# Working Paper Series

Christiane Hellmanzik and
Martin Schmitz

## Virtual proximity and audiovisual services trade

**Abstract**

Audiovisual services such as music and movies in digital formats have gained substantial importance over the last decade. This paper analyses audiovisual services in a gravity model framework. In particular, we explore the role of virtual proximity - a new proxy for cultural proximity based on bilateral hyperlinks and bilateral website visits between countries - and find that 'virtually-proximate' countries trade significantly larger amounts of audiovisual services. Our results show that virtual proximity also has a larger impact on trade in audiovisual services than on total services trade. Moreover, in line with Hanson and Xiang (2011), our analysis indicates that in the audiovisual services sector, global fixed export costs dominate bilateral fixed export costs for most countries in our sample.

**Keywords:** International trade; audiovisual services; cultural proximity; hyperlinks; internet

# Non-technical summary

Up to the early 2000s, cultural products were largely traded in the form of goods, but due to technological advancements over the last decade, they increasingly appear in the services sector. Accordingly, the role of audiovisual services – as reflected by ever increasing digital music and movie sales – has grown substantially over the past decade. Moreover, audiovisual services are contentiously discussed in international trade negotiations, since music, movies and television shows play a key role in transmitting culture and values across the globe. Hence, international trade in audiovisual services and its determinants has been of high interest for both economic researchers and policy-makers.

This paper analyses the determinants of audiovisual services trade in a gravity model framework. In particular, we explore the role of virtual proximity – a new proxy for cultural proximity based on bilateral hyperlinks on webpages and bilateral website visits between countries. The idea is to reflect, for instance, how often British or French internet users set links to or visit websites from the United States. The underlying assumption is that cultural proximity of two countries increases with the interest shown in each others' web content.

We consider the audiovisual sector to be a suitable candidate for testing our new virtual proximity indicator as the sector's very nature is closely linked to a country's cultural identity. Thus far, the most commonly used measures of cultural proximity in gravity trade models have been common language and common religion. Given the growing importance of communication and information technology, and the sharp increase of its influence on almost all transactions – be it in a business or private setting – we propose virtual proximity as an up-to-date alternative to traditionally-used measures of cultural proximity.

Our findings indicate that 'virtually-proximate' countries trade significantly larger amounts of audiovisual services. Moreover, virtual proximity also has a larger impact on trade in audiovisual services than on total services trade. These findings are robust to a wide range of tests. Accordingly, our paper contributes to the growing body of literature that links economic outcomes to cultural factors. Moreover, it accounts for and highlights the growing importance of the internet on economic transactions.

# 1   Introduction

Audiovisual and related services are a component of *personal, cultural and recreational services* in international services trade statistics.[1]  These pertain to movies, music, radio and television as well as services relating to performing arts.  They can be in various electronic formats (e.g. mp3 files) and include licenses for broadcasting purposes (e.g. to show the latest James Bond movie in a local cinema) and live performances by artists (e.g. Beyonce Knowles performing in London is an audiovisual services import to the United Kingdom from the United States).[2]

Cultural products have largely been traded in the form of goods, but due to technological advancements over the last decade, they increasingly appear in the services sector.  This is reflected by decreasing sales of compact discs and other physical products in lieu of electronic formats such as mp3 files.  In the United States, digital album sales accounted for 37% of all album purchases in 2012 compared to 5.5% in 2006 (according to the Nielsen Company & Billboard's 2012 Music Industry Report).  Over time, services have continuously replaced goods, with sale volumes of services increasing and customers gaining ever more control and choice over their consumption patterns, for example by means of iTunes, Netflix or pay-per-view channels, making the audiovisual services sector one with the most dynamic growth in recent years.

This paper analyses audiovisual services trade in a gravity model framework. Our particular interest is in the role of cultural proximity, for which we propose new measures that reflect the virtual proximity of two trading partners.  One of these novel proximity measures captures bilateral hyperlinks on webpages as an indicator of countries' virtual linkages with each other. The idea is to reflect, for instance, how often British or French internet users set links to websites from the United States (say the homepage of the New York Times).  In addition, we construct an alternative indicator of virtual proximity based on bilateral website visits using data from GoogleAd Planner. In case these indicators are, *ceteris paribus*, higher for the United Kingdom than for France, we interpret this as British citizens being culturally closer to the United States than the French. The underlying assumption is that cultural proximity of two countries increases with the interest shown in each others' web content.  In terms of the empirical specification, the virtual proximity measure is either used in lagged form in an otherwise standard gravity model, or we employ an instrumental variable technique to account for potential endogeneity issues and reverse causality.

Virtual proximity is a bilateral, bidirectional and potentially asymmetric indicator of revealed preferences.  A key advantage of using 'virtual proximity' as a measure of integration is that

---

[1]In the remainder of this paper, we use the term 'audiovisual services' as an abbreviation for audiovisual and related services.

[2]It is important to note that physical products (such as music on CDs) are not contained in audiovisual services; only downloads and licenses to use such cultural products fall in this category.

internet activities are relatively costless (in particular as they have zero variable trade costs), i.e. with few usage barriers in light of high and rising global internet penetration rates. Given the growing importance of communication and information technology, and the sharp increase of its influence on almost all transactions - be it in a business or private setting - we propose this measure as an up-to-date alternative to traditionally-used measures of cultural proximity. As such, virtual proximity might just be an updated reflection of traditional cultural and societal features, but it could also reveal additional information, for example induced by the almost unrestricted access and anonymity provided by the world wide web. In related research, Freund and Weinhold (2002) find that internet development in its partner countries has resulted in increased exports of services to the United States. Choi (2010) reports that a doubling of internet usage in a country leads to a 2% to 4% increase in services trade.

Despite the fact that audiovisual services only accounted for about 1% of global services trade in 2009, it is an important example of the increasing role of the services industry in the economy. Moreover, audiovisual services are contentiously discussed in international trade negotiations, since music, movies and television shows play a key role in transmitting culture and values across the globe. We consider the audiovisual sector to be a suitable candidate for testing our new virtual proximity indicator as the sector's very nature is closely linked to a country's cultural identity. Thus far, the most commonly used measures of cultural proximity in gravity trade models have been common language and common religion. Melitz (2008) and Melitz and Toubal (2014) compile and analyse an extensive dataset on the importance of language in trade which greatly expands on previously-existing measures. They find that countries of the same linguistic roots tend to be closer trading partners. A proxy that bears similarity to our virtual proximity measure, but is only available for European countries, was introduced by Felbermayr and Toubal (2010) in the form of bilateral scores in the Eurovision song contest; this is also an annual, bilateral and bidirectional measure of revealed preferences.

Our theoretical framework comprises two models, based on Felbermayr and Toubal (2010) and Hanson and Xiang (2011), respectively. The former model yields our baseline gravity model equation, while the latter allows for gauging the relative importance of global fixed costs and bilateral fixed costs in audiovisual services trade.

Research interest in services trade has generally grown over past years, concomitant with its rising importance in the global economy. Services span a wide range of economic activities, are very heterogeneous and due to their intangible characteristics inherently more difficult to define and measure than goods. Kimura and Lee (2006) find that services trade is better predicted by gravity equations than goods trade. Moreover, recent papers by Francois and Manchin (2011) and Johnson and Noguera (2012) report that the role of the services sector in international trade is much larger in value added terms than suggested by gross trade flow data.

Our paper also ties in with the literature on trade in cultural goods and services. Marvasti

and Canterbery (2005) find in their analysis of US motion picture exports that common language, religion and a higher education level exert a positive impact on bilateral exports from the US. Hanson and Xiang (2009) confirm the importance of market size and language for bilateral US movie exports and report that countries with more trade barriers import fewer US movies. Hanson and Xiang (2011) propose an adaptation of the Melitz (2003) model allowing fixed trade costs to be broken down into global and bilateral fixed export costs, and test this model empirically by analysing imports of US movies relative to domestic production sales. Ferreira, Petrin and Waldfogel (2012) develop a model of the global movie industry and are able to quantify the welfare consequences of foreign trade in movies. For example, they find that EU subsidies mostly benefit EU producers, indicating that these function as a trade, rather than cultural policy. Disdier et al. (2010) estimate determinants of trade in cultural goods and use bilateral trade in cultural goods as a measure of cultural proximity. Ferreira and Waldfogel (2013) analyse global music trade and find an increasing bias toward consumption of domestic music which is not negatively affected by new communications channels – such as local MTV stations and higher internet penetration rates. Trade policies, like radio airplay quotas, are found to be effective in that they increase local music consumption at the expense of foreign music. On the impact of trade in cultural services and national culture, Disdier, Head and Mayer (2010) find a significant link between non-national baby names and the prominence of foreign television shows.

The remainder of the paper proceeds as follows: in Section 2, we present the empirical gravity model and its theoretical foundation. Section 3 introduces the data, while the empirical results are shown in Section 4. Section 5 concludes.

