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RÉSUMÉ – Cet article estime les coûts des échanges de services en utilisant un modèle de gravité dans le cas des importations de services de 22 pays européens à partir de 43 pays partenaires et pour 17 secteurs de services sur la période 2005 à 2012. Il analyse les échanges en termes de caractéristiques de service en plus des variables de gravité traditionnelles. La nécessité de la proximité entre le fournisseur et le client continue d'entraver les échanges de services, bien que moins que par le passé.

MOTS-CLÉS – Échange de services, équations de gravité, coûts commerciaux, intangibilité, services de proximité, chaînes d'approvisionnement

SMITH (Peter M.), « Trade costs and services »

ABSTRACT – This paper estimates trade costs for services using a gravity model for imports of services to 22 European countries from 43 partner countries for 17 service sectors covering the period 2005 to 2012. It analyses trade in terms of service characteristics in addition to traditional gravity variables. The need for proximity between supplier and client continues to depress trade in services, albeit less so than in the past.

KEYWORDS – Trade in services, gravity equations, trade costs, intangibility, proximity services, supply chains

TRADE COSTS AND SERVICES

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INTRODUCTION

Twenty-five years after the date set for completion of the European Single Market, import penetration for non-financial commercial services in the EU at 6 % remains very low (Smith, 2015). It contrasts with the situation with regard to goods (36 %) and also with regard to permanent presence, for which there has been substantial cross-border investment. What can explain this low level of cross-border trade in services? This paper seeks to investigate possible reasons for "missing trade" in services with the help of gravity equations and recent disaggregated services trade data for a sample of European countries.

The paper innovates in five ways. First it uses data for more services than other studies, which is important because services are very heterogeneous in the way they are traded. Second the data is quite recent, covering the years 2005 to 2012. Since the advent of the Internet has brought significant changes to the ways that services can be traded and associated costs, recent data is important. Third it provides substantial coverage of new Member States and their trade in services. Fourth it extends the usual explanatory variables for trade to a new set of characteristics that distinguish one service from another. Fifth it relates the amount and development of cross-border trade in services to recent developments in the literature on international trade.

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I. STRUCTURAL GRAVITY MODEL

Gravity equations have become the workhorse of the literature on international trade, but to apply gravity equations correctly five different issues need to be addressed: the correct specification of the basic gravity equation, the problem of missing or zero values for trade flows, heteroscedasticity, endogeneity of explanatory variables and aggregation bias. These will be taken in turn.

Gravity equations can be applied in a wide class of models provided that trade across countries can be analysed separately from production and consumption within countries (Anderson and van Wincoop, 2003; 2004). Bilateral trade depends on relative trade barriers. It follows that the gravity model can only identify relative costs. Anderson and van Wincoop (2004) summarise their model as a system with a CES demand structure in which:

$$X_{ij}^k = \frac{E_j^k Y_i^k}{Y^k}\left(\frac{t_{ij}^k}{P_j^k \Pi_i^k}\right)^{1-\sigma_k} \quad (1)$$

$$\left(\Pi_i^k\right)^{1-\sigma_k} = \sum_j \left(\frac{t_{ij}^k}{P_j^k}\right)^{1-\sigma_k} \frac{E_j^k}{Y^k} \quad (2)$$

$$\left(P_j^k\right)^{1-\sigma_k} = \sum_i \left(\frac{t_{ij}^k}{\Pi_i^k}\right)^{1-\sigma_k} \frac{Y_i^k}{Y^k} \quad (3)$$

where X_{ij}^k is defined as exports from i to j (or imports of j from i) in product class k, σ_k is the elasticity of substitution among brands, E_j^k is total expenditure on product k in country j, Y_i^k is total sales of product k from country i to all destinations and Y^k is world output in sector k. P_j^k and Π_i^k can be solved as a function of the trade barriers t_{ij}^k and the set $\{Y_i^k, E_i^k\}$. P_j^k and Π_i^k are the inward and outward multilateral resistance variables and must be estimated in some form in any structural gravity model.

Several different estimation methods are consistent with theory and account for multilateral resistance terms (Head and Mayer, 2014). Fixed effects has become the method of choice. For multi-product panel data, the correct specification is for importer*time*product and

exporter*time*product fixed effects. One key advantage of the fixed effects approach is that it is very parsimonious in data. Only the data on exports or imports disaggregated by origin and destination is required. For cross-border trade in services, fixed effects have an important advantage. Barriers to trade in services do not typically take place at the border, but behind the border in the form of domestic regulation that even if non-discriminatory can constitute a barrier to trade (Crozet et al., 2012). Country fixed effects can control for these type of country varying regulations but they are not separately identifiable within the fixed effects.

From the earliest versions of the gravity equation it has been the custom to take logs of the trade variables thus transforming a multiplicative model into an additive one that can be estimated with OLS. However, one of the consequences of taking logs is to drop all observations with a zero or missing value. Since all data sets for international trade contain many zeros and the proportion usually rises with the degree of product disaggregation, ignoring zero and missing values can be a source of substantial selection bias. To deal with zero values it has now become standard to estimate gravity equations using Poisson pseudo-Maximum Likelihood (PPML) in the place of OLS (Santos Silva and Tenreyro, 2006). To correct for standard errors when faced with heteroscedasticity, robust methods clustered on the country pair, *ij*, should be used.

The Poisson regression model specifies the count y to have a conditional mean of the exponential form (Anderson et al., 2015):

$$E(X|Z) = \exp(Z'\beta) = \frac{Y_i E_j}{Y}\left(\frac{\tau_{ij}(\beta)}{\Pi_i \mathrm{P}_j}\right)^{1-\sigma} \qquad (4)$$

Which following Anderson *et al*. (2015) can be estimated as:

$$X_{ij}^k = \chi^k x_i^k m_j^k \tau_{ij}^k + \varepsilon_{ij,} \ \forall i,j \qquad (5)$$

Where χ^k denotes the constant, x_i^k is an exporter fixed effect for country *i*, m_j^k is an importer fixed effect for country *j*, and τ_{ij}^k is a trade

cost factor representing the effect of gravity forces that reduce bilateral trade between i and j, X_{ij}. They point out that when sufficient data are available to distinguish between trade within and between countries, it is possible to include and identify τ_{ii}, the intra-cost trade cost. Its relationship to τ_{ij}, $i \neq j$ reflects the relative cost of crossing a border.

Anderson *et al.* (2015) model the unobservable bilateral trade frictions τ_{ij}^{k} by a standard set of observables in the gravity literature, but extend the standard gravity specification to include a direct measure of the border effect which is possible when data on internal trade is available:

$$\tau_{ij}^{k} = exp\big(1 - SCMTRY_{ij}\big)\big[\beta_1 lnDIST_{ij} + \beta_2 CNTG_{ij} + \beta_3 LANG_{ij} + \beta_4 CLNY_{ij}\big] + \beta_5 SMCTRY_{ij} \quad (6)$$

$lnDIST_{ij}$ is the log of the distance measured between country i and country j, $CNTG_{ij}$ takes the value of 1 when two countries share a common border and 0 otherwise, $LANG_{ij}$ takes the value of 1 when two countries share a common official language and 0 otherwise, $CLNY_{ij}$ takes the value of 1 when two countries share a common colonial past and 0 otherwise. $SMCTRY_{ij}$ is an indicator variable equal to 1 if $i=j$ and zero otherwise. According to Anderson et al. (2015), $SMCTRY_{ij}$ has the advantage of being an exogenous variable that picks up all the relevant forces that discriminate between internal and international trade.

Several commonly used variables in gravity equations, including membership of the European Union, of a regional trade agreement in general or sharing a common currency are clearly endogenous. To correct for endogeneity bias several approaches have been suggested including instrumental variables, first differencing and matching econometrics (Anderson and van Wincoop, 2004; Baier and Bergstrand, 2007; 2009). The problem of endogeneity cannot be dealt with effectively in the context of standard structural gravity equations and therefore the issue is left to be covered separately.

Aggregation bias results from estimating trade costs with aggregate data when trade costs vary at the disaggregate level, which can happen with aggregation over trading partners or aggregation over products (Anderson and van Wincoop, 2004). This is highly likely with services.

