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Distance and Trade*

Disentangling unfamiliarity effects and transport cost effects

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Abstract

This paper provides evidence supporting Grossman's (1996) claim that not only transport costs but also unfamiliarity can explain the negative correlation between geographic distances and bilateral trade volumes. A gravity model that controls for as many natural causes of trade as possible reveals that countries high in uncertainty-aversion (based on Hofstede's survey) export disproportionately less to distant countries (with which they are presumably less familiar). More important, this result is mainly driven by differentiated products, not by products with international organized exchanges or with reference prices. For transport costs alone to explain such a trade pattern, one would have to assume that distance-related *ad valorem* transport costs are higher when a trade route originates from a high uncertainty-aversion country, which is unlikely. This trade pattern is easy to explain, however, if one accepts that geographic distance is a proxy for unfamiliarity and that exporters in high uncertainty-aversion countries are more sensitive to informational ambiguity. A further result is that high uncertainty-aversion countries trade less and thus grow more slowly in the long run, which suggests that cultural factors are as important as geographic ones in determining trade openness.

JEL Classification: F15 (Economic Integration); Z13 (Social Norms and Social Capital); F43 (Economic Growth of Open Economies)

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1. Introduction

The negative correlation between geographic distances and bilateral trade volumes is considered by Leamer and Levinsohn (1995) to be one of the most robust empirical findings in economics. It is, however, difficult to distinguish whether transport costs alone, or unfamiliarity in addition, are behind the distance effects, given that both of them are increasing in geographic distances. This paper employs a gravity model that allows for distance effects to vary across countries endowed with different levels of uncertainty tolerance, so as to disentangle the effects of unfamiliarity from the effects of transport costs in bilateral trade volumes. The modeling shows that uncertainty-tolerant countries are better in capitalizing on exporting opportunities, and thus have become richer in the long-term.

1.1. Distance and Trade: Transports Costs or Unfamiliarity?

Gravity models of international trade show that countries trade less with distant partners. There is, however, no consensus on what geographic distances are proxying for. Obstfeld and Rogoff (2001), among many others, assert that transport costs cause the distance effects. Grossman (1996), Hummels (2001), and others, however, argue that transport costs are too low to explain the magnitude of the distance effects, particularly after taking into account that gravity models can also explain the flow of "weightless" goods such as capital (e.g., Portes, Rey, and Oh, 2001; Portes and Rey, 2005). The flow of such goods, some theories argue, should instead increase in geographic distances. Grossman (1996) conjectures that distance between two trade partners should proxy not only for transport costs but also for unfamiliarity (i.e., informational barriers/frictions). He further suggests that we need "a model with imperfect information, where familiarity declines rapidly with distance" (should have a page citation for a direct quotation).

Information is very important in bilateral trade. In the search models of Rangan and Lawrence (1999) and Casella and Rauch (2003), the difficulty of searching for matched buyers in an unfamiliar foreign country can create informational frictions and barriers for international trade, particularly for differentiated products. Empirically,

Rauch (1999) finds that common language and/or colonial ties can overcome informational barriers in international trade and increase bilateral trade, particularly for differentiated products. Among others, Gould (1994) and Head and Ries (1998) discovered the roles of immigrants in exchanging information and promoting bilateral trade between their host countries and their origin countries. Combes et al. (forthcoming), using French data, show that more than 60% of intra-national border effects can be explained by the composition of the local labor force in terms of birthplace (social networks) and by inter-plant connections (business networks). Controlling for these network effects reduces the impact of transport cost on trade flows by a comparable factor. Finally, Gelos and Wei (2004) recently found that emerging market funds systematically invest less in less transparent countries.

Kasa (2000) suggests that uncertainty-aversion, interacting with information frictions, can create barriers in international trade. Recent developments in uncertainty aversion models, such as those by Uppal and Wang (2002), also establish uncertainty aversion as a potential cause of home biases in international trade and investment. The reasoning proceeds as follows. Uncertainty-averse economic agents dislike ambiguity (i.e., situations where information is less available), or as Camerer and Weber (1992) classically put it, "people prefer to bet on events they know more about." In international trade, it is not surprising that merchants usually possess more information about the domestic market and markets in adjacent or nearby countries. As argued by Portes et al. (2001), "countries which are near each other tend to know much more about each other, either because of direct interaction between their citizens for tourism or business, or because of better media coverage, or because they tend to learn each other's language." Because of uncertainty-aversion, they would naturally have biases against trading with more distant partners (in addition to the consideration of transport costs). Furthermore, such bias should be stronger among exporters with higher uncertainty-aversion. Here, it is speculated that this bias should be stronger when it comes to differentiated products than for products traded on organized exchanges, as

more information must be collected when matching buyers and sellers of differentiated products.

1.2. Identification Strategy: Allow Distance Effects to Vary Across Countries

Empirically, however, it is difficult to separate unfamiliarity effects from transport costs effects, as presumably both of them are log-linear increasing functions of geographic distances. This paper proposes a novel approach to disentangle the two effects, utilizing the systematic variations of uncertainty-aversion across countries (quantified by Hofstede's [1980] cross-country survey).

Transport cost is function of geographic distances between two nodes, regardless of which parties are at the two ends of the trade routes. Unfamiliarity, however, is perceived differently by high uncertainty-aversion and low uncertainty-aversion countries, and thus the same level of unfamiliarity would generate stronger resistance to trade for high uncertainty-aversion countries than for low uncertainty-aversion countries. Exploiting this difference, the model in this study allows the correlations between distances and bilateral trade volumes to vary across countries. The working hypothesis is that high uncertainty-aversion countries, compared to low uncertainty-aversion countries, trade disproportionately more with close neighbors and less with distant partners than what standard gravity models predict, and this is more the case for differentiated products than for products traded on international organized exchanges.

For transport costs alone to explain such a trade pattern (if found), one would have to assume that distance-related *ad valorem* transport costs are much higher when high uncertainty-aversion exporters are involved. This assumption is not supported empirically. Although Micco and Serebrisky (2004) and Clark, Dollar, and Micco (2004) find that port inefficiency and bad airport infrastructure, respectively, can increase transport costs, they enter as fixed costs not proportionate to distance, and they cannot explain the differential effects found in the data. Neither can such factors explain why the trade pattern is observed for differentiated products only, when they are actually less likely to be affected by transport costs (because they generally have higher value-to-size ratios). The unfamiliarity and uncertainty-aversion story, however, predicts such a trade

pattern very well, if one assumes that the same distance "looks longer" in the eyes of uncertainty-averse countries.