## 2  Theoretical and empirical framework of the gravity model

As theoretical foundations of this paper we follow a two-tier strategy. First, we use a multi-country trade model with monopolistic competition and differentiated audiovisual services by country of origin following Felbermayr and Toubal (2010). With this framework, we want to assess the importance of cultural proximity variables, especially our virtual proximity indicators, relative to other barriers to trade. Second, we complement our study with a cost-analysis along the lines of Hanson and Xiang (2011), who propose an adaptation of the Melitz (2003) model allowing fixed costs to be broken down into global and bilateral fixed export costs. If global fixed costs dominate, the sales ratio (sales of audiovisual services produced in country $u$ and imported to country $k$ relative to audiovisual services produced domestically in country $k$) decreases in variable trade barriers.[3] As this is what Hanson and Xiang (2011) find for the movie sector, we compare their results to ours on audiovisual services.

---

[3]In Hanson and Xiang (2011) an *average sales ratio* is defined. However, due to lack of information on quantities produced, we define a total sales ratio.

## 2.1 Felbermayr and Toubal (2010) model

A representative economic agent of country *i* derives utility from consuming various differentiated audiovisual services according to the following utility function with constant elasticity of substitution (CES) preferences:

$$U_{it} = \sum_{j=1}^{C} \alpha_{ijt}^{(\sigma-1/\sigma)} \sum_{z=1}^{n_{jt}} (m_{zijt})^{(\sigma-1/\sigma)} \tag{1}$$

with *z* denoting the index of a generic variety, $n_{jt}$ the number of varieties produced in country *j* at time *t*, $\sigma > 1$ the elasticity of substitution between varieties produced and $m_{zijt}$ the quantity of consumption of variety *z* in country *i*. $\alpha_{ijt} \geq 0$ is a weight for the preference of consumers in country*i* for audiovisual services from country *j*, which follows Combes, Lafourcade and Mayer (2005).

All varieties of services produced in country *j* have the same ex-'factory' price $p_{jt}$ and iceberg ad valorem trade costs ($t_{ijt} \geq 1$). Hence, all varieties imported from country *j* have a uniform consumer price: $p_{ijt} = p_{jt}t_{ijt}$.[4]

Maximising (1) subject to a standard budget constraint yields country *i*'s demand $m_{zijt}$ for a generic variety. With $M_{ijt} = n_{jt}p_{ijt}m_{ijt}$ being the resulting value of total imports from country *j* at time *t*, we obtain

$$M_{ijt} = (\frac{\alpha_{ijt}}{t_{ijt}})^{\sigma-1}\mu_{it}\phi_{jt} \tag{2}$$

with variables $\mu_{it} = E_{it}p_{it}^{\sigma-1}$ and $\phi_{jt} = n_{jt}p_{jt}^{1-\sigma}$ capturing country *i*'s or *j*'s respective characteristics.[5]

We are interested in the effects of the various dimensions of cultural proximity on bilateral trade in audiovisual services as specified in equation (2), where it appears in two parameters: trade costs $t_{ijt}$ and the preference weight $\alpha_{ijt}$. Regarding the former, cultural proximity is negatively correlated with trade costs as, for example, linguistic similarity, migrants, trust and general ease of networking result in lower trade costs and are thus trade-enhancing. For the latter, a stronger preference in country *i* (reflected in a higher $\alpha_{ijt}$) for audiovisual services produced in country *j* leads to larger imports from country *j* - given the assumption that $\sigma > 1$.

Our empirical set-up captures cultural proximity by revealed cultural affinity, as reflected in our 'virtual proximity' measures, and combines these with traditional proxies for cultural proximity such as language and religion (see below and Section 3.2). With $\tilde{H}$ indicating virtual proximity, $K$ indicating the vector of traditional measures and $\kappa'$ being a (column) vector of

---

[4]As consumed quantities $m_{zijt}$ are identical for all *z*, we drop the variety index in the remainder of the derivation.

[5]$E_{it}$ denotes country *i*'s GDP, while $p_{it}$ and $p_{jt}$ are aggregate price indices.

parameters, following Felbermayr and Toubal (2010), we postulate that

$$H_{ijt} = \tilde{H}_{ijt} + \kappa' \cdot K_{ijt} \tag{3}$$

$K$ includes an indicator of the similarity of legal systems as legal fees might be substantially lower if the trading partners have similar legal structures (*common law*). In the same vein, this applies to interpretation and communication costs if countries have similar languages (*common language*). Moreover, bilateral relationships between countries are likely to be closer and of higher mutual trust if countries' religions are similar (*common religion*) and bilateral migration stocks are large (*migrants stock*). In addition, we control for both countries being member states of the EU.[6] Appendix Table I provides an overview of all variables included in this paper.

Country $i$'s cultural proximity to country $j$ depends on bilateral affinity and trade costs. Specifically, we assume that

$$ln\ \alpha_{ijt} = \alpha H_{ijt} \tag{4}$$

with $\alpha > 0$. In addition, $H_{ijt}$ has an impact on trade costs $t_{ijt}$ which are also affected by other factors, such as transportation costs. These are proxied by physical distance ($distance_{ijt}$), time zone difference ($time_{ijt}$) and the existence of common borders ($contiguous_{ijt}$). Thus we obtain the following iceberg trade costs equation:

$$ln\ t_{ijt} = \delta_1\ ln\ distance_{ijt} - \delta_2\ contiguous_{ijt}$$
$$+\delta_3 time_{ijt} - \delta_4 H_{ijt} \tag{5}$$

All parameters are expected to be positive. Combining equations (3) to (5) in (2) we obtain the following log-linear gravity equation:

$$ln(AV imports)_{ijt} = \lambda_1 distance_{ij} + \lambda_2 contiguous_{ij} + \lambda_3 time_{ij} + \lambda_4 common\ law_{ij}$$
$$+\beta_1 common\ language_{ij} + \beta_2 common\ religion_{ij} + \beta_3 migrants\ stock_{ij} + \beta_4 EU\ dummy_{ijt}$$
$$+\theta_1 virtual\ proximity_{ijt-n} + \delta\mathbf{Y}_i + \alpha_{jt} + e_{ijt} \tag{6}$$

We use audiovisual services imports (in log terms) as the dependent variable and the bilateral variables described in Section 3 as explanatory variables. In our baseline estimations, we use a cross-sectional approach for different years. Crucially, we use our measures for virtual

---

[6]Moreover, we control in robustness estimations for common colonial history, regional trade agreements, common currency zones and cultural distance based on Hofstede (2013).

proximity in lagged form or apply instrumental variable techniques to address endogeneity concerns (see Section 4.1 for details). The estimations also include exporter fixed effects $\alpha_{jt}$ and a set of importer-specific variables $\mathbf{Y}_i$.

In other estimations (Section 4.2), we pool several years of cross-sectional data and apply the gravity modelling approach of Baldwin and Taglioni (2006) by introducing time-varying importer and exporter fixed effects which remove both the cross-sectional and time-series 'omitted price' bias. Hence, only country pair-specific variables enter these pooled cross-sectional estimations.

## 2.2 Hanson and Xiang (2011) model

As a second theoretical and empirical framework, we employ the model of Hanson and Xiang (2011) to assess the relative importance of global fixed costs and bilateral fixed costs in audiovisual services trade. Hanson and Xiang (2011) propose an adaptation of the Melitz (2003) model allowing fixed trade costs to be broken down into global and bilateral fixed export costs and test this model empirically by analysing imports of US movies relative to domestically-produced sales. The properties of the audiovisual sector lend themselves to an application of the Melitz (2003) model as fixed costs are important, variable costs are relatively small and products are highly differentiated. Moreover, exports of services in this sector, such as movie licences for cinemas, air play rights and live music performances, are distinct from manufactured goods as most of the variable costs are incurred in the destination country rather than in the country of production. At the same time, fixed production costs are relatively large, for instance when producing a movie or a music recording. Another important feature of the audiovisual services sector is that transport costs are virtually zero given the nature of most services included in this category (the notable exception being live performances). Our virtual proximity measure constitutes an important cost factor for audiovisual services: closer bilateral virtual linkages between two countries may not only imply that cultural tastes are similar, but also that there is a better distribution network for audiovisual services, in particular if these are in digital format.