Anderson and van Wincoop's recommendation is to disaggregate. But disaggregation can never be as fine as reality, so some degree of aggregation bias is inevitable.

II. LITERATURE REVIEW

The relative importance of different forms of trade in services differs from that in trade in goods (Lejour and Smith, 2008). Nevertheless there are some signs that trade in services and trade in goods are becoming more similar. Value added trade has highlighted the importance of imported components for trade in goods and the attendant breakdown in individual tasks that this implies (Baldwin, 2016). Increasing tradability of services cross-border has led to a similar rise in back office tasks in IT and services such as call centres. Because most cross-border trade in services are those sold to other businesses, such trade has a dual role as an enhancer of efficiency in using firms as well as expanding possibilities for specialisation and economies of scale in the firms supplying the service.

Trading either goods or services incurs transaction costs. It is the nature and amount of these costs compared to those incurred by domestic suppliers that determines to a large degree the amount of trade. Trade costs are as applicable to services as they are to goods (Miroudot et al., 2013). However the nature and level of trade costs for services are not necessarily the same as those for goods because of different characteristics of services and because they are traded in a number of different ways to goods.

The OECD divides trade costs into three categories according to whether they occur behind the border, getting to the border or at the border (OECD, 2013). For services, most barriers occur behind the border. In particular differences in regulation, even when non-discriminatory, can raise costs to trade. Kox et al. (2004) show that heterogeneity in regulation hampers bilateral service trade in the EU, and also bilateral direct investment.

Anderson and van Wincoop illustrate the difficulties and drawbacks of measuring costs directly whether for policy barriers such as tariffs,

transport or distribution costs. As a result most trade costs are inferred from trade flows mainly using the gravity model outlined in the previous section in order to relate unobservable costs to observable variables. Since the theoretical gravity model infers unobservable trade costs by linking trade costs to observable cost proxies, the choice of those proxies as well as their functional form constitute important determinants of the degree to which gravity equations effectively model trade costs. The relevance of the commonly used proxies for trade in services needs to be examined critically. This applies in the first instance to transport costs, since services do not typically incur such costs. The role of distance, which can be directly linked to transport costs for goods, can therefore be expected to be different for services than for goods.

Where distance can be expected to play a similar role for services than for goods is for those services that involve the physical transfer of something or someone from one place to another. This obviously covers transport services themselves as well as for instance postal services that convey mail or parcels. Imports or exports of transport services are a necessary counterpart for trade in goods and should vary with the distance to be transported. While it is to be expected that the distance variable is important for all types of transport service, it is likely to be non-linear and of a different order for the different modes and between passengers and freight.

Hirsch provides a theoretical justification for the importance of distance for trade in services based on the inherent characteristics of services (Hirsch, 1989). His analysis of trade in services turns around the degree and forms of interaction between producer and user, which is formalised as the fraction of the total costs of service to the user incurred during that interaction. To the extent that cost and time of travel depends on distance, one would expect that services requiring proximity would be most likely to be affected by distance and therefore incur increased costs for cross-border trade. Technology can weaken the effect of proximity on trade as it has already for services that can be supplied over the internet.

Services which can be delivered electronically without any interaction between supplier and client ought to be distance free since costs are not related to distance. However, gravity holds in the case of digital goods consumed over the Internet that have no trading costs (Blum

and Goldfarb, 2006). Americans are more likely to visit websites from nearby countries, even controlling for language, income, immigrant stock, etc. Furthermore, this effect only holds for taste-dependent digital products, such as music, games, and adult content. For non-taste-dependent products, such as software, distance had no statistical effect.

The commonly used contiguity or adjacency variable often found in gravity equations is clearly not independent of distance, since adjacent countries must be closer together than non-adjacent ones. The question then arises what in addition to distance are the costs to which contiguity refers. In the case of services and the EU contiguity may play a specific role for local cross-border markets, which cover a third of the EU population. Here it would be feasible to provide services cross-border which are locationally constrained such as plumbing, distribution or professional services such as accountancy for small businesses as takes place within the US for local cross-state markets.

Common language is the variable most often found in gravity equations after distance and contiguity. The relationship between language and trade costs has been examined in more detail, but only with regard to goods (Melitz, 2008; Melitiz and Toubal, 2014). For certain forms of commerce, such as e-commerce, translation may be sufficient to overcome barriers to commerce. When interaction with clients becomes important then the ability to function in a common language is also required. The costs associated with translation or hiring competent speakers in a foreign language are obviously not the same. Using four different measures of language and a decomposition of bilateral trade between homogeneous goods, listed goods and differentiated goods, Melitz and Toubal find that for differentiated goods, which most resemble services, both common official language and common spoken language are significant.

The nature of language related costs for services deserves further examination. Particularly when language is used as a proxy for trust, it is better to measure those dimensions directly. Trust for instance has been found to have a significant influence on the willingness of consumers to purchase cross-border on-line even where there are no significant barriers to doing so (Devlieger, 2013; Palmans, 2015). The influence of trust on trade in goods has also been found to have a significant effect (Guiso et al. (2004).

Separating cultural values and communication is less straight forward since language serves both as a means of communication and as an insight into the culture of a foreign country. Language related costs may be quite different for different services or even for the same or related services. For audiovisual services such as television programmes or films it may be sufficient to limit translation to sub-titles where the population is sufficiently conversant with the foreign language, the typical situation for English language programmes in Scandinavia. In other countries such as Germany or France, these programmes are generally dubbed into the native language, entailing a different set of costs.

Just as contiguity and distance are clearly related, language and former colonial ties are also related. The language of former colonisers may remain widely spoken even when it is no longer an official language as is the case for French in Morocco, Algeria and Tunisia. Where the coloniser's language becomes the language of the colony as with Portuguese for Brazil, the association is obviously closer still. Enlargement of the EU has brought a new set of relationships between former colonies that are near neighbours. Compared with the colonial ties between western European countries and their colonies on other continents, the European near neighbours do not usually share common languages with their former colonisers.

Anderson et al. (2015) estimate barriers to services trade using a structural gravity model for 12 service sectors for 28 countries over the period 2000 to 2007. They find important differences in estimated coefficients of standard gravity variables between goods and services and across different services. Distance effects on services trade are highly non-linear with strong negative effects for short distances and insignificant effects for long distances for sectors such as Transportation, Travel, Communication, Construction, Merchanting and Audiovisual services. For Financial and Computer services they obtain insignificant short-distance effects but negative and significant effects over long distances. Distance effects were insignificant for Insurance services, Operational Leasing, Business services and Research and Development. These results therefore support the non-linear nature of distance costs for services posited from the previous discussion.

Language has a positive and usually significant coefficient while contiguity and colonial ties have more nuanced effects. In terms of the

size of trade costs compared to domestic costs, Anderson *et al.* (2015) find that border barriers in services trade are large, significant, and vary widely across countries with economic size reducing border barriers in services trade.

Regional Free Trade Agreements (FTAs), including the European Union as a special case, and sometimes membership of a currency union such as the Euro zone are also proxies commonly found in gravity equations of trade. However as mentioned in the previous section, they are clearly endogeneous. Countries may join a free trade agreement or a currency union because they already have close trade relationships and similar economic structures, geographical proximity and shared history rather than the other way around.

The standard procedure of using dummies for membership of a free trade agreement in a gravity equation usually provide very low or even negative coefficients. A number of studies have applied such approaches to European integration with similar results (Nitsch, 2000; Frankel and Rose, 2002; Kimura & Lee, 2006; Ceglowski, 2006; Walsh, 2008; Head et al., 2009; Miroudot and Shepherd, 2015). Baier & Bergstrand (2007) used fixed effects and first differencing to show that accounting econometrically for the endogeneity of free trade agreements quintupled the effect of FTAs on trade flows and that on average a FTA approximately doubled two members' bilateral trade after 10 years. Baier et al. (2014) find that economic integration agreements have larger effects than FTAs and the latter have large effects than preferential trade agreements. The latter studies cover goods trade not services.

