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The Effect of Domestic Institutions on International Trade Flows

A sectoral analysis

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Abstract

Barriers to international trade are more sizeable than can be accounted for on the basis of formal trade barriers and transport costs alone. Search costs in the international marketplace and insecurity of property and contract enforcement have recently been stressed to explain this observation. This paper proposes that both elements can be combined to explain observed trade patterns. Distinguishing between homogeneous and differentiated product groups, I estimate gravity equations to investigate how patterns of bilateral trade are affected by variation in the quality of institutions across countries. In doing so, the occurrence of zero-entried observations of bilateral trade has been dealt with. The results show that governance matters most for trade in differentiated goods. This suggests that product heterogeneity is an important determinant of trade costs, and that search costs and the relevance of contract enforcability interact.

JEL codes: F14, F15

Keywords: institutions, bilateral trade, trade costs, gravity model, zero flows, sectoral analysis, networks

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1. Introduction

The observed size of trade flows is much smaller than trade theory would predict. This has been documented by Trefler (1995) as the missing trade mystery, and was dramatically illustrated in the border puzzle, or home bias to trade, by McCallum (1995). The barriers to international trade thus appear to be more sizeable than can be accounted for on the basis of formal trade barriers and transport costs alone. Apparently, unobserved trade costs are important for understanding the patterns of trade (Deardorff 2001; Obstfeld and Rogoff 2001; Anderson 1999). Search costs in the international marketplace and insecurity of property and contract enforcement have recently been stressed as explanation of this observation (Rauch 1999; Anderson and Marcouiller 2002; De Groot et al. 2004).

In this paper, we propose that both explanations are complementary. We estimate sector specific gravity equations and show that search costs and property insecurity matter most for differentiated products. This finding suggests that a network view of international trade is relevant as well for understanding the impact of cross-country variation in institutional effectiveness on openness to international trade.

The paper proceeds as follows. In section 2, we review the arguments that link unobserved trade costs to search processes and property insecurity in the international market place, and argue for the complementarity of both views. Section 3 introduces the data and empirical method used for analysis. The empirical results are presented in section 4. Finally, section 5 presents conclusions and directions for further research.

2. The network and insecurity views of informal trade barriers

2.1 The network view

To understand how trade patterns evolve, recent studies have pointed at the importance of networks, rather than atomistic markets (e.g., Rauch 1999, 2001). The search/network view starts from the observation that a majority of products is not traded on organized exchanges. Therefore, search processes are important in order to match buyers and sellers. Networks serve to facilitate the search for matching partners. As a result, understanding the characteristics and development of networks is important to explain the observed patterns of trade.

Rauch (1999) classifies products into generic groups, which can be characterized according to the relevance of ‘markets’ versus networks for (international) trade. The relevant distinction is

that between homogeneous products and differentiated goods. Homogeneous goods can be compared solely on the basis of price differences. In principle, they can be traded on organized exchanges, where supply and demand are matched by the equivalent of a ‘Walrasian auctioneer’. Not all homogeneous products are, however. Most homogeneous products are sold on a decentralized market. Still, the matching approaches a perfectly competitive market, where the comparison is based on prices as only relevant characteristic. For these products, reference prices are often published, illustrating the competitive process, with the possibility for international arbitrage of price differences. Because of their heterogeneity, diverse varieties of a differentiated product cannot be compared on the basis of prices alone. Price differences across suppliers, locations or countries must be adjusted for ‘multidimensional differences in characteristics’ and quality between the varieties, and the relative importance of the various characteristics differs across countries depending on the available supply and preferences that prevail in each country (Rauch 1999, p. 9). In the end, each variety has its own unique blend of characteristics. The product is ‘branded’, with a single supplier for each brand.

Because of the difficulty of comparing differentiated products, and the prohibitive costs of setting up exchanges for each brand separately, differentiated products cannot be traded on organized exchanges.² Moreover, the demands in terms of information are so high that international arbitrage by specialized traders across varieties is not feasible either. Instead, differentiated products are traded through search and match between traders, customers and suppliers. Rauch (1999) argues that the process of search is facilitated by factors that improve the information flow and knowledge of foreign markets. He refers to shared language, colonial links and geographical proximity as search enabling factors, because they increase bilateral familiarity (viz., decrease ‘psychic distance’, see Frankel 1997).

Summarizing, Rauch (1999) identifies three product groupings that reflect the ‘network versus market’ mechanisms in trade. Homogeneous products are separated into two groups: products traded on an organized exchange and reference priced articles; the third group is comprised of differentiated goods. The network theory of trade hypothesizes that search costs are most important for the pattern of trade in differentiated products and least important for organized exchange products. Hence, we expect spatial distance, language and colonial links to be more important for trade in differentiated products.

² An organized exchange would not be plausible on a different note, either: given that a firm is the single supplier of its brand, it will recognize its product’s imperfect substitutability and set price rather than participate in a competitive tâtonnement process.