To make the findings as convincing as possible, the gravity model used controls for as many as possible of the "natural" causes of trade that have been documented in the international trade literature. The empirical strategy exploits variations in two dimensions of international trade. The first is variations of unfamiliarity and transport costs across country-pairs, both proxied by geographic distances. (For the "distances and unfamiliarity" theories in international trade, Anderson [2000] and Loungani et al. [2002] both provide good surveys). The second is systematic variations of uncertainty-aversion across countries, caused by cultural differences. The assumption is that, for cultural reasons, there exist systematic differences in uncertainty-aversion across countries. In some cultures, what is unknown is dangerous, while in others, what is unknown is curious. This is supported by Hofstede's (1980, 2001) cross-country survey of 50 countries, which finds substantial systematic variations of uncertainty-aversion across countries. He finds that typical continental Europeans (Greeks, Portuguese, Belgians, Spanish, French, Italians, etc.), compared with Anglo-Saxons and Nordics, are less tolerant of uncertainty. Huang (2004), using the results of this survey, finds robust evidence that high uncertainty-aversion countries grow slower in industries where information is less available, a result that demonstrates the effects of uncertainty aversion at a macro level.

This study is not the first to try to explain the home bias puzzle from a cultural perceptive. Den Butter and Mosch (2003) and Guiso, Sapienza, and Zingales (2004), using cross-country value survey data, both find that lower relative levels of trust toward citizens of a country lead to less trade with that country.

1.3. Summary of Findings

The gravity model employed in this study provides robust evidence that uncertainty-averse countries trade disproportionately less with distant partners than standard gravity models predict, and the results are driven by differentiated products, not by commodities traded on organized exchanges or with reference prices. Also, the

effects are driven by the identities of exporters, not by the importers. Unfamiliarity effects explain this trade pattern, whereas transport costs effects cannot. Furthermore, using Frankel and Romer (1999)'s methodology, the study further shows that uncertainty-averse countries trade less and grow more slowly in the long run.

The rest of the paper is organized as follows. Section 2 discusses the empirical strategy. Section 3 introduces the concept and measure of national uncertainty aversion. Section 4 estimates the model using aggregate trade volumes. Section 5 distinguishes between differentiated products, exchange-traded products, and reference-priced products. Section 6 explores how uncertainty-aversion affects long-term growth, through the channel of international trade. Section 7 offers conclusions and discusses policy implications.

2. Empirical Strategy

A gravity model is employed to test hypotheses. Gravity models commonly are used in empirical research on international trade. [1] To control for as many "natural" causes of trade as possible, the specification consists of a comprehensive set of control variables. The model allows for correlations between distances and bilateral trade volumes to vary across importers and exporters. This is done by including in the regression uncertainty-aversion indicators of exporters and importers, interacted with geographic distances of the trade routes. The main regression is specified as follows:

$$\text{Ln (Export Volume}_{x,i,t}) = \text{Ln (Distance}_{x,i}) (\beta_1 + \beta_2 \times \text{UAI}_x + \beta_3 \times \text{UAI}_i) + \Psi \times \text{Country-Pair Characteristics} + \text{Origin Dummies}_x + \text{Destination Dummies}_i + \text{Year Dummies}_t + \varepsilon_{i,j,t}$$

where subscripts x and i indicate exporting and importing countries respectively, and t is the year of observation. Ψ is a vector of coefficients. UAI is the acronym of Uncertainty

[1] For instance, Tinbergen (1962), Pöyhönen (1963), Linnemann (1966), Anderson (1979), Deardorff (1984, 1995, 1998, 2003), Bergstrand (1985, 1990), Baldwin (1994), Leamer and Levinsohn (1995), Evenett and Keller (1998), Frankel and Romer (1999), Helpman (1999), and Rose (2004).

Avoidance Indicator, which measures a country's culture of uncertainty-aversion, supplied by Hofstede (1980, 2001), and will be discussed in detail in Section 3.

Because directions of trade volumes matter for the analysis, export volume instead of total trade volume is used. Following previous literature, the dependent variable is the natural logarithm of yearly export volume (in nominal U.S. dollar) from country x to country i in year t. This effectively drops country-pairs with zero trade volumes[2]. In constructing the interaction terms, as recommended by Wooldridge (2002, pp. 194,), we de-mean both UAIs and distances before interacting them.

Both transport costs and unfamiliarity are proxied by the natural logarithm of geographic distance of a trade route. The use of distance as an exogenous proxy for unfamiliarity is commonly accepted (Anderson [2000] and Loungani et al. [2002] provide good surveys of the evidence). Bilateral distances are exogenously given and provide a lot of variations across trade routes. The empirical design creates the following interpretation of the coefficients. β_1 captures both the transport cost effects and the unfamiliarity effect, because the magnitudes of the effects are constant across trade routes. β_2 and β_3 capture the differential (across countries) effects of unfamiliarity on export volumes, as distance effects are allowed to vary across countries with different extents of uncertainty-aversion.

If unfamiliarity barriers exist in bilateral trade, the coefficients on the interaction terms (i.e., β_2 and/or β_3) are expected to be significantly negative, which means that the trade flows from/into a high uncertainty-aversion country are more sensitive to the level of unfamiliarity between country-pairs. β_2 and β_3 also are expected to be more negative for differentiated products than for products traded on organized exchanges, as they require more information exchange and thus are more sensitive to unfamiliarity. Both transport cost effects and unfamiliarity effects would be reflected by a negative coefficient on β_1, as both of them increase in geographic distances.

[2] Ln (1 + Export) also was used as the dependent variable. The results (unreported) show that the signs and significance levels of the variables of interests did not change. This is not surprising, as observations with zero trade volume make up less than 2% of the sample.