The previous discussion has looked at those variables that have traditionally been used in gravity equations for goods to explain why there is so much less trade between countries than within (home bias) and how they relate to trade costs in services. However the choice of these variables has been based on empirics and the availability of measures suitable for the gravity equations. The most theoretically grounded reason for specific trade costs for services relates to tangibility (Gadrey, 2000). Literature identifies not one but three dimensions of tangibility, physical tangibility, generality and mental intangibility (Laroche et al., 2001). Physical tangibility is linked to the possibility to store and transport an article. Generality refers to the degree to which a consumer can define or describe a particular product even when physically intangible.

A third dimension, mental intangibility refers to the degree to which a product is capable of clear mental representation even where it is physically tangible. It is a step beyond generality. The three dimensions of tangibility are linked to the perceived difficulty of evaluation. They are also linked to perceived risk of purchase both directly and indirectly through the difficulty of evaluation. Because purchasing from a foreign supplier is perceived as more risky than purchasing from a domestic supplier, additional costs to overcome this perceive riskiness will be incurred when trading services cross-border.

The economics literature on search, experience and credence goods has proved a rich source of understanding for the functioning of markets for services as well as for goods (Nelson, 1970; Darby and Karni, 1973). Search goods are those for which it is possible to accurately predict quality before purchase while the quality of experience goods can only be determined by use and experience after purchase. With credence goods the consumer can ex post only observe but may not be able to assess quality even after purchase. Girard et al. (2002; 2006) examine the extent to which the willingness to shop on the internet differs according to the product category. Overall they conclude that products that are costly and difficult to evaluate are the least likely to succeed on the Internet.

Two papers use Canadian data on inter-provincial trade to measure home bias in trade in services. Lejour and de Paiva Verheijden (2007) compare Canadian inter-provincial trade with intra-EU trade in services to estimate the possibilities for increased trade in services within the EU. They find that on average distance is less a hindrance for services trade than for goods trade. Language and regulation differences hamper intra-EU trade significantly. The finding on distance in particular is at variance with most other studies of services trade.

Anderson et al. (2014) compare Canadian intra-provincial sales of service with inter-provincial and international trade in services to generate measures of home, domestic and foreign bias in services trade. The border directly reduces average provincial trade with the United States relative to interprovincial trade to 2.4 % of its borderless level. Geography reduces services trade some seven times more than goods trade overall. An important finding is that the bias towards sales within the home province are always high and significant across services and across provinces.

Richard Baldwin (2016) in his book "The Great Convergence" describes how information technology has fostered a new form of globalization. Cross border trade implies the separation of production and consumption. Before the Industrial Revolution the high cost of transporting goods from one place to another restricted trade in goods to luxury items or to a few necessities not produced locally, such as salt. Falling transport costs during the Industrial Revolution and throughout the nineteenth century meant that industrial goods could be manufactured on a mass scale in one place and consumed in another. This the author calls the first unbundling. While the cost of moving goods became cheaper, those of moving ideas and people fell much less. The effect of the ICT revolution was to radically lower the cost of moving ideas. In turn this enabled the coordination of complex activities at a distance and led to the offshoring of parts of the production chain to low-wage countries called the second unbundling.

A number of implications follow that have profound consequences for trade in services. Services that are required to trade goods have themselves been traded from the earliest times. These services remain heavily traded. The second unbundling generated new requirements for telecommunications, computer and knowledge intensive business services to manage international production chains. We would expect therefore trade in such services to have expanded in recent years.

While the second unbundling depends on falling information costs, the cost of moving people remains high. If, however, suitable substitutes can be found to the cost of moving people, this opens up the possibility of a third unbundling in which many service tasks currently undertaken in developed countries migrate to low-wage countries. Technology has a big role to play in the degree to which it will be possible to substitute for physical presence. Existing substitutes already permit a good degree of interaction at distance and it is already possible to undertake complex medical operations remotely. Looking at how the need for physical interaction in the past is affecting trade in services today and recent developments in that requirement represents an important contribution of the paper.

III. THE DATA

Two different data sets have been combined to provide data on trade in services that covers both internal trade in services and cross-border trade. Imports (and exports) of services are available from Eurostat using the EBOPS Balance of Payments classification of trade in services. They cover 22 European countries for 8 years (2005-2012) for which sufficiently detailed bilateral trade data was available (Table A1 in Annex). Unfortunately many major EU-15 countries do not report sufficiently detailed trade data either at the level of the individual service or at the partner level. Missing EU-15 countries are Ireland, UK, Luxembourg, Portugal and Spain. New Member States are well covered with only Malta missing. This is not as surprising as might be expected since these countries built their statistics ex nihilo after the fall of the Berlin wall while the EU-15 countries merely adapted their existing balance of payment figures.

The World Input-Output Data Base from the Groningen Growth and Development Centre is the source for internal trade in services. Not only does the WIOD provide time series of world input-output tables but the period covered exactly matches that of Eurostat data and all the countries covered by the Eurostat data are also covered by the WIOD. Internal trade is calculated as the sum of domestically produced intermediate consumption and final demand for each service for each country. The NACE Rev2 breakdown of WIOD allows both a much better and a more detailed match with the data on imports and exports of services than the NACE Rev1.1 breakdown in the paper of Anderson et al. (2015).

Services covered are listed in Annexe Table A2. The great majority of these services are B2B rather than B2C. The main services sold cross-border to consumers are contained within the category “travel”. Travel has no direct equivalent with any sectoral classification. For that reason it is not advisable to try to include travel in a data set that matches cross-border trade with domestic sectors. The main advantage of the data set used for this paper is the disaggregation into 17 services compared to the 12 of Anderson et al. (2015). Based on differences

between services in expected trade costs, the disaggregation of transport, communications and business, professional and technical services is particularly important.

Although data on both exports and imports are available, the gravity equations use only that on imports. In his study of European integration, import penetration is used as a measure for integration (Smith, 2015) and the purpose of the gravity equations is to shed light on why there is so little integration through cross-border trade in services. Coverage of imports is also wider than that for exports. Land locked countries such as Slovakia are not expected to export services of sea transport but can import them.

The structure of cross-border trade in services has undergone considerable change during the eight year period covered. The decline in the share of the largest group of services, transport, (from 46.6 % to 39.5 %) was almost entirely matched by the increase in the second largest group, professional and business services, (from 26.2 % to 32.9 %). Similarly the 0.7 % increase in communications and 2.6 % increase in the share of computer and information services matched the declines in the share of construction (-0.5 %), insurance and financial services (-1.4 %) and services to households (-1.2 %). Changes in shares of different services reflect changes in their relative importance; changes that are consistent with a narrative of a second unbundling related to production chains.

Data on distance are from CEPII as are those for contiguity, common official language and former colonial ties (CEPII, 2011). A further set of distance variables was calculated in order to account for non-linearities in distance in the gravity equations. Following Anderson et al. (2015) distances were divided into below and above the median value in the data. Eaton and Kortum (2001) divide distances into six classes. For the data set used in this paper and based on the distribution of observations by distance, it appears that five intervals beginning with less than 500 km and then doubling the values fits this data set quite well. The intervals in kilometers are then: [0,500];[500,1000];[1000,2000];-[2000,4000];[4000 and above].

The data set contains 128656 observations of which 38550 or 30.0 % are zeros. This share is not particularly high and indeed lower than that seen in many data sets for goods. Average value of imports of services from any origin excluding domestic sales was 22.1 million

euros with a standard deviation of 102.89 million euros. Only 8 % of observations are between countries sharing a common border, 3 % sharing a common language and 3 % a common colonial past. 58 % of observations are for imports within the EEA but only 15 % within the euro zone, in spite of the fact that the sample contains the three largest euro zone countries.

Concerning the characteristics of the services that are traded, they are on average very low in physical tangibility (so intangible) and that in terms of mental intangibility (so complexity) they rank neither very high nor very low since the value is near to the modal value of 4 (neither high nor low on the criteria). Traded services tend on average not to be very searchable, to be very high on requiring to be experienced in order to judge quality and neither high nor low on credence characteristics. Finally for 41 % of observations some physical interaction between supplier and user will usually be required.

