[25] We see that for all commodity classifications and years the coefficient on the linear term *CHINPOP*∗(1-*CHINA*) is positive and highly significant and the coefficient on its square is negative and highly significant, indicating the presence of diminishing returns to (potential) network size. The size at which the impact of ethnic Chinese networks peaks by this measure ranges between 58 and 61 trillion potential connections in 1980 and between 70 and 81 trillion potential connections in 1990. In both years, only country-pair observations including Taiwan lie above this range: Taiwan-Indonesia, Taiwan-Thailand,

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[24]Similarly, we can multiply the *CHINSHARE* variables used in the last three columns of Tables 3-6 by 1-*CHINA* and add the variable *CHINSHARE*∗*CHINA*. The main impact is to increase the estimated coefficients on the *CHINSHARE* variables used in the last three columns of Tables 3-6 (the diminishing returns effect again) and slightly sharpen the differences between the differentiated and the homogeneous commodity groups. Incidentally, these results also provide an additional check on the possibility that the product of ethnic Chinese population shares is associated with a greater increase in bilateral trade in differentiated than in homogeneous products because it is proxying for taste similarity. We might expect such taste similarity to be reflected most strongly in trade of "cultural" goods with China, e.g., import of Chinese herbal medicines by ethnic Chinese abroad. In this case removing country pairs that include China from the estimation of the coefficients on the product of ethnic Chinese population shares should have narrowed the differences in the coefficients between the differentiated and homogeneous commodity groups.

[25]To save space we do not report coefficients on other variables, which did not change substantially.

Taiwan-Hong Kong, and Taiwan-Malaysia. The impact of ethnic Chinese networks, measured at the mean values of *CHINPOP* and $(CHINPOP)^2$ for country pairs excluding China, is always largest for the differentiated commodity group and smallest for the organized exchange commodity group, just as in Tables 3-6.

We are now ready to assess the statistical significance of the differences across commodity groups of the impacts of ethnic Chinese networks, whether specified as in the last three columns of Tables 3-6 or last rows (for 1980 and 1990) of Table 7. We employ two tests. The first is a simple $t$ test under the assumption that the covariances of coefficient estimates across equations are zero. For example, we examine the ratio of the difference between the coefficients on *CHINSHARE*∗(1-*TWO80ONE*) to the square root of the sum of squared standard errors reported for those coefficients. The second test is a Wald test of the cross-equation restriction that the impacts of ethnic Chinese networks are equal, where the equations within any year and conservative or liberal aggregation are estimated as a Seemingly Unrelated Regression (SUR) system with $\ln(1 + V_{ijk})$ as the dependent variables. Since SUR and OLS yield the same coefficient estimates when the right-hand side variables of each equation in the system are the same, these are just the single-equation OLS estimates we have been using to check the robustness of our threshold Tobit results throughout. The Wald tests are equivalent to performing the simple $t$ tests on the OLS estimates if the covariances of coefficient estimates across equations are in fact zero. The Wald tests will tend to reject the null hypothesis of no difference across equations less frequently because the OLS estimates tend to be less precise (with the important exception of the coefficients on *COLOTIE* in 1990), but on the other hand they net out the typically positive covariances of the estimates for coefficients on the same variables across equations, making it easier to reject the null.

Table 8 reports the *p* values for both the *t* and Wald tests. There are two important patterns in the results for ethnic Chinese networks, taking the ten percent significance level as our cutoff for rejecting the null hypothesis. First, when the strength of ethnic Chinese networks is measured by the product of the trading partners' ethnic Chinese population shares, we can consistently reject the hypothesis of equality of impact on bilateral trade between the differentiated commodity group and either homogeneous product group in 1990, whereas in 1980 we cannot consistently reject. Second, when the strength of ethnic Chinese networks is measured by the product of ethnic Chinese populations, we can consistently reject the hypothesis of equality of impact between the differentiated and the organized exchange commodity groups, but not between the differentiated and the reference priced commodity groups.[26] Results for *COLOTIE* are also presented to provide a basis for comparison. We see that we can consistently reject the hypothesis that direct and indirect colonial ties have the same impact on bilateral trade for the differentiated commodity group and either homogeneous commodity group, except for reference priced commodities in 1980. The stronger results for colonial ties than for ethnic Chinese networks are in line with the view that both help to collect market information and find matches in characteristics space, but only ethnic Chinese networks help to enforce contracts.

We also tested for differences across the two homogeneous commodity groups between the impacts of ethnic Chinese networks, and between the impacts of colonial ties. These tests showed that we can never *consistently* reject the hypothesis of equality of impacts across these

[26]In tests not shown, we cannot reject the hypothesis of equality between the product of ethnic Chinese populations at which network impact peaks for any pair of commodity groups in any year.

two commodity groups, though some tests do permit rejection. This suggests that, if our main interest is in the differential impact of ethnic Chinese networks across commodity groups, we could aggregate the organized exchange and reference priced commodity groups into one homogeneous commodity group.[27] If we do so, we find that this aggregate homogeneous commodity group inherits the properties of the organized exchange commodity group summarized in the previous paragraph regarding rejection of the hypothesis of equality with the differentiated commodity group of the impact of ethnic Chinese networks.[28]

We now evaluate the quantitative importance of ethnic Chinese networks for bilateral trade, using direct and indirect colonial ties as a standard for comparison. Given the results in Tables 3-6, it would be misleading to compute the percentage increases in bilateral trade attributable to ethnic Chinese networks using the means for the entire sample of country pairs. Instead, we compute these percentage increases separately using the means for trade between countries with at least one percent ethnic Chinese populations and the means for all other country pairs, applying the estimated coefficients reported in the last three columns of Tables 3-6.[29] To

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[27]Other coefficients differ significantly across organized exchange and reference priced commodity groups, and pooling the two groups can be rejected (allowing for different constant terms) in every case except the liberal aggregation in 1990.