Global fixed export costs are those that are incurred when entering the export market per se while bilateral fixed trade costs are associated with costs pertaining to trading with one particular partner country. If global fixed export costs dominate, adjustments in trade take place along the intensive margin. If bilateral fixed costs dominate, on the other hand, adjustments happen along the extensive margin with product variety increasing. Consequently, if global trade costs are large relative to bilateral fixed export costs, a decreasing variety of products will be imported. Hanson and Xiang's (2011) model reveals if global or bilateral fixed costs dominate through the correlation of the average sales ratio and proxies for trade costs. Hanson and Xiang's (2011) extension of the Melitz (2003) model yields the following equation for the average sales ratio:

$$ln(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}) = (1-\sigma)ln(\frac{t_{uk}}{\delta_{uk}}) + lnC_u \qquad (7)$$

with $S_{uk}/n_{uk}$ and $S_{kk}/n_{kk}$ representing the relative average sales in country $k$ of audiovisual services produced in country $u$ and of domestic audiovisual services produced in country $k$, respectively. By expressing imports and domestically-produced sales as a ratio, preferences drop out of the model and thus do not need to be controlled for empirically. $\sigma$ measures the elasticity of substitution, $t_{uk}$ captures variable ad valorem trade fees and $\delta_{uk}$ is a cultural discount factor which is smaller the larger the cultural differences between two countries. Under the assumption that global fixed export costs dominate for a set of countries $G$, there is no binding constraint for domestic production. The set of countries $G$ is defined by Hanson and Xiang (2011) as being the most accessible markets for audiovisual imports from country $u$. Thus, the average sales ratio is *negatively* correlated with variable trade barriers between source and destination country.

In the case of a standard monopolistic competition model with no firm heterogeneity or fixed export costs, the average sales ratio is:

$$ln(\frac{s_{uk}/n_{uk}}{s_{kk}/n_{kk}}) = ln(\frac{s_{ukj}}{s_{kkj}}) = (1-\sigma)ln(\frac{t_{uk}}{\delta_{uk}}) \qquad (8)$$

Hanson and Xiang (2011) assume that for a set of importer countries $B$, bilateral fixed export costs dominate global export costs and thus the domestic production constraint is binding. The set of countries $B$ is characterised as having a small market size and/or high variable trade cost. Thus, Hanson and Xiang (2011) arrive at the following equation:

$$ln(\frac{s_{uk}/n_{uk}}{s_{kk}/n_{kk}}) = ln(\frac{f_{uk}}{b}) \qquad (9)$$

where the average sales ratio is *positively* correlated with fixed trade costs $f_{uk}$, which is consistent with the Melitz (2003) model.[7] In line with Hanson and Xiang (2011), we estimate the following equation based on (7) and (9):

$$ln(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}) = \alpha_u + \beta\mathbf{X}_{uk} + \lambda\mathbf{Y}_k + e_{uk} \qquad (10)$$

where we use the same empirical approach as in the gravity model presented in the previous subsection. $\mathbf{X}_{uk}$ contains all proxies for trade costs including physical distance and virtual proximity. $\mathbf{Y}_k$ includes control variables specific to country k such as population size and GDP

---

[7] $b$ is a fixed production cost parameter.

per capita. Crucially, the signs of the $\beta$-coefficients determine if global or bilateral fixed costs dominate. If the $\beta$-coefficient exhibits a negative sign with respect to trade impediments, global fixed costs dominate. In other words, most of the importing countries will be in the $G$-set. This approach also implies that one does not need to distinguish between fixed or variable trade costs, as the model predicts different signs for global and bilateral fixed costs. Thus, the question of whether global or bilateral fixed costs dominate is answered empirically.

Given our data, however, we cannot fully emulate the analysis of Hanson and Xiang (2011) as we do not have any information on the variety of products $n_{uk}$ and $n_{kk}$ due to the fact that we are analysing aggregate trade data. Thus, we cannot assess whether or not adjustments to trade barriers take place along the extensive or intensive margin. Nevertheless, we can use Hanson and Xiang's (2011) framework to assess if global or bilateral fixed costs dominate trade in audiovisual services. The lack of information on the number of varieties produced domestically or abroad implies that we need to assume either that there is only one variety traded or that the varieties produced domestically and abroad are equal. Empirically, while Hanson and Xiang (2011) difference log sales per product among imports from log sales per product among domestically-produced movies, we use several variations of their approach to gauge measures of domestic production of audiovisual services. First, we use the closest measure, namely domestic production in the audiovisual and broadcasting sector. Second, we use the broader category of domestic production of recreational, cultural and sporting activities. Third, we use a country's total audiovisual services exports as a proxy for the size of its domestic audiovisual services production.[8]

# 3 The dataset

## 3.1 Audiovisual trade data

The bilateral audiovisual services trade data are based on a combination of various data sources (the UN, OECD and Eurostat) collected for the period from 2000 to 2012. These institutions provide a detailed geographical breakdown of bilateral trade in audiovisual services following the Extended Balance of Payments Services Classification (EBOPS) methodology for transactions between residents and non-residents. Data on trade in international services are collected by national authorities from two main sources which are often combined to generate the final statistics: International Transactions Reporting System (ITRS) and enterprise surveys. In the ITRS, international payments channelled through domestic banks, and information on the purpose of a payment, are reported to the statistical agencies. Enterprise surveys enquire about all international transactions from a representative sample of service providers. For instance,

---

[8]We also experimented with scaling all bilateral audiovisual services imports by US imports in that category in order to separate out underlying cultural biases in preferences and the dominance of the US in the production of audiovisual services.

in the United Kingdom, statistics on trade in services are based on a survey covering 14,500 businesses in an annual sample (Office for National Statistics, 2015). This survey requires the reporting companies to provide details about their income from exports and expenditure on imports for various categories of trade in services, with one subitem being trade in audiovisual services. Moreover, a geographical breakdown of exports and imports must be provided.

In order to maximise the number of observations for our empirical exercise, we employ the mirror data approach as is commonly done in the services trade literature (Francois and Pindyuk, 2013). In case a country does not report bilateral data vis-a-vis a certain partner country, the gap is derived by using the data reported by the partner country (if available). The resulting country sample is shown in Appendix Table II for 2009, the year with the most complete data coverage.

Based on 2009 data, Figure 1 shows the top exporters in the audiovisual services sector. The United States is by far the main exporter of audiovisual services globally, and also has one of the largest audiovisual shares in total services exports in our sample. Interestingly, some of the main exporting countries of audiovisual services are also large importers. Germany and France are the biggest importers of audiovisual services (see Figure 2) although they have strong national and subsidised production bases for cultural products, in particular movies. France is among the five largest importers, but is not one of the five largest exporters. Interesting patterns are also visible in terms of bilateral trade of the major players in the audiovisual sector (Appendix Tables III and IV). Table III shows that the biggest bilateral trade flow takes place in the form of exports from the United States to the United Kingdom, while the reciprocal flow is much smaller and is even surpassed by Canadian and German exports to the United States. On the import side, all countries import most from the United States, followed by France in the case of Canada and the United Kingdom. Germany imports many audiovisual services from Switzerland, the UK and the Netherlands.

These statistics are indicative of the existence of a 'trading club' which has a strong taste for audiovisual services. Countries in this club are strong domestic producers of audiovisual services and import relatively large quantities. This is in line with Hanson and Xiang's (2011) concept of the G-set, with member countries of this 'trade club' being more easily accessible than others.

## 3.2 Gravity model variables

The standard geographic variables as used in equations (6) and (10) are provided by the CEPII datasets: *distance* captures the bilateral physical distance between two countries' capitals, while *time* refers to the time zone difference between two countries. We also employ indicators for countries which share a common border (*contiguous*) or have a common legal origin (*common law*). Appendix Table I gives a detailed overview of all the variables used in this paper, their sources and descriptive statistics.

*Common language index* is an aggregate index constructed by Melitz and Toubal (2014). This measure summarises evidence about linguistic influences including common official language, common native language and linguistic proximity. It thus goes beyond traditionally used measures of common language and Melitz and Toubal (2014) find that it has a strongly positive impact on trade in goods. We also use the measure of religious proximity (*common religion*) computed by Melitz and Toubal (2014), which is mainly based on the CIA Factbook. The stock of migrants data (*migrants stock*) are obtained from the World Bank International Bilateral Migration Stock database in order to control for demand by major immigrant groups in the host country. Furthermore, we use a dummy variable for joint EU membership and control in robustness estimations for common colonial history, regional trade agreements, common currency zones and cultural distance based on Hofstede (2013).

Data on GDP per capita, population, the share of urban population and internet users are retrieved from the World Bank's World Development Indicators. The OECD STAN database provides information on the domestic production in the audiovisual and broadcasting sector (which is, however, only available for a relatively small sample of countries). From the same source, we obtain the broader category of domestic production of recreational, cultural and sporting activities.

### 3.3   Virtual proximity data

Due to communication and information flows having overcome geographic boundaries with the rise of the internet, we propose virtual proximity as a novel proxy for cultural proximity. Accordingly, the main contribution of this paper in terms of data collection is gathering information from various sources on this proxy. This task is particularly difficult in light of the fact that data on bilateral internet connectivity are notoriously sparse despite the internet's growing importance.