Following previous literature, to control for country-pair□specific factors that have impacts on bilateral trades, the model includes dummy variables for whether a country-pair shares a common language (English, French, Spanish, etc.), a common border, a common currency (e.g., the United States and Panama), a common colonizer post-1945, or a common country (e.g., France and its overseas dependencies). Dummies also are used for current colonial relationship, previous colonial relationship, and whether both countries are members of GATT/WTO or are members of a regional trade agreement, respectively. The model also controls for whether either or both of the two countries are landlocked or islands, respectively (the two variables can thus take values of 0, 1, or 2).

The model also includes country dummies for exporters and importers, respectively, to take out the effects of origin- or destination-specific unobservable market attributes or frictions from both the exporter and importer sides. Recent literature on gravity models (e.g., Matyas, 1997; Egger, 2000; Anderson and Van Wincoop, 2003; Estevadeordal et al., 2003; Redding and Venables, 2004) increasingly recommend that this practice, grounded in trade theory, takes better care of the "omitted variable" problems and yields more moderate and reasonable estimates. The practice is very robust to alternative theories, whether based on consumer differentiation among goods on the demand side (Anderson and Van Wincoop, 2003; Redding and Venables, 2004) or on Ricardian differences in technology on the supply side (Eaton and Kortum 2002). As exporter/importer dummies remove only time-invariant country-specific factors, the model still directly controls for logarithms of real GDP of both countries, although they will now only capture time series variations. The coefficients on GDP are not constrained to be the same for importers and exporters.

The data set, compiled by Andrew K. Rose, is the standard in the empirical literature. Interested readers can refer to, among others, Rose (2004) for original data sources. Estimation of the gravity model is performed for a 30-year period (1970-2000). Yearly observations are pooled, and year dummies are included to control for global factors such as the global business cycle, the extent of globalization, oil shocks, and so

forth. There are very few within-variations for the country-specific explanatory variables, whereas there are at most 30 yearly observations of bilateral trade volumes per country-pair. For this reason, the standard errors reported are adjusted to be robust to potential clustering of residuals by country-pairs. In the sample period, the world recovered from the aftermath of World War II and became more integrated, to a level exceeding that achieved in the Golden Era of Commerce of the 19th century.

3. Measuring National Uncertainty Aversion

The measure of national uncertainty-aversion derives from a cross-country psychological survey conducted by Geert Hofstede (then director of the personnel research department, IBM Europe) between 1967 and 1973. The survey involved a naturally matched sample of respondents: 88,000 IBM local employees in marketing and customer service positions working in subsidiaries located in more than 50 countries around the world. Using this survey, Hofstede (1980, 2001) developed a measure of national uncertainty-aversion for 50 countries, which he calls the "Uncertainty Avoidance Indicator" (UAI). He defines an individual's uncertainty-aversion as "feeling uncomfortable with uncertainty and ambiguity, and therefore valuing beliefs and institutions that provide certainty and conformity," and national uncertainty aversion as the collectively held attitude of a society toward uncertainty. An important assumption of this measure is that, for his matched sample of IBM employees around the world, the cross-subsidiary difference of corporate culture reflects cross-society culture differences. The methodology Hofstede uses to construct this uncertainty-aversion indicator is described briefly in the Appendix of this paper.

The National Uncertainty Aversion indictors[3] for 49 countries around the world

[3] The uncertainty-aversion survey was carried out around 1970, whereas this study examines trade volumes from 1970 through the 1990s. The study requires only a weak assumption that people's cultures and attitudes are stable in the short run. Williamson (2000) argues that culture and particularly religion, which is the foundation of all the other formal institutions, usually changes very slowly – on the order of centuries or millennia – and the feedback from formal institutions to culture is minimal. Empirically, numerous replicate studies, with respondents of different occupations, have produced robust results and attested to the persistence of cross-country differences in uncertainty-aversion. In the long run, uncertainty aversion may

are reported in Table 1. (Taiwan is excluded from the sample because bilateral trade data are not available.] Anglo-Saxon and Nordic countries as well as previous British colonies are among those scoring the lowest on the Uncertainty Avoidance Indicator (UAI), whereas typical continental European countries (Greece, Portugal, Spain, France, Belgium, Italy, etc.) as well as their previous Latino colonies are among those with the highest UAIs. Catholic countries in general have higher UAIs, whereas Protestant countries have lower ones. A series of data sets collected by La Porta et al, reveals that uncertainty-averse countries emphasize formality in judicial procedures (Djankov et al. 2003) and heavily regulate their labor markets (Botero et al. 2004). These two "syndromes" are very much related to two of the questions asked in Hofstede's survey: rule orientation and employment stability.

[insert table 1 about here]

4. Results: Unfamiliarity and Long-Distance Trade

The gravity model is estimated using aggregate trade volume data without distinguishing between differentiated and non-differentiated products. The results are reported in Table 2. Columns (1) and (2) of that table take into account the identity of both exporters and importers; thus, country-pairs are excluded if uncertainty-aversion data are missing for either the exporter or the importer. Theoretically, there are 49 X 48=2352 pairs of trading partners, but the number of observations varies by year depending on data availability.

[insert table 2 about here]

Confirming findings in previous gravity model literature, the regression results show that distant partners in general trade less. The negative coefficient on geographic

change. The Spanish were not at all uncertainty-averse in the 1500s (Hapsburg Empire), when they dominated the long-distance Atlantic trade (Acemoglu, Johnson, and Robinson, 2005). Their loss of sea power to the English and consequent loss of share in Atlantic trade may have changed their culture, rather than trade changing in response to cultural change.

distances reflects trade barriers that are proportional to geographic distances, which can result from both transport costs and informational unfamiliarity. Most important (in the perspective of this study), the interaction term takes on a negative and significant value. This result suggests that high uncertainty-aversion exporters are particularly affected by the distance effects that they export disproportionately less to distant partners than what a gravity model predicts. For transport costs alone to explain this trade pattern, one would have to assume that distance-related *ad valorem* transport costs are much higher when goods are exported from high uncertainty-aversion countries, an assumption that lacks empirical support. If one accepts Grossman's (1996) argument that geographic distances proxy for unfamiliarity, this finding is completely predictable, because uncertainty-averse countries dislike unfamiliarity more than other countries do and would attach more negative feeling to the same level of unfamiliarity.