[28]In fact, the results are a bit stronger in that equality of the coefficients on the *CHINSHARE* variables can be consistently rejected in 1980 except for *CHINSHARE*∗*TWO80ONE* in the conservative aggregation.

[29]To be precise about this calculation, let $b_k^1$ be the relevant vector of coefficient estimates reported in the last three columns of Tables 3-6, $b_k^0$ be the same vector with the coefficients on the *CHINSHARE* variables set equal to zero, and $\bar{x}$ be the vector of means of the right-hand side variables in the last three columns of Tables 3-6 for the appropriate country-pair sample (*TWO80ONE* = 0, *TWO80ONE* = 1, *TWO90ONE* = 0, and *TWO90ONE* = 1). The percentage increase in bilateral trade attributable to ethnic Chinese networks for each sample is then computed as $100[\exp(\bar{x}b_k^1) - \exp(\bar{x}b_k^0)]/[\exp(\bar{x}b_k^0) - \hat{a}_k]$, where $\hat{a}_k$ is the estimated threshold in

compute the percentage increase in bilateral trade attributable to direct and indirect colonial ties we also apply the estimated coefficients reported in the last three columns of Tables 3-6, but use the means for the entire country-pair sample.

The results of these computations are reported in Table 9. First, note that the quantitative importance of ethnic Chinese networks is much higher in the exceptional case when both countries have substantial ethnic Chinese population shares (as one would expect), despite the much lower marginal impact of *CHINSHARE* for those country pairs. Second, we see that with one exception the average importance of ethnic Chinese networks for the more typical country pairs is between 32 and 43 percent of the average importance of direct and indirect colonial ties, not counting the organized exchange commodity group in 1990 because the coefficient on *CHINSHARE*∗(1-*TWO90ONE*) is insignificant for both the conservative and liberal aggregations. Third, the percentage increase in bilateral trade attributable to ethnic Chinese networks is 63-102 percent greater for the differentiated than the organized exchange commodity group in 1980 and 132-149 percent greater in 1990, again not counting the results for *CHINSHARE*∗(1-*TWO90ONE*).

With only two years of data a decade apart, a (small) change in the overall sample of country pairs, and a change in the subsample of country pairs between which ethnic Chinese network strength is greatest, our study is not well suited to analysis of time trends. Nevertheless, the consistency with which the average importance of ethnic Chinese networks for the more

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equations (3). If $\hat{a}_k$ were zero this expression would reduce to the much simpler calculation $100[\exp(\overline{CHINSHARE}\hat{\psi}_k) - 1]$, where $\overline{CHINSHARE}$ is the mean for the appropriate country-pair sample as given in footnote 21 and $\hat{\psi}_k$ is the corresponding coefficient from the last three columns of Tables 3-6.

typical country pairs and the average importance of direct and indirect colonial ties register decreases invites speculation. These decreases could reflect improvements in communications technology and strengthening of international legal institutions, or they could reflect weakening of ethnic bonds and direct colonial ties and the spread of English as a common business language. In any case, the reduced importance of ethnic Chinese networks and colonial ties shown in Table 9 is countered by the increase in the share of differentiated products in world trade from about one-half to about two-thirds between 1980 and 1990 (Rauch 1999, Table 2).

We conclude this section with some additional checks for robustness of our results to changes in sample and specification. In subsection III.B we noted that, from the Frankel (1997) sample of 63 countries, we omitted six countries in 1980 and four countries in 1990 due to lack of ethnic Chinese population data. Given the identities of the omitted countries (Algeria, Iceland, Tunisia, and Yugoslavia in both years plus Israel and Kuwait in 1980), it seems not far wrong to assume their ethnic Chinese populations are zero and include them in the sample. This causes no qualitative changes in any of the coefficients of interest (i.e., those on the ethnic Chinese network variables, *COLOTIE*, and *LANGUAGE*) for any year or aggregation. We also noted in subsection III.B a concern that China-Hong Kong and Hong Kong-Taiwan trade might be artificially inflated by inclusion of China-Taiwan trade. These two country pairs could conceivably account for why we find the economic impact of ethnic Chinese networks on bilateral trade between countries with substantial ethnic Chinese population shares to be so large. We therefore examined the results of omitting not only China-Taiwan trade but also China-Hong Kong and Hong Kong-Taiwan trade. The effect was actually to raise the marginal impacts of ethnic Chinese networks within this subset of country pairs in both 1980 and 1990,[30] which was not surprising given that the ethnic Chinese population shares exceed 90 percent in each of the three countries involved. In combination with the reduced mean values of *CHINSHARE* for the country-pair samples *TWO80ONE* = 1 and *TWO90ONE* = 1, this left the economic impacts of ethnic Chinese networks virtually unchanged or increased from their values in Table 9 in all cases.

