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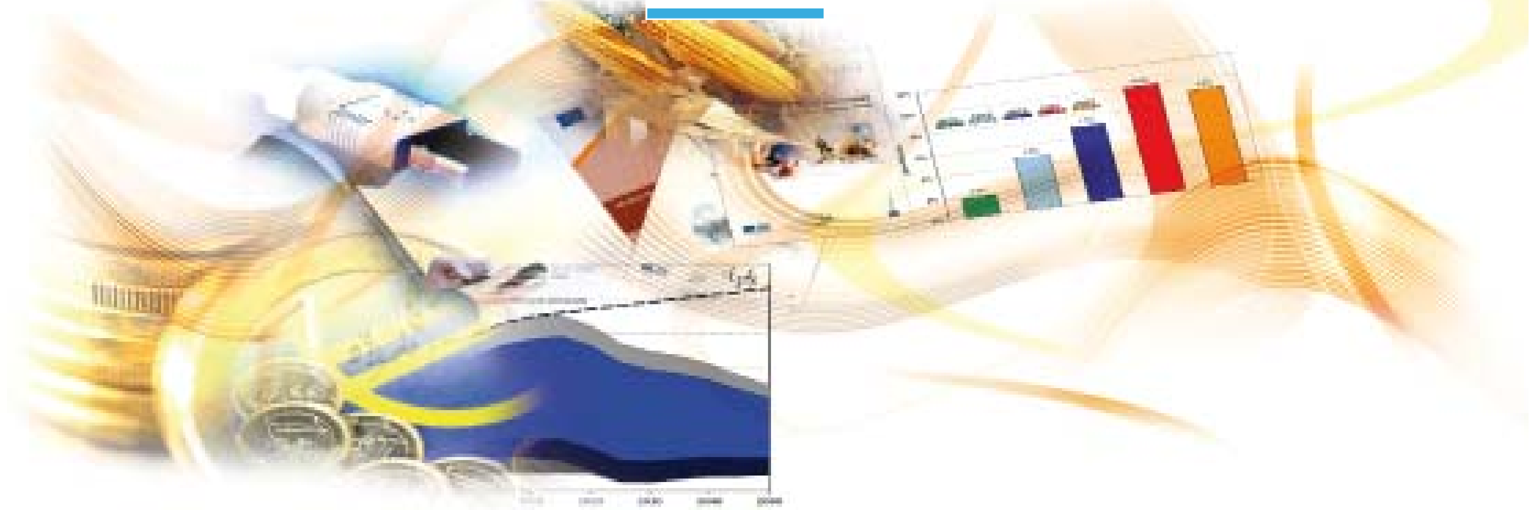

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# The Drivers and Impediments for Cross-border e-Commerce in the EU

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## Abstract

There are no official statistics on international online trade in goods so far. This paper uses a consumer survey to construct a unique matrix of online B2C domestic and cross-border trade in goods between the 27 EU Member States. We compare online and offline trade patterns for similar goods. We find that the standard gravity model performs well in explaining online cross-border trade flows. The model confirms the strong reduction in geographical distance-related trade costs, compared to offline trade. However, the trade costs associated with crossing language barriers increase when moving from offline to online trade. Institutional variables such as online payments facilities and cost-efficiency of parcel delivery systems might play a significant role in cross-border trade and our analysis confirms this. In a linguistically segmented market like the EU, online home market bias remains high compared to bias in offline cross-border trade. We conclude that it is hard to predict at this stage whether regulators could boost online cross-border trade through improvements in legal and financial systems, and parcel delivery infrastructure.

**JEL codes: F15, O52**

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## 1. Introduction

According to the European Commission (2012), ten years after the adoption of the EU E-Commerce Directive, e-commerce is still limited to less than 4% of total European trade, far below its full economic potential. The Commission's Digital Agenda for Europe aims to get 50% of all European citizens to buy online and 20% to engage in online cross-border transactions by 2015. The communication "Building trust in the Digital Single Market for e-commerce" (European Commission, 2012) proposed measures to boost online retail trade in the EU and overcome obstacles to e-commerce. These obstacles include an insufficient number of online shops willing to sell across the border, inadequate payment and parcel delivery systems, and too many cases of abuse and disputes that are difficult to settle. These conclusions were mainly based on descriptive statistics derived from a consumer survey on online business-to-consumer (B2C) trade in goods (Civic Consulting, 2011). The current paper uses the same consumer survey data but submits them to a more in-depth econometric analysis to quantify the importance of the main drivers and impediments to online cross-border transactions by EU consumers.

The analytical tool that we use for this purpose is the "gravity model" of cross-border international trade, the standard workhorse for explaining international trade flows in the offline economy (Deardorff, 1984; Anderson & Van Wincoop, 2003). This model is rooted in the Newtonian idea that many of the observed patterns of international trade flows can be explained by the economic size of the trading partners and their physical distance. “Distance” can be more broadly interpreted as a catch-all variable and proxy for various sources of international trade costs that affect the relative price of domestic and imported goods. This may include physical transport costs, the cost associated with import tariffs and regulator barriers, and risks related to poor contract enforcement between different jurisdictions. In a traditional bricks and mortar economy, information retrieval is costly and requires physical transport, either to bring information about a good to potential customers or to bring the customer to the good to observe its characteristics. The rise of the internet and, more generally, digital communications technology, has led many observers to announce the "death of distance" (Cairncross, 1997; Blum & Goldfarb, 2006). It does not matter anymore where buyers and sellers are located since information is only a mouse click away and no longer related to physical distances. On the other hand, new sources of trade costs may emerge that are specific to online cross-border transactions. Low information costs and the resulting wider geographical reach may result in increased price competition among suppliers and increased variety of goods available, but also weaker interaction between consumers and suppliers. This reduces trust and increases risk perceptions, compared to offline trade. These factors may increase online trade costs.

This paper examines the importance of three sources of trade costs in online trade. First, it assesses to what extent the shift from ordinary offline trade to internet-enabled online trade has reduced the importance of geographical distance-related trade costs. While distance may no longer matter for information and purely digital products and services (Blum & Goldfarb, 2006), goods still need to be physically transported, and sometimes cross borders between different regulatory regimes, to reach the buyer. Consequently, only part of the distance-related trade costs is affected by the shift from analogue to digital information technology. Second, the paper examines the importance of a set of cultural and institutional factors, such as language and the quality of legal institutions, as determinants of online trade. The shift from offline to online trade may well increase their relative importance. Third, we assess the importance of two essential ingredients of online trading platforms, flexible online payments systems and cost-efficient parcel delivery systems. Though we focus on online digital trade, the money and the physical goods still need to be able to cross borders in order to complete a transaction. Finally, we examine how the shift from offline to online trade affects home bias or the "natural" preference for home markets.