The magnitude of the effect is economically significant. The results show that, *ceteris paribus*, the increase of national uncertainty aversion from that of the United States, a typical uncertainty-tolerant country, to that of France, a typical uncertainty-averse country, can increase the distance effects by 12.5%. For the United States, exports fall by only 1.3% for every 1% increase in distance, whereas for France, export volumes fall by 1.5%. A trip of 1,000 miles looks, in the eyes of American exporters, like 1,250 miles looks in the eyes of French exporters.

The results also show that whether the importer is uncertainty-averse or not does not make a difference, which suggests both that an exporting transaction is mostly initiated by the exporter's active search for matched importers and that partial equilibrium search models (which assumes importers to be passive in the search), such as employed by Rauch (1996), are a good approximation to reality. Uncertainty-averse exporters are reluctant to explore distant markets, whereas uncertainty-averse importers are less sensitive, probably because exporters can always push information. This also reveals that uncertainty-aversion reduces a country's access to distant markets but not distant suppliers.

Column (2) of Table 2 controls for observable country-specific factors directly instead of using fixed-effect country dummies. This is an approach used by older literature on the gravity model, and it requires observation of all country-specific characteristics that potentially affect trade (which is not possible). The fixed-effect approach, since Anderson and Van Wincoop (2003), is becoming the new standard for bilateral trade estimation, but it is still interesting to compare it with results from the old approach to show how unobservable factors affect estimates. The results show that national uncertainty aversion of the exporters still makes a difference, but the effect is only very marginally significant ($p = 0.09$). This is not surprising. As suggested by Feenstra (2003), when country-specific fixed-effects are not controlled for, the existence of omitted variables could cause the fall in statistical significance, as the commonly used "weight" controls (GDP, population, etc) miss many details in the bilateral trade equations directly derived from new trade theory models (which assume monopolistic competition, CES demand, and iceberg trade costs). The comparison of the results shows that it is important to control for unobservable country-specific factors using fixed effects. Finally, the negative coefficients on UAI terms suggest that uncertainty-averse countries in general trade less with foreigners.

Columns (1) and (2) show that national uncertainty aversion of importing countries does not make a difference. Therefore, Column (3) controls only for uncertainty-aversion of the exporter countries, so that more of the information in the data set can be utilized. That is, the analysis now can examine those countries dropped in the regressions done for Columns (1) and (2). The sample size is thus more than tripled. The results in Column (1) are very well replicated in Column (3).

Column (4) includes only Western European countries as exporters. These countries are a unity, geographically speaking, but each of them has a different level of uncertainty-aversion. Northern countries are more uncertainty-tolerant, while their southern neighbors are more uncertainty-averse. Testing the differences of trading patterns thus provides a clean and natural experiment. Among these Western European countries, there is very strong evidence that uncertainty-tolerant countries trade more

with distant partners (which presumably are located on the other side of the Atlantic, or in the East, in Asia Pacific). This provides strong support for the working hypothesis, as these countries are at similar levels of development and face almost the same trade opportunities, geographically speaking.

Although many factors potentially can affect trade openness (most of which are already addressed by the country-specific dummies and country-pair□specific controls included in the regressions), few can affect trade patterns in the systematic way identified in this study. Several, however, come to mind. First, Becker and Greenberg (2003) show that better financial development can disproportionately help long-distance trade (which presumably requires up-front investment). Their preferred measure of financial development is accounting standards in 1995. Column (5) follows their choice in measuring financial development and includes in the regression accounting standards of exporters interacted with geographic distances. Accounting standard data are not available for 10 of the 49 exporters. Financial development does indeed foster long-distance trade, but not significantly, whereas the effect of national uncertainty-aversion remains strong, thus suggesting that national uncertainty-aversion is not proxying for financial development. Second, economically developed countries may be better able to exploit long-distance trade opportunities. Long-term economic development, however, is endogenous to culture in the system used in this study.The solution to this problem is to utilize the time series variation of economic development, which is presumably less endogenous. In the last three decades, world income per capita increased threefold, but some countries grew much faster than others. Column (6) includes each country's log GDP per capita relative to its own 1985 level and also interacts this number with bilateral distance (the proxy for unfamiliarity). The results show that as an economy grows, it actually becomes less likely to trade with foreign countries that are far away. After controlling for this, uncertainty-tolerant countries still trade disproportionately more with distant foreign countries.

Finally, there may exist a reverse causality problem in the regressions: National culture may change over time in response to international trade. Countries can become

more uncertainty-tolerant after dealing with distant countries, but not the other way around. To address this problem, Column (7) uses religion composition (the percentage of Protestants, Catholics, and Muslims in the population, respectively[4]) as a set of instrumental variables for UAI. This study is not alone in finding that religions affect culture. Among others[5], Guiso, Sapienza and Zingales (2003) find that religious beliefs have important impacts on people's economic attitudes. In this study's sample, national uncertainty-aversion is significantly and substantially lower ($\rho = 0.49$, significant at 1%) in countries with a higher fraction of Protestant population, and significantly higher ($\rho = 0.46$, significant at 1%) in countries with a higher fraction of Catholic population. Weber's (1930) theory provides some explanation for this correlation[6]. The instrumental variable regression results are reported in Column (7) with the same specification as the OLS regression in Column (3). The IV results replicate the OLS results that uncertainty-averse countries trade much less with distant partners. As a matter of fact, the magnitude of the effect is much stronger.

5. Differentiated Products, Reference-Priced Products, and Organized-Exchange-Traded Products

After examining how unfamiliarity affects bilateral trade volumes at the aggregate level, this section will distinguish between trade volumes of differentiated and

[4] The rest of the population is defined as affiliated with "other religions and atheism." As usual practice, it is dropped from the set of instrumental variables, as by construction it is always equal to 100 minus the percentage of people affiliated with the three major religions.

[5] La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997) find that dominant hierarchical religions such as Catholicism deter the formation of interpersonal trust between strangers and thus have a negative impact on the performance of large organizations such as governments and large corporations. Stulz and Williamson (2003) find that Catholic countries protect the rights of creditors less than other countries, and that long-term debt is less important in these countries.