#### 3.3.1   Hyperlink data

To capture information flows via the internet, we use bilateral, inter-domain hyperlinks that internationally connect webpages in country A to webpages in country B. Our main source on hyperlinks data is Chung (2011), who provides data on bilateral hyperlinks for two years (2003 and 2009) for up to 87 countries resulting in a large bilateral dataset on internet connectivity. Chung conducted his analysis in May 2009 with the help of Yahoo's search function and LexiURL Searcher, a social science web analysis tool developed by Thelwall (2009). At the time, Yahoo had indexed about 47 billion websites, among which Chung found more than 9.3 billion hyperlinks included in 33.8 billion sites from 273 different top-level domains.

Due to the bidirectional nature of the data, bilateral hyperlinks reflect the number of links from websites with domain .xx (i.e. from the country with domain .xx) to domain .yy (i.e. to the country with domain .yy) and vice versa. In 2009, the largest number of bilateral hyperlinks

arose from webpages hosted in the US, which contained about 49 million links to websites in the UK (Appendix Table V), followed by hyperlinks from the US to Japan (44 million) and from the US to Germany (41 million).[9] So as long as we are using country top-level domains (ccTLD) such as *.de* for Germany or *.it* for Italy, classifying source and host countries is an easy task. However, determining the host and source countries for non-national domain names, such as *.org* or *.edu*, is technically not straightforward. In particular, how to deal with the popular *.com* domain, which most international businesses use, is a crucial issue and due to the magnitude of the effect, is not negligible.[10] In addition, we obtained hyperlinks data for a smaller sample of countries referring to the year 1998 as reported by the OECD Communications Outlook 1999.

For the year 2009, Chung (2011) developed an attribution method which 'cracks', and thereby uniquely identifies the host country of a *.com* domain for his sample of 87 countries. This makes the data much richer and allows for a more complete and accurate picture of internet connectivity in light of the popularity of the *.com* domain.

An alternative approach would be to use bilateral data on internet bandwidth, for example provided by TeleGeography. However, bandwidth data often reflect the fact that countries act as internet hubs bundling and transmitting regional and often cross-border internet traffic (for example, in France, Belgium and the Netherlands) rather than content-based linkages. Thus, bandwidth data might not necessarily be indicative of national internet traffic and bilateral internet communication, and hence do not qualify as a good measure of virtual proximity.

### 3.3.2 Popularity data

In addition, we construct an alternative indicator of virtual proximity based on bilateral website visits with data retrieved from GoogleAd Planner. This source provides data on the top-100 websites (in terms of visits) for 21 countries and 60 'visiting' countries. Hence, this source also offers bilateral and bidirectional data. In order to obtain a consistent measure across countries, we choose the three most-visited 'news' websites for each country. We focus on news websites as these are likely to best gauge the interest of foreigners in a country.[11] We checked carefully that these websites are genuine news websites and not - for example - email providers which also offer some news or weather pages. For instance, the three most-visited US news websites are CNN, the New York Times and Fox News, while in the case of the UK these are the BBC, the Daily Mail and the Guardian (see Appendix Table VII).

For the three top websites for each country, we collect bilateral data on average monthly unique visitors and overall visitors for 2011 (where the former only counts each visitor once,

---

[9]Appendix Table VI provides a list of the ten smallest values of bilateral hyperlinks in our sample.

[10]For the United States, usually the sum of the domains *.edu, .us, .mil and .gov* has been used (Barnett, Chon and Rosen, 2001) in the literature. In previous studies (e.g. Barnett and Sung, 2005), the *.com* domain had either been disregarded or completely attributed to the United States.

[11]As this variable might be heavily influenced by cross-country migration, it is important to control for this in any econometric estimation.

whereas the latter counts every time that site is visited). For both measures we take averages across the three most-visited news websites to derive a consistent measure of bilateral visits that is not distorted by exceptionally popular outlier websites. We view this measure as complementary to bilateral hyperlinks as it is narrower in terms of the content but at the same time allows inference on the genuine interest in a foreign country, say when a Frenchman accesses the homepage of the New York Times. The data availability of this measures is, however, lower than for Chung's (2011) hyperlinks data. Appendix Table VIII shows the 10 closest bilateral relationships according to this metric: as in the bilateral hyperlinks measure, the highest number of (overall) visitors is recorded between the United States and the United Kingdom, followed by Canada and the United States and the United States and South Korea.[12]

### 3.3.3 Descriptive statistics on virtual proximity

In Table 1, we show the correlation coefficients between our 'benchmark' virtual proximity measure (com-cracked bilateral hyperlinks for 2009), alternative measures of virtual proximity and conventional measures of cultural and geographic proximity. These correlation coefficients are small in magnitude, which highlights the novelty of the new virtual proximity measures. The correlation between physical distance and virtual proximity is negative, while being positive for time-zone difference. Measures of cultural proximity, such as language or religion, are positively correlated with virtual proximity. Equivalently, cultural distance as defined by Hofstede (2013) is negatively correlated with virtual proximity. Moreover, there is a positive correlation between com-cracked bilateral hyperlinks and the alternative measures of virtual proximity (based on hyperlinks and popularity data).

Table 2 comprises a number of summary statistics for the various virtual proximity measures employed in the paper. It is particularly striking that the average amount of bilateral hyperlinks in our sample is twice as large for the 2009 indicator compared to the 2003 measure. While this is in part driven by the larger coverage of the 'com-cracked' 2009 measure, it also demonstrates the growth in global interconnectedness over past years.

## 4 Empirical analysis

### 4.1 Baseline results - annual estimations

We first run cross-sectional specifications for individual years to analyse the impact of the novel 'virtual proximity' measure in the log-linear gravity equation (6). The log of imports of audiovisual services is used as the dependent variable. We begin by estimating our gravity equation for the year 2009, i.e. the year for which Chung's (2011) com-cracked hyperlink variable is available and the non-national '.com' domain can be uniquely attributed to the respective host

---

[12]Appendix Table IX provides a list of the 10 smallest values of bilateral overall visitors in our sample.

country. Moreover, we can introduce country-specific characteristics of the importing country in this cross-sectional framework, while we opt for fixed effects for the exporting countries.

We first focus on our virtual proximity variable (in logs, measuring how many hyperlinks are set from the importing country to the exporting country). In Table 3, column 1, we find a positive coefficient of 0.45 for bilateral hyperlinks (significant at the 1% level). Hence, a 1% increase in the level of bilateral hyperlinks set from the importing country to the exporting country is associated with a 0.45% increase in bilateral audiovisual imports.

In column 1, virtual proximity and audiovisual services are measured for the same year. Thus, implicitly, the estimation treats internet connectivity as exogenous, which might raise concerns as individuals and firms choose the number of hyperlinks. Virtual proximity could thus be endogenous to audiovisual trade. For instance, when foreign consumers increase their downloads of US movies, this might increase the number of hyperlinks to the US. Given the unique and novel nature of our virtual proximity measure, valid instruments are not available. However, we opt for using lagged proximity measures in two ways to address the potential reverse causality problem. First, we use the virtual proximity measure for 2009 (as in column 1), but estimate the gravity equation for 2010, 2011 and 2012 (columns 2 to 4, respectively). Using its 2009 values, we find highly significant coefficients for virtual proximity of 0.64 for 2010 and 2011 as well as 0.53 for 2012.

Second, we follow Felbermayr and Toubal (2010) and use the 2003 and 1998 virtual proximity measures as instruments for the 2009 virtual proximity measure in the equation for 2009. This allows for using the time dimension of our virtual proximity data to estimate the effect of an exogenous change in virtual proximity. It is reasonable to assume that past bilateral hyperlinks (i.e. from 2003 and 1998) are pre-determined and unaffected by future shocks to bilateral trade volumes. This implies that current shocks in the gravity equation are uncorrelated with lagged virtual proximity values and thus qualify as valid instruments. Columns 5 and 6 present the results based on 2SLS instrumental variable estimation (IV). Using the 2003 virtual proximity measure as the instrument actually increases the size of the coefficient to 0.63 (column 5), compared with a value of 0.45 in the original estimation for 2009 (column 1). The coefficient even increases to 1.47 (column 6) when 1998 bilateral hyperlinks data are employed. For this estimation, however, the sample size is significantly reduced. Nevertheless, the IV results strongly support the contemporaneous impact of virtual proximity on bilateral trade in audiovisual services both in terms of significance and magnitude, with all coefficients in fact being larger in the IV estimation than in the OLS specification.

In columns 7 and 8 we introduce our popularity data-based measure of virtual proximity collected from GoogleAd Planner for 2011 on visitors (unique and overall) to the most important news websites. In order to avoid any reverse causality issues, we estimate this specification for 2012. These bilateral and bidirectional measures of virtual proximity also exhibit positive signs and are significant, albeit with a substantially reduced sample size.

Among the control variables in Table 3, we find a negative coefficient on physical distance and a positive and significant effect (at the 1% level) on the bilateral level of audiovisual imports from the bilateral stock of migrants (which is however not significant in the IV estimations). As demand for audiovisual services is particularly driven by information, socialisation and tastes, it is reasonable to assume that migrants have consistent cultural preferences across their locations of residence and thus tend to import cultural content from their home countries.