The absence of official and comprehensive statistics on cross-border e-commerce trade flows in goods has so far prevented empirical work on this subject, or restricted it mostly to non-tangible cross-border transactions in pure information products that can be transported across the internet, basically with zero distance-related transport costs (Blum & Goldfarb, 2006). A new online consumer survey (Civic Consulting, 2011) has generated a unique dataset on the value of cross-border e-commerce in goods in the EU. We use these data to construct a bilateral online trade matrix for the 27 EU Member States, plus some major non-EU trading partners. While these survey data have by no means the same comprehensive and exhaustive coverage as standard international trade data, they enable us to start looking into the drivers and impediments of online cross-border trade in the EU.

We find that that the importance of geographical distance-related trade costs is indeed reduced in online trade, compared to offline trade.  On the other hand, socio-cultural variables such as language increase in importance and counterbalance the declining cost of distance.  Moreover, other sources of trade costs gain in prominence for online transactions, in particular the quality of legal institutions, payments and parcel delivery systems. Overall, home bias turns out to be equally significant online and offline.  This may be due to the fact that consumers (in a B2C online trade setting) are more sensitive to these new sources of trade costs than businesses (in a B2B offline trade setting) dealing with each other in more established offline relationships.

This study introduces several innovations. First, it uses a new and unique database on online cross-border trade in goods in the EU to go beyond previous research that focused on domestic online trade in goods (Hortaçsu et al., 2009) and Blum & Goldfarb (2006) who focus on international online trade in pure information services.  This paper is very similar to Lendl et al. (2012) who also apply a gravity model to online cross-border trade in goods, using a propriety eBay database.  Second, it builds on the work of McCallum (1995), Wolf (2000), Coughlin & Novy (2009) and Pacchioli (2011) who measure home bias and the border effect in offline trade.  We apply this framework to online international trade in goods between the 27 EU Member States.

The paper is structured as follows.  The next section presents a brief literature overview of the extant literature on international online trade and the use of gravity models in international trade, including the role and interpretation of the distance variable in these models.  Section 3 discusses the gravity model that we apply to this trade matrix.  Section 4 explains the data sources for the model.  The construction of the bilateral online trade matrix is explained in Annex 1.  Section 5 presents the estimation results. Section 6 summarizes and presents some policy-related conclusions.

## 2. Literature review

The gravity model is a well-known and often-used workhorse in international economics to explain the pattern of trade flows between countries.  Tinbergen (1962) was the first to suggest that Newton's law of gravity could be applied to trade flows between economies. Deardorff (1984) notes the somewhat dubious underpinnings of the gravity model in economic theory but nevertheless concludes that it is very successful in predicting trade flows. Over the last two decades the gravity model has undergone substantial improvement and modifications, especially after Anderson & Van Wincoop (2003) provided solid theoretical underpinnings and a reformulation of the original Tinbergen model. Since then it has become widely used in trade economics and beyond. Distance is a key variable in the gravity model. It is basically a catch-all term that proxies various sources of cross-border trade costs that affect the relative price of domestic and imported goods. This may include transport costs, import tariffs, differences in technical standards and regulatory regimes between countries that induce additional trade costs, and risks related to poor institutional quality and weak contract enforcement across borders. The higher the trade costs, the less outward-oriented or the more home-biased trade patterns will be. McCallum (1995) applies the gravity model to trade between Canadian provinces and US states. He finds that although Canadian provinces are often closer to neighbouring US states than to neighbouring provinces, the US-Canada border still constitutes a significant source of trade costs and thus a barrier to trade. Wolf (2000) uses gravity to estimate home bias as an alternative measure of border costs in trade between US states. As language, culture, regulatory regimes and technical standards are pretty much similar across US states, at least much more so than between the US and other countries, one would expect the border effect or home bias to disappear in trade flows between US states. His research shows that home bias is indeed substantially lower in intra-US trade than in intra-OECD trade but remains a significant trade barrier. In the absence of regulatory differences, this may simply reflect a "natural" degree of consumer preference for local suppliers. Closeness of buyers and sellers may enhance the perception of trust, verification of product quality and easier settlement of disputes. Coughlin & Novy (2009) extend Wolf's research to cover both domestic trade between US states and international trade between US states and foreign trade partners. Somewhat surprisingly, they find that the domestic border between US states constitutes a larger trade barrier than crossing the international US border. Frankel & Wei (1993) apply the gravity model to trade between EU countries and conclude that trade costs at intra-EU borders are significant despite the fact that all these countries belong to a customs union. Pacchioli (2011) compares home bias in the US and in the EU internal market, as a proxy measure of the success of the EU's drive to complete the Single Market. She uses data on trade flows between EU Member States and between states in the US. She finds a higher degree of home bias in the EU than in the US and concludes that there is still some way to go for the EU Single Market.

All the above work was conducted on traditional offline trade data. Empirical work on online trade flows has been very limited so far, mainly because of the absence of official statistics on online cross-border trade. Data are generated mainly by private companies involved in online e-commerce. Commercial interests stop them from publishing these data. A few empirical research papers have tried to circumvent this data gap and examine cross-border online operations from various indirect angles. Freund & Weinhold (2000) examine how the extent of internet penetration in countries affects their ordinary offline trade patterns. Blum & Goldfarb (2006) try to explain international internet click stream patterns using a gravity model. Their research focuses on online digital information products that can be transported across the internet at zero trade cost – anything but physical goods that need physical transport to reach the consumer. Still, they find that geographical distance plays a relevant role in these international purely digital transaction patterns. This finding is particularly true for digital products that depend on what they call "taste". Distance decreases the likelihood of a shared cultural context. For less taste and culture-dependent products distance has no statistically significant effect in their findings. This fits well with a comment by Grossman (1998) who notes that the usual order of magnitude of estimates of the distance elasticity in gravity models exaggerates the real cost of transport by at least an order of magnitude. He speculates that estimates of the distance elasticity must thus be due to other factors such as cultural differences and lack of familiarity between trading partners. Hortaçsu et al. (2009) are the first to look at actual online transactions in physical goods. They take a sample of intra-US trade observations from eBay and cross-border trade from MercadoLibre to examine the importance of distance in these transactions. They conclude that distance still has an impact on trade, though less so in online than in offline transactions. Lendl et al. (2012) uses eBay data on cross-border transactions between 62 countries for the period 2004-2007 to estimate a gravity model of online trade with several explanatory variables, including distance, transport costs, common language, border, legal regime or colonial background and quality of governance. They find that nearly all these factors generate less trade costs on eBay than in offline trade, except language and shipping costs – very much in line with our own findings.