[6] Weber (1930) links the rise of capitalism with Protestant reformations and thus weakening of uncertainty aversion: "The Catholic is quieter, having less of the acquisitive impulse; he prefers a life of the greatest possible security, even with a smaller income, to a life of risk and excitement, even though it may bring the chance of gaining honor and riches. … The Protestant prefers to eat well, the Catholic to sleep undisturbed." Put formally, Catholics value a predictable life more than an exciting life, whereas Protestants do the opposite. It is conjectured that the Protestant reformations in the 1500s could explain why the English and Dutch began to challenge and finally dominate the Spanish and Portuguese in long-distance Atlantic trade.

homogenous products in order to shed more light on the working hypothesis. First, compared to products with reference prices or traded on organized exchanges, trading of differentiated products requires more effort in collecting transaction-specific information but less transport costs. Thus, it is expected that unfamiliarity between countries should have greater impacts on differentiated products, which require better matches of buyers and sellers, than on homogenous products. This, if true, would be reflected by a more negative value of the interaction term when the gravity model is estimated with bilateral trade volumes of differentiated products. Second, there is a possibility that uncertainty-averse countries export more exchange-traded commodities (which are heavier and incur greater transport costs) than uncertainty-tolerant countries do, which can also generate the trade pattern found previously. By "comparing apples with apples", we can directly address this concern.

Rauch (1999) argues that information is more important for the match of buyers and sellers of differentiated products. He groups commodities (at the three- and four-digit SITC levels) into three categories: exchange-traded, reference-priced, and differentiated. Reference-priced commodities are those for which prices can be quoted without knowing the identity of the producers. 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. Rauch (1999) presents evidence that proximity and common language/colonial ties are more important for differentiated products than for products traded on organized exchanges.

Table 3 re-runs the baseline regression (i.e., using the same specification as in Table 2, Column (3)), but separately for each of the three categories of commodities, using conservative and liberal classifications, respectively. The disaggregated bilateral trade data are from Statistics Canada Trade Data, cleaned and complied by NBER and UC Davis. The data are then matched with Andrew Rose's country-pair-specific variables. Differentiated products account for about 50% of trade values, while exchange-

traded and reference-priced products each account for about 25%. Following Rauch (1999), the model is estimated for the years 1970, 1980, and 1990, respectively, instead of all years being pooled, as in Table 2. To save space and also to present the findings more clearly, Table 3 reports only the coefficients of interest, which are the coefficients on the interaction terms between distance and national uncertainty aversion.

[insert Table 3 about here]

In all cases, coefficients on the interaction terms, which presumably capture unfamiliarity effects, are highly significant for differentiated products. The magnitude of the impact is also much greater for differentiated products than for reference-priced or exchange-traded products. Commodities traded on organized exchanges are least affected by uncertainty aversion. In four out of six cases, the impacts of unfamiliarity on exchange-traded products are marginally indistinguishable from zero. Commodities with reference prices are more sensitive to unfamiliarity than exchange-traded commodities, but the magnitude is always smaller than that for differentiated products. Coefficients for differentiated products consistently are thelargest, followed by those for reference-priced products. In light of the above findings, it is concludec that the results in the previous section are driven mainly by differentiated products, which require extensive information for matching of buyers and sellers.

This pattern cannot be explained by transport cost effects. Differentiated products generally have higher value-to-size or value-to-weight ratios, and thus they are presumably less affected by transport costs. Rauch (1999), basing analysis on insurance and freight data of U.S. imports from Japan, shows that differentiated products have lower transport costs than reference-priced products, which in turn are more transportable than exchange-traded products. The unfamiliarity story, which assumes that differentiated products are more sensitive to information asymmetry, however, explains the pattern very well: The more information-intensive a transaction is, the more cautious a trader is in dealing with unfamiliar counterparties.

6. Geographic Openness, Uncertainty-Aversion, and Long-Term Growth

Frankel and Romer (1999), using geographic openness as an instrumental variable for actual trade openness, show that trade *causes* long-term growth. They show that countries naturally more open (i.e., located near to densely populated countries) are richer (the result of faster growth in the long term)[7].

Sections 4 and 5 showed that uncertainty-aversion plays important roles in international trade; thus, it would be interesting to revisit Frankel and Romer's (1999) results with the new findings. It is expected that national uncertainty-aversion would provide additional and important information to predict a country's actual trade openness and, in turn, long-term growth. The results will also shed some light on the debate over transport costs vs. unfamiliarity. (A la Frankel and Romer (1999), this study uses geographic factors as well as a cultural factor (i.e., national uncertainty-aversion) as instruments for actual openness, and it tests for the effects of an exogenous component of trade openness on per capita income (the result of long-term growth).

The actual openness and predicted openness index are obtained from the appendix of Frankel and Romer (1999). Due to limitations of data availability for the UAI,this study has only 50 countries in its sample, less than half of Frankel and Romer's (1999) samples. However, the sample here is overrepresented by economically important countries and accounts for a disproportionately large share of world trade volumes; it thus provides representative evidence.

[insert table 4 about here]

Panel A of Table 4 regresses actual trade openness against geographic and culture factors. Geographic factors.(i.e., constructed trade share) explain much of the

[7] Acemolgu, Johnson, and Robinson (2005) further argue that long-distance trade is more important than short-distance trade. They argue that the geographic access to the Atlantic, interacted with the increasingly important Atlantic trade, caused the rise of Western Europe after the 15th century, whereas short-distance Mediterranean trade did not.

actual trade share. National uncertainty-aversion, however, provides additional information: high uncertainty-aversion countries trade significantly less with foreign countries. Another interesting result appears in Columns (3) and (5), which include an interaction term between national uncertainty-aversion and geographic openness. The term enters negatively [8] and significantly, which implies that, geographically open countries (e.g., western European countries) indeed achieve higher actual openness, but this effect is much smaller for those with higher uncertainty-aversion (e.g., Southern European countries). This suggests that high uncertainty-aversion countries do not utilize their geographic advantage very well. Were they more uncertainty-tolerant, they would have traded much more with foreigners with so many big countries nearby. Geographic and culture factors combined explain 70% to 80% of the cross-country variations of actual trade openness, which is unusually high in typical cross-country regressions.