IV. METHODOLOGY

This paper estimates a gravity model for imports to 22 countries from 43 partner countries for 17 service sectors covering the period 2005 to 2012. The broad sectoral and country coverage as well as the inclusion of intra-national trade flows enables a replication of the results of those of Anderson et al. (2015) with this data set while also extending their paper with more sectoral detail, more recent data and countries that have joined the EU from 2004 which do not usually figure in standard gravity models. Panel data with two year intervals are used because the dependent variable in gravity estimates with fixed effects cannot fully adjust in a single year (Cheng; Wall, 2005). A longer time period such as five years would be preferable but the short period covered by the data constrains the possibilities for taking into account longer periods.

The final model specification proceeds in three stages. The first stage is intended to provide an estimation of the average effect on trade in services of the standard variables. The models are run as repeated

cross-sections which allows some identification of trends over time. Interacted fixed effects between origin and destination countries and the different services control for the fact that the data set uses trade in individual services and not the grand total. As well as the specification with all countries, the gravity models are run for groups of countries by size, by whether the country concerned was a member of the EU prior to the 2004 enlargement (the EU-15) or a new member state (NMS) as well as whether the trade in services was intra or extra EU.

Assuming that bilateral trade data follow a Poisson distribution with its conditional mean taking the exponential form, the following structural gravity equation is estimated by substituting equation (6) into equation (5) to form:

$$X_{ij,k} = exp\big[\big(1 - SCMTRY_{ij}\big)\big(\beta_1 lnDIST_{ij} + \beta_2 CNTG_{ij} + \beta_3 LANG_{ij} + \beta_4 CLNY_{ij}\big) + \beta_5 SMCTRY_{ij} + \eta_{i,k} + \theta_{j,k}\big] + \varepsilon_{ij,k} \quad (7)$$

$X_{ij,k}$ represents the imports to country i from country j for service k. $\beta_1 lnDIST_{ij}$, $\beta_2 CNTG_{ij}$ $\beta_3 LANG_{ij}$, $\beta_4 CLNY_{ij}$ and $SMCTRY_{ij}$ are all defined as for equation (6) in section 1 above. Fixed effects are represented by $\eta_{i,k}$, the set of importer dummies varying by type of service and $\theta_{j,k}$, the set of exporter dummies varying by type of service. $\varepsilon_{ij,k}$ is the error term. Because $SMCTRY_{ij}$ is a dummy with value one if trade is internal to a country, it measures the border effect as the degree to which internal trade exceeds cross-border trade and is expected to be positive.

In the second stage, the models are run for individual services in order to highlight the specificities of each service. Because of the large number of sectors covered, the models are run with origin and destination fixed effects interacted with time dummies. The specification for the second stage is similar to that of the first stage except that the interaction with type of service is replaced by interaction with time dummies.

$$X_{ij,t} = exp\big[\big(1 - SCMTRY_{ij}\big)\big(\beta_1^k lnDIST_{ij} + \beta_2^k CNTG_{ij} + \beta_3^k LANG_{ij} + \beta_4^k CLNY_{ij}\big) + \beta_5^k SCMTRY_{ij} + \eta_{i,t} + \theta_{j,t}\big] + \varepsilon_{ij,t} \qquad \forall k \quad (8)$$

The results of equation (8) are used to compare coefficients across different service sectors. They are not intended to make comparisons with those of the first phase.

There are obviously many other trade costs than those treated by the traditional gravity models. As developed in the section on trade costs for services, certain characteristics of services in particular can be related to costs which may serve to increase or decrease trade. Each service can then be defined by a bundle of characteristics. These characteristics are those that are commonly found in the literature as defining the nature of a service but they can also serve as here to differentiate one service from another. They can provide additional insights into why the amount of trade in services varies so much between different types of service.

The specification for the third stage regressions with service characteristics is similar to that of the first stage with which comparisons can be made plus additional explanatory variables to capture the influence of service characteristics:

$$X_{ij,k} = exp\big[(1 - SCMTRY_{ij})(\beta_1 lnDIST_{ij} + \beta_2 CNTG_{ij} + \beta_3 LANG_{ij} + \beta_4 CLNY_{ij}) + \beta_5 SMCTRY_{ij} + \beta_6 Tangibility_k + \beta_7 Generality_k + \beta_8 Conceptibility_k + \beta_9 Search_k + \beta_{10} Experience_k + \beta_{11} Credence_k + \beta_{12} Mode_k + \eta_{i,k} + \theta_{j,k}\big] + \varepsilon_{ij,k} \quad (9)$$

Here the variables β_6 to β_{12} represent the different characteristics that serve to define a service. The first three (Tangibility, Generality and Conceptibility or mental intangibility) describe the service in terms of physical and mental characteristics. The next three (Search, Experience and Credence) describe the characteristics from the point of view of the user. Mode assesses whether simultaneity of place is usually required between supplier and user to supply a service.

These characteristics can also be related to the different forms of unbundling discussed in the section on trade costs. Characteristics related to physical tangibility and search tend to be directly associated with the movement of goods. More intangible services tend to be associated with the movement of ideas. Experience and particularly credence characteristics typify knowledge intensive business services used to manage international production chains. The need for joint physical presence between supplier and user is linked to the possibilities for a third unbundling with the capacity to radically reshape trade in tasks for services.

A first series of service characteristics based on the categories identified by Laroche et al. (2001) cover tangibility (Table 1). Each of the

dimensions relating to tangibility is covered by responses to three different questions on a seven point Likert scale. Similarly the responses to five different questions on a seven point scale of semantic differentials covers the search-experience-credence framework, three of which relate to search (Verhagen et al., 2010). Different services are considered as displaying a bundle of different attributes rather than belonging to a single category based on their dominant characteristic.

Physical Tangibility			*Generality*			*Mental Intangibility*		
7-point Likert scale from strongly disagree to strongly agree								
This product is very easy to see and touch	I can physically grasp this product	This product is very tangible	I could easily explain many features associated with this product	It is not difficult to give a precise des-cription of this product	It is easy to describe many features related to this product	I need more information about this product in order to form a clear idea of what it is	This is a difficult product to think about	This is not the sort of pro-duct that is easy to picture

Search			*Experience*	*Credence*
7-point semantic differentials				
hard to evaluate before purchasing-easy to evaluate before purchasing	hard to describe-easy to describe	hard to inspect before purcha-sing-easy to inspect before purchasing	difficult to know without experiencing it-easy to know without experiencing it	difficult to know **even after** experiencing it-easy to know after experiencing it

TAB. 1 – Characteristics of Services.
Source: Laroche et al. (2001) & Verhagen et al. (2010).

Responses to each question for each of the goods or services were coded by three different coders at a Belgian university[2]. Since the constructs to be measured as well as the variables to measure these constructs have been developed in previous studies, confirmatory factor analysis

2 One was a recent PhD in business economics, a second a teaching assistant with a master's degree in business economics and the third an undergraduate in an unrelated discipline. Using an indicator of similarity of the responses of the different coders compared to the average, a high degree of consistency was found in coding by the different coders. As a result a simple average of the responses was used for the values of the different variables.

was employed to ensure that the latent variables of interest were being satisfactorily described by the variables as coded for trade in services.

While each of the three dimensions of tangibility has three different indicators, only the search criteria in the S-E-C framework is being measured by three different indicators. In subsequent analysis the three dimensions of tangibility and the search criteria are measured using the factor scores from the confirmatory factor analysis while for the experience and credence variables only the coding of the relevant questions could be used.

Each of the indicators loads strongly and positively on the relevant construct. Only the indicator describe among the search indicators has a somewhat weaker coefficient. Goodness of fit can only be measured for the intangibility model. In terms of the standard criteria for goodness of fit, four are within minimum accepted levels (Chi-square/df<3, p value >.05, Comparative Fit Index (CFI)>.90, Root Mean Square Error of Approximation (RMSEA) between .05 and .10) while the value of one, the Standardized Root Mean Square Residual (SRMR), is clearly outside the accepted range (>0.9). Overall goodness of fit can be considered as acceptable.