The role of distance in international trade and the interpretation of the distance variable in gravity models of trade remains a difficult issue. Despite the decline in international transport costs and especially communication costs, the importance of distance does not appear to decline in gravity estimates over longer time periods. Disdier & Head (2008) perform a meta-analysis on 1467 estimates of the distance elasticity in gravity models. They conclude that the importance of distance decreased in international trade between 1870 and 1950 but since then it has been rising again. Berthelon & Freund (2003) show that this increase is not related to changes in the composition of trade. The importance of distance has increased for about 25% of all goods, mostly for homogenous goods sold on bulk exchange markets. Information on homogenous goods is easier to convey, mainly thanks to the fall in information costs. That results in a relative decline in the importance of information costs and a relative increase in the importance of distance-related transport costs. By contrast, differentiated products require more information and are thus relatively less sensitive to distance-related transport costs. Despite the fall in information costs, the ratio of distance to non-distance related trade costs for differentiated goods seems to have remained fairly constant. In contrast, Rauch (1999) argues that the fall in communication costs had a greater impact on differentiated goods than on homogenous goods.

## 3. The gravity model

In order to make sense out of the bilateral trade data generated by the consumer survey, we need an explanatory model for these trade flows. In line with previous research on online trade (Blum & Goldfarb, 2006; Hortaçsu, 2010; Lendl et al., 2012) we apply the well-known gravity model, the workhorse of international trade modelling. The gravity model explains the value of bilateral trade (*Tij*) between two countries i and j as a function of the product of the size of the two economies (proxied by GDP) and the distance (*Dij*) between them. This approach is essentially the equivalent of Newton's gravity theory from physics:

$$T_{ij} = \alpha(GDP_i x GDP_j) / D_{ij} \qquad (1)$$

The advantage of putting this model in log-log format is that the coefficients become elasticities. The value of b for instance is the percentage change in cross-border trade *Tij* induced by a one-percent change in GDPi.

$$\ln T_{ij} = \beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln D_{ij} + \varepsilon_{ij} \qquad (2)$$

Despite its strong empirical performance, this traditional version of the model had no roots in economic theory. Several authors (Deardorff (1998), Bergstrand (1990), Anderson (1979)) have provided some economic foundations for the gravity model. Anderson & Van Wincoop (2003) derive the gravity model from a consumer demand system based on a CES utility function. Consumers maximize utility by consuming goods produced in several regions, including their own, subject to a budget constraint. Prices differ between regions because of trade costs $t_{ij}$. Trade between countries i and j is not only a function of i,j specific factors but also affected by the presence and trade costs of other countries. The impact of i on j is thus a combination of bilateral and multilateral effects. McCallum's (1995) path-breaking work on cross-border trade between Canadian provinces and US states uses "remoteness" as a measure of multilateral resistance, i.e. the weighted average distance between a country and all its trading partners. Anderson & Van Wincoop (2003) criticize this remoteness concept because it has no theoretical economic foundations in gravity theory. They propose the inclusion of multilateral resistance terms for the importer and the exporter to proxy for the existence of unobserved trade barriers. They construct these terms as a function of each country's full set of bilateral trade resistance terms, using the observed variables in their model (distances, borders, and income shares). However, the computation of these terms is complex and highly data consuming. Alternatively, Feenstra (2002) proposes the introduction of importer and exporter fixed effects. The coefficient of the dummies for the importer and the exporter should reflect the multilateral resistance for each country. Moreover, the dummies would capture any other country specific characteristic that may influence trade. The main drawback of this approach is that the GDP coefficients are no longer observed, since in a cross-section analysis these variables are perfectly collinear with the dummies and should be dropped. Lendl et al (2012) use this method in the eBay study. A third option consists of introducing multilateral resistance terms for each explanatory variable (Baier & Bergstrand, 2009). This variable is not a dummy but calculated as the GDP-weighted average of the values for the relevant variables across all other trading partners. This method introduces an additional constraint in the regression because the value of the coefficient of the original variable and the multilateral resistance term need to sum up to zero.

We have experimented extensively with multilateral Anderson & Van Wincoop type gravity models with multilateral resistance terms and found that their performance is considerably weaker than the traditional gravity model. We therefore do not report on these experiments in this paper. Finally, we have opted for the Feenstra (2002) approach and introduce country specific fixed effects. Hence, the final specification of our variable is as follows:

$$\ln T_{ij} = \beta_0 + \beta_1 \ln D_{ij} + \eta_i + \eta_j + \varepsilon_{ij} \tag{3}$$

where $\eta_i$ and $\eta_j$ are a set of dummies for the importer and the exporter correspondingly.

Apart from the specification of the gravity model, Santos & Tenreyro (2006) question the estimation methods for gravity models. They argue that log-linearised gravity equations are potentially subject to biased estimation for two reasons: heteroskedasticity in the error term and zero values for some observations. The estimation of a stochastic version of the gravity equation with OLS assumes that the errors are normally distributed and not correlated with the explanatory variables. Heteroskedasticity tests show however that this is not always the case. Moreover, the logarithmic version of the gravity equation forces us to drop zeros and not available trade observations from the estimation because the logarithm of zero is not defined. OLS regressions simply drop all zero values for the dependent variable. This process discards information that may be useful for the regression. Santos & Tenreyro (2006) demonstrate that pseudo maximum likelihood (PML) is a less biased and more efficient estimator that avoids the problems of zero observations and heteroskedasticity. We report below on our PML estimates of the gravity model.

In addition, two-step estimation methods have been proposed in recent gravity literature. The reason is that, although some previous methods such as PPML allow for the inclusion of zeros, they do not provide any explanation for these zero trade observations. Two-step estimators allow including all zero observations in the sample and, what is more important, they provide a rationale for these flows. This is due to the fact that the decision on whether to trade or not and the decision on how much to trade are not modeled as completely independent. Instead, the model allow for some positive correlation between the error term in the selection and regression equations to better reflect the real decision process.

Among the two-step estimation procedures, the Helpman, Melitz & Rubinstein (2008) (HMR henceforth) approach has a particular importance. The authors claim that traditional estimates are biased not only due to selection but mainly due to the omission of the extensive margin.[1] According to them, the heterogeneity of firms introduces a bias in the estimation that should be taken into account. To correct it, they propose an extended version of Heckman model that introduces a correction for non-observable firm heterogeneity and fixed trade costs. In this model, the first step consists of the estimation of the probability of exporting using a Probit model. In this equation, some variables affecting the probability of exporting, but not the size of exports (exclusion variables) are included. HMR chooses variables related to trade barriers that affect fixed trade costs but do not affect variable (per-unit) trade costs. Using the residuals of this Probit regression, two correction terms are constructed. The first one is the usual Inverse Mills Ratio (IMR henceforth), which is the ratio of the probability density function and the cumulative density function evaluated at the predicted outcomes, divided by the standard error of the Probit estimation. This term allows controlling for the sample selection bias. The second correction term accounts for the selection of firms into export markets. In a B2C environment, it is assumed that only those firms that exceed a level of productivity will export to other countries. Hence, firms are assumed to be heterogeneous. Since we do not have firm level data, we follow the HMR proposal of assuming that if a number of firms in country *j* choose to export is because these firms can at least break even in terms their profits. These two additional terms to control for selection into the export market and for heterogeneity in firm-level productivity are functions of fitted values from the Probit and are introduced in an exponential way into the regression equation. Hence, the second step in HMR consists of the estimation of this equation using Nonlinear Least Squares. In section 5 we describe the result of OLS, PML and HMR estimation methods and compare the results.