As a benchmark for trade in audiovisual services we also estimate the same specifications with trade in total services as the dependent variable (Appendix Table X). This exercise shows that bilateral hyperlinks are also positively associated with bilateral trade in total services albeit with half the size of the coefficient. We also observe that physical distance tends to exert a more negative effect on bilateral trade in audiovisual services than on total trade. The popularity-based measures of virtual proximity, however, fail to be significant for total services trade, while a common legal origin imposes a significant positive impact only on total services trade.

The presented evidence from both the lagged values approach and the IV estimation suggests that the OLS results bias the effect of virtual proximity downwards. This is in line with the findings of Felbermayr and Toubal (2010) for the effect of European Song Contest scores on trade in goods and lends further proof to the significance of virtual proximity for audiovisual services trade. Our new proxy is indicative of the fact that virtual proximity matters for international trade in services and expands on the list of determinants in a traditional gravity model. Particularly, given the information-intensity in the services sector and the increasing frequency of virtual exchanges in the conduct of business, it appears that the inclusion of virtual proximity is an important addition to the literature. This is especially the case as the intensity of hyperlinks between countries reveals the underlying preferences of economic agents in choosing their partner countries and their cultural products (similarly to the Eurovision Song Contest scores used by Felbermayr and Toubal, 2010).

## 4.2    Robustness analysis - annual and pooled cross-sectional estimations

A common concern in the literature are zero trade flows, which are often observed in international trade statistics. Trade flows recorded with a value of zero disappear in conventional logarithmic estimations. This could give rise to selection problems, for example in the case that virtual proximity had only a significant role in explaining non-zero trade flows. For comparison, in Table 4 we use a remedy in dealing with this phenomenon, namely the Poisson quasi-maximum likelihood estimation method (PPML) as proposed by Santos Silva and Tenreyro (2006), which includes audiovisual services trade in levels rather than in log form. This removes the zero trade flow problem as the dependent variable does not require a logarithmic transformation and almost doubles the number of observations compared to the results in Table 3. Silva and Tenreyro (2006) point out that PPML estimators perform better in the presence of heteroskedasticity as OLS estimators are not efficient in this case. In our PPML estimations,

we follow the same approach as presented in Table 3, i.e. running annual estimations and employing IV techniques. The coefficient on bilateral hyperlinks becomes slighlty larger for the 2009 estimation (0.55), but smaller for the years 2010 to 2012 (in the range of 0.21 to 0.37). The change in magnitude of the virtual proximity coefficient for these years might be explained by the fact that the values of these variables are positive, while a substantial amount of zero trade flows are added to the estimation. We also use the PPML IV estimator as proposed by Windmeijer and Santos Silva (1997). Using the 2003 bilateral hyperlinks measure as an instrument yields a coefficient of 0.33 on virtual proximity (column 5), while the coefficient based on the 1998 measure (column 6) results in a coefficient of 3.1 (both significant at the 1% level). Furthermore, the popularity-based virtual proximity measures are also significant in the PPML estimations (columns 7 and 8) for 2012. Thus, the PPML estimation shows largely equivalent results, with linguistic and religious similarity turning significant in some estimations, confirming that our findings obtained with log-linear OLS are not significantly affected by excluding zero trade flows. Accordingly, we opt for using OLS estimations as our baseline approach because our interest is in explaining 'significant' trade - which is by definition non-zero. However, we take it as reassuring that the PPML estimations are in line with our benchmark findings. Employing OLS in the baseline estimations and complementing with PPML follows the approach of Toubal and Melitz (2014).

Given the novelty of the virtual proximity variable and its importance for the audiovisual sector, we present further evidence on the robustness of this measure in Table 5. In columns 1 to 4, we produce regressions based on the year 2012 in order to have the biggest time gap between observed virtual proximity and audiovisual trade outcomes (as in Table 3, column 4).

In column 1, the set of traditionally-used gravity model determinants is expanded by including country-pair dummy variables for common colonial history, common currency and participation in the same regional trade agreement. These three variables fail to be significant, while not changing the main findings and significance levels of our benchmark regression. Next, we explicitly control for cultural factors by including data on cultural distance from Hofstede (2013), as for example employed by Lucey and Zhang (2010) in the context of international stock market movements and Davies, Ionascu and Kristjansdottir (2008) for foreign direct investment. This index combines different dimensions of the cultural environment, namely individualism, masculinity, power distance and uncertainty avoidance. We construct this variable based on Kogut and Singh's (1988) method of measuring deviations along each dimension between all bilateral country pairs. The resulting indicator is not significant, but the results on virtual proximity remain unaltered (column 2). Third, the dominance of the United States in audiovisual services might affect our findings. Hence, in column 3, we report results of our benchmark regression excluding the United States as a trading partner for audiovisual services. The findings on virtual proximity still hold (with a coefficient of 0.54) while most of the other coefficients are also in line with the previous estimations. Consequently, there is no evidence that the United

States is driving the general results of our analysis.

Furthermore, in our cross-sectional framework we can introduce country-specific characteristics of the importing country while continuing to use fixed effects for the exporting countries. Thus - apart from standard controls such as GDP per capita and population size - we include the percentage of internet users in the importing country as well as the share of urban population in column 4. Both of these variables are indicative of a country's state of modernity, openness and access to new technologies. A higher share of internet users in the total population is significantly associated with more audiovisual imports (column 4), which is in line with the finding of Choi (2010) for total services, and a higher share of urban population implies more audiovisual imports. The latter could be a direct effect as usually in countries with a higher concentration in cities, a larger number of cultural events (such as concerts and festivals) takes place. These are included in audiovisual services imports if the performing artists are foreign residents. Moreover, an indirect effect could materialise as a higher share of urban population might reflect a more modern society which is thus more open to audiovisual content from abroad. Controlling for these factors, the results on virtual proximity are still consistent with the benchmark estimation, exhibiting high significance with a coefficient of 0.51.

We also analyse the impact of the novel 'virtual proximity' measure in the log-linear gravity equation (6) based on pooled cross-sections for the years 2010 to 2012 and 2011 to 2012, respectively, in columns 5 to 8. Columns 5 and 6 use exporter and importer time fixed effects, while columns 7 and 8 include separate importer, exporter and year dummies.[13] Virtual proximity is highly significant with coefficients of around 0.55. Strikingly however, physical distance turns out to be the only other significant variable with a coefficient of around 0.70.

In Appendix Table XI, we again use pooled cross-sectional estimations, but this time with the virtual proximity measure for 2003 (columns 1 to 3) and 1998 (columns 4 to 6). We include the full set of exporter and importer time-varying fixed effects in these estimations. In columns 1 to 3, we let the sample start in 2004, 2005 and 2006, respectively, and find positive, highly significant coefficients on virtual proximity in the range of 0.26 to 0.29. In columns 4 to 6, we let the sample start in 2000, 2001 and 2002, respectively, and again find positive, highly significant coefficients on virtual proximity of around 0.60. The larger coefficients in the latter set of estimations might arise from the particular, smaller sample of countries included in these estimations.

## 4.3 Difference estimations

In this section, we follow Hanson and Xiang's (2011) approach to shed light on the question of whether global or bilateral fixed costs dominate trade in audiovisual services. As described in Section 2.2, we take the ratio of log audiovisual services imports to various proxies for domestic

---

[13]In the pooled cross-sectional estimations in this paper, we employ standard errors that are clustered at the country-pair level as in Melitz and Toubal (2014), thus adjusting upwards the standard errors.

production of audiovisual services. We run annual cross-sectional and pooled cross-sectional estimations of these ratios on the same set of explanatory variables as in our previous analysis and in line with equation (10). Due to data constraints, the annual regressions are estimated for 2010 with virtual proximity being measured by Chung's (2011) 'com-cracked' data for 2009. We largely find the results (Table 6, columns 1 to 3) to be consistent with our previous analysis (except when using total exports as a proxy for domestic production, column 3). In our preferred estimation reported in column 1, we scale audiovisual imports by domestic production. Distance (both physical and time zone) has a negative impact on this ratio, while the coefficient on virtual proximity is positive. The same holds true when we use domestic production of the broader category of recreational, cultural and sporting activities (column 2). These results are confirmed in a pooled cross-sectional framework (columns 4 to 6), where we lump together all years after 2010: physical distance and virtual proximity are significant across all of these estimations.[14]

Thus, in line with Hanson and Xiang's (2011) findings for movies, we find a negative correlation between proxies for trade barriers and the import to domestic production ratio of audiovisual services. Moreover, according to their framework, our results indicate that distance and virtual proximity matter for audiovisual services trade through variable costs rather than through fixed costs. The results further suggest that global fixed export costs dominate bilateral fixed costs for most countries in the sample. These findings are indicative of the fact that as in Hanson and Xiang (2011), the majority of countries belong to the $G$-set, i.e. importing countries that have a relatively large market and/or have low variable trade costs. In addition, the findings indicate that adjustment in audiovisual services tends to occur at the intensive margin.