Reliability of the results of the factor analysis was confirmed with a Composite Reliability indicator (CR) above 0.7 and convergent validity with both a CR above Average Variance Extracted (AVE) and a value of AVE above 0.5. Finally, a value of Average Shared Variance (ASV) lower than AVE was used to establish discriminant validity. Mental intangibility and generality shared the highest variance without compromising discriminant validity while physical tangibility and search also share some common variance.

In order to facilitate comparison across the different characteristics, the factor scores have been normalised so that they conform to the original one to seven scale. Values on the experience and credence variables are reversed compared to the original questions so that services which are high on experience or credence also have a high instead of a low value as originally coded.

Since the need for proximity between provider and customer has been identified as an important influence on trade, it was necessary to add a variable that captures this aspect. When physical proximity is required either the customer must move to the supplier (mode 2 under

the GATS) or the supplier must move to the customer (mode 4 under the GATS). For certain services for which either the necessity to move is inherent in the service (construction services must be supplied in situ) or where it is the overwhelmingly dominant way to provide a service (the customer moving physically to the provider in the case of travel), a simple identification of the mode by which the service is supplied should be sufficient to take in the proximity requirement.

However certain services can be supplied in multiple ways and this creates a problem of identification because the data on cross-border trade do not distinguish between the different modes. As indicated previously physical proximity is not always required for interaction to occur and physical proximity is becoming less and less necessary for certain services so that any identification of modes 2 and 4 is likely to change over time. Based on work in the World Trade Organisation (WTO) an identification was made of the principle mode by which different services are traded at that point in time (WTO, 2008; 2009). A dummy variable was then created taking the value of one for services for which the principle mode requires either the supplier or the customer to move physically across a border.

V. RESULTS

The gravity equations were run in the three stages specified in the section on methodology. Regressions for the full sample are run using the specification in equation (7). After running the regressions on the full sample of countries, results were tested by dividing the importer sample into Member States from the EU-15 and the new Member States, and into four groups by size of population as well as intra and extra-EU imports.

As pointed out in the literature review, it is to be expected that the effect of distance would be non-linear, a result that would also be in line with that of Anderson et al. (2015). Table 2 compares the results of using different distance measures in the context of a gravity equation. Wald tests of a breakdown of distance into categories below and above the median do not yield significant differences in coefficients unlike the results of Anderson et al. (2015).

	2006	2008	2010	2012	2006	2008	2010	2012	2006	2008	2010	2012
ln_distance	-0.3708**	-0.3788***	-0.3646***	-0.3821***								
	(0.1204)	(0.0997)	(0.0905)	(0.0959)								
<Median					-0.3122*	-0.3283**	-0.3380***	-0.3482***				
					(0.1378)	(0.1127)	(0.0986)	(0.1041)				
>Median					-0.3489**	-0.3599***	-0.3562***	-0.3724***				
					(0.1264)	(0.1032)	(0.0919)	(0.0969)				
0-500 km									-0.4999*	-0.2777	-0.0984	-0.1166
									(0.1999)	(0.1826)	(0.1988)	(0.1860)
500-1000 km									-0.4313*	-0.2668	-0.1280	-0.1429
									(0.1893)	(0.1692)	(0.1778)	(0.1711)
1000-2000 km									-0.4676**	-0.3019*	-0.1623	-0.1803
									(0.1714)	(0.1539)	(0.1642)	(0.1557)
2000-4000 km									-0.4958**	-0.3275*	-0.1943	-0.2117
									(0.1621)	(0.1467)	(0.1571)	(0.1503)
4000 km & over									-1.3373	-1.1250	-1.7781	-3.4942***
									(1.1511)	(1.1167)	(1.0894)	(1.0313)
contiguity	0.6098***	0.6487***	0.7361***	0.7480***	0.6128***	0.6503***	0.7351***	0.7462***	0.5914***	0.6506***	0.7503***	0.7724***
	(0.1745)	(0.1491)	(0.1562)	(0.1519)	(0.1714)	(0.1459)	(0.1544)	(0.1492)	(0.1499)	(0.1395)	(0.1417)	(0.1362)
common language	0.3083	0.3379	0.2652	0.3023	0.3304	0.3573	0.2765	0.3165	0.3225	0.3529	0.2834	0.3147
	(0.2889)	(0.2347)	(0.2137)	(0.2255)	(0.2882)	(0.2324)	(0.2127)	(0.2234)	(0.2513)	(0.2139)	(0.1917)	(0.2018)
colony	0.1928	0.2154	0.0880	0.1437	0.1727	0.1971	0.0796	0.1329	0.1105	0.1297	-0.0214	-0.0271
	(0.1362)	(0.1304)	(0.1251)	(0.1186)	(0.1349)	(0.1296)	(0.1241)	(0.1178)	(0.1460)	(0.1412)	(0.1366)	(0.1366)
smctry	4.2987***	4.3548***	4.2811***	4.0763***	4.6564***	4.6624***	4.4411***	4.2795***	3.6638**	4.9588***	5.7759***	5.5726***
	(0.8465)	(0.7003)	(0.6424)	(0.6766)	(0.9448)	(0.7679)	(0.6811)	(0.7167)	(1.2571)	(1.1318)	(1.2066)	(1.1462)
N	12646	13876	13534	13498	12646	13876	13534	13498	12646	13876	13534	13498

Standard errors in parentheses

* p<0.05 ** p<0.01 *** p<0.001

TAB. 2 – Distance measures for services.

Average coefficients for distance do vary when they are divided into five classes. Coefficients are generally higher for distances of less than 500 km than for those between 500 and 1000 km before increasing again up to the category 2000-4000km. The coefficients for the highest category of above 4000 km are considerably higher. Many of the distance variables are not significant even at the 5 % level. The evidence for non linearity in the distance variable for services is therefore weak. There is also some weak evidence that over time the coefficients for distances less than 4000 km tend to diminish indicating that distance is playing a lesser role in trade in services, consistent with technological developments.

Since there is a clear break in the effect of distance over 4000 km, it is worth exploring this facet in greater detail. The major long distance partners are the US, which alone accounts for 58.2 % of long distance imports, followed by China, Japan, Canada and India which together account for 87.5 % of non-European imports. Two thirds of imports of services from China and Japan are for transport services and therefore linked with goods trade. 61 % of imports from India, 48 % from the US and 41 % Canada are for computer, professional and business services. They can be seen as the trade in services counterpart of managing international production chains.

Generally speaking, standard explanatory variables for gravity equations behave as expected. The variables contiguity and sharing a common language are all signed positively as expected but are not significant in the case of the common language. Border effects for services (*smctry*) are always large and nearly always significant or highly significant, in line with other gravity equations for services.

Results for as heterogeneous group of countries as those in this data set cannot be expected to be apply in equal measure to different countries. The coefficient on the distance variable decreases with size of country. Differences in the coefficients between countries of different size are highly significant for distance but generally not for contiguity, common language or colonial ties. Contrary to the findings of Anderson et al., the border effect *smctry* increases with country size and the difference between country groups is significant at the 1 % level. For small and very small countries the coefficient on *smctry* is even under half that of the large countries.

Some differences can be observed between the coefficients for those countries that were members prior to 2004 and new Member States, which corresponds more or less to a division according to level of development irrespective of country size. Distance coefficients are again systematically higher for new Member States than for those of the EU-15 and the difference is always significant at least at the 5 % level. Contiguity, common language and former colonial ties are always positive but differences between the coefficients for EU-15 and New Member States are not significant. Border effects are higher for EU-15 countries than for New Member States but again the difference between the coefficients is not significant.

Distance coefficients are higher for extra-EEA imports than for intra-EEA ones as expected, but only from 2008 do the difference in coefficients become significant. The variables for contiguity, sharing a common official language or former colonial ties are all positive and significant for intra-EEA imports but none are significant for extra-EEA imports and the common language variable is even negative. Border effects are also similar between intra and extra-EEA trade, which may say something about the functioning of the Single Market for services. Overall it is difficult to conclude that there are major differences in standard explanatory variables between intra and extra-EEA imports.