Finally, we tried two alternative measures of common birth language and verified that the point estimate of the coefficient was still lowest for the differentiated commodity group in all cases. One measure was constructed by Boisso and Ferrantino (1997) using essentially the same formula as our measure but a completely different source of data.[31] The correlation coefficient between their variable and ours is 0.96 for both the 1980 and 1990 country-pair samples. The other measure is a dummy variable constructed on the basis of country articles in the *Encyclopedia Britannica*, which list major languages spoken in each country. This variable takes the value one if at least ten percent of the populations in countries *i* and *j* share one common birth language, and zero otherwise. The correlation coefficient between this variable and our common language measure is 0.85 for both the 1980 and 1990 country-pair samples. The log-likelihood values were typically greater using our variable than either of the alternatives.

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[30]All other coefficients were essentially unchanged.

[31]Boisso and Ferrantino describe the construction of their common language variable on pp. 464-465 of their paper. Unlike our variable, theirs is a measure of linguistic *dis*similarity computed as one minus the formula we use. For the sake of comparability we multiplied by minus one and added one before using their variable, and we also filled in values for two countries present in our sample but missing from theirs, Libya and Taiwan, with the country-pair values for Tunisia and China, respectively.

**V. Conclusions**

We have found that ethnic Chinese networks have an economically greater positive impact on bilateral trade in differentiated than homogeneous products in both 1980 and 1990, where the strength of ethnic Chinese networks is measured by the probability that, if we select an individual at random from each country, both will be ethnic Chinese. In 1990 this impact is consistently statistically greater as well. When we measured the strength of ethnic Chinese networks by the number of potential international connections, we found that ethnic Chinese networks displayed diminishing returns to network size. We also found that a dummy variable for direct or indirect colonial ties has an economically and statistically greater effect on bilateral trade in differentiated than homogeneous products, whereas various measures of common birth language have smaller effects on differentiated than homogeneous product trade. Together our results suggest that ethnic Chinese networks have a quantitatively important impact on bilateral trade through the mechanisms of market information and matching and referral services, in addition to their effect through community enforcement of sanctions that deter opportunistic behavior. Our study also confirms what other studies had suggested: informal barriers to trade are quantitatively large. For differentiated products trade between countries with ethnic Chinese population shares at the levels prevailing in Southeast Asia, the smallest of our estimates (for the conservative aggregation in 1990) is that ethnic Chinese networks increase bilateral trade by nearly 60 percent.

Our results point to two areas of concern for policy makers: inadequate information regarding trading opportunities, and a weak international legal system. In the latter regard, although institutions such as letters of credit and international commercial arbitration are private, their authority ultimately relies on enforcement by national court systems. International commercial arbitration in particular could benefit from harmonization of national legal treatments of the international arbitral process.[32] Regarding information, it is common for governments to sponsor trade missions and to run international trade promotion organizations (see Rauch 1996 and the references therein). Yet, as Rhee and Soulier (1989, p. 25) point out, such efforts complement rather than substitute for the services of private intermediaries because the latter provide greater "depth of information". Private intermediaries tend to be small and specialized, limiting their ability to facilitate "package deals" that stretch across industries. A strength of ethnic Chinese networks relative to private intermediaries may then be their capacity to provide deep information across many industries and countries. Indeed, some governments have come to the conclusion that large-scale, diversified private intermediaries are what is needed: the governments of Korea and Turkey subsidized (in the 1970s and 1980s, respectively) the formation of general trading companies in imitation of the Japanese *sogo shosha* (Rauch 1996). We must keep in mind, however, that the costs of establishing ethnic Chinese networks have been sunk, whereas the costs of establishing new general trading companies have not.

[32]For thoughts on how national courts could accelerate the international arbitral process, see Davis (1998).

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**Table 1**
**Countries, Chinese Population (CHIN), and Population (POP, millions), Circa 1980 and Circa 1990**

| Country | CHIN (1980) | POP (1980) | CHIN (1990) | POP (1990) |
|---|---|---|---|---|
| Taiwan | 17444000 | 17.80 | 19943000 | 20.35 |
| Hong Kong | 4885600 | 4.99 | 5686140 | 5.86 |
| China | 898564000 | 976.7 | 1032608000 | 1122.4 |
| Singapore | 1856237 | 2.41 | 2112663 | 2.72 |
| Malaysia | 3630542 | 10.89 | 5471700 | 18.24 |
| Thailand | 4800000 | 46.46 | 6000000 | 55.45 |
| Indonesia | 6150000 | 153.03 | 7315000 | 179.32 |
| Canada | 289245 | 24.08 | 680000 | 26.25 |
| Peru | 52000 | 18.79 | 500000 | 21.79 |
| Australia | 122700 | 15.17 | 300000 | 16.81 |
| Philippines | 1036000 | 50.74 | 820000 | 61.48 |
| New Zealand | 19248 | 3.13 | 35000 | 3.31 |
| US | 806040 | 226.55 | 1645472 | 249.6 |
| France | 210000 | 54.22 | 200000 | 56.16 |
| Netherlands | 60000 | 14.31 | 45500 | 14.83 |
| UK | 230000 | 55.78 | 125000 | 57.07 |
| Saudi Arabia | 45000 | 9.68 | 30000 | 14.43 |
| Paraguay | 4000 | 3.37 | 7000 | 4.16 |
| Ecuador | 12800 | 8.95 | 15000 | 10.49 |
| Sweden | 5000 | 8.33 | 12000 | 8.4 |
| Belgium | 4000 | 9.85 | 13000 | 9.93 |
| Japan | 54607 | 118.69 | 150339 | 123.26 |
| Denmark | 2000 | 5.12 | 6000 | 5.13 |
| S. Africa | 11000 | 31.01 | 36000 | 33.75 |
| Turkey | 36000 | 46.31 | 60000 | 56.74 |
| Chile | 2000 | 11.49 | 13000 | 12.96 |
| Austria | 4500 | 7.57 | 6000 | 7.62 |
| Venezuela | 14000 | 14.17 | 15000 | 19.25 |
| Switzerland | 3200 | 6.48 | 5000 | 6.65 |
| Brazil | 11213 | 118.61 | 100000 | 147.4 |
| W. Germany | 20000 | 61.64 | 39500 | 61.99 |
| Argentina | 2000 | 28.43 | 20000 | 31.93 |
| Bolivia | 2000 | 5.92 | 4000 | 7.19 |
| S. Korea | 46192 | 37.41 | 22842 | 42.79 |
| Portugal | 2500 | 10.06 | 4700 | 10.47 |
| Spain | 3500 | 37.93 | 15000 | 38.81 |
| Italy | 3500 | 56.28 | 20662 | 57.52 |
| Ireland | 1000 | 3.6 | 1000 | 3.6 |
| Mexico | 20000 | 73.01 | 20000 | 84.27 |