2.2 Insecurity of property and trade

Recently, an alternative explanation for unobserved trade costs focuses on variation in institutional effectiveness across countries. The unobserved barriers to trade are often related to incomplete or asymmetric information and uncertainty in exchange. North (1990) argues that, because of imperfect insight and incomplete information, people form institutions. He defines institutions as ‘humanly devised constraints that shape human interaction’ (1990, p.3). These rules of the game are intended to reduce the uncertainty in exchange, and lower transaction costs. A poor governance system entails negative externalities for private transactions, and consequently raises transaction costs with negative effects on growth and development (see, e.g., Olson 1996). Institutional economics has recently been applied to international trade (e.g., Dixit 2004; Anderson and Marcouiller 2002; Wei 2000). This approach states that insecurity of property and contract enforcement imposes high costs on trade. Rodrik (2000, p. 179) argues that the transaction cost problem of contract enforcement is aggravated for international trade, compared to domestic exchange. International trade involves at least two jurisdictions, which makes contract enforcement more difficult. This discontinuity in the political and legal system increases uncertainty and the risk of opportunistic behaviour by either party to the exchange. Accordingly, the effectiveness of both countries’ institutional systems in securing contract enforcement are important determinants of bilateral trade costs.³

2.3 Complementarity of the search and insecurity views

Both network/search theories and institutional theories offer credible explanations for the origin of unobserved trade barriers. Strikingly, they have developed more or less independently so far. For example, Anderson and Marcouiller (2002, p. 343) say that their theory of insecurity does not explicitly incorporate the role of networks in facilitating trade. Rauch (1999), on the other hand, does not deal with the implications of asymmetric information for contract enforcement in international trade as an aspect of trade costs. Still, I would argue that there is sufficient overlap in the underlying features of both approaches to consider a combination of hypotheses.⁴ The insecurity view argues that bilateral trade will be

³ Anderson and Marcouiller (2002) and De Groot et al. (2004) offer empirical support for the effect of governance quality on bilateral trade patterns.

⁴ Both Anderson and Rauch implicitly acknowledge the kinship between both approaches to trade costs. The former notes that the insecurity and information-based models overlap ‘to the extent that information about exposure to misappropriation matters’. The micro-economic foundations for Rauch’s theory also consider the effects of search costs on the formation of institutions (Rauch 1996). Moreover, Rauch (2001) deals with networks as informal mechanisms to enforce cooperative behaviour.

lower when property is less secure, while network theory stresses the importance of search costs for trade in differentiated products. I propose that the characteristics of differentiated products also imply a higher impact of governance on trade than for homogeneous goods.

When contracts are complex and necessarily incomplete, informal governance structures are devised to mitigate opportunism. Most notably, networks of business and social relations serve to this purpose (Dixit 2004; Rauch 2001), aside from their role in lowering search costs. The characteristic of networks that enables them to curb opportunistic behaviour has been termed 'closure'. This refers to the existence of sufficient mutual links between network members, in a setting of repeated interaction, that norms of cooperative behaviour can be propagated and renegeing is signalled and can be sanctioned (Coleman 1988).

Networks work fine in this respect in more or less stable markets (e.g., the domestic rather than global market [Rodrik 2000]). However, they sometimes lack the openness to new opportunities and potential trading partners needed to widen the scope of trade and realize the potential of new sales markets or supply chains. For this, ties have to be 'weak', meaning that they should not focus on kinship or ethnic relations exclusively. Granovetter (1985) characterizes this as the 'strength of weak ties'. In general, however, openness comes at the expense of a trade-off. Closure by intense mutual ties of repeated contact within networks becomes more difficult to obtain in open networks that continuously renew and extend their scope. The reach of informal governance is limited, which invokes the need for formal institutions to protect property rights. The limit to networks in securing property, however, is complemented by problems to secure trade by more formal legal systems as markets grow beyond this limit (Dixit 2004), most notably when exchange crosses national borders (McCallum 1995) and thus involves multiple jurisdictions (Rodrik 2000).

In an extending market, the use of networks focuses more on signalling new opportunities and lowering search costs, instead of acting as tight informal governance structures. Rodrik (2000) continues to stress the importance of networks as signalling and sanctioning mechanism to mitigate opportunism in trade. Although their effectiveness as enforcement mechanism is arguably more vulnerable on the international market, their use for this purpose still provides a rationale for the importance of selective networks for trade in especially differentiated goods. In differentiated product industries, as opposed to organized exchange goods, exchange relations themselves are comparatively bilateral and asset specific. Trade relations in differentiated goods will tend to be characterized by incomplete contracts and long term, repeated interaction. In such a situation of bilateral dependencies, repeated interaction can

become a curse, rather than a blessing. Search costs and product differentiation increase the extent of asset specific investment made by both parties to the relation. As a consequence, the risk of opportunism will potentially rise, creating the possibility of hold-up problems (see, e.g., Grout 1984 and Caballero and Hammour 1996 for analysis of hold-up problems).

Especially in international markets, the type of repeated interaction that balances bilateral opportunism (e.g., through network closure) such that cooperative behaviour is privately optimal, is harder to achieve (Rodrik 2000, p. 179). Moreover, it is difficult to sustain, both because formal enforcement and informal sanctioning are less effective, and because (asset specific!) search costs are higher. One of the parties in the exchange is then more vulnerable to opportunism of the other, depending on the specifics of the situation. The quality of domestic legal and political governance systems is an important element in the judgements to be made.

For homogeneous products, on the other hand, the risk and costs of opportunistic behaviour are less severe. The trade relation remains 'at arm's length', curbing the costs of opportunistic behaviour by greater possibilities to diversify or substitute away from defectors, due to competitive discipline. Moreover, product homogeneity allows more complete and transparent contracts, which can focus on prices. Still, if the reach of markets extends (across national boundaries), effective enforcement of contracts becomes more difficult for homogeneous products as well (Dixit 2004). We would generally expect the costs of property insecurity to be lowest for organized exchange products, because diversification is easiest there. Specialized traders can diversify systemic risk of contract breach by ordering from many different suppliers, without any concern left for final customers. For reference priced commodities, the need for more case-specific search raises search costs and the incentive to enter into closer relations. Search will be more focused on avoiding environments with low contract enforceability.