In the second stage, regressions applying equation (8) are run at a more detailed service level to see whether the results obtained with the full sample are also to be found for individual services (Table A3 in Annexe). Services are clearly non-linear in distance beyond 4000 km but not so much at lesser distances. Coefficients for 4000km and over are positive for sea transport and auxiliary transport services. Both of those services are heavily linked with trade in goods and the first unbundling. For air transport and land transport the coefficients are negative but much less so for air transport than for land transport, occupying an intermediate place between sea and land forms, as would be expected from the discussion of trade costs. Combined with the large increase in passenger traffic after the entry of low-cost suppliers for short haul flights, trade in air services remains dominated by passenger rather than freight transport and cannot be linked directly to developments in international supply chains. Land transport is overwhelmingly for freight via road and plays an important role in local supply chains able

to cross borders freely within the EU. Within "Communications" the coefficients for postal and courier services are systematically higher than those for telecommunications while displaying a similar pattern. These results can be considered in line with what theory on service costs would suggest.

Construction services represent something of a special case. They are among the least traded of all services and require the supplier to move to the premises of the client (mode 4 under the GATS). Coefficients decline with distance and become positive for distances above 4000 km, the only other service than sea transport and auxiliary transport services to do so. Residential and repairs will likely only be undertaken domestically. Major international construction works typically concern public works and are undertaken by a small number of multinationals in the field. Three fifths of imports of construction services from above 4000 km originate from the US, China and S. Korea.

A number of services have non-significant distance coefficients (insurance services, advertising and market research, research and development and architectural and engineering services). Other services (financial services, computer and information services, legal, accounting and management services, other miscellaneous business services, audiovisual and other personal services) all display negative and significant distance coefficients. Standard gravity variables perform notably less well at the individual service level. Contiguity is positive and significant for only 8 out of 17 services, common language for 7 out of 17 and former colonial ties for only two. Nor is there any clear pattern as to which services are most affected. Common language would be expected to be particularly important for relational services and while this is generally the case, legal, accounting and management services prove the exception. Perhaps the prevalence of the use of English can explain why the coefficient while positive is not significant in this case.

Border effects are negative but not significant for a few services (air and land transport, construction, audiovisual and other personal services) while other services have generally positive but non significant border effects. Border effects are particularly high (and significant) for insurance services, legal, accounting and management services and architectural and engineering services. It is difficult to provide any coherent interpretation for these.

Wald tests provide a more synthetic view of the extent to which coefficients on gravity variables vary significantly between different services. Tests on the coefficients for the distance variable of 4000 km and over differ significantly from each other at the 5 % level for two fifths of different services, but for only a quarter or less of the other distance coefficients. The three services that stand out as markedly different from other services on the basis of the standard gravity variables are other personal services, for which the coefficients differ significantly from other services in 58 % of possible cases, sea transport and architectural and engineering services with differences in both around one third of possible cases. Heterogeneity between different services as posited by the literature does not appear reflected to the same extent in this more disaggregated and more recent data set.

Given the previous results of the gravity model there are obviously many other trade costs than those treated by the traditional gravity models that could be important for explaining missing trade in services. In the third stage, the model is extended to cover certain characteristics of services. Under strict gravity, the variables characterising services need to be introduced in addition to the origin and destination country-service fixed effects. Where service characteristics behave differently at the country level, these effects will be picked up by the country-service fixed effects. It is only the common effect across countries that will be picked up in the strict gravity equation. This is consistent with an interpretation of the impact of service characteristics that considers them as intrinsically promoting or restricting trade irrespective of time and place.

	2006	2008	2010	2012
Physical Tangibility	-0.2203	-0.0892	-0.2335	-0.6664***
	(0.1781)	(0.1343)	(0.1956)	(0.1821)
Generality	-1.0852***	-1.3928***	-1.3037***	-1.2425***
	(0.2050)	(0.2020)	(0.2067)	(0.2195)
Mental Intangibility	0.6397***	0.2909*	0.2711	0.1730
	(0.1664)	(0.1338)	(0.1605)	(0.1415)
Search	0.1951	0.1670	0.8114*	0.4775
	(0.3585)	(0.3186)	(0.3597)	(0.2862)
Experience	0.8812*	0.4652	0.5357	0.8554*
	(0.4030)	(0.3885)	(0.3137)	(0.3694)
Credence	0.9930***	0.9559***	1.0716***	0.8578***
	(0.1904)	(0.1439)	(0.1294)	(0.1535)
Mode	-3.0925***	-2.2839***	-2.0982***	-1.7635***
	(0.5613)	(0.4670)	(0.6072)	(0.5241)
ln_distance	-0.3708**	-0.3788***	-0.3646***	-0.3821***
	(0.1204)	(0.0997)	(0.0905)	(0.0959)
contiguity	0.6098***	0.6487***	0.7361***	0.7480***
	(0.1745)	(0.1491)	(0.1562)	(0.1519)
common language	0.3083	0.3379	0.2652	0.3023
	(0.2889)	(0.2347)	(0.2137)	(0.2255)
colony	0.1928	0.2154	0.0880	0.1437
	(0.1362)	(0.1304)	(0.1251)	(0.1186)
smctry	4.2987***	4.3548***	4.2811***	4.0763***
	(0.8465)	(0.7003)	(0.6424)	(0.6766)
N	12646	13876	13534	13498

Standard errors in parentheses
* p<0.05 ** p<0.01 *** p<0.001

TAB. 3 – Service Characteristics and Trade.

Results from regressions applying equation (9) show that physical tangibility and mental intangibility do not behave as expected but the coefficients are not always significant (Table 3). Generality – the ability to conceive a service in general terms even if it is not physically tangible – has a negative sign and is always significant contrary to expectations. Coefficients for services that are searchable are positive as expected but rarely significant, those for experience sometimes significant and always positive while they would be expected to be negative. Nearly all services have a high experience characteristic (the average in the data set is 6.1 out of a possible 7 with a standard deviation of only 0.65) and it may be that this variable has low discriminatory power.

Coefficients for credence, which would be expected to be negative, are positive and always highly significant. The average value for credence in the data set is 3.81 which is quite close to the pivot value of 4 (neither agree nor disagree) and a standard deviation of 1.82. Mental

intangibility (conceptibility), also with positive coefficients and an average value of 3.9 and standard deviation of 1.55, is somewhat close to the credence characteristic. As mentioned above, both are associated with complexity and high level business services. These services can be linked with the second unbundling and their shares in cross-border trade have been rising quite substantially over the period of this data. While mental intangibility and credence would a priori add to the risk of purchasing cross-border, their important role in facilitating recent trends in international trade could mean that suppliers are credibly able to overcome the inherent riskiness of the service in order to facilitate the efficient management of cross-border production chains. The preceding results would seem to indicate that the common effect of service characteristics does not play the prominent role usually ascribed to them in the literature. Rather it would seem that the degree to which a service involved fulfills a trade enhancing function for clients determines the extent of cross-border trade.

The requirement for physical interaction between supplier and client is always negatively signed and always highly significant. This could be taken as an indication that the need for physical proximity between supplier and client continues to play an important role in depressing international cross-border trade in services. The coefficient on the mode variable which measures the need for proximity declined to nearly half its initial value between 2006 and 2012 and a Wald test shows that this difference is highly significant itself with a probability of less than 0.01 % over the eight year period. This provides the first convincing evidence that the impact of the need for physical proximity is declining and might presage the possibility of a future third unbundling.

CONCLUSION

Gravity equations for services perform less well than for goods. Heterogeneity of services and the different way in which standard variables such as distance may affect individual services points to the

need to adopt an disaggregated approach. Data for trade in services remains however highly aggregated limiting the possibilities to go down this path.

The main function of cross-border trade in services is as a facilitator of other cross-border trade in goods and services. This is most obviously the case for transport which is directly linked to trade in goods. Recent developments in international trade linked to the management of complex production chains with trade in components as well as finished goods has led to much greater need for exchange of information and high level management skills to transfer know-how from developed countries to the low wage countries in which assembly increasingly takes place.