## 5 Conclusion

Against the background of strong growth in audiovisual services as reflected by ever increasing digital album sales and live music performances, audiovisual services and their determinants are of importance for economic researchers and policy-makers.

This paper analyses audiovisual services in a gravity model framework. In particular, we explore the role of virtual proximity - a new proxy for cultural proximity based on bilateral hyperlinks and bilateral website visits between countries - and find that 'virtually-proximate' countries trade significantly larger amounts of audiovisual services. Virtual proximity also has a larger impact on trade in audiovisual services than on total services trade. Moreover, in line with Hanson and Xiang (2011), our results indicate that distance and virtual proximity matter for audiovisual services trade through variable costs rather than fixed trade costs, while global fixed export costs dominate bilateral export costs.

Our new virtual proximity measure is found to be a very significant determinant of trade in audiovisual services, which represents a natural candidate to test this novel proxy. This

---

[14]Scaling bilateral audiovisual services imports by imports from the United States delivers very similar results.

finding is robust to a wide range of tests. Accordingly, our paper contributes to the growing body of literature that links economic outcomes to cultural factors. Moreover, it accounts for and highlights the growing importance of the internet on economic transactions. Thus, it will be crucial for future research to analyse the effects of virtual proximity on other trade flows of goods and services and their subcomponents. Furthermore, one could explore the role of virtual proximity for cross-border investment patterns.

## References

[1] Baldwin, R., Taglioni, D. 2006. 'Gravity for Dummies and Dummies for Gravity Equations'. NBER Working Papers No. 12516, National Bureau of Economic Research, Inc.

[2] Barnett, G., Chon, B., Rosen, D. 2001. 'The Structure of the Internet Flows in Cyberspace'. Network and Communication Studies NETCOM, 15(2): 61-80.

[3] Barnett, G., Sung, E. 2005. 'Culture and the Structure of the International Hyperlink Network'. *Journal of Computer-Mediated Communication*, 11(1): 217-238.

[4] Choi, C. 2010. 'The Effect of the Internet on service trade'. *Economics Letters*, 109(2): 102-104.

[5] Chung, J. 2011. 'The Geography of Global Internet Hyperlink Networks and Cultural Content Analysis'. Dissertation, University at Buffalo.

[6] Combes, P.P., Lafourcade, M., Mayer,T. 2005. 'The trade-creating effects of business and social networks: evidence from France.' *Journal of International Economics*, 66 (1): 1-29.

[7] Davies, R., Ionascu, D., Kristjansdottir, H. 2008. 'Estimating the Impact of Time-Invariant Variables on FDI with Fixed Effects'. *Review of World Economics*, 144(3): 381-407.

[8] Disdier, A., Head, K., Mayer, T. 2010. 'Exposure to foreign media and changes in cultural traits: Evidence from naming patterns in France.' *Journal of International Economics*, 80(2): 226-238.

[9] Disdier, A., Tai, S., Fontagne, L., Mayer, T. 2010. 'Bilateral trade of cultural goods'. *Review of World Economics*, 145(4): 575-595.

[10] Felbermayr, G., Toubal, F. 2010. 'Cultural proximity and trade'. *European Economic Review*, 54(2): 279-293.

[11] Ferreira, F., Petrin, A., Waldfogel, J. 2012. 'Trade and Welfare in Motion Pictures'. Manuscript, University of Pennsylvania, University of Minnesota and NBER.

[12] Ferreira, F., Waldfogel, J. 2013. 'Pop Internationalism: Has Half a Century of World Music Trade Displaced Local Culture?'. *The Economic Journal*, 123: 634-664.

[13] Francois, J., Manchin, M. 2011. 'Services linkages and the value added content of trade', World Bank working paper No. 6432.

[14] Francois, J., Pindyuk, O. 2013. 'Consolidated Data on International Trade in Services'. IIDE Discussion Papers 20130101, Institue for International and Development Economics.

[15] Freund, C., Weinhold, D. 2002. 'The Internet and International Trade in Services', *The American Economic Review*, 92(2): 236-240.

[16] Hanson, G., Xiang, C. 2009. 'International Trade in Motion Picture Services'. In: Reinsdorf, M., Slaughter M. (Eds.) *International Trade in Services and Intangibles in the Era of Globalization*: University of Chicago Press, 203-222.

[17] Hanson, G., Xiang, C. 2011. 'Trade Barriers and Trade Flows with Product Heterogeneity: An Application to US Motion Picture Exports'. *Journal of International Economics*, 83(1): 14-26.

[18] Hofstede, G. 2013. Cultural dimensions data retrieved from http://www.geert-hofstede.com.

[19] Johnson, R. and Noguera, G. 2012. 'Accounting for intermediates: Production sharing and trade in value added', *Journal of International Economics*, 86(2): 224-236.

[20] Kimura, F., Lee, H. 2006. 'The Gravity Equation in International Trade in Services'. *Review of World Economics*, 142(1): 92-121.

[21] Kogut, B., Singh, H. 1988. 'The effect of national culture on the choice of entry mode.' *Journal of International Business Studies*, 19(3): 411-432.

[22] Lucey, B., Zhang, Q. 2010. 'Does Cultural Distance Matter in International Stock Market Comovement? Evidence from Emerging Economies around the World'. *Emerging Markets Review*, 11(1): 62-78.

[23] Marvasti, A., Canterbery, E. R. 2005. 'Cultural and Other Barriers to Motion Pictures Trade'. *Economic Inquiry*, 43(1): 39-54.

[24] Melitz, M. J. 2003. 'The impact of trade on intra-industry reallocations and aggregate industry productivity.' *Econometrica*, 71(6): 1695-1725.

[25] Melitz, J. 2008. 'Language and Foreign Trade'. *European Economic Review*, 52(4): 667-699.

[26] Melitz, J., Toubal, F. 2014. 'Native Language, Spoken Language, Translation and Trade'. *Journal of International Economics*, 93(2): 351-363.

[27] OECD 1999. 'OECD Communications Outlook 1999'. OECD Publishing.

[28] Office for National Statistics 2015. 'Quality and Methodology Information in International Trade in Services', retrieved from http://www.ons.gov.uk/ons/rel/itis/international-trade-in-services/2013/index.html.

[29] Santos Silva, J.M.C. and Tenreyro, S. 2006. 'The Log of Gravity', *Review of Economics and Statistics*, 88(4): 641-658.

[30] Thelwall, M. 2009. Introduction to Webometrics. New York: Morgan & Claypool.

[31] Windmeijer, F. and Santos Silva, J.M.C. 1997. 'Endogeneity in count data models: an application to demand for health care', *Journal of Applied Econometrics*, 12(3), pp. 281-294.

Figure 1: Largest audiovisual exporters in 2009



total audiovisual exports in million USD (left scale)
audiovisual exports to total sevices exports in percent (right scale)
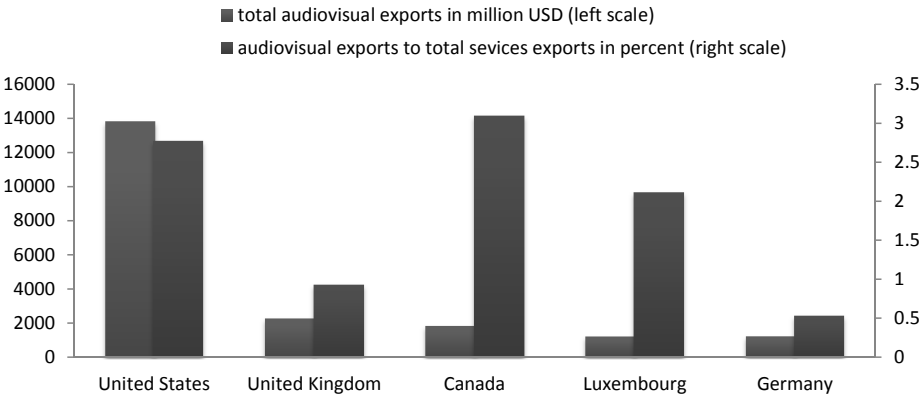
## Figure 2: Largest audiovisual importers in 2009

■ total audiovisual imports in million USD (left scale)