The combination of search and product characteristics with the importance of governance in international exchange leads us to a proposition on the relevance of governance for trade patterns that parallels Rauch's proposition on search costs. Inadequate legal and political systems are expected to affect trade patterns most severely for differentiated products, and least so for organized exchange products. Moreover, just as colonial and language links facilitate search, they are also likely to increase trader's skills to operate effectively in each other's institutional settings (Anderson and Marcouiller 2002). This provides an additional reason to expect a higher bias to result from these links with respect to trade in differentiated

products. Our null hypothesis is that governance matters for trade (for the reasons mentioned in section 2.2), but does not matter more for trade in differentiated goods. One possible defense for this would be to argue that, although the risk and costs of opportunistic actions are lower in homogeneous goods, the responsiveness of traders to an increase in trade costs due to insecurity is larger. The size of trade diversion would reflect the higher price elasticities that are likely to exist in homogeneous markets, because of the availability of perfect substitutes. The remainder of the paper investigates these hypotheses more closely by estimating gravity equations, augmented to include indicators for institutional effectiveness, on bilateral trade flows in differentiated, reference priced and organized exchange commodities. First, the next section will discuss the data and the empirical model.

3. Data description and model setup

3.1 The gravity model of bilateral trade

In order to identify the effects of institutions on bilateral trade, we estimate a gravity equation. The gravity model owes its name to the fact that it relates bilateral trade multiplicatively proportionately to the combined economic ‘mass’ of the country pair (mostly reflected by GDPs or GNPs), and inversely to the economic distance between them (Rauch, 1999). The use of gravity models to analyse trade patterns has a long history, dating back to the 1960s at least (see Frankel 1997 for an overview). Although it has always been successful in providing economically and statistically significant results, while explaining most variation in bilateral trade (Rose 2004), the gravity model has been criticized for lacking a theoretical foundation. However, several contributions have been made to address the relation between trade theory and the gravity model. These have shown that the gravity model is consistent with both Heckscher-Ohlin type models of trade and models of monopolistic competition, economies of scale and intra-industry trade (e.g., Evenett and Keller 2002; Deardorff, 1998 and Helpman and Krugman 1985).

The gravity equation that we estimate below looks as follows:

$$\begin{aligned} \ln(T_{ij}) = & \beta_0 + \beta_1 \ln(Y_i) + \beta_2 \ln(Y_j) + \beta_3 \ln(y_i) + \beta_4 \ln(y_j) + \beta_5 \ln(D_{ij}) + \beta_6 Adj_{ij} \\ & + \beta_7 Lang_{ij} + \beta_8 PTA_{ij} + \beta_9 Religion_{ij} + \beta_{10} Col_{ij} + \beta_{11} Inst_i + \beta_{12} Inst_j + \beta_{13} InstDist_{ij} + \varepsilon_{ij} \end{aligned} \quad (1)$$

where i and j denote the exporting and importing country. Our dataset comprises 114 countries.

The dependent variable T_{ij} is aggregate merchandise exports (in US\$) from i to j for 1998. The independent variables are, respectively: national income (Y), income per capita (y), the distance between i and j (D_{ij}), dummies reflecting whether i and j share: a land border (Adj), their primary language ($Lang$), membership in a regional Preferential Trade Agreement (PTA), their main religion ($Religion$), and whether they were part of a common colonial empire (Col). The focus of Rauch (1999) was to test the implications of the search/network view for trade patterns. He was interested mainly in the parameters on distance and links (defined as either colonial or language links). The specification adopted in this paper closely follows Rauch (1999) in spirit. However, we separate the influences of language and colonial ties, and add a variable reflecting cultural links as expressed in the main religion adhered to.

The variables of particular interest in this paper deal with the institutional framework. The first two reflect the level of subjective institutional quality ($Inst$) in both countries. The quality of the formal legal system also conditions informal norms of behaviour and inter-personal trust, which influence the procedures of doing business in a country. Thus, familiarity with the legal system in another country, in turn, may also impact on risk perceptions and preferences for international trading partners (De Groot et al. 2004). The effect of bilateral distance between the institutional systems, in terms of effectiveness, is reflected by the variable $InstDist$. The last term is the stochastic error term, which captures all other (omitted) effects on trade and is assumed to be well-behaved.

The gravity model estimates are acquired using OLS. Separate gravity equations are estimated for the three commodity groups that we distinguish (organized exchange, reference priced and differentiated commodities). The standard loglinearized gravity model can only deal with observations of bilateral trade that are larger than zero. In a large data set of bilateral country pairs, some of the potential trade flows will in practice be recorded as zero or missing. This either reflects trade flows that are too small to register, or trade that really does not occur. The country-pairs involved would in most cases be expected to have little bilateral trade, because of (for example) small size and remoteness, or (on a sectoral level of analysis) perfect specialization and comparative disadvantages. Omitting zero flows may bias the results, if the distribution of observed positive flows depends on the presence of a zero trade censoring level. A separate section will discuss a modified gravity equation that allows the inclusion of zero flow observations in the analysis.