When interpreting gravity equations for services the role of trade in services as an enabler of other forms of trade needs to be taken into consideration. For this reason traditional explanatory variables used for gravity equations in goods such as contiguity, common language and former colonial ties may not be relevant if the services required are for new forms of international trade rather than the established patterns of intra-industry trade between countries of comparable levels of development. Distance remains important for trade in services but the discontinuity observed between inter-continental trade and that with nearer neighbours would support the idea that such trade is a complement to new forms of trade in goods and services associated with the second unbundling.

The need for physical proximity between supplier and client remains an important constraint on the development of cross-border trade in services, serving rather to encourage local establishment and trade via permanent presence. It is the only one of the traditional explanatory variables for the lack of cross-border trade in services for which a clear negative impact could be observed. However, recent development indicates a lessening impact of the need for physical presence with potentially profound implications for the amount and type of services that are traded internationally.

REFERENCES

Anderson J. E., van Wincoop E. (2003), "Gravity with Gravitas: A Solution to the Border Puzzle", *The American Economic Review*, vol. 93, nº 1, p. 170–192.

Anderson J.E., van Wincoop E. (2004), "Trade Costs", *Journal of Economic Literature*, vol. 42, nº 3, p. 691-751.

Anderson J.E., Milot C.A. & Yotov Y.V. (2014), "How much does geography deflect services trade? Canadian Answers", *International Economic Review*, vol. 55, nº 3, p. 791-818.

Anderson J.E., Borchert I., Mattoo A. & Yotov Y.V. (2015), "Dark costs, missing data: shedding some light on services trade", NBER working paper nº 21546.

Baier S.L. & Bergstrand J.H. (2007), "Do free trade agreements actually increase members' international trade?", *Journal of International Economics*, vol. 71, nº 1, p. 72-95.

Baier S.L. & Bergstrand J.H. (2009), "Estimating the effects of free trade agreement on international trade flows using matching econometrics", *Journal of International Economics*, vol. 77, nº 1, p. 63-76.

Baier S.L., Bergstrand J.H. & Feng M. (2014), "Economic integration agreements and the margins of international trade", *Journal of International Economics*, vol. 93, nº 2, p. 339-350.

Baldwin R. (2016), *The Great Convergence. Information Technology and the New Globalization*, Cambridge, Harvard Belknap.

Blum B.S. & Goldfarb A. (2006), "Does the internet defy the law of gravity?", *Journal of International Economics*, vol. 70, nº 2, p. 384–405.

Ceglowski J. (2006), "Does gravity matter in a Service Economy?" *Review of World Economics*, vol. 142, nº 2, p. 308-329.

Cheng I-H & Wall H.J. (2005), "Controlling for Heterogeneity in Gravity Models of Trade and Integration", *Federal Reserve Bank of St. Louis Review*, January/February.

Crozet M., Milet E. & Mirza D. (2012), "The Discriminatory Effect of Domestic Regulations on International Services Trade: Evidence from Firm-Level Data", CEPII Document de Travail, nº 2012 – 02.

Darby M.R. & Karni E. (1973), "Free Competition and the Optimal Amount of Fraud", *Journal of Law and Economics*, vol. 16, nº 1, p. 67-88.

Devlieger E. (2013), "Antecedents of trust in e-commerce: A theoretical and empirical analysis of the European marketplace", KU Leuven Master's thesis.

Eaton J. & Kortum S. (2001), "Trade in capital goods", *European Economic Review*, vol. 45, n° 7, p. 195-1235.

Frankel J. & Rose A. (2002), "An estimate of the effect of common currencies on trade and income", *The Quarterly Journal of Economics*, vol. 117, n° 2, p. 437-466.

Gadrey J. (2000), "The Characterization of Goods and Services: An Alternative Approach", *Review of Income and Wealth*, vol. 46, n° 3, p. 369-387.

Girard T., Silverblatt R. & Korgaonkar P. (2002), "Influence of product class on preference for shopping on the internet", *Journal of Computer-Mediated Communication*, vol. 8, n° 1, p. 1-35.

Girard T., Silverblatt R. & Korgaonkar P. (2006), "Online retailing, product classifications, and consumer preferences", *Internet Research*, vol. 16, n° 3, p. 267-288.

Guiso L., Sapienza P. & Zingales L. (2004), "Cultural Biases in Economic Exchange", NBER Working Paper n° 11005.

Head K., Mayer T. & Ries J. (2009),"How remote is the offshoring threat?", *European Economic Review*, vol. 53, n° 4, p. 429-444.

Head K., & Mayer T. (2014), "Gravity Equations:Workhorse, Toolkit, and Cookbook", in Gopinath G, Helpman E. and Rogo K. (eds), *Handbook of International Economics*, Amsterdam, Elsevier, p. 131-195.

Hirsch S. (1989), "Services and Service Intensity in International Trade", *Weltwirtschaftliches Archiv*, vol. 125, n° 1, p. 45-60.

Kimura F. & Lee H-H. (2006), "The Gravity Equation in International Trade in Services", *Review of World Economics*, vol. 142, n° 1, p. 92-121.

Kox H., Lejour A. & Montizaan R. (2004), "The free movement of services within the EU", CPB Document n° 69.

Laroche M., Bergeron J., & Goutaland C. (2001), "A Three-Dimensional Scale of Intangibility", *Journal of Service Research*, vol. 4, n° 1, p. 26-38.

Lejour A. & De Paiva Verheijden J-W. (2007), "The Tradability of Services within Canada and the European Union", *The Service Industries Journal*, vol. 27, n° 4, p. 389-409.

Lejour A. & Smith P. M. (2008), "International Trade in Services: Editorial Introduction", *Journal of Industry Competition and Trade*, vol. 8, n° 3/4, p. 169-180.

Mayer T. & Zignago S. (2011), "Notes on CEPII's distance measures: The *GeoDist* database", CEPII Document de Travail n° 2011-25.

Melitz J. (2008), "Language and Foreign Trade", *European Economic Review*, vol. 52, n° 4, p. 667-699.

Melitz J. & Toubal F. (2014), "Native language, spoken language, translation and trade", *Journal of International Economics*, vol. 93, n° 2, p. 351-363.

Miroudot S., Sauvage J. & Shepherd, B. (2013), "Measuring the cost of international trade in services", *World Trade Review*, vol. 12, nº 4, p. 719-735.
Miroudot S. & Shepherd B. (2015), "Regional Trade Agreements and Trade Costs in Services", European University Institute Working Paper RSCAS 2015/85.
Moïsé E. & Le Bris F. (2013), "Trade Costs – What Have We Learned?: A Synthesis Report", *OECD Trade Policy Papers*, nº 150.
Nelson P. (1970), "Information and Consumer Behaviour", *Journal of Political Economy*, vol. 78, nº 2, p. 311-329.
Nitsch V. (2000), "National Borders and International Trade: Evidence from the European Union", *Canadian Journal of Economics*, vol. 33, nº 4, p. 1091-1105.
Palmans S. (2015), "Market integration, trust and personal attributes in Europe: A cross-cultural theoretical and empirical analysis of the socio-demographic and cultural antecedents of trust in Europe", KU Leuven master's thesis.
Santos Silva J., Tenreyro S., 2006, "The log of gravity", *The Review of Economics and Statistics*, vol. 88, nº 4, p. 641-658.
Smith P. M. (2015), "Does integration for services differ from integration for goods?", *The Service Industries Journal*, vol. 35, nº 4, p. 217-235.
Verhagen T., Boter J., Adelaar T. (2010), "The Effect of Product Type on Consumer Preferences for Website Content Elements: An Empirical Study", *Journal of Computer-Mediated Communication*, Vol. 16, nº 1, p. 139-170.
Walsh K. (2008), "Trade in Services: Does Gravity Hold?", *Journal of World Trade*, vol. 42, nº 2, p. 315-334.
WTO (2008), "Measuring GATS Mode 4 Trade Flows", Staff Working Paper ERSD-2008-05.
WTO (2009), "Cross-Border Supply (Modes 1 & 2) Background Note by the Secretariat", S/C/W/304 of 18 September 2009.