The interpretation of the coefficient for the distance variable in the gravity equation is not straightforward. Apart from transport costs directly linked to geographic distance, it may also include import tariffs, costs due to regulatory differences between countries, financial transaction costs, and information costs to bring the trading partners together in a transaction, etc. Since we are looking at intra-EU trade, there are no import tariffs on these cross-border transactions. The distance elasticity may also measure differences in

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[1] The "new new trade theory" proposes a framework in which firms are heterogeneous and only the most productive firms decide to export to other countries. Consequently, trade flows can be decomposed in two components: the extensive margin -number of exporting firms in a country - and the intensive margin - the volume of trade per exporter.

regulatory barriers, combined with ways of getting around these barriers by switching from offline to online trade. The introduction of a legal governance quality variable may capture consumers' regulatory "regime switching" behaviour (see below).

Since goods still need to be physically transported to the consumer following an online transaction, we can assume that transport costs remain important in online trade. Online B2C trade usually implies transport of individual small parcels while offline B2B may benefit from economies of scale in large cargo consignments. Consequently, physical transport costs for goods bought online could actually be higher than offline. On the other hand, the higher number of intermediaries in offline trade (wholesalers, importers, etc) may add to offline trade costs. We have no data to compare online and offline trade costs between 27 EU member states and therefore limit the analysis to online trade costs only. We introduce as explicit parcel delivery cost variable in the gravity equation to test the importance of physical transport costs for online trade.

The gravity equation can also handle observations on domestic trade (country of origin and destination are identical, i=j). In that case, domestic distance is a measure of the size of a country. In line with the methodology applied by Pacchioli (2011), McCallum (1995) and Wolf (2000), we introduce a dummy variable for domestic trade observations in the gravity model. The coefficient on this dummy is an indicator of home bias, or the extent of consumer preference for domestic over foreign products. The home bias factor essentially measures the combined impact of all the variables that drive online (or offline) sales, including any omitted variables in the gravity equation such as "natural" preference for the home market. We calculate home bias only for online trade since we have no information on domestic sales for offline products. However, we can compare with home bias estimates for offline trade produced by other authors.

## 4. Data sources

While there is a wealth of statistics on ordinary offline cross-border trade, there are as yet no official statistics on online cross-border transactions. Companies involved in online trading have their own statistics on cross-border transactions but these offer only partial pictures, depending on the company's market position in different countries and product groups. In this paper we use a unique dataset from an online consumer survey in the 27 EU Member States (Civic Consulting, 2011). The survey contains information on consumer online expenditure on goods, at home as well as in foreign countries. We use these data to construct a 27 x 27 bilateral online trade matrix for the EU27. We also construct an offline trade matrix between the same trading partners and for the same types of goods, so that we can compare online and offline trade patterns. See Annex 1 for a detailed explanation on the construction of the online bilateral trade matrix.

A critical issue in the construction of the online matrix is the extrapolation from survey level to population level. We use Eurostat data for the percentage of population that is connected to the internet (see table in Annex 3). However, there is a large difference between the Eurostat and the survey figures for the share of online consumers who actually buy online and buy online abroad. Since the Eurostat figures (43 and 10% of the population respectively) are lower than the survey figures (63 and 32% respectively), we stick to Eurostat to avoid overestimation. The survey figures would suggest that the EU Digital Agenda policy targets of getting 50% of all EU consumers to buy online and 20% actually shopping online abroad have already been reached in 2011; the Eurostat data suggest otherwise.

Based on the consumer survey, we estimate the total value of online traded goods in and between EU Member States at about 241 billion €. Out of that total, 197 billion € (80%) is traded domestically. Only about 44 billion € (18%) crosses borders between EU Member States, and another 6 billion € (2%) is imported from non-EU countries. Comparing the value of estimated online cross border trade (44 billion €) and observed offline intra-EU trade in the corresponding products categories (491 billion €) (Comext, 2010), we conclude that online trade represents about 8.7% of all cross-border trade in the EU. This indicates that online orders for the relevant categories of goods constitute a significant part of physical cross-border trade in goods.

The question arises to what extent the offline and online trade figures are actually comparable. On the one hand, offline and online trade involve the sale of identical consumer products: books, electronics, clothing, etc. These are final products and the trade volume is determined by consumer demand for these goods. However, the organization of both supply chains is very different. Offline trade is mostly conducted business-to-business (B2B). Wholesalers export and import and use retailers as intermediaries before a good reaches the final consumer. By contrast, online trade is mostly B2C, with online wholesalers selling directly to final consumers. Differences in supply chains may, in turn, result in differences in the structure of the trade costs that underpin the two sets of trade flows. Wholesalers often have established relations with their foreign customers, with a fixed cost that can be amortized over many transactions. Transaction size is likely to be larger, again inducing economies of scale. Offline B2B cross-border trade figures would have to be augmented with retail gross price margins to produce a trade value figure that is comparable to direct B2C estimates. The above estimate of online B2C representing 8.7% of B2B cross-border trade should therefore be interpreted with caution.

Distance estimates were obtained from CEPII (2007). We use distance between capitals. Domestic distances are based on the greatest circle method. EU GDP figures are taken from Eurostat (2011). Besides the bilateral online trade estimates, we have complemented equation (3) with several explanatory variables that are expected to influence trade among countries. On top of the standard Newtonian gravity variables we add three types of explanatory variables:

**(a) Cultural and institutional variables:**

Contemporary applications of the gravity trade model routinely include shared language between trading partners as an explanatory variable, and in most cases this turns out to be significant. This is meant to capture the trade costs related to "cultural distance", signalled by Blum & Goldfarb (2006) and Grossman (1998). Language may be the most important measure of cultural distance, especially in a B2C trading environment where a shared language is essential. The relative importance of language may vary by type of good. It is likely to be more important for cross-border trade in books for instance, than for electronic goods that are more or less standardized across the world. Our dataset does not allow us to separate trade by type of good however. The three major languages spoken within the countries in the sample are English, French and German. We introduce dummies to capture to what extent these three languages influence online trade.

To measure the role of institutional quality in online trade, we add an indicator of the relative quality of the legal system, taken from the World Bank (2011) dataset of global governance indicators. This will capture the differences in expected trade costs related to dispute settlement between importers and exporters in online trade. One peculiar aspect of online B2C in the EU is that consumers buying abroad are still protected by consumer laws at home, not the law in the exporting country. This means that consumers do not really have a choice of legal regime in which they carry out their online transactions. Still, consumers may not be aware of this; even if they are, they may still trust foreign suppliers more than their domestic counterparts because of a subjective comparison of the quality of legal systems at home and abroad. If objective information dominates, the coefficient for this variable is expected to be close to zero. If subjective preferences dominate, the coefficient may be significantly different from zero and consumers "vote with their mouse" to move to a foreign legal regime.