3.2 The data

For scores on the effectiveness of governance systems, we have used the updated and revised data for the year 2000, from the database constructed by Kaufmann et al. (2002). Drawing on 17 different sources of subjective institutional quality, they have constructed six indicators of perceived institutional quality. Each indicator captures a different aspect of governance. These indicators are presented below.

1. Voice and Accountability: reflects the political process and includes the independence of the media.
2. Political stability: includes the likelihood that the government will be overthrown by unconstitutional interference and reflects the stability of the economic environment.
3. Government effectiveness: measures the quality of the public service provision, the bureaucracy, and the competence of civil servants. More general it reflects the ability of the government to formulate and implement good policies.
4. Regulatory quality: reflects the quality of the implemented policies, like the degree of over regulation of business development and the incidence of market-unfriendly policies
5. Rule of law: measures the degree to which citizens have confidence in the law and abide by the rules of society. It concentrates on the quality of the legal system and the enforceability of contracts.
6. Control of corruption: reflects the degree to which public power is exercised for private gain.

All aspects of governance are interrelated. As a result, the indicators are highly positively correlated. An investigation of Cronbach's alpha suggests that all indicators reflect a single latent variable. Consequently, we can regard all of them as measures of overall quality of governance. For that reason, we have aggregated the six indicators into a composite measure of institutional quality. The simple arithmetic average of the scores on each separate indicator serves as the composite indicator. Similarly, we can compose a single indicator of institutional distance, reflecting the bilateral distance in terms of governance effectiveness. We have chosen to express institutional distance as the Kogut-Singh index of distance (Slangen and Beugelsdijk, 2004):

$$InstDist_{ij} = \sum_{k=1}^6 \{(I_{ki} - I_{kj})^2 / V_k\} / 6 \quad (2)$$

where I_{ki} indicates the score of country i on indicator k , and V_k stands for the variance in indicator scores across all countries in the sample.

For data on bilateral trade and the other regressors in the gravity equation, we have used diverse sources. I refer to De Groot et al. (2004) for a more comprehensive discussion.

The data on trade have been taken from the United Nation's COMTRADE database, accessed through the Worldbank's WITS integrated database system. I have collected bilateral trade data at the macroeconomic level and for each of the three groups of products, following the classification of products according to type composed by Rauch (1999) at the 4 digit SITC level.⁵ Table 1 below reports the absolute amounts and shares of total bilateral exports in the sample accounted for by 4 digit products that could be classified into any of the three groups.

Table 1. Bilateral exports (1998) in the sample and shares within product group

Product Group	Trade (mln. US\$)	Trade (share)
Organized exchange	330.9218	0.077418
Organized exchange (excl. Petroleum)	198.7203	0.04649
Reference priced	610.3248	0.142783
Differentiated goods	2167.534	0.507087
Bilateral exports (sample total)	4274.5	1

Note: the share total of differentiated and homogeneous groups does not add to one, because many 4 digit codes have not been included in the classification.

⁵ The classification is available at Jon Haveman's data resources webpage

<http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/Verbal.Desc/SITC/>

I have used Rauch's conservative classification of products according to types. He also lists a more liberal classification, in which products are more easily denoted as traded on an organized exchange. The problem of categorization arises since the actual classification was done at the 5 digit SITC level, for which usually no trade data are reported. Therefore, an aggregation to the 4 digit level was necessary, introducing some ambiguity in classification into one of the product groups.

4. Empirical results and the zero flow problem

4.1 Basic results for non-zero observations

The results of the regression analysis are presented in Table 2 below.

Table 2. Gravity equations; dependent variable: log bilateral export (per product group)

non-zero flows only	Total Trade	Organized exchange	Org. exch. (excl. petroleum)	Reference priced	Differentiated goods
Log GDP exporter	1.20	1.00	0.98	1.05	1.27
	80.76	38.44	38.82	58.17	85.62
Log GDP importer	0.86	0.95	0.92	0.90	0.87
	58.59	38.88	38.75	51.35	58.98
Log GDP/cap exporter	-0.04	0.34	0.22	0.18	0.03
	-0.82	4.38	2.94	3.16	0.58
Log GDP/cap importer	-0.05	-0.04	0.02	-0.21	-0.07
	-1.21	-0.52	0.34	-3.80	-1.58
Log Distance	-1.15	-0.95	-0.88	-1.14	-1.27
	-41.50	-21.40	-20.44	-34.81	-45.02
Border Dummy	0.84	1.15	1.28	0.99	0.78
	5.76	5.52	6.41	5.91	5.13
Language Dummy	0.31	0.13	0.03	0.14	0.44
	3.00	0.75	0.16	1.15	4.14
Trade area Dummy	0.82	1.03	0.98	1.11	0.67
	9.56	8.23	8.09	11.07	7.51
Religion Dummy	0.49	0.17	0.18	0.34	0.49
	8.99	1.86	2.03	5.19	8.90
Colonial Dummy	0.46	0.61	0.64	0.55	0.51
	5.07	4.09	4.42	5.04	5.44
Governance exporter	0.39	-0.71	-0.29	0.29	0.73
	7.43	-8.03	-3.41	4.53	13.95
Governance importer	0.31	-0.01	-0.13	0.26	0.40
	5.93	-0.09	-1.55	4.10	7.70
Institutional distance	-0.03	-0.05	-0.09	-0.09	-0.05
	-2.49	-2.76	-5.08	-6.75	-4.59
adj.R2	0.67	0.43	0.44	0.59	0.71
number of observations	8518	5921	5869	7713	9228
F-statistic	1359.72	346.39	356.64	844.55	1712.77

Note: t-statistics are reported in the line below the parameter estimates. Constant terms are not shown in the table.