■ audiovisual imports to total services imports in percent (right scale)
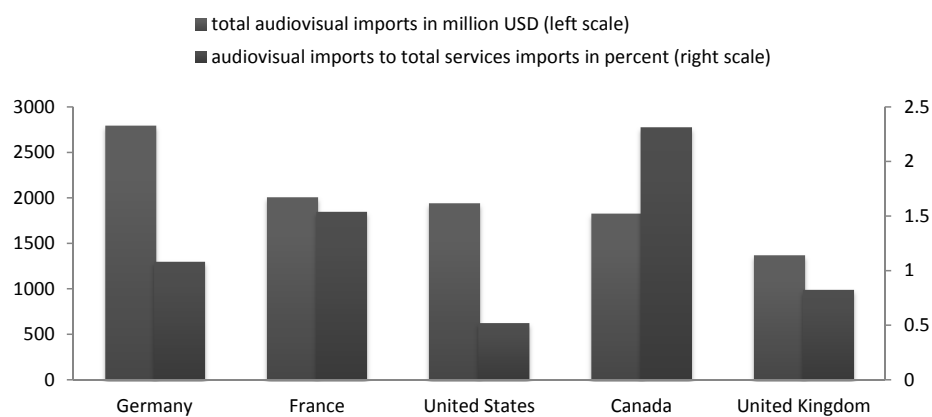


## Table 1: Correlation coefficients of different measures of cultural proximity

|  | Bilateral hyperlinks 2009 (.com cracked) |
|---|---|
| Distance (log) | -0.062 |
| Common border | 0.206 |
| Time zone difference | 0.086 |
| Common legal origin | 0.104 |
| Common religion | 0.198 |
| Common language Index | 0.272 |
| Migrants (log) | 0.552 |
| Bilateral hyperlinks 2003 | 0.668 |
| Bilateral hyperlinks 1998 | 0.775 |
| Unique visitors (log) | 0.265 |
| Overall visitors (log) | 0.260 |
| Cultural distance (Hofstede) | -0.236 |

Table 2: Summary statistics for different measures of virtual proximity

| Variable | Observations | Mean | Stand. Dev. |
|---|---|---|---|
| Bilateral hyperlinks 2009 (level, .com-cracked) | 950 | 1,574,068 | 4,287,740 |
| Bilateral hyperlinks 2009 (log, .com-cracked) | 950 | 12.56 | 2.02 |
| Bilateral hyperlinks 1998 (level) | 472 | 7,061 | 19,359 |
| Bilateral hyperlinks 1998 (log) | 472 | 7.48 | 1.63 |
| Bilateral hyperlinks 2003 (level) | 827 | 725,646 | 1,974,963 |
| Bilateral hyperlinks 2003 (log) | 827 | 11.89 | 1.88 |
| Unique visitors (level) | 238 | 4,602 | 211,147 |
| Unique visitors (log) | 238 | 8.43 | 3.49 |
| Overall visitors (level) | 239 | 25,118 | 1,210,702 |
| Overall visitors (log) | 239 | 10.13 | 3.60 |

Table 3: Annual cross-sections: virtual proximity

| Log (imports) | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2009 IV | 2009 IV | 2012 | 2012 |
| Distance (log) | -0.771 | -0.691 | -0.769 | -0.965 | -0.667 | -0.440 | -0.697 | -0.705 |
| | [0.138]*** | [0.151]*** | [0.133]*** | [0.149]*** | [0.144]*** | [0.277] | [0.187]*** | [0.188]*** |
| Common border | -0.152 | -0.300 | -0.351 | -0.151 | -0.154 | -0.195 | 0.598 | 0.599 |
| | [0.228] | [0.242] | [0.250] | [0.262] | [0.246] | [0.269] | [0.325]* | [0.325]* |
| Time zone difference | -0.053 | -0.012 | -0.006 | 0.107 | -0.066 | -0.039 | 0.095 | 0.096 |
| | [0.042] | [0.047] | [0.043] | [0.049]** | [0.043] | [0.080] | [0.060] | [0.060] |
| Common legal origin | 0.173 | 0.297 | 0.082 | -0.244 | 0.342 | 0.217 | 0.114 | 0.123 |
| | [0.172] | [0.185] | [0.177] | [0.193] | [0.181]* | [0.247] | [0.268] | [0.264] |
| Common religion | -0.437 | -0.121 | -0.042 | -0.219 | -0.096 | -0.004 | -0.794 | -0.813 |
| | [0.348] | [0.357] | [0.315] | [0.347] | [0.377] | [0.384] | [0.557] | [0.556] |
| Common language Index | 0.345 | 0.308 | 0.090 | 0.105 | -0.154 | -0.595 | -0.473 | -0.417 |
| | [0.450] | [0.489] | [0.422] | [0.487] | [0.523] | [0.672] | [0.685] | [0.686] |
| GDP per cap (log) | 0.625 | 0.419 | 0.302 | 0.360 | 0.632 | -0.130 | 0.652 | 0.627 |
| | [0.138]*** | [0.148]*** | [0.149]** | [0.154]** | [0.176]*** | [0.410] | [0.177]*** | [0.178]*** |
| Population (log) | 0.430 | 0.257 | 0.251 | 0.173 | 0.291 | -0.419 | 0.475 | 0.484 |
| | [0.115]*** | [0.112]** | [0.115]** | [0.119] | [0.160]* | [0.390] | [0.101]*** | [0.101]*** |
| EU | -0.097 | 0.067 | 0.285 | 0.255 | -0.086 | 0.100 | 1.124 | 1.125 |
| | [0.235] | [0.281] | [0.265] | [0.266] | [0.258] | [0.290] | [0.420]*** | [0.422]*** |
| Migrants (log) | 0.113 | 0.116 | 0.092 | 0.151 | 0.057 | 0.004 | 0.217 | 0.208 |
| | [0.034]*** | [0.037]*** | [0.035]*** | [0.037]*** | [0.039] | [0.071] | [0.077]*** | [0.078]*** |
| Bilateral hyperlinks | 0.447 | 0.644 | 0.639 | 0.525 | 0.630 | 1.474 | | |
| | [0.113]*** | [0.109]*** | [0.118]*** | [0.129]*** | [0.171]*** | [0.466]*** | | |
| Unique visitors (log) | | | | | | | 0.124 | |
| | | | | | | | [0.074]* | |
| Overall visitors (log) | | | | | | | | 0.132 |
| | | | | | | | | [0.075]* |
| Exporter country FE | yes | yes | yes | yes | yes | yes | yes | yes |
| Observations | 883 | 794 | 765 | 807 | 719 | 416 | 200 | 200 |
| R-squared | 0.64 | 0.63 | 0.62 | 0.63 | 0.62 | 0.63 | 0.714 | 0.714 |

*Notes:* The dependent variable is audiovisual services imports (in natural log form); the explanatory variables are distance between capitals (in natural log form), time zone difference (in hours), the bilateral stock of migrants (in natural log form), bilateral hyperlinks for 2009 (com-cracked, in natural log form, columns 1-6), dummy variables for common border, common legal origin and EU membership and similarity indices for religion and languages. Moreover, the estimation includes GDP per capita and population of the importing country (both in natural log form). Columns 7 and 8 include bilateral amounts of visitors on news websites (in natural log form, unique and overall, respectively). The estimation uses exporter fixed effects. Instrumental variables estimation (2SLS) in columns 5 and 6. Bilateral hyperlinks for 2009 (com-cracked) are instrumented by bilateral hyperlinks for 2003 (column 5) and bilateral hyperlinks for 1998 (column 6). Robust standard errors in brackets. * significant at 10% level; ** significant at 5% level, *** significant at 1% level.