Panel B regresses per capita income against trade openness. Column (1) uses actual trade openness directly and tries to find its correlation with per capita income. The OLS results show that open economies are richer. The effect becomes marginally insignificant in Column (2), however, when constructed trade share (predicted by geographic factors) is used as an instrumental variable for actual trade openness. Columns (3) and (4) include both constructed trade share and national uncertainty-aversion as instrumental variables for actual openness. The IV results show that the components of trade volumes predicted by cultural and geographic factors cause long-term growth significantly. The magnitude of the effect suggests that a one percentage

[8] One may ask why the coefficient is not positive, if one expects uncertainty-tolerant countries to be less restricted by geographic factors (i.e., they can always trade with distant partners when there are few partners nearby), whereas uncertainty-averse countries should value geographic advantage more highly, given that they do not want to trade with distant partners. The explanation here is that when people decide to trade with someone, they not only have to decide whether to trade with near or distant countries, but also have to decide whether to trade domestically or overseas. In Sections 4 and 5, in order to identify the channel through which uncertainty aversion affects international trade, the study emphasizes the choice between foreign countries of different geographic proximity, to exploit variation of unfamiliarity across trade routes. Nevertheless, the dominant factor considered by traders is actually the option between domestic trade and international trade (Anderson and van Wincoop 2003). Taking this into account, the negative coefficient found is not surprising – that high uncertainty-aversion countries trade less than the gravity model predicts even when there are many densely populated countries nearby.

point increase in trade openness can increase income per worker by 0.8%. The analysis also tested for the over-identifying restriction, and the test showed that national uncertainty-aversion does not affect per capita income directly, but has to work through its impact on trade openness. Finally, Rodriguez and Rodrik (2001) argue that geographic openness is proxying for distance from the equator, because most economic activities of the world are concentrated in a band between 20° and 50° to the North and South of the equator. Tropical climate directly affects income level through higher levels of malaria and other climate-related conditions. In our case, it seems that at least in Europe, distance from the equator is correlated with uncertainty-tolerance. Column (5) includes latitude to control for this factor, and the results are still robust.

The results suggest that geographic distances from trading partners reduce per capita income because they create barriers for international trade. More important, the barriers created by geographic distances are both physical (by the transport cost effects) and informational/psychological (by the unfamiliarity effects). The results suggest that uncertainty-averse countries are discouraged from international trade even when endowed with geographic advantages.

7. Conclusions

Gravity models suggest that countries trade much less with distant partners, a finding that according to Leamer and Levinsohn (1995) is one of the most robust empirical findings in economics. Geographic distances between two countries proxy not only for transport costs but also for unfamiliarity and thus informational barriers. Informational frictions, interacted with uncertainty aversion, can keep people from doing business with unfamiliar people in distant countries. It is, however, difficult to disentangle the effects of unfamiliarity from those of transport costs, as both effects are presumably increasing functions of geographic distances.

This study attempted to disentangle the two effects, using historic and systematic differences of uncertainty-aversion across countries. It showed that high uncertainty-aversion countries trade disproportionately less with distant partners than gravity models predict, and the results are driven by the group of differentiated

products, thus identifying a new "unfamiliarity channel" through which geographic distances affect trade volumes. This suggests that geographic distance can create, in addition to transport costs, informational and psychological frictions in long-distance international trade. These frictions interact with uncertainty aversion to cause the "mystery of the missing trade" (Trefler 1995). Using Frankel and Romer's (1999) methodology, the study also showed that national uncertainty-aversion negatively affects per capita income by reducing trade openness for geographically open countries.

One of the policy implications from the findings is that, in high uncertainty-aversion countries, it is efficiency-improving for government to subsidize some export-promoting activities, as well as to improve the communication and interaction with distant and unfamiliar countries, so as to minimize the negative consequences of being culturally uncertainty-averse. This is not an easy task. Eichengreen and Irwin (1996) show that bilateral trade flows are very persistent and history dependent. As a matter of fact, the effect of uncertainty version on long-distance trade has not been decreasing even though communication costs have dropped substantially. If people do not want to interact, then they will not, no matter how low the costs. As Guiso et al. (2004) argue, people believe what they want to believe. This, however, also suggests that the benefits would be huge, as familiarity erodes only slowly once it is established. The findings here also suggest that such policy measures would be most productive and immediate for those countries that are geographically more open to trade.

One must be careful not to overstate the direct effect of national uncertainty-aversion on long-distance trade. The coefficients estimated include indirect feedback effects as well as that high uncertainty-aversion countries trade less with distant countries, which reduces interactions and reinforces unfamiliarity, which further reduces trade, and so on.

Finally, international trade data from prior to World War II can shed additional light on the topic examined in this study. Estevadeordal et al. (2003) document the boom and bust of world trade from 1870 to 1939, as international trade was in some periods promoted and in other periods distorted by payment frictions, transport costs,

and commercial policy. Prior to the war, there was no significance improvement of communication technologies, and thus unfamiliarity was relatively stable over the period. Through examining the 1870 -1913, period when transport costs dropped substantially, as well as the 1929-1939 period, when transport costs rose again, it should be possible to directly disentangle the two effects (i.e., transport costs versus unfamiliarity). A prediction we can make is that the coefficient on the interaction term should be stable between 1870 and 1939, whereas the coefficient on distance should go down first and then go up again.

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Appendix: Measuring National Uncertainty Aversion

To construct the Uncertainty Avoidance Indicator (UAI), Hofstede uses the answers of respondents to the three basic questions that follow. (He asked other questions as well in the survey in relation to uncertainty-aversion, but by factor analysis these three turn out to provide most of the information.)

(a) Rule Orientation: Agreement with the statement "Company rules should not be broken – even when the employee thinks it is in the company's best interest" (1 for strongly agree and 5 for strongly disagree)

Motivation: Rule is a mechanism invented by human beings, since the primitive era, to stabilize the present and future, minimize undesirable uncertainty, and hold organizations together. The disagreement with the "rule orientation" statement thus indicates a higher level of tolerance for ambiguity, by allowing the breaking of rules upon unexpected and unstructured situations. "Rule" is not a bad word per se, but it is usually perceived negatively, as it is sometimes associated with bureaucracy and red tape. The answer to this question is highly correlated with formality in judicial procedures (data from Djankov et al. 2003).

(b) Employment stability: Employees' statement that they intend to continue with the company for more than X years

Motivation: The "employment stability" statement reflects modern human beings' attitude toward situations of ambiguity, in a employer-employee context. The answers to this question are strongly correlated with the answers to the "rule orientation" statement. Later survey also found that the intention is consistent with actual action. The answer to this question is highly correlated with the regulation of the labor market (data from Botero et al. 2004).