For aggregate trade, reported exports from country *i* to *j* were used; for disaggregated trade groups, reported imports by *j* from *i* were used (i.e. mirror imports), because the coverage of import data is larger on a disaggregated level. This also leads to a larger # of non-zero observations for differentiated goods than for aggregate trade.

A separate column reports the gravity estimates for bilateral trade patterns in organized exchange products excluding petroleum from the group. This serves as a robustness check on the results for organized exchange products, because petroleum accounts for a large share of total trade in this group, while it has often been indicated that trade flows reported for this product are prone to suffer from false reporting and misreporting (also see Rauch 1999, footnote 7).

Column 1 reports the results for aggregate, macroeconomic bilateral trade. The results indicate that trade positively depends on GDP and negatively on distance. Furthermore, the impact of the quality of governance on trade is positive and significant, both from the export and import side. As reported by Anderson and Marcouiller (2002), the effect of GDP per capita is negative once the model includes institutional variables. This reflects the tendency of expenditure shares on traded goods to fall with the level of development. The expenditure pattern shifts into non-tradable, notably services (not recorded in the bilateral trade statistics). The remaining columns present the estimates for organized exchange products, reference priced goods and differentiated products, respectively. We may first note that the hypotheses of Rauch (1999) are mostly supported by these results. The distance effect on trade indeed is more important for differentiated goods, than for homogeneous goods, and least important for organized exchange products. The same holds for religious ties as well as language links, which are least significant and substantive for organized exchange goods. Colonial history seems to be most important for organized exchange products, however, compared to reference priced products and differentiated goods. Although this seems to contrast with Rauch's expectations, the pattern in colonial links, as well as in language effects, may be related to omitted variable bias. We have not controlled for an important source of trade in our model yet: comparative advantages on the basis of factor endowments.

Homogeneous products (most notably, perhaps, in the organized exchange group) relatively frequently classify in basic industries, such as steel or resource extraction (Feenstra et al., 2001). The countries with comparative advantages include many ex-colonies, while the importers are mostly industrial nations, as reflected by the (weakly) positive parameter estimate on importer GDP per capita for organized exchange goods (excl. petroleum). Language links may have turned insignificant because of the relatively small number of exporters (also reflected in the small number of observations of positive trade flows), which ship to a wider diversity of other nations. Common membership in a free trade area promotes trade most in homogeneous goods. This may reflect that trade in homogeneous goods is more sensitive to price differences than trade in heterogeneous goods.

Concerning the hypotheses put forward in this paper, the results support the view that insecurity of contract enforcement matters most for trade in differentiated goods. In particular, the levels of institutional effectiveness are more important for differentiated products trade. These are the direct determinants of property rights insecurity and the scope for opportunistic behaviour.

The impact of governance effectiveness on trade in organized exchange commodities appears negative, sometimes statistically significant. This may reflect the prominence of low-governance developing countries among exporters, especially when petroleum exports are included. However, this result for organized exchange products is most likely related to the effect of per capita income, which has mostly been estimated as positive. For differentiated goods and reference priced homogeneous commodities, the estimates for both GDP per capita and institutions are more in line with the aggregate pattern. Perhaps, the number of observations in the sample is too low for the group of organized exchange products to disentangle the various underlying mechanisms reflected by GDP per capita, and its correlation to institutional effectiveness.

Institutional distance between traders also negatively affects the intensity of trade, because of adjustment costs that result from unfamiliarity and lack of skill to operate effectively in each other's institutional settings. However, this effect does not differ much across reference priced products and differentiated goods.

4.2 Accounting for zero flows

In the data on bilateral trade, many observations are recorded as missing or zero. The prevalence is especially pervasive in the data I used, because the focus was on a subset of sectoral (3 and 4 digit SITC) data for which Rauch has made a classification according to product type (see Table 1). In particular the smallest group, that of organized exchange products, has a large share of zero flows (around 50% in 1998). We have to take these flows into account for a proper analysis of the relevance of product types to bilateral trade patterns. The reason is two-fold. First, the omission of zero flows introduces econometric bias. These flows provide relevant information, and the censoring at zero leads to estimation bias for OLS. I will come back to the econometric issues of the problem, and propose a solution below.

The second reason is related to the validity of the empirical results for assessing the theoretical hypotheses. As Rauch (1999) argues, disregarding zero flows leads to an underestimation of the impact of distance and historical and cultural links on trade, '[i]f zero observations tend to occur between countries that are far apart and do not share a common language/colonial tie' (p. 18-19). Because zero flows are most prominent in organized exchange products and occur least in differentiated goods trade, the underestimation will be disproportionately in the former group. This biases the empirical conclusions in favour of the network/search theory proposed by Rauch (1999; 1996). He estimated a model that accounts

for zero flows to investigate and adjust for this phenomenon. Below, I also propose a model similar (though not equivalent) to that used by Rauch. For this, it is necessary to discuss the econometric issues involved first.