**Table 1 (continued)**
**Countries, Chinese Population (CHIN), and Population (POP, millions), Circa 1980 and Circa 1990**

| Country | CHIN (1980) | POP (1980) | CHIN (1990) | POP (1990) |
|---|---|---|---|---|
| Norway | 600 | 4.13 | 950 | 4.23 |
| India | 110000 | 711.16 | 130000 | 811.82 |
| Colombia | 5600 | 28 | 4000 | 31.19 |
| Uruguay | 250 | 2.95 | 350 | 3.08 |
| Kuwait | | | 200 | 2.05 |
| Libya | 300 | 3.22 | 356 | 4.23 |
| Israel | | | 225 | 4.51 |
| Ghana | 300 | 12.4 | 500 | 14.13 |
| Pakistan | 3600 | 87.13 | 3600 | 108.68 |
| Nigeria | 1000 | 82.39 | 2000 | 105.47 |
| Greece | 186 | 9.73 | 100 | 10.01 |
| Kenya | 100 | 17.85 | 150 | 23.88 |
| Iran | 300 | 40.24 | 300 | 54.2 |
| Sudan | 45 | 0.53 | 68 | 29.13 |
| Hungary | 24 | 10.67 | 23 | 10.33 |
| Poland | 77 | 35.01 | 84 | 38.27 |
| Egypt | 20 | 44.67 | 110 | 51.74 |
| Finland | 9 | 4.75 | 10 | 4.9 |
| Ethiopia | 50 | 32.78 | 55 | 47.88 |
| Morocco | 10 | 21.27 | 20 | 23.91 |
| Algeria | | | | |
| Iceland | | | | |
| Tunisia | | | | |
| Yugoslavia | | | | |

*Sources*: China and Taiwan: *Encyclopedia Britannica*, various years
All other countries: Poston, Mao and Yu (1994)

**Table 2**
**Summary Statistics for Key Variables, 1980 and 1990 Country-Pair Samples**

| | | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| | *LANGUAGE* | 0.0416 | 0.1657 | 0.0000 | 0.9653 |
| 1980 | *COLOTIE* | 0.1417 | 0.3488 | 0.0000 | 1.0000 |
| (n=1595) | *CHINSHARE* | 0.0039 | 0.0486 | 0.0000 | 0.9595 |
| | *LANGUAGE* | 0.0418 | 0.1650 | 0.0000 | 0.9653 |
| 1990 | *COLOTIE* | 0.1427 | 0.3499 | 0.0000 | 1.0000 |
| (n=1710) | *CHINSHARE* | 0.0037 | 0.0465 | 0.0000 | 0.9509 |

**Table 3**
**Dependent Variable: Log of 1980 Bilateral Trade in Organized Exchange, Reference Priced, and Differentiated Commodities (Conservative Aggregation)**