(c) Stress: as expressed in the mean answer to the question "How often do you feel nervous or tense at work" (1 for "I always feel this way" and 5 for "I never feel this way")

Motivation: The question about stress is less familiar to economists but is a well-researched topic in social psychology literature. It taps a fundamental phenomenon in human life. Stress and anxiety are states of mind and body, or anxiety about the future, and they corresponds to the state of preparation for aggression in primitive people, released through acts of arbitrary aggression into unknown territory, and accumulated when the social norms and rules forbid them from overt aggression. The medical community commonly believes that stress and

anxiety are caused mainly by the fear of uncertainty in the future, which is also the main difference of it from another psychological illness, depression, which is caused by the belief that the future is doomed (certain) to be hopeless. Therefore, *ceteris paribus*, people in an uncertainty-avoidance society would generally accumulate more stress. The answer to this question is highly consistent with cross-country medical surveys, which suggests that it is a social problem rather than a corporate problem.

To make the contribution of each question roughly equal, Hofstede uses the following formula to adjust the weights and compute the aggregate score of national uncertainty aversion: UAI = 300 – 30 (mean score rule orientation) – (% intending to stay less than 5 years) – 40 (mean stress score)

Table 1: National Uncertainty Aversion

Country	Uncertainty Avoidance Indicator(UAI)	Protestant %	Catholic %	Muslim %
Greece	112	0.1	0.4	1.5
Portugal	104	1.1	94.1	0.0
Guatemala	101	4.9	94.0	0.0
Uruguay	100	1.9	59.5	0.0
Belgium	94	0.4	90.0	1.1
El Salvador	94	2.4	96.2	0.0
Japan	92	0.9	0.6	0.0
Yugoslavia	88	1.0	4.0	19.0
Peru	87	2.7	95.1	0.0
Argentina	86	2.7	91.6	0.2
Chile	86	1.9	82.1	0.0
Costa Rica	86	5.8	90.5	0.0
France	86	2.4	76.4	3.0
Panama	86	5.2	85.0	4.5
Spain	86	0.1	96.9	0.0
South Korea	85	12.2	3.9	0.0
Turkey	85	0.0	0.1	99.2
Mexico	82	1.2	94.7	0.0
Israel	81	0.2	1.0	8.0
Colombia	80	0.9	96.6	0.2
Brazil	76	4.0	87.8	0.1
Venezuela	76	1.0	94.8	0.0
Italy	75	0.4	83.2	0.1
Austria	70	6.5	88.8	0.6
Pakistan	70	0.8	0.5	96.8
Ecuador	67	1.9	96.4	0.0
Germany	65	46.4	35.0	0.0
Thailand	64	0.2	0.4	3.9
Finland	59	93.1	0.1	0.0
Iran	59	0.0	0.1	97.9
Switzerland	58	43.2	52.8	0.3
Netherlands	53	42.4	42.6	1.0
Australia	51	23.5	29.6	0.2
Norway	50	97.8	0.3	0.1
New Zealand	49	37.9	18.7	0.0
South Africa	49	39.0	10.4	1.3
Canada	48	29.6	46.6	0.6
Indonesia	48	4.8	2.7	43.4
United States	46	43.6	30.0	0.8

Philippines	44	3.8	84.1	4.3
India	40	1.1	1.3	11.6
Malaysia	36	1.4	2.8	49.4
Ireland	35	1.1	95.3	0.0
United Kingdom	35	16.1	13.1	1.4
Hong Kong	29	7.5	7.9	0.5
Sweden	29	68.4	1.4	0.1
Denmark	23	95.2	0.6	0.2
Jamaica	13	55.5	9.6	0.1
Singapore	8	2.6	4.7	17.4
Correlation with UAI	-	−0.4860	0.5	−0.0473

Note: Uncertainty aversion data are from Hofstede (1980, 2001). Religion data are from La Porta et al. (1997) and originally from Barrett (1982). Countries in the list are sorted by uncertainty aversion indicator (from highest to lowest).

Table 2: Unfamiliarity and long-distance trade

	Dependent Variable: Ln (Exports)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Fixed Effects	No Fixed Effects	Include Importers Without UAI Data	Western European Countries	Control for Financial Development	Controlling for GDP/pc	Using Religion as IV
Distance	-1.1221 (0.0433)***	-0.9972 (0.0445)***	-1.2930 (0.0269)***	-1.4166 (0.0909)***	-1.3006 (0.0299)***	-1.2900 (0.0272)***	-1.2817 (0.0269)***
Distance × Exporter UAI	-0.0041 (0.0011)***	-0.0022 (0.0013)*	-0.0031 (0.0010)***	-0.0075 (0.0008)***	-0.0037 (0.0010)***	-0.0032 (0.0010)***	-0.0062 (0.0014)***
Distance× Importer UAI	-0.0006 (0.0011)	-0.0008 (0.0013)					
Exporter UAI		-0.0100 (0.0011)***					
Importer UAI		-0.0064 (0.0010)***					
Distance×Finance					0.0032 (0.0021)		
Distance×GDP/pc						-0.1057 (0.052)**	
Exporter/Importer Fixed Effects	Yes	No	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	66,814	66,814	171,594	65,397	144,338	171,000	171,594
R-Squared	0.8238	0.7675	0.7782	0.8855	0.8025	0.7778	0.7778

Exporter- and importer-specific characteristics (for which coefficients are not reported): sharing a common language, a common border, or a common colonizer after 1945; having a current colonial relationship, a previous colonial relationship, or a

common country; number of landlocked countries in the pair; number of islands in the pair; and common membership in GATT/WTO, a regional FTA, or a currency union.

Country-specific characteristics (for which coefficients are not reported): log of real GDP for both importers and exporters. Log of real GDP per capita for both importers and exporters are also controlled for when exporter and importer dummies are not included, as are log products of land area.

Instrumental variables: Proportion of Catholic, Protestant, and Muslim in the population. The IV regression is estimated with the GMM technique.