**(b) Quality of the online enabling environment:**

It is important to identify possible trade costs linked to the specific organisational needs of online transactions in goods. Though they may be subsumed in the catch-all "distance" variable we introduce two explanatory variables explicitly related to the overall enabling environment for online trade in goods. Consumers need to have easy access to online means of cross-border payments to settle a transaction at the lowest possible transaction cost. We capture the maturity of online payment systems in two ways. First, the market share of cash payments on delivery is considered to be an indicator of the relative underdevelopment of payments systems, combined with an absence of trust in online payments and high transaction costs (the transport of money). Compared to credit or debit card payment systems, it is a costly and risky system as it involves the transport of large amounts of cash, and transporter and consumer need to be available at the same location and same point in time. Second, the market share of PayPal is taken as a proxy of the maturity of online payment systems whereby consumers trust a non-bank financial intermediary. It may however also point to deficiencies in the local banking system so that PayPal helps consumers to circumvent these deficiencies. Credit and debit cards are widely available in almost every country and supported by the banking system. We do not take the share of credit and debit cards as an indicator. These cards are very common in all EU countries and their share of transactions is highly negatively correlated with the previous two variables. In fact, cash-on-delivery and PayPal are also negatively correlated. To avoid multi-colinearity problems we use these variables in separate regressions. Both cash-on-delivery and PayPal indicators are obtained from the World Payments Report by CapGemini et al. (2011).

Furthermore, an efficient parcel delivery system needs to be in place to physically ship the goods from their warehouses to the consumer and to minimize physical transport costs and delivery time. As argued above, the shift from offline to online trade only reduces the information cost component of trade costs, not the physical transport cost; on the contrary, because of diseconomies of scale in parcel delivery compared to bulk cargo, physical transport costs may actually increase. We capture this by introducing a parcel delivery cost indicator: the ratio of foreign to domestic parcel delivery costs, taken from Meschi et al. (2011). We take foreign parcel delivery costs by country pair and direction of trade. Parcel transport costs are asymmetric for a given country pair.

## 5. Findings

We present three sets of results using the OLS, PPML and HMR regression techniques. For each regression technique we compare online and offline trade in the traditional gravity model setting, with GDP, distance, language and governance as explanatory variables. We then add more specific e-commerce related variables to the online gravity model: parcel delivery costs and online payments systems. Finally, we examine home bias in online trade.

The OLS results are presented in Table 1 in Annex 4. As can be observed, there are some important changes in the coefficients when trade is switched from offline to online platforms. The most apparent and most expected change is that the coefficient of the distance variable is about two times as high for offline (elasticity of -1.349) than for online (elasticity of -0.899) trade. Lendl et al. (2012) and Cowgill & Dorobantu (2012) find similar reductions in the distance coefficient. Distance matters far less for online trade, an empirical proof of the "death of distance" that is often associated with the rise of digital information technology and the internet and the corresponding decline in information costs. We have also run these regressions for pooled online and offline trade data and find that the difference between the online and offline coefficients is statistically significant.

However, as the importance of geographical distance, and the high analogue information costs that come with distance, decrease, other sources of information costs become more prominent in online trade, in particular language barriers. The coefficient for shared language between trading partners increases more than fourfold between offline (0.657) and online (2.564) trade. Lendl et al (2012) also find a fourfold increase in the importance of language in their eBay study.[2] In an offline B2B trade environment with established long-term relationships, economies of scale may facilitate the amortization of translation costs, for instance by means of translated catalogues or hiring multilingual staff to deal with foreign clients. This is more difficult in a B2C online trading environment where consumers have direct exchanges with e-merchants. Besides that, the dummies for the three dominant languages within the Union show a positive and significant coefficient, reinforcing our previous conclusion.

Table 2 presents Pseudo-Poisson Maximum Likelihood (PPML) estimates for the same gravity model specification. The Stata routine for this estimation was prepared by Santos & Tenreyro (2006). It deals with potential heteroskedasticity problems and missing or zero bilateral trade observations in log-linear gravity models. We can observe however similar changes in the coefficients for distance and language between online and offline as already observed in the OLS regressions. Most PPML coefficients are considerably larger than the corresponding OLS coefficients. The parcel delivery cost is still not significant; payments systems variables are significant with a lower coefficient for PayPal and a higher value for cash on delivery. On the other hand, the English, French and German language variables are not significant. The PPML results generally confirm and boost the statistical significance of the findings from the OLS regressions. However, the change of sign for the language coefficient and the statistical insignificance of the offline results are puzzling.

In Table 3, we present the results for the HMR estimation.[3] For each specification we present two columns. The first shows the results from the selection equation (Probit) that defines the probability of two countries trading. In the second column, the expected values of the trade flows, conditional on that country trading, are estimated using Nonlinear Least Squares (NLS) regression equation. A selection variable is required to identify the parameters on both equations.[4] This exclusion variable should affect only the decision process; in other words, it should be correlated with a country's propensity to export but not with its current levels of exports. HMR proposes to include two indicator variables based on regulation of entry costs, as well as common religion. Shepotylo (2009) propose several

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[2] The increase may be lower for eBay-specific trade because eBay has many language versions of its trading platform, probably more so than the average e-retailer website.

[3] We are grateful to Cosmina Dorobantu for sharing her STATA routines for the estimation of the HMR model.

[4] See Heckman (1979) for further information on this issue.

governance indicators of regulatory quality. Cowgill & Dorobantu (2012) construct an indicator based on the number of procedures to build a warehouse (World Development Indicators). We have opted for the Logistic Performance Index reported by the World Bank (2012). Table 3 shows that this variable is positive and significant in all cases for the Probit equation. The Inverse Mills Ratio is significant as well, indicating the presence of selection bias. Results are generally consistent with the two previous regressions and confirm the outcomes obtained using OLS and PPML.

Sharing a language is also shown to be an incentive to trade more. In addition, when the language of the exporter country is either English or French, there is an additional positive effect on trade. By the contrary, the coefficient for German is not significant. The results for parcel delivery and payments systems are very similar to those obtained in the previous regressions.

To obtain some policy conclusions, we have simulated an increase in the market share of PayPal in all countries. The result show that an increase in this share of 1% would lead to a 4% increase in trade. Analogously, an increase of 5% would lead approximately to a 24%. These results reinforce the perception that online payment systems are significant drivers in online cross-border trade.