| Variable | Org. | Ref. | Dif. | Org. | Ref. | Dif. |
|---|---|---|---|---|---|---|
| Intercept | -44.502 | -21.505 | -16.673 | -42.373 | -19.039 | -13.236 |
| | (3.904) | (2.862) | (2.640) | (3.932) | (2.875) | (2.648) |
| Threshold | 140.343[a] | 117.709[a] | 94.672[a] | 140.141[a] | 117.837[a] | 95.607[a] |
| ($US Thous.) | (18.900) | (14.975) | (15.616) | (18.882) | (14.970) | (15.724) |
| ln($GNP_i GNP_j$) | 1.077[a] | 0.912[a] | 0.903[a] | 1.074[a] | 0.907[a] | 0.897[a] |
| (1980) | (0.041) | (0.028) | (0.027) | (0.041) | (0.028) | (0.027) |
| ln($PGNP_i PGNP_j$) | 0.382[a] | 0.494[a] | 0.535[a] | 0.367[a] | 0.476[a] | 0.510[a] |
| (1980) | (0.051) | (0.036) | (0.036) | (0.051) | (0.036) | (0.036) |
| ln(*DISTANCE*) | -1.416[a] | -1.114[a] | -0.858[a] | -1.410[a] | -1.107[a] | -0.847[a] |
| | (0.111) | (0.086) | (0.082) | (0.111) | (0.086) | (0.082) |
| ln(*REMOTE*) | 2.005[a] | 0.693[a] | 0.317[b] | 1.898[a] | 0.570[a] | 0.146 |
| | (0.222) | (0.172) | (0.159) | (0.222) | (0.172) | (0.159) |
| *ADJACENT* | 0.046 | 0.516[c] | 0.643[b] | 0.075 | 0.549[b] | 0.689[b] |
| | (0.353) | (0.272) | (0.274) | (0.354) | (0.274) | (0.278) |
| *EEC* | -0.351 | -0.060 | -0.020 | -0.344 | -0.051 | -0.006 |
| | (0.228) | (0.160) | (0.148) | (0.227) | (0.159) | (0.147) |
| *EFTA* | -0.642 | 0.232 | 0.434[b] | -0.643 | 0.232 | 0.434[b] |
| | (0.410) | (0.219) | (0.219) | (0.409) | (0.218) | (0.216) |
| *LANGUAGE* | 0.092 | 0.047 | -0.382 | 0.201 | 0.172 | -0.211 |
| | (0.470) | (0.368) | (0.275) | (0.473) | (0.371) | (0.279) |
| *COLOTIE* | 0.631[a] | 0.933[a] | 1.259[a] | 0.592[b] | 0.888[a] | 1.198[a] |
| | (0.234) | (0.175) | (0.166) | (0.234) | (0.174) | (0.163) |
| *CHINSHARE* | 3.696[a] | 4.796[a] | 5.963[a] | --- | --- | --- |
| | (1.033) | (0.849) | (0.880) | | | |
| *CHINSHARE*∗ | --- | --- | --- | 277.283[a] | 327.196[a] | 456.104[a] |
| (*1-TWO80ONE*) | | | | (79.553) | (48.744) | (56.349) |
| *CHINSHARE*∗ | --- | --- | --- | 3.680[a] | 4.776[a] | 5.935[a] |
| *TWO80ONE* | | | | (1.039) | (0.858) | (0.893) |
| Log Likelihood | -16262.2 | -16777.1 | -18431.9 | -16258.9 | -16769.1 | -18414.8 |

Maximum likelihood estimation of threshold Tobit model.
Eicker-White standard errors in parentheses. Number of observations = 1595.
[a]Significant at one percent level. [b]Significant at five percent level. [c]Significant at ten percent level.

**Table 4**

**Dependent Variable: Log of 1980 Bilateral Trade in Organized Exchange, Reference Priced, and Differentiated Commodities (Liberal Aggregation)**

| Variable | Org. | Ref. | Dif. | Org. | Ref. | Dif. |
|---|---|---|---|---|---|---|
| Intercept | -36.111 | -23.872 | -16.409 | -34.003 | -21.382 | -12.894 |
| | (3.445) | (2.752) | (2.682) | (3.458) | (2.756) | (2.689) |
| Threshold ($US Thous.) | 147.854[a] | 120.655[a] | 86.286[a] | 147.690[a] | 120.824[a] | 87.188[a] |
| | (20.337) | (15.458) | (14.251) | (20.318) | (15.457) | (14.352) |
| $\ln(GNP_i GNP_j)$ (1980) | 0.999[a] | 0.959[a] | 0.898[a] | 0.996[a] | 0.955[a] | 0.892[a] |
| | (0.037) | (0.027) | (0.028) | (0.037) | (0.027) | (0.027) |
| $\ln(PGNP_i PGNP_j)$ (1980) | 0.392[a] | 0.499[a] | 0.547[a] | 0.376[a] | 0.481[a] | 0.521[a] |
| | (0.046) | (0.036) | (0.036) | (0.046) | (0.035) | (0.036) |
| ln(*DISTANCE*) | -1.268[a] | -1.195[a] | -0.826[a] | -1.262[a] | -1.187[a] | -0.815[a] |
| | (0.102) | (0.084) | (0.083) | (0.102) | (0.084) | (0.084) |
| ln(*REMOTE*) | 1.581[a] | 0.792[a] | 0.277[c] | 1.476[a] | 0.668[a] | 0.103 |
| | (0.199) | (0.164) | (0.161) | (0.199) | (0.163) | (0.162) |
| *ADJACENT* | 0.124 | 0.370 | 0.699[b] | 0.152 | 0.404 | 0.746[a] |
| | (0.323) | (0.287) | (0.279) | (0.324) | (0.288) | (0.283) |
| *EEC* | -0.481[b] | -0.099 | 0.020 | -0.473[b] | -0.089 | 0.035 |
| | (0.206) | (0.162) | (0.150) | (0.205) | (0.161) | (0.148) |
| *EFTA* | -0.435 | 0.301 | 0.455[b] | -0.436 | 0.301 | 0.455[b] |
| | (0.306) | (0.210) | (0.223) | (0.305) | (0.208) | (0.220) |
| *LANGUAGE* | 0.059 | -0.021 | -0.334 | 0.166 | 0.106 | -0.159 |
| | (0.439) | (0.361) | (0.278 | (0.442) | (0.364) | (0.281) |
| *COLOTIE* | 0.659[a] | 0.909[a] | 1.268[a] | 0.621[a] | 0.864[a] | 1.205[a] |
| | (0.211) | (0.176) | (0.167) | (0.210) | (0.175) | (0.164) |
| *CHINSHARE* | 3.741[a] | 4.817[a] | 6.042[a] | --- | --- | --- |
| | (1.012) | (0.791) | (0.890) | | | |
| *CHINSHARE* ∗ (*1-TWO80ONE*) | --- | --- | --- | 278.431[a] | 328.400[a] | 466.347[a] |
| | | | | (68.910) | (47.252) | (56.739) |
| *CHINSHARE* ∗ *TWO80ONE* | --- | --- | --- | 3.724[a] | 4.796[a] | 6.014[a] |
| | | | | (1.020) | (0.799) | (0.903) |
| Log Likelihood | -17238.1 | -16368.4 | -18328.2 | -17234.2 | -16360.3 | -18310.4 |