ANNEXES

Sample Countries	**Partner Countries**	
Large (>30 million)	Austria (EEA)	Japan
Germany (EU-15)	Australia	South Korea
France (EU-15)	Belgium (EEA)	Lithuania (EEA)
Italy (EU-15)	Bulgaria (EEA)	Luxembourg (EEA)
Poland (NMS)	Brazil	Latvia (EEA)
Medium (10-20 million)	Canada	Malta (EEA)
Romania (NMS)	Switzerland	Mexico
Netherlands (EU-15)	China	Netherlands (EEA)
Greece (EU-15)	Cyprus (EEA)	Norway (EEA)
Belgium (EU-15)	Czech Republic (EEA)	Poland (EEA)
Czech Republic (NMS)	Germany (EEA)	Portugal (EEA)
Hungary (NMS)	Denmark (EEA)	Romania (EEA)
Small (5-10 million)	Estonia (EEA)	Russia
Sweden (EU-15)	Greece (EEA)	Sweden (EEA)
Austria (EU-15)	Spain (EEA)	Slovenia (EEA)
Bulgaria (NMS)	Finland (EEA)	Slovakia (EEA)
Denmark (EU-15)	France (EEA)	Turkey
Slovakia (NMS)	Croatia	Taiwan
Finland (EU-15)	Hungary (EEA)	United Kingdom (EEA)
Very Small (<5 million)	Indonesia	United States
Croatia	Ireland (EEA)	
Lithuania (NMS)	India	
Latvia (NMS)	Italy (EEA)	
Slovenia (NMS)		
Estonia (NMS)		
Cyprus (NMS)		
NMS New Member State	EEA European Economic Area	
N=22	N=43	

Tab. A1 – Country coverage of the data.

TRANS-PORT	**COMMUNIC-ATIONS**		**INSURANCE & FINANCIAL SERVICES**		**PRO-FESSIONAL & BUSINESS SERVICES**	**SERVICES TO HOUSEHOLDS**
Sea Transport	Postal & Courier Services	*CON-STRUCTION*	Insurance	*COMPUTER & INFORMATION SERVICES*	Legal, Accounting and Management Services	Audiovisual Services
Air Transport	Telecommun-ications		Financial Services		Advertising & Market Research	Other Personal Services
Land Transport					Research & Development	
Auxiliary Transport Services					Architectural & Engineering Services	
					Other Business Services	

TAB. A2 – Services coverage of the data.

	Sea Transport	Air Transport	Land Transport	Auxiliary transport services	Postal and courier services	Telcommun-ications	Construction services	Insurance services	Financial services
0-500 km	-0.6039	-0.9779	-0.9857***	-0.4801	-0.9327	-0.7164	-1.5976***	0.3348	-1.2209***
	(0.4041)	(0.5590)	(0.2084)	(0.3176)	(0.4809)	(0.3662)	(0.2414)	(0.3259)	(0.3280)
500-1000 km	-0.6308	-0.8611	-0.9137***	-0.4872	-0.7808	-0.6818*	-1.4453***	0.2820	-1.0485***
	(0.3467)	(0.5249)	(0.1798)	(0.2819)	(0.4434)	(0.3440)	(0.2170)	(0.2845)	(0.2956)
1000-2000 km	-0.6119	-0.9241	-0.9501***	-0.5300*	-0.8940*	-0.6977*	-1.4325***	0.2080	-1.1534***
	(0.3211)	(0.4905)	(0.1684)	(0.2629)	(0.4049)	(0.3238)	(0.2005)	(0.2700)	(0.2782)
2000-4000 km	-0.6251*	-0.8550	-0.9251***	-0.5237*	-0.8848*	-0.7290*	-1.3542***	0.1718	-1.1370***
	(0.3042)	(0.4642)	(0.1605)	(0.2495)	(0.3806)	(0.3038)	(0.1885)	(0.2460)	(0.2604)
4000 km & over	3.0053	-2.1132	-8.3297**	1.4701	-12.5579***	-4.2910**	1.3539	-2.9012**	-7.0070**
	(1.5959)	(1.5917)	(2.8319)	(2.3029)	(3.4423)	(1.5384)	(1.2041)	(1.0784)	(2.2636)
contiguity	0.2217	0.3919	0.6671***	0.4156	0.2117	0.3980	0.5153*	0.8751***	0.3301
	(0.1989)	(0.4055)	(0.1534)	(0.2257)	(0.4270)	(0.2443)	(0.2073)	(0.2034)	(0.2245)
common language	0.2369	0.5782	0.4280	-0.0212	1.3520***	0.4585*	0.6965**	0.5895**	0.3298
	(0.2946)	(0.3196)	(0.2371)	(0.2021)	(0.3259)	(0.1974)	(0.2688)	(0.2223)	(0.3183)
colony	0.2315	0.2260	0.1600	-0.1268	-1.4970*	-0.2248	0.0452	0.2115	-0.3335
	(0.2302)	(0.2933)	(0.2452)	(0.2327)	(0.6715)	(0.1747)	(0.2648)	(0.2140)	(0.3351)
smctry	0.6302	-0.9151	-0.3697	2.8345	2.0228	2.2863	-1.3121	8.8907***	0.5167
	(2.2999)	(3.5583)	(1.2060)	(1.8682)	(2.9818)	(2.3379)	(1.4241)	(1.9324)	(1.9822)
N	3485	3486	3486	3486	3486	3486	3483	3423	3486

	Computer and information services	Legal, accounting management and public relations services	Advertising and Market Research	Research and development services	Architectural & Engineering services	Other miscell-aneous business	Audio-visual and related services	Other personal cultural and recreational services
0-500 km	-1.3739***	-0.5512*	-0.3990	-0.3859	-0.5181	-1.0768***	-1.3561**	-2.3528***
	(0.3039)	(0.2354)	(0.3224)	(0.2859)	(0.2788)	(0.2701)	(0.4459)	(0.3568)
500-1000 km	-1.3138***	-0.5074*	-0.3878	-0.3164	-0.4280	-0.9760***	-1.3195**	-2.2665***
	(0.2732)	(0.2183)	(0.2949)	(0.2611)	(0.2403)	(0.2347)	(0.4167)	(0.3259)
1000-2000 km	-1.2479***	-0.5428**	-0.4592	-0.3850	-0.4837*	-0.9639***	-1.3397***	-2.1332***
	(0.2519)	(0.2011)	(0.2692)	(0.2331)	(0.2198)	(0.2165)	(0.3841)	(0.2968)
2000-4000 km	-1.2772***	-0.5427**	-0.4635	-0.4371	-0.5317*	-0.9774***	-1.3110***	-2.0118***
	(0.2359)	(0.1918)	(0.2580)	(0.2269)	(0.2080)	(0.2036)	(0.3609)	(0.2777)
4000 km & over	-4.3841**	-3.7993**	-0.9528	-7.9578***	-2.9454*	-3.4005**	-6.9922*	-2.9294
	(1.4947)	(1.2892)	(2.1635)	(1.5878)	(1.3496)	(1.1954)	(3.2978)	(2.1666)
contiguity	0.2093	0.6386*	0.6065**	0.7579**	1.0508***	0.5095***	0.0414	0.5185**
	(0.2366)	(0.2837)	(0.2049)	(0.2622)	(0.2654)	(0.1338)	(0.3492)	(0.1881)
common language	0.4323	0.0160	0.7608***	0.8003***	0.5208*	-0.0367	0.6516	-0.4445
	(0.2549)	(0.1904)	(0.1944)	(0.2331)	(0.2273)	(0.2549)	(0.3400)	(0.2362)
colony	0.0199	0.0966	-0.1923	-1.2967***	-0.0927	0.3125*	-0.2903	0.3625
	(0.2120)	(0.3027)	(0.2325)	(0.1777)	(0.2689)	(0.1260)	(0.2729)	(0.2541)
smctry	-2.5299	3.3693*	3.2576	3.1842	3.5225*	0.9729	-1.6838	-5.2847*
	(1.8024)	(1.4344)	(1.9625)	(1.7080)	(1.5837)	(1.5638)	(2.7938)	(2.1233)
N	3486	3486	3486	3486	3485	3486	3486	3486

Standard errors in parentheses
* p<0.05 ** p<0.01 *** p<0.001

TAB. A3 – Gravity equations by service.