All the above results are based on cross-border trade data online. For online trade we also have domestic trade data in the survey database. We can introduce these in the regressions. The introduction of a dummy variable for domestic online trade allows us to quantify the well-known phenomenon of home bias in international trade: the "inherent" preference to buy on the domestic market rather than abroad. We find a domestic dummy coefficient value of 2.804 in the OLS regressions and 2.811 in the HMR regressions. This results in a border effect in EU online markets of approximately 16 (exp(2.8) = 16). This means that consumers are about 16 times more likely to buy a product on the home market than on cross-border markets. This online home bias estimate is at the higher end of available estimates for overall offline trade. Since we do not have domestic trade values for the offline dataset, we can only compare our home bias in online trade with estimates for offline trade from the available economic literature. For example, Pacchioli (2011) compares home bias in offline trade for EU Member States and US states. Depending on the specification of the gravity model, she finds border effects in the EU between 7.4 and

24: EU Member States are between 7 and 24 times more likely to buy at home than in any other EU Member State, considerably higher than in the US where border effects are estimated to be between 2.6 and 7. One can question whether our finding for online trade, based on a limited number of online traded consumer products, is comparable with the home bias values found for overall goods trade patterns, including consumer goods as well as intermediates and primary products. Ideally, the comparison would have to be made for a similar product composition. If not, selection bias may lead to distorted results. More research will be required to get a better understanding of the magnitude and sources of home bias in online trade, compared to offline trade. Understanding this mechanism is important for policy makers who want to boost online cross-border trade.

## 6. Summary and conclusions

We could paraphrase Marc Twain and say that “rumours about the death of distance are greatly exaggerated”. Nevertheless, there is some truth in this rumour. First, the results show that the importance of geographical distance is strongly reduced in online trade, compared to offline trade, due to a drastic reduction in information costs in the digital economy that enables consumers to scan a much wider territory to satisfy their wishes and place their buying orders. These findings can contribute to the debate on trends in international trade costs, building on the arguments explored by Berthelon & Freund (2008) and Disdier & Head (2008). On the other hand, there is a strong increase in the trade costs associated with crossing linguistic borders. The change in coefficient values for distance and language is confirmed across different regression models. We could discard geographical distance as a self-standing explanatory variable and replace it with parcel delivery costs. Second, the three models that we run fail to confirm the statistical significance of the quality of legal governance, the cost of parcel delivery and the efficiency of online payments systems in explaining cross-border online trade in the EU. While the coefficients for these variables have the expected sign, their statistical significance is limited in most cases. This leaves policy makers with little regulatory margin to boost cross-border online trade. It makes it difficult to predict whether EU policies that aim to increase competition in parcel delivery, and strengthen online payment systems are a step in the right direction. Third, the results provide a preliminary indication that home bias is not significantly different in online markets and traditional offline trade. Despite the fact that reduced information costs widen the market for consumers and facilitate buying abroad, consumer still have a strong tendency to buy at home. Language barriers certainly play an important role here, but other as yet unobserved variables may also be part of the explanation. In particular, we have not been able yet to examine the role of consumer perceptions for buying abroad, compared to the perceived risks of buying at home. Further research is required in this domain.

The total volume of consumer online expenditure is likely to increase over time as more consumers become more confident with online shopping and move a larger share of their shopping online. An important limit on that growth potential is the composition of the online shopping basket. The consumer survey shows that this is heavily biased towards a limited number of goods such as electronics, clothing, music/film and a few other items. The online shopping basket differs considerably from the overall consumer goods basket, probably because other types of goods do not lend themselves so easily to online trade. Further research is also needed to explain the composition and restrictions on the online consumer basket and explore ways to widen the range of goods that can be traded online. Even if the total volume of online shopping still has very considerable growth potential, the gravity model indicates that the ratio of domestic to foreign online shopping may not change that much because it is held back by linguistic fragmentation in the EU market. Since only 36 out of 702 EU27 country pairs share a common language, online retailers who want to expand their business abroad are strongly advised to have a range of language versions of their websites. However, it is difficult to see how language could become a policy variable; there is probably little that EU policy makers can do in that respect.

A final word of caution. This analysis is based on a single EU consumer survey data set that offers some unique insights into the value and direction of online cross-border trade between EU countries. Obviously, these data do not have the same validity as the far more comprehensive and detailed international offline trade in goods statistics that have accumulated over the years. They offer a first insight but more effort will have to go into the construction of more comprehensive and reliable online cross-border trade data sets that will enable a more detailed and rigorous testing of the drivers and impediments to online cross-border trade. The studies by Lendle et al. (2012) and Cowgill & Dorobantu (2012) offer more support for some of the findings in this dataset. Further work would have to include more details on product-specific cross-border trade, transport costs, prices and information costs.

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## ANNEXES

### Annex 1: The construction of the online bilateral trade matrix

For the purpose of this paper we use a unique dataset from an online survey of 29.100 consumers in the 27 Member States of the EU, carried out by Civic Consulting (2011) on behalf of the European Commission. The advantage of consumer survey data is that they offer a more comprehensive picture, not affected by specific market and product biases of company data. The disadvantage of this survey is that it generates no details on products and prices and only provides an overall expenditure pattern. Eurostat household and firm level survey data also offer some insights into consumer online spending and company online sales. However, they provide no information on the geographical direction of cross-border online trade; consequently, they could not be used for the purpose of this research. Another major advantage of the consumer survey is that it covers online trade in goods, a subject on which there is little information to date. At the same time, the fact that it covers goods only constitutes a major limitation. Online trade in services is probably more important than online goods trade.

The survey also makes an explicit distinction between online expenditures on domestic and foreign websites. One may question if consumers are consistently able to distinguish between these categories. The dot com or country extensions of web addresses are not always a good indicator of the actual geographical location of the supplier. Some major e-merchants have physical supply networks that are unrelated to the website addresses. That opens up several possibilities for the definition of cross-border online trade in goods. The simplest definition is an online transaction that triggers a flow of goods crossing one or more national borders. However, these may not necessarily be the same border(s) as between the country of residence of the buyer and the country of origin of the website of the seller – depending on where the warehouse of the seller is located. Another possible definition is a transaction that triggers a financial transfer across national borders, independently of the underlying physical transaction. In this study we stick to the simple definition and assume that the physical delivery and the financial transaction follow the same geographical pattern. In the underlying consumer survey data it is assumed that cross-border online trade means that the good crosses at least one state border.

Questionnaires were administered through computer-assisted web interviews.[5] As such, they cover consumers who have internet access and could potentially carry out e-commerce transactions, though not all of them actually do so. Overall, 85% of the respondents in the sample are online shoppers, i.e. they bought at least one product online in the twelve months prior to the survey date. This compares to an EU average of 52% of respondents who have Internet access at home and who do online shopping, according to a recent Eurobarometer (2011) survey. Online panels may over-represent online shoppers, though there are no a-priori reasons to give more credibility to either of these surveys. It is possible that online panels are biased towards consumers who feel more at ease with computers and the internet. Oversampling is not problematic when the data are used to analyze the patterns of domestic and foreign online shopping. We should however bear the potential risks of oversampling in mind when we extrapolate the survey data to population levels to estimate the extent and total value of online shopping. We use the more conservative Eurobarometer (2011) data to extrapolate, to avoid overestimation. Panel size was approximately 1000 per country, with some variation according to country size. Country survey panels were built to ensure that all key demographic groups (e.g. gender, age, region, household size, occupation) are represented. The sample distribution for gender and age is close to the national figures.