For a double-log gravity equation, zero-valued observations are problematic. A log-linear model cannot explain zero-trade flows, other than when at least one of the (multiplicative) regressor variables is zero as well (Bikker 1982, p. 371). This will in general not be the case. Moreover, the logarithm of zero is minus infinity so a loglinear model technically cannot handle these observations either. Several approaches have been applied or suggested in the literature to address the problem of zero-flows (e.g., see Frankel 1997, p. 145-46; Bikker 1982, p. 371-72). Apart from confining the sample to non-zero observations, these vary from substituting arbitrary small numbers for the zero flows to estimating transformed gravity equations (e.g., semi-log specifications).

This paper follows Eichengreen and Irwin (1995), who propose a transformation of the gravity model that can be estimated as a Tobit model, to account for the influence of zero-flows.

The logic of the Tobit model can be used in two cases. Reported trade may be zero, if the actual flow is positive, but below some lower limit of registration (rounding of small flows to zero), or if desired trade would be negative (censoring from below). The relevance of rounding of trade flows is not directly apparent from the data set. Bikker (1982, p. 373) mentioned that trade flows had been rounded to zero, if smaller than half the unit of measurement. However, this does not seem to hold for more recent data, which include flows much smaller than one unit of measurement (i.e. 1000 US\$ as default in COMTRADE). The Tobit model is appropriate, because negative values are all mapped onto zero: trade flows are censored from below at zero (Verbeek 2000, p. 198-99).

The transformed gravity equation that can account for zero flows looks as follows:

$$\begin{aligned} \ln(1+T_{ij}^*) &= \beta_0 + \beta_1 \ln(Y_i) + \beta_2 \ln(Y_j) + \beta_3 \ln(y_i) + \beta_4 \ln(y_j) + \beta_5 \ln(D_{ij}) + \beta_6 Adj_{ij} \\ &+ \beta_7 Lang_{ij} + \beta_8 PTA_{ij} + \beta_9 Religion_{ij} + \beta_{10} Col_{ij} + \beta_{11} Inst_i + \beta_{12} Inst_j + \beta_{13} InstDist_{ij} + \varepsilon_{ij} \end{aligned} \quad (2)$$

$$\begin{aligned} \ln(1+T_{ij}) &= \ln(1+T_{ij}^*) \text{ if } \ln(1+T_{ij}^*) > 0 \\ &= 0 \text{ if } \ln(1+T_{ij}^*) \leq 0 \end{aligned}$$

The Tobit model describes both the probability that a flow is observed as zero, given the values for the regressors, and the distribution of trade, given that it is larger than zero

(Verbeek 2000, page 199). The expected value of trade, given that it is larger than zero, then can be shown to exceed:

$$\beta_0 + \beta_1 \ln(Y_i) + \beta_2 \ln(Y_j) + \beta_3 \ln(y_i) + \beta_4 \ln(y_j) + \beta_5 \ln(D_{ij}) + \beta_6 Adj_{ij} + \beta_7 Lang_{ij} + \beta_8 PTA_{ij} + \beta_9 Religion_{ij} + \beta_{10} Col_{ij} + \beta_{11} Inst_i + \beta_{12} Inst_j + \beta_{13} InstDist_{ij}$$

because of the censoring at zero. The reason is that the expectation of the mean-zero normally distributed error term, conditional on trade being larger than zero, exceeds zero. If this is not taken into account in the regression, i.e. if we estimate (2) only using the sub-sample of positive trade flows, we will not appreciate that a disproportionate part of the observations in reality has positively biased error terms (mostly so for values of T_{ij}^* , hence also T_{ij} , close to zero). The regression estimates thus will tend to underestimate the true parameters. The Tobit model is usually estimated through maximum likelihood (ML), and takes into account the information contained in both zero-flows and positive flows.⁶

The model to be estimated remains log-linear, but is able to handle zero-entries as well. The equation can be evaluated as if it were the familiar double-log gravity equation for large values of trade, since then $\log(1 + Trade_{ij}) \approx \log(Trade_{ij})$. For very small values of trade, the function converges to a semi-log relationship, because $\log(1 + Trade_{ij}) \approx Trade_{ij}$ and $\partial \log(1 + Trade_{ij}) / \partial Trade_{ij} = 1$ for $Trade_{ij} = 0$.

The results regression results are presented in Table 3 below.

⁶ Eichengreen and Irwin (1995) estimate the model using scaled OLS instead of ML. Greene (1981) shows that the slope estimates of a Tobit model can be approximated by dividing the OLS estimates by the fraction of non-limit observations in the sample (i.e., scaling the OLS estimates). Since this is only an approximation, I have estimated the model by standard techniques for Tobit models using E-Views software.

Table 3. Gravity equations; dependent variable: $\log(1+\text{Export}_{ij})$ (per product group)