Maximum likelihood estimation of threshold Tobit model.
Eicker-White standard errors in parentheses. Number of observations = 1595.
[a]Significant at one percent level. [b]Significant at five percent level. [c]Significant at ten percent level.

**Table 5**
**Dependent Variable: Log of 1990 Bilateral Trade in Organized Exchange, Reference Priced, and Differentiated Commodities (Conservative Aggregation)**

| Variable | Org. | Ref. | Dif. | Org. | Ref. | Dif. |
|---|---|---|---|---|---|---|
| Intercept | -45.295 | -26.422 | -19.805 | -45.057 | -25.804 | -18.457 |
| | (3.601) | (2.649) | (2.570) | (3.602) | (2.645) | (2.532) |
| Threshold | 107.518[a] | 141.481[a] | 131.468[a] | 107.425[a] | 141.817[a] | 133.457[a] |
| ($US Thous.) | (14.155) | (20.069) | (22.530) | (14.145) | (20.112) | (22.867) |
| ln$(GNP_i GNP_j)$ | 1.046[a] | 0.969[a] | 0.981[a] | 1.043[a] | 0.962[a] | 0.964[a] |
| (1990) | (0.035) | (0.024) | (0.024) | (0.036) | (0.025) | (0.024) |
| ln$(PGNP_i PGNP_j)$ | 0.155[a] | 0.227[a] | 0.271[a] | 0.153[a] | 0.224[a] | 0.263[a] |
| (1990) | (0.039) | (0.027) | (0.026) | (0.039) | (0.026) | (0.026) |
| ln*(DISTANCE)* | -1.230[a] | -0.863[a] | -0.677[a] | -1.237[a] | -0.881[a] | -0.715[a] |
| | (0.108) | (0.087) | (0.088) | (0.109) | (0.087) | (0.088) |
| ln*(REMOTE)* | 2.148[a] | 0.989[a] | 0.518[a] | 2.142[a] | 0.974[a] | 0.487[a] |
| | (0.208) | (0.159) | (0.158) | (0.208) | (0.159) | (0.156) |
| *ADJACENT* | 0.818[b] | 0.921[a] | 1.038[a] | 0.811[b] | 0.902[a] | 0.997[a] |
| | (0.340) | (0.286) | (0.287) | (0.340) | (0.286) | (0.286) |
| *EEC* | 0.098 | 0.359[b] | 0.425[b] | 0.102 | 0.371[b] | 0.454[a] |
| | (0.225) | (0.177) | (0.169) | (0.224) | (0.176) | (0.167) |
| *EFTA* | -0.264 | 0.303 | 0.489[b] | -0.260 | 0.313 | 0.512[b] |
| | (0.440) | (0.206) | (0.231) | (0.440) | (0.206) | (0.230) |
| *LANGUAGE* | 0.903[b] | 1.142[a] | 0.316 | 0.913[b] | 1.166[a] | 0.368 |
| | (0.439) | (0.341) | (0.324) | (0.440) | (0.341) | (0.323) |
| *COLOTIE* | 0.303 | 0.472[a] | 0.934[a] | 0.298 | 0.458[a] | 0.903[a] |
| | (0.205) | (0.153) | (0.154) | (0.205) | (0.153) | (0.153) |
| *CHINSHARE* | 2.261[c] | 3.208[a] | 4.950[a] | --- | --- | --- |
| | (1.221) | (0.639) | (0.778) | | | |
| *CHINSHARE* ∗ | --- | --- | --- | 101.258 | 257.393[a] | 560.476[a] |
| (1-*TWO90ONE*) | | | | (99.561) | (78.217) | (111.286) |
| *CHINSHARE* ∗ | --- | --- | --- | 2.256[c] | 3.195[a] | 4.920[a] |
| *TWO90ONE* | | | | (1.222) | (0.638) | (0.775) |
| Log Likelihood | -17813.8 | -19086.4 | -20763.5 | -17813.8 | -19084.7 | -20752.9 |

Maximum likelihood estimation of threshold Tobit model.
Eicker-White standard errors in parentheses. Number of observations = 1710.
[a]Significant at one percent level. [b]Significant at five percent level. [c]Significant at ten percent level.