The survey questionnaire contains information about the number of domestic and foreign online transactions over the last 12 months, the countries where cross-border transactions where made, and the amount of money spent on domestic and foreign transactions. We use this information to construct a first matrix of the sample-level value of online transactions among the 27 EU Member States. Theoretically, the matrix could contain up to 27 x 27 = 729 trade observations. In practice, some cells are empty when no cross-border transactions are reported for particular pairs of countries. The survey also contains information on cross-border transaction with non-EU countries: the US, China, Norway, Iceland and Switzerland, and the residual category Rest of the World. The diagonal line of that matrix contains the value of domestic online transactions. For the non-diagonal cells (cross-border trade), we use survey information on the total amount spent per consumer on cross-border transactions over the last 12 months, and the countries where this spending took place. We calculate average spent for each consumer per cross-border transaction

[5] Except for Malta and Cyprus where interviews were administered by telephone.

and apply the same average to all transactions, assuming that all cross-border transactions for a given consumer have the same value. This is admittedly a simplification but survey data do not allow us to be more specific.

Since all country survey samples have a more or less similar size of 1000 respondents, the sample-level trade matrix is not representative of the population-level trade pattern in the EU. Ten percent of respondents in Malta doing a transaction with the rest of the EU have not the same economic weight as 10% of German respondents doing a cross-border transaction. We therefore construct a second trade matrix at population level, using the ratio of sample (online) population to total (online) population as a multiplier. Total online population figures are taken from Eurostat (see Annex 3)

## Annex 2: Frequency distribution by type of good in the sample survey

| | |
|---|---|
| Electronics | 19% |
| Cloth & shoes | 17% |
| Books | 10% |
| Music/video | 6% |
| Cosmetics | 6% |
| Software | 6% |
| Electrical | 6% |
| Toys | 5% |
| Sports eq. | 4% |
| Car parts | 3% |
| Furniture | 2% |
| Tools | 2% |
| Medicines | 2% |
| Other | 12% |
| | |
| TOTAL | 100% |

Source: Civic Consulting (2011) and own calculations

## Annex 3: Percentage of population buying online and abroad

| Country | Population ('000) | % online | % online that buys | % online that buys abroad | % pop that buys online /Survey | % pop that buys online abroad /Survey | %pop that buys online /Eurostat | %pop that buys online abroad /Eurostat |
|---|---|---|---|---|---|---|---|---|
| Austria | 8.372 | 80% | 96% | 77% | 76% | 62% | 44 | 32 |
| Belgium | 10.827 | 83% | 84% | 51% | 69% | 43% | 43 | 24 |
| Bulgaria | 7.576 | 51% | 72% | 34% | 37% | 17% | 7 | 3 |
| Cyprus | 801 | 58% | 57% | 56% | 33% | 32% | 21 | 18 |
| Czech | 10.512 | 73% | 96% | 24% | 70% | 18% | 30 | 5 |
| Denmark | 5.547 | 91% | 95% | 55% | 86% | 50% | 70 | 28 |
| Estonia | 1.340 | 77% | 72% | 26% | 56% | 20% | 21 | 10 |
| Finland | 5.350 | 89% | 94% | 52% | 84% | 47% | 62 | 28 |
| France | 64.709 | 80% | 94% | 40% | 75% | 32% | 53 | 14 |
| Germany | 81.757 | 83% | 97% | 41% | 81% | 34% | 64 | 9 |
| Greece | 11.125 | 53% | 91% | 57% | 48% | 30% | 18 | 7 |
| Hungary | 10.013 | 70% | 69% | 15% | 48% | 10% | 22 | 4 |
| Ireland | 4.468 | 77% | 89% | 74% | 68% | 57% | 43 | 22 |
| Italy | 60.397 | 57% | 86% | 50% | 49% | 28% | 15 | 5 |
| Latvia | 2.249 | 72% | 70% | 38% | 50% | 27% | 20 | 8 |
| Lithuania | 3.329 | 65% | 74% | 32% | 48% | 21% | 16 | 5 |
| Luxemburg | 502 | 91% | 82% | 75% | 75% | 69% | 65 | 56 |
| Malta | 416 | 69% | 59% | 58% | 41% | 40% | 45 | 38 |
| Netherlands | 16.577 | 92% | 89% | 29% | 82% | 27% | 69 | 14 |
| Poland | 38.164 | 65% | 95% | 27% | 62% | 18% | 30 | 2 |
| Portugal | 10.637 | 58% | 81% | 43% | 47% | 25% | 18 | 7 |
| Romania | 21.466 | 44% | 79% | 19% | 35% | 9% | 6 | 1 |
| Slovakia | 5.424 | 78% | 96% | 47% | 75% | 36% | 31 | 11 |
| Slovenia | 2.054 | 69% | 79% | 36% | 54% | 25% | 37 | 11 |
| Spain | 47.150 | 69% | 84% | 46% | 58% | 32% | 27 | 9 |
| Sweden | 9.348 | 94% | 95% | 43% | 89% | 40% | 71 | 16 |
| UK | 62.042 | 87% | 97% | 45% | 84% | 39% | 71 | 10 |
| TOTAL % | | 74% | 85% | 44% | **63%** | **32%** | 43% | **10%** |
| TOTAL # | 502.152 | 370.069 | | | | | | |

*Source: Eurostat for population and percentage online, online buyers and buyers abroad from the Civic Consulting (2011) consumer survey and from Eurostat.*

## Annex 4: Regression results

### Table 1: OLS estimates

| VARIABLES | (1) logCBT | (2) logCBT | (3) logCBT | (4) logCBT | (5) logCBT | (6) logCBT | (7) logCBT |
|---|---|---|---|---|---|---|---|
| lnDistance | -0.899*** | -1.349*** | -0.723*** | -0.773*** | -0.773*** | -0.639*** | -0.899*** |
| | [0.0812] | [0.0997] | [0.0983] | [0.117] | [0.117] | [0.0955] | [0.0812] |
| Common Language | 2.564*** | 0.657** | 1.307*** | 1.305*** | 1.305*** | 1.505*** | 2.564*** |
| | [0.268] | [0.287] | [0.221] | [0.265] | [0.265] | [0.215] | [0.268] |
| Postal Costs | | | -0.00429 | | | | |
| | | | [0.0113] | | | | |
| Paypal | | | | 0.0685*** | | | |
| | | | | [0.00639] | | | |
| Cash | | | | | -0.00927** | | |
| | | | | | [0.00466] | | |
| Home bias | | | | | | 2.804*** | |
| | | | | | | [0.375] | |
| English | | | | | | | 4.131*** |
| | | | | | | | [0.515] |
| French | | | | | | | 2.909*** |
| | | | | | | | [0.489] |
| German | | | | | | | 1.510*** |
| | | | | | | | [0.498] |
| Constant | 11.22*** | 15.22*** | 10.39*** | 10.35*** | 10.95*** | 9.723*** | 9.706*** |
| | [0.598] | [0.702] | [0.642] | [0.794] | [0.794] | [0.660] | [0.749] |
| Observations | 610 | 701 | 582 | 363 | 363 | 610 | 610 |
| R-squared | 0.838 | 0.878 | 0.837 | 0.873 | 0.873 | 0.857 | 0.838 |