Tobit estimation accounting for zero flows (export in '000 US \$)	Total Trade	Organized exchange	Org. exch. (excl. petroleum)	Reference priced	Differentiated goods
Log GDP exporter	1.58	1.90	1.83	1.48	1.42
	82.10	65.48	65.85	75.12	96.37
Log GDP importer	1.20	1.40	1.34	1.14	0.97
	62.60	50.39	50.19	58.41	66.33
Log GDP/cap exporter	0.21	-0.03	-0.10	0.28	0.03
	3.64	-0.41	-1.28	4.78	0.69
Log GDP/cap importer	-0.35	-0.16	-0.11	-0.27	-0.08
	-6.17	-1.95	-1.43	-4.59	-1.78
Log Distance	-1.61	-1.84	-1.73	-1.61	-1.42
	-42.88	-34.99	-34.42	-42.58	-49.27
Border Dummy	0.58	1.31	1.42	0.94	0.60
	2.82	4.86	5.50	4.62	3.76
Language Dummy	0.63	0.59	0.47	0.59	0.63
	4.44	2.98	2.46	4.16	5.79
Trade area Dummy	0.67	1.23	1.16	1.01	0.62
	5.52	7.68	7.57	8.35	6.61
Religion Dummy	0.85	0.61	0.59	0.66	0.66
	11.74	5.94	6.00	8.99	11.71
Colonial Dummy	0.99	1.13	1.16	0.85	0.72
	7.99	6.56	7.03	6.79	7.59
Governance exporter	0.63	0.00	0.33	0.61	0.89
	9.33	-0.04	3.60	8.87	17.07
Governance importer	0.77	0.45	0.35	0.57	0.57
	11.34	4.68	3.79	8.31	10.96
Institutional distance	0.01	0.00	-0.04	-0.03	-0.03
	0.67	0.14	-1.87	-1.92	-2.50
adj.R2	0.72	0.62	0.63	0.71	0.78
number of observations	10920	10920	10920	10920	10920
Log likelihood	-23369.71	-18811.46	-18414.37	-21363.18	-22154.91

Note: t-statistics are reported in the line below the parameter estimates. Constant terms are not shown in the table.

For aggregate trade, reported exports from country i to j were used; for disaggregated trade groups, reported imports by j from i were used (i.e. mirror imports), because the coverage of import data is larger on a disaggregated level.

After including zero flows, the results indeed do not seem to provide strong support for the network/search view anymore. The effect of distance is smaller for differentiated products than for homogeneous goods, and largest for organized exchange goods. Saying this, it is important to note that Rauch (1999) provides an explanation for this. He constructed a measure of transportability that shows that differentiated products are roughly twice as transportable as homogeneous goods, due to lower transport costs. Our results do not correct for this. In his paper, Rauch does correct for this, and finds that the results after correction support the network view.⁷ With respect to the other variables relevant to search costs, the

⁷ In fact, his estimates before correcting for transportability differences already supported his hypothesis on distance. Moreover, the transformed gravity model in this paper produces quite large estimates on GDP. Rauch (1999) states that these parameters should be close to 1 (also see Anderson and Van Wincoop 2003). Although this may point at a structural problem with our gravity model (perhaps related to the larger sample of countries in this paper, including many developing countries: this may cause problems of non-linearities in the underlying

differences in impact are smaller as well, once zeros have been taken into account. Language links remain more important for differentiated products. Religious ties, as proxy for cultural familiarity and psychic distance between countries, remain only slightly more important for differentiated products. Colonial links remain strikingly more important for organized exchange commodities, perhaps for reasons explained in section 4.1 that have not been controlled for by the inclusion of zero flows. The parameters on exporter GDP per capita for organized exchange products have turned negative, offering some support for the view that comparative advantages in these commodities are mostly located in low income countries. Both in reference priced and in differentiated products, the impact of exporter GDP per capita is positive instead, as for aggregate trade.

The impact of governance quality remains most strong in differentiated goods, although the pattern for reference priced products is somewhat more similar to differentiated goods, especially in the impact of importer governance. In general, the estimated effect sizes on governance have increased after including zero flows in the model. For organized exchange goods, the impact of governance quality now also generally has the expected sign (although it is insignificant for exporter governance when petroleum products are included). This suggests that zero flows are partly related to insecurity costs as a result of bad governance. The impact of institutional distance (reflecting adjustment costs and trust in exchange) is negative, but not as significant statistically after correcting for zero flows.

5. Summary and conclusions

To explain the patterns of bilateral trade, it is necessary to consider what causes the unobserved barriers to trade that appear to be so important for observed international trade flows. Recent research has suggested that networks and search costs are important for explaining the size of trade and the differences in trade patterns across homogeneous and differentiated goods. Other studies emphasize the difficulties of securing contract enforceability, given the prominence of incomplete contracts, in transactions that move across national jurisdictions. This paper argues that both explanations can be combined, since the existence of poor contract enforcement will aggravate the selectiveness of trade relations that are subject to high search costs. I estimated a gravity model for trade in organized exchange

model [see Fontagné 2001]), the parameters found are not unusual (e.g., compare to Nahuis 2002), especially after correcting for zero flows (e.g., compare to Bikker and De Vos 1992).

products, reference priced and differentiated products that confirmed the hypothesis. Institutions matter most for trade in differentiated products, as do search costs.

The results on organized exchange products indicate that the analysis has not controlled sufficiently for the role of comparative advantages between countries. The inclusion of GDP per capita captures some of the effects, though. To consistently analyse comparative advantages, a different sectoral disaggregation may be necessary as well. Another problem of the estimates, is the large number of zero-entried trade flows, especially in the organized exchange group. Rauch (1999) notes that if these observations tend to occur between distant countries that do not exhibit cultural or historical links, the comparison between product types is biased, because the omission of these observations tends to reduce the size of the effects related to search costs and insecurity transaction costs. A transformed Tobit gravity model has been estimated for each product group. The results again confirm the hypothesis on the impact of institutional quality, but do not unambiguously support the search cost hypothesis proposed by Rauch (1999). Whether this may be related to problems related to the extended sample of countries, their trade data or the transformed gravity model, remains open to further research. A further extension of the paper will link the effect of governance on bilateral trade patterns to an analysis of the impact of variation in institutional effectiveness on export specialization and the importance of intra-industry flows. If good governance is important for exporting and importing differentiated goods, this may provide a new link between dynamic specialization, economic development and intra-industry trade.