Notes:

1. The basic regression model is specified as follows:

$$\text{Ln (Export Volume}_{x,i,t}\text{)} = \text{Ln (Distance}_{x,i}\text{)}(\beta 1 + \beta 2 \times \text{UAI}_x + \beta 3 \times \text{UAI}_i) + \text{Extended Set of Gravity Model Control} + \text{Origin Dummies}_x + \text{Destination Dummies}_i + \text{Year Dummies}_t + \varepsilon_{i,j,t}$$

Subscripts *x* and *i* denote exporting and importing countries, respectively, and *t* is the year of observation. The dependent variable is logarithm of yearly export volume from country *x* to country *i* in year *t*.

2. Both transport costs and unfamiliarity are measured by logarithm of geographic distance between a pair of exporter and importer. The empirical design creates the following interpretation of the coefficients. β_1 captures the transport cost effects because the magnitude of the effects are constant across trade routes. β_2 and β_3 capture the differential effects of unfamiliarity on export volumes, because distance effects are allowed to vary between uncertainty-averse and uncertainty-tolerant exporters/importers.

3. The gravity model is estimated using pooled yearly data from year 1970 to year 2000. Fixed-effects by year are controlled for, and the standard errors reported are adjusted to be robust to potential clustering of residuals by country-pairs.

4. In the "Extended Gravity Model Control Set", fully following Rose (2004), dummies are included for whether a country-pair shares a common language, a common border, a common country, or a common colonizer (either presently or in the past); for a current colonial relationship and for a colonial relationship in the past; and for country-pairs both in GATT/WTO, in the same currency union, and in the same regional trade agreement, respectively. The regression also controls for whether either of the two countries is landlocked or an island.

5. The main regressions include country dummies for exporters and importers respectively, to remove the origin-specific and destination-specific effects. Results are compared to those obtained using the traditional approach by controlling for country-specific factors directly (i.e., log product of real GDP, log product of GDP per capita, and log product of land area, as well as UAI for both importers and exporters).

Table 3: Differentiated commodities vs. homogeneous commodities

	Dependent Variable: Ln (Export)					
	Conservative Classification			Liberal Classification		
	(1) Org.	(2) Ref.	(3) Dif.	(4) Org.	(5) Ref.	(6) Dif.
Year 1970						
Distance × Exporter UAI	-0.0007 (0.0019)	-0.0040 (0.0015)***	-0.0053 (0.0014)***	-0.0034 (0.0017)**	-0.0039 (0.0015)**	-0.0049 (0.0013)***
Observations	3074	3812	4292	3437	3775	4272
R-Squared	0.619	0.670	0.754	0.643	0.677	0.756
Year 1980						
Distance × Exporter UAI	0.0032 (0.0018)*	-0.0050 (0.0014)***	-0.0053 (0.0013)***	-0.0010 (0.0017)	-0.0027 (0.0014)*	-0.0051 (0.0013)***
Observations	3363	4395	5142	3753	4368	5123
R-Squared	0.604	0.706	0.754	0.625	0.714	0.755
Year 1990						
Distance × Exporter UAI	0.0011 (0.0017)	-0.0025 (0.0012)**	-0.0059 (0.0012)***	-0.0017 (0.0016)	-0.0015 (0.0012)	-0.0062 (0.0012)***
Observations	3774	4908	5692	4120	4934	5671
R-Squared	0.608	0.731	0.788	0.634	0.735	0.790
Exporter/Importer Fixed effects	YES	YES	YES	YES	YES	YES

Country-Pair Specific Characteristics (for which coefficients are not reported): sharing a common language, a common border, a common colonizer after 1945, current colonial relationship, previous colonial relationship, common country, number of landlocked in the pair, number of islands in the pair, GATT/WTO, Regional FTA, Currency Union.

Notes:

1. For model specification, please refer to notes underneath Table 2.

2. Commodities are sorted into three categories according to Rauch (1999): organized exchange (Org.), reference priced (Ref.), and differentiated (Dif.), at the three- and four-digit SITC level. Referenced priced commodities are those for which prices can be quoted without knowing the identity of the producers. 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.

Table 4: Trade and income

Panel A: Geography, Culture, and Actual Trade Openness

	Dependent Variable: Actual trade openness % in 1985				
	(1)	(2)	(3)	(4)	(5)
Geographic Openness %	2.8583 (0.7731)***	2.7283 (0.5716)***	5.9589 (1.1708)***	2.1126 (0.8083)**	5.9332 (1.5799)***
UAI		-0.8422 (0.2695)***	0.3699 (0.3202)	-0.7542 (0.2203)***	0.3665 (0.3158)
Geographic Openness × UAI			-0.0509 (0.0177)***		-0.0509 (0.0176)***
Ln population				-0.4352 (2.7033)	-0.5350 (2.3057)
Ln Area				-5.8505 (4.6688)	0.1031 (4.5125)
Observations	50	50	50	50	50
R Squared	0.5152	0.6783	0.7902	0.7135	0.7903

Panel B: Openness and Income

	Dependent Variable: Log of income per worker in 1985				
	(1)	(2)	(3)	(4)	(5)
	OLS	IV (geographic)	IV (geography and UAI)	IV (geography, UAI, and UAI interacted with geography)	IV (geography, UAI, and UAI interacted with geography)
Actual Openness %	0.0238 (0.0092)**	0.0115 (0.0074)	0.0081 (0.035)**	0.0081 (0.0032)**	0.0059 (0.0014)***
Ln Population	-0.0357 (0.1118)	-0.0587 (0.1033)	-0.0662 (0.1010)	-0.0644 (0.0994)	-0.0527 (0.0727)
Ln land area	0.1095 (0.0550)*	0.2108 (0.1457)	0.1482 (0.0683)**	0.1490 (0.0588)**	0.1053 (0.0463)**
Latitude					0.0216 (0.0026)***
Observations	50	50	50	50	50
R-Squared	0.1626	-	-	-	-
OIR- p value	-	-	0.4206	0.7290	0.4451

Note: In Panel A, actual trade openness is regressed against geographic openness (as defined in Frankel and Romer 1999) and uncertainty aversion (as measured by Hofstede). Economy size is controlled for by including population and land area. In Panel B, log of income per worker is

regressed against trade openness (%), population, land area, and latitude. In Column (2), actual trade openness is instrumented by geographic openness. In Columns (3), (4), and (5), UAI is also included in the instrumental variable set. IV regressions are estimated using GMM techniques. Wherever available, p-values of over-identifying restrictions are also reported.