Notes: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Paypal is defined as the logarithm of market share of PayPal in transactions in importing country. Cash is the logarithm of market share of cash-on-delivery transactions in importing country

**Table 2: PPML estimates**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| VARIABLES | CBT | CBT | CBT | CBT | CBT | CBT | CBT |
| lnDistance | -4.340*** | -0.573*** | -0.222** | -0.223* | -0.223* | -0.512*** | -4.340*** |
| | [0.731] | [0.0798] | [0.102] | [0.132] | [0.132] | [0.106] | [0.731] |
| Common language | 3.996*** | 1.197*** | 1.775*** | 1.880*** | 1.880*** | 1.332*** | 3.996*** |
| | [0.308] | [0.216] | [0.186] | [0.228] | [0.228] | [0.339] | [0.308] |
| Postal Costs | | | 0.0196 | | | | |
| | | | [0.0142] | | | | |
| Paypal | | | | 0.0343*** | | | |
| | | | | [0.00514] | | | |
| Cash | | | | | -0.261*** | | |
| | | | | | [0.0391] | | |
| Home bias | | | | | | 5.300*** | |
| | | | | | | [0.273] | |
| English | | | | | | | 0.0393 |
| | | | | | | | [2.437] |
| French | | | | | | | 0.623 |
| | | | | | | | [2.356] |
| German | | | | | | | -1.802 |
| | | | | | | | [2.473] |
| Constant | 27.25*** | -2.854*** | 4.449*** | 4.510*** | 6.349*** | 6.711*** | 29.05*** |
| | [3.511] | [0.513] | [0.732] | [0.927] | [0.914] | [0.675] | [4.761] |
| Observations | 729 | 702 | 701 | 390 | 390 | 729 | 729 |
| LogLikelihood | -181669 | -5.636 | -7952 | -5930 | -5930 | -15001 | -181669 |

Notes: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Paypal is defined as the logarithm of market share of PayPal in transactions in importing country. Cash is the logarithm of market share of cash-on-delivery transactions in importing country.

## Table 3: The HMR gravity model

| VARIABLES | (1) Probit | (2) NLS | (4) Probit | (5) NLS | (7) Probit | (8) NLS | (10) Probit | (11) NLS | (13) Probit | (14) NLS | (16) Probit | (17) NLS | (19) Probit | (20) NLS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| lnDistance | -0.353*** | -0.771*** | -0.713*** | -1.139*** | -0.425*** | -0.627*** | -1.079*** | -0.429** | -0.771*** | -0.580*** | -0.353*** | -0.493*** | -0.384*** | -0.751*** |
| | [0.0988] | [0.108] | [0.226] | [0.0914] | [0.108] | [0.111] | [0.248] | [0.170] | [0.215] | [0.159] | [0.0988] | [0.104] | [0.101] | [0.0925] |
| Common language | | 2.073*** | | -0.0600 | | 1.235* | | 0.970*** | | 0.990** | | 0.774 | | 1.778*** |
| | | [0.667] | | [0.279] | | [0.693] | | [0.264] | | [0.406] | | [0.563] | | [0.335] |
| Logistic Index | 0.536*** | | -0.890*** | | 0.503*** | | 0.681** | | 0.568** | | 0.536*** | | 0.466*** | |
| | [0.148] | | [0.339] | | [0.149] | | [0.283] | | [0.272] | | [0.148] | | [0.148] | |
| Postal Costs | | | | | 0.0102* | -0.0120 | | | | | | | | |
| | | | | | [0.00565] | [0.0106] | | | | | | | | |
| Paypal | | | | | | | 0.0505*** | 0.0427*** | | | | | | |
| | | | | | | | [0.0130] | [0.0115] | | | | | | |
| Cash | | | | | | | | | -0.0121* | -0.461*** | | | | |
| | | | | | | | | | [0.00618] | [0.0541] | | | | |
| German | | | | | | | | | | | | | 0.793* | 0.381 |
| | | | | | | | | | | | | | [0.467] | [0.278] |
| IMR | | -0.460 | | -1.084*** | | -0.745** | | -0.618 | | -0.358 | | -0.387 | | -0.268 |
| | | [0.377] | | [0.329] | | [0.353] | | [0.403] | | [0.483] | | [0.364] | | [0.345] |
| Home bias | | | | | | | | | | | | 2.811*** | | |
| | | | | | | | | | | | | [0.319] | | |
| English | | | | | | | | | | | | | | 2.252*** |
| | | | | | | | | | | | | | | [0.450] |
| French | | | | | | | | | | | | | | 1.040** |
| | | | | | | | | | | | | | | [0.460] |
| Constant | -7.222*** | 14.21*** | -6.861** | 11.70*** | -6.645*** | 14.18*** | -3.431 | 11.86*** | -5.952** | 16.25*** | -7.222*** | 12.33*** | -6.350*** | 13.32*** |
| | [1.114] | [1.080] | [2.797] | [0.826] | [1.138] | [1.010] | [3.117] | [1.428] | [3.015] | [1.699] | [1.114] | [0.921] | [1.134] | [0.827] |
| Observations | 674 | 610 | 674 | 701 | 673 | 582 | 371 | 363 | 371 | 363 | 674 | 610 | 602 | 610 |
| LogLikelihood | -244.5 | -719.5 | -56.57 | -539.1 | -243.0 | -582.0 | -64.10 | -253.0 | -69.29 | -262.3 | -244.5 | -635.3 | -236.7 | -703.4 |

Notes: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

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Abstract
There are no official statistics on international online trade in goods so far. This paper uses a consumer survey to construct a unique matrix of online B2C domestic and cross-border trade in goods between the 27 EU Member States. We compare online and offline trade patterns for similar goods. We find that the standard gravity model performs well in explaining online cross-border trade flows. The model confirms the strong reduction in geographical distance-related trade costs, compared to offline trade. However, the trade costs associated with crossing language barriers increase when moving from offline to online trade. Institutional variables such as the quality of legal institutions, online payments facilities and cost-efficiency of parcel delivery systems might play a role in cross-border trade but they remain statistically insignificant in this dataset. In a linguistically segmented market like the EU, online home market bias remains high compared to bias in offline cross-border trade. We conclude that it is hard to predict at this stage whether regulators could boost online cross-border trade through improvements in legal and financial systems, and parcel delivery infrastructure.

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