References

- Anderson, J.E. (1999): *Why Do Nations Trade (So Little)?*, unpublished manuscript.
- Anderson, J.E. and E. Van Wincoop (2003): 'Gravity with Gravitas: A Solution to the Border Puzzle', *American Economic Review*, 93, pp. 170-192.
- Anderson, J.E. and D. Marcouiller (2002): 'Insecurity and the pattern of trade: an empirical investigation', *Review of Economics and Statistics*, 84, pp. 342-352.
- Bikker, J.A. (1982): 'Vraag-aanbodmodellen voor stelsels van geografisch gespreide markten, toegepast op de internationale handel en op ziekenhuisopnamen in Noord-Nederland', Vrije Universiteit Amsterdam, Dissertation.
- Bikker, J.A. and A.F. De Vos (1992): 'An International Trade Flow Model with Zero Observations: an Extension of the Tobit Model', *Cahiers Economiques de Bruxelles*, 135, pp. 379-404.

- Caballero, R.J. and M.L. Hammour (1996): 'Transactional Microstructure and Macroeconomic Performance: The "Fundamental Transformation" in Macroeconomics', *American Economic Review, AEA Papers and Proceedings*, 86, pp. 181-186.
- Coleman, J.S. (1988): 'Social Capital in the Creation of Human Capital', *American Journal of Sociology*, 94, pp. 95-120.
- De Groot, H.L.F., G.M. Linders, P. Rietveld and U. Subramanian (2004): 'The institutional determinants of bilateral trade patterns', *Kyklos*, 57, pp. 103-123.
- Deardorff, A.V. (1998): 'Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?', in: J. Frankel (ed.), *The Regionalization of the World Economy*, Chicago: University of Chicago Press.
- Deardorff, A.V. (2001): *Local Comparative Advantage: Trade Costs and the Pattern of Trade*, unpublished manuscript.
- Dixit, A.K. (2004): *Lawlessness and Economics*, The Gorman Lectures in Economics, Princeton and Oxford: Princeton University Press.
- Evenett, S.J. and W. Keller (2002): 'On Theories Explaining the Success of the Gravity Equation', *Journal of Political Economy*, 110, pp. 281-316.
- Feenstra, R., J. Markusen and A.K. Rose (2001): 'Using the gravity model to differentiate among alternative theories of trade', *Canadian Journal of Economics*.
- Fontagné, L., M. Pajot, and J.M. Pasteels (2001): *Potentiels de commerce entre économies hétérogènes: un petit mode d'emploi des modèles de gravité*, unpublished manuscript.
- Frankel, J.A. (1997): *Regional Trading Blocs in the World Economic System*, Washington D.C.: Institute for International Economics.
- Granovetter, M. (1985): 'Economic Action and Social Structure: the problem of embeddedness', *American Journal of Sociology*, 91, pp. 481-510.
- Greene, W.H. (1981): 'On the asymptotic bias of the ordinary least squares estimator of the Tobit model', *Econometrica*, 49, pp. 505-513.
- Grout, P.A. (1984): 'Investment and Wages in the Absence of Binding Contracts: A Nash Bargaining Approach', *Econometrica*, 52, pp. 449-460.
- Helpman, E. and P. Krugman (1985): *Market Structure and Foreign Trade*, Cambridge, MA: MIT Press.

- Kaufmann, D., A. Kraay and P. Zoido-Lobaton (2002): 'Governance Matters II: Updated Indicators for 2000-01', *World Bank Policy Research Working Paper*, 2772.
- McCallum, J. (1995): 'National Borders Matter: Canada-U.S. Regional Trade Patterns', *American Economic Review*, 85, pp. 615-623.
- Nahuis, R. (2002): 'One Size Fits All? Accession to the Internal Market, an Industry Level Assessment of EU Enlargement', *CPB Discussion Paper*, 14, October 2002.
- North, D.C. (1990): *Institutions, institutional change and economic performance*, Cambridge: Cambridge University Press.
- Obstfeld, M., and K. Rogoff (2001): 'The Six Major Puzzles in International Macroeconomics: Is There a Common Cause?', in: *NBER Macroeconomics Annual 2000*.
- Olson, M. (1996): 'Big Bills Left on the Sidewalk: Why Some Nations are Rich, and Others Poor', *Journal of Economic Perspectives*, 10, pp. 3-24.
- Rauch, J.E. (1999): 'Networks versus markets in international trade', *Journal of International Economics*, 48, pp. 7-35.
- Rauch, J.E. (2001): 'Business and Social Networks in International Trade', *Journal of Economic Literature*, 39, pp. 1177-1203.
- Rauch, J.E. (1996): 'Trade and search: social capital, sogo shosha, and spillovers', *NBER Working Paper*, 5618.
- Slangen, A.H.L. and S. Beugelsdijk (2004): *National cultural distance and bilateral trade flows*, unpublished manuscript.
- Trefler, D. (1995): 'The case of missing trade and other mysteries', *American Economic Review*, 85, pp. 1029-1046.
- Verbeek, M. (2000): *A guide to modern econometrics*, Wiley.
- Wei, S.J. (2000): 'Natural openness and good government', *NBER Working Paper*, 7765.