**Table 6**

**Dependent Variable: Log of 1990 Bilateral Trade in Organized Exchange, Reference Priced, and Differentiated Commodities (Liberal Aggregation)**

| Variable | Org. | Ref. | Dif. | Org. | Ref. | Dif. |
|---|---|---|---|---|---|---|
| Intercept | -38.309 | -27.168 | -19.549 | -38.060 | -26.453 | -18.137 |
| | (3.281) | (2.604) | (2.596) | (3.283) | (2.592) | (2.555) |
| Threshold | 132.005[a] | 125.125[a] | 123.389[a] | 131.917[a] | 125.475[a] | 125.323[a] |
| ($US Thous.) | (17.308) | (17.990) | (20.574) | (17.297) | (18.036) | (20.888) |
| ln($GNP_iGNP_j$) | 0.993[a] | 0.986[a] | 0.987[a] | 0.990[a] | 0.978[a] | 0.969[a] |
| (1990) | (0.032) | (0.024) | (0.024) | (0.033) | (0.024) | (0.024) |
| ln($PGNP_iPGNP_j$) | 0.179[a] | 0.214[a] | 0.284[a] | 0.177[a] | 0.210[a] | 0.275[a] |
| (1990) | (0.036) | (0.026) | (0.026) | (0.035) | (0.026) | (0.026) |
| ln(*DISTANCE*) | -1.083[a] | -0.920[a] | -0.681[a] | -1.091[a] | -0.940[a] | -0.720[a] |
| | (0.102) | (0.087) | (0.089) | (0.102) | (0.087) | (0.089) |
| ln(*REMOTE*) | 1.761[a] | 1.044[a] | 0.480[a] | 1.755[a] | 1.027[a] | 0.447[a] |
| | (0.192) | (0.157) | (0.159) | (0.192) | (0.156) | (0.157) |
| *ADJACENT* | 0.855[a] | 0.820[a] | 1.080[a] | 0.848[a] | 0.798[a] | 1.037[a] |
| | (0.317) | (0.288) | (0.291) | (0.317) | (0.287) | (0.289) |
| *EEC* | 0.051 | 0.318[c] | 0.422[b] | 0.056 | 0.333[c] | 0.451[a] |
| | (0.213) | (0.174) | (0.171) | (0.212) | (0.173) | (0.169) |
| *EFTA* | 0.071 | 0.331[c] | 0.485[b] | 0.076 | 0.344[c] | 0.509[b] |
| | (0.320) | (0.193) | (0.239) | (0.320) | (0.193) | (0.238) |
| *LANGUAGE* | 0.676 | 1.339[a] | 0.278 | 0.686[c] | 1.367[a] | 0.332 |
| | (0.417) | (0.343) | (0.322) | (0.417) | (0.342) | (0.321) |
| *COLOTIE* | 0.460[b] | 0.349[b] | 0.966[a] | 0.454[b] | 0.333[b] | 0.935[a] |
| | (0.189) | (0.152) | (0.157) | (0.190) | (0.152) | (0.156) |
| *CHINSHARE* | 2.491[b] | 3.056[a] | 5.102[a] | --- | --- | --- |
| | (1.132) | (0.624) | (0.794) | | | |
| *CHINSHARE* ∗ | --- | --- | --- | 105.975 | 297.443[a] | 586.368[a] |
| (1-*TWO90ONE*) | | | | (92.909) | (81.779) | (114.231) |
| *CHINSHARE* ∗ | --- | --- | --- | 2.485[b] | 3.040[a] | 5.070[a] |
| *TWO90ONE* | | | | (1.133) | (0.622) | (0.790) |
| Log Likelihood | -18776.2 | -18943.6 | -20557.5 | -18776.2 | -18941.2 | -20546.0 |

Maximum likelihood estimation of threshold Tobit model.
Eicker-White standard errors in parentheses. Number of observations = 1710.
[a]Significant at one percent level. [b]Significant at five percent level. [c]Significant at ten percent level.

**Table 7**
**Strength of Ethnic Chinese Networks Measured by Product of Ethnic Chinese Populations (*CHINPOP*) Instead of Product of Ethnic Chinese Population Shares (*CHINSHARE*)**

| | | Conservative aggregation | | | Liberal aggregation | | |
|---|---|---|---|---|---|---|---|
| | | Org. | Ref. | Dif. | Org. | Ref. | Dif. |
| 1980 | *CHINPOP* ∗ (1-*CHINA*) | 0.1217[a] (0.0281) | 0.1718[a] (0.0215) | 0.1971[a] (0.0270) | 0.1343[a] (0.0252) | 0.1675[a] (0.0210) | 0.2023[a] (0.0276) |
| | [*CHINPOP* ∗ (1-*CHINA*)]$^2$ | -0.001044[a] (0.000351) | -0.001410[a] (0.000302) | -0.001672[a] (0.000330) | -0.001143[a] (0.000345) | -0.001414[a] (0.000270) | -0.001721[a] (0.000338) |
| | *CHINPOP* ∗ *CHINA* | 0.000450[a] (0.000145) | 0.000596[a] (0.000100) | 0.000638[a] (0.000095) | 0.000447[a] (0.000142) | 0.000600[a] (0.000088) | 0.000646[a] (0.000096) |
| | $-\hat{\psi}_k^1/2\hat{\psi}_k^2$ | 58.3 | 60.9 | 58.9 | 58.7 | 59.2 | 58.8 |
| | $\hat{\psi}_k^1\overline{CHINPOP}+\hat{\psi}_k^2\overline{(CHINPOP)^2}$ | 0.0297 | 0.0433 | 0.0485 | 0.0329 | 0.0413 | 0.0496 |
| 1990 | *CHINPOP* ∗ (1-*CHINA*) | 0.0607[a] (0.0167) | 0.0863[a] (0.0128) | 0.1135[a] (0.0163) | 0.0651[a] (0.0155) | 0.0843[a] (0.0126) | 0.1173[a] (0.0168) |
| | [*CHINPOP* ∗ (1-*CHINA*)]$^2$ | -0.000433[a] (0.000160) | -0.000537[a] (0.000119) | -0.000713[a] (0.000140) | -0.000450[a] (0.000148) | -0.000529[a] (0.000119) | -0.000737[a] (0.000144) |
| | *CHINPOP* ∗ *CHINA* | 0.000308[a] (0.000078) | 0.000387[a] (0.000041) | 0.000409[a] (0.000050) | 0.000340[a] (0.000075) | 0.000336[a] (0.000038) | 0.000418[a] (0.000052) |
| | $-\hat{\psi}_k^1/2\hat{\psi}_k^2$ | 70.1 | 80.4 | 79.6 | 72.3 | 79.8 | 79.5 |
| | $\hat{\psi}_k^1\overline{CHINPOP}+\hat{\psi}_k^2\overline{(CHINPOP)^2}$ | 0.0194 | 0.0311 | 0.0406 | 0.0215 | 0.0302 | 0.0419 |

See notes to Tables 3-6. $\hat{\psi}_k^1$ = coefficient on *CHINPOP* ∗(1-*CHINA*) for commodity group *k*. $\hat{\psi}_k^2$ = coefficient on [*CHINPOP**(*1-CHINA*)]$^2$ for commodity group *k*. $\overline{CHINPOP}$ = mean of *CHINPOP* for country pairs that exclude China. $\overline{(CHINPOP)^2}$ = mean of $(CHINPOP)^2$ for country pairs that exclude China.

**Table 8**
**Significance Levels for Rejecting Hypotheses that Impacts of Ethnic Chinese Networks or Colonial Ties are Equal for the Differentiated Commodity Group and the Organized Exchange or Reference Priced Commodity Group**

| | | | Conservative Aggregation | | Liberal Aggregation | |
|---|---|---|---|---|---|---|
| | | | Org. vs. Dif. | Ref. vs. Dif. | Org. vs. Dif. | Ref. vs. Dif. |
| 1980 | *CHINSHARE*∗(1-*TWO80ONE*) | *t* test | 0.067 | 0.084 | 0.035 | 0.062 |
| | | Wald test | 0.209 | 0.154 | 0.111 | 0.095 |
| | *CHINSHARE*∗*TWO80ONE* | *t* test | 0.100 | 0.349 | 0.093 | 0.312 |
| | | Wald test | 0.166 | 0.395 | 0.123 | 0.365 |
| | $\hat{\psi}_k^1\overline{CHINPOP}+\hat{\psi}_k^2\overline{(CHINPOP)^2}$ | *t* test | 0.016 | 0.451 | 0.024 | 0.236 |
| | | Wald test | 0.082 | 0.680 | 0.091 | 0.378 |
| | *COLOTIE* | *t* test | 0.034 | 0.194 | 0.028 | 0.155 |
| | | Wald test | 0.002 | 0.055 | 0.002 | 0.034 |
| 1990 | *CHINSHARE*∗(1-*TWO90ONE*) | *t* test | 0.002 | 0.026 | 0.001 | 0.040 |
| | | Wald test | 0.010 | 0.004 | 0.001 | 0.006 |
| | *CHINSHARE*∗*TWO90ONE* | *t* test | 0.085 | 0.086 | 0.061 | 0.044 |
| | | Wald test | 0.054 | 0.079 | 0.047 | 0.034 |
| | $\hat{\psi}_k^1\overline{CHINPOP}+\hat{\psi}_k^2\overline{(CHINPOP)^2}$ | *t* test | 0.002 | 0.117 | 0.002 | 0.055 |
| | | Wald test | 0.029 | 0.211 | 0.023 | 0.091 |
| | *COLOTIE* | *t* test | 0.018 | 0.040 | 0.050 | 0.006 |
| | | Wald test | 0.001 | 0.002 | 0.003 | 0.000 |

See notes to Table 7. *t* tests performed using threshold Tobit estimates as described in the text. Wald tests performed using SUR estimates as described in the text.

**Table 9**
**Percentage Increase in Bilateral Trade Attributable to Ethnic Chinese Networks and Colonial Ties**

| | | Conservative aggregation | | | Liberal aggregation | | |
|---|---|---|---|---|---|---|---|
| | | Org. | Ref. | Dif. | Org. | Ref. | Dif. |
| 1980 | *CHINSHARE* ∗ (1-*TWO80ONE*) | 3.8 | 4.5 | 6.2 | 3.8 | 4.5 | 6.4 |
| | *CHINSHARE* ∗ *TWO80ONE* | 88.8 | 128.3 | 177.8 | 90.0 | 129.3 | 181.6 |
| | *COLOTIE* | 9.0 | 13.7 | 18.6 | 9.4 | 13.3 | 18.7 |
| 1990 | *CHINSHARE* ∗ (1-*TWO90ONE*) | 1.0 | 2.5 | 5.5 | 1.0 | 2.9 | 5.7 |
| | *CHINSHARE* ∗ *TWO90ONE* | 23.8 | 35.4 | 59.2 | 26.5 | 33.4 | 61.5 |
| | *COLOTIE* | 4.4 | 6.8 | 13.8 | 6.8 | 4.9 | 14.3 |

All figures for *CHINSHARE* are computed as described in footnote 29, and figures for *COLOTIE* are computed analogously.