Table 4: Annual cross-sections: virtual proximity, PPML estimations

| Log (imports) | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2009 IV | 2009 IV | 2012 | 2012 |
| Distance (log) | -0.369 | -0.801 | -0.636 | -0.638 | -0.646 | -1.315 | -0.417 | -0.426 |
| | [0.139]*** | [0.147]*** | [0.116]*** | [0.117]*** | [0.202]*** | [0.585]** | [0.172]** | [0.169]** |
| Common border | -0.515 | -0.032 | -0.157 | -0.030 | -0.045 | -0.231 | 0.354 | 0.389 |
| | [0.229]** | [0.309] | [0.255] | [0.253] | [0.412] | [0.554] | [0.256] | [0.258] |
| Time zone difference | -0.103 | 0.001 | 0.014 | 0.010 | 0.149 | -0.133 | 0.039 | 0.058 |
| | [0.046]** | [0.052] | [0.044] | [0.045] | [0.063]** | [0.153] | [0.061] | [0.059] |
| Common legal origin | 0.300 | -0.142 | 0.147 | 0.110 | 0.022 | -0.963 | -0.180 | -0.204 |
| | [0.148]** | [0.352] | [0.177] | [0.178] | [0.242] | [0.677] | [0.218] | [0.229] |
| Common religion | 0.316 | 0.914 | 0.877 | 0.696 | 0.962 | 1.690 | -0.082 | -0.141 |
| | [0.415] | [0.482]* | [0.408]** | [0.413]* | [0.508]* | [1.233] | [0.413] | [0.413] |
| Common language Index | 1.578 | 0.888 | 0.938 | 0.608 | 2.316 | 2.170 | -0.730 | -0.517 |
| | [0.543]*** | [0.631] | [0.590] | [0.588] | [0.842]*** | [1.043]** | [0.805] | [0.783] |
| GDP per cap (log) | -0.028 | -0.730 | -0.057 | -0.055 | -0.097 | -1.469 | 0.132 | 0.247 |
| | [0.262] | [0.557] | [0.300] | [0.296] | [0.187] | [0.623]** | [0.334] | [0.401] |
| Population (log) | 0.483 | 0.506 | 0.613 | 0.613 | 0.107 | -0.379 | 0.428 | 0.324 |
| | [0.208]** | [0.309] | [0.281]** | [0.285]** | [0.101] | [0.367] | [0.278] | [0.270] |
| EU | 0.360 | 0.400 | 0.526 | 0.531 | -0.980 | -3.010 | 0.380 | 0.391 |
| | [0.144]** | [0.196]** | [0.163]*** | [0.158]*** | [0.307]*** | [0.743]*** | [0.138]*** | [0.127]*** |
| Migrants (log) | 0.018 | 0.023 | 0.070 | 0.073 | 0.238 | -0.697 | 0.175 | 0.153 |
| | [0.059] | [0.068] | [0.060] | [0.060] | [0.077]*** | [0.199]*** | [0.061]*** | [0.062]** |
| Bilateral hyperlinks | 0.548 | 0.368 | 0.252 | 0.212 | 0.326 | 3.061 | | |
| | [0.124]*** | [0.131]*** | [0.114]** | [0.116]* | [0.112]*** | [0.595]*** | | |
| Unique visitors (log) | | | | | | | 0.385 | |
| | | | | | | | [0.106]*** | |
| Overall visitors (log) | | | | | | | | 0.380 |
| | | | | | | | | [0.104]*** |
| Exporter country FE | yes | yes | yes | yes | yes | yes | yes | yes |
| Observations | 1,583 | 1,448 | 1,408 | 1,405 | 1,120 | 526 | 222 | 222 |
| R-squared | 0.87 | 0.78 | 0.86 | 0.88 | 0.14 | 0.01 | 0.93 | 0.93 |

*Notes:* The dependent variable is audiovisual services imports (in natural log form); the explanatory variables are distance between capitals (in natural log form), time zone difference (in hours), the bilateral stock of migrants (in natural log form), bilateral hyperlinks for 2009 (com-cracked, in natural log form, columns 1-6), dummy variables for common border, common legal origin and EU membership and similarity indices for religion and languages. Moreover, the estimation includes GDP per capita and population of the importing country (both in natural log form). Columns 7 and 8 include bilateral amounts of visitors on news websites (in natural log form, unique and overall, respectively). The estimation uses exporter fixed effects. Instrumental variables estimation in columns 5 and 6. Bilateral hyperlinks for 2009 (com-cracked) are instrumented by bilateral hyperlinks for 2003 (column 5) and bilateral hyperlinks for 1998 (column 6). Estimation by PPML. Robust standard errors in brackets. * significant at 10% level; ** significant at 5% level, *** significant at 1% level.

Table 5: Virtual proximity: robustness

| Log (imports) | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | 2012 | 2012 | 2012 | 2012 | >2009 | >2010 | >2009 | >2010 |
| | | | Excl. US | | | | | |
| Distance (log) | -0.956 | -0.942 | -0.944 | -0.961 | -0.703 | -0.700 | -0.722 | -0.715 |
| | [0.149]*** | [0.150]*** | [0.150]*** | [0.159]*** | [0.162]*** | [0.172]*** | [0.152]*** | [0.165]*** |
| Common border | -0.149 | -0.120 | -0.141 | -0.117 | -0.088 | -0.054 | -0.088 | -0.043 |
| | [0.263] | [0.257] | [0.263] | [0.262] | [0.222] | [0.241] | [0.210] | [0.232] |
| Time zone difference | 0.129 | 0.102 | 0.105 | 0.087 | -0.013 | -0.012 | -0.007 | -0.005 |
| | [0.058]** | [0.050]** | [0.053]** | [0.051]* | [0.045] | [0.045] | [0.043] | [0.044] |
| Common legal origin | -0.300 | -0.231 | -0.310 | -0.293 | 0.162 | 0.031 | 0.181 | 0.044 |
| | [0.207] | [0.194] | [0.200] | [0.196] | [0.177] | [0.179] | [0.166] | [0.172] |
| Common religion | -0.201 | -0.304 | -0.107 | -0.044 | 0.068 | 0.046 | 0.063 | 0.044 |
| | [0.352] | [0.350] | [0.352] | [0.350] | [0.316] | [0.331] | [0.299] | [0.315] |
| Common language Index | 0.117 | -0.130 | 0.077 | 0.314 | 0.646 | 0.551 | 0.647 | 0.547 |
| | [0.491] | [0.495] | [0.497] | [0.486] | [0.452] | [0.483] | [0.429] | [0.467] |
| GDP per cap (log) | 0.337 | 0.384 | 0.310 | -0.165 | | | | |
| | [0.160]** | [0.166]** | [0.156]** | [0.225] | | | | |
| Population (log) | 0.170 | 0.158 | 0.121 | 0.214 | | | | |
| | [0.122] | [0.125] | [0.121] | [0.120]* | | | | |
| EU | 0.134 | 0.263 | 0.228 | 0.191 | -0.122 | -0.042 | -0.127 | -0.066 |
| | [0.285] | [0.271] | [0.268] | [0.273] | [0.450] | [0.470] | [0.417] | [0.446] |
| Migrants (log) | 0.144 | 0.149 | 0.144 | 0.146 | 0.051 | 0.054 | 0.047 | 0.050 |
| | [0.038]*** | [0.038]*** | [0.038]*** | [0.036]*** | [0.041] | [0.043] | [0.039] | [0.042] |
| Bilateral hyperlinks | 0.545 | 0.538 | 0.542 | 0.511 | 0.517 | 0.564 | 0.497 | 0.551 |
| | [0.131]*** | [0.138]*** | [0.130]*** | [0.128]*** | [0.128]*** | [0.136]*** | [0.124]*** | [0.136]*** |
| Common colony | 0.865 | | | | | | | |
| | [1.140] | | | | | | | |
| Common currency | 0.094 | | | | | | | |
| | [0.226] | | | | | | | |
| Regional trade agreement | 0.320 | | | | | | | |
| | [0.350] | | | | | | | |
| Cultural distance (Hofstede) | | -0.046 | | | | | | |
| | | [0.053] | | | | | | |
| Internet users | | | | 0.018 | | | | |
| | | | | [0.010]* | | | | |
| Share Urban population | | | | 0.019 | | | | |
| | | | | [0.008]** | | | | |
| Exporter dummies | yes | yes | yes | yes | no | no | yes | yes |
| Importer dummies | no | no | no | no | no | no | yes | yes |
| Exporter time dummies | no | no | no | no | yes | yes | no | no |
| Importer time dummies | no | no | no | no | yes | yes | no | no |
| Time dummies | no | no | no | no | no | no | yes | yes |
| Observations | 807 | 807 | 780 | 768 | 2371 | 1575 | 2371 | 1575 |
| R-squared | 0.71 | 0.63 | 0.61 | 0.60 | 0.71 | 0.71 | 0.68 | 0.69 |

*Notes:* The dependent variable is audiovisual services imports (in natural log form); the explanatory variables are distance between capitals (in natural log form), time zone difference (in hours), the bilateral stock of migrants (in natural log form), bilateral hyperlinks for 2009 (com-cracked, in natural log form), dummy variables for common border, common legal origin and EU membership as well as common colonial history, common currency and regional trade agreements (column 1), cultural distance (column 2) and similarity indices for religion and languages. Columns 1 to 4 include GDP per capita and population of the importing country (both in natural log form) and column 4 includes the share of internet users in the total population and the share of urban population. Column 3 excludes all observations of the United States. Robust (columns 1 to 4)/clustered standard errors (at the country-pair level, columns 5 to 8) in brackets. * significant at 10% level; ** significant at 5% level, *** significant at 1% level.

Table 6: Cross-section for 2010: difference equations

| Log difference | (1) AV imports/ AV domestic production | (2) AV imports/ Recreation, cultural and sporting activities | (3) AV imports/ total AV exports | (4) AV imports/ AV domestic production | (5) AV imports/ Recreation, cultural and sporting activities | (6) AV imports/ total AV exports |
|---|---|---|---|---|---|---|
| Distance (log) | -0.565 | -0.688 | -0.054 | -0.519 | -0.762 | -0.694 |
| | [0.258]** | [0.231]*** | [0.178] | [0.255]** | [0.187]*** | [0.163]*** |
| Common border | -0.473 | -0.320 | 0.756 | -0.334 | -0.171 | -0.083 |
| | [0.308] | [0.268] | [0.325]** | [0.311] | [0.242] | [0.222] |
| Time zone difference | -0.523 | -0.134 | -0.027 | -0.065 | -0.051 | -0.016 |
| | [0.231]** | [0.069]* | [0.058] | [0.389] | [0.081] | [0.045] |
| Common legal origin | -0.195 | 0.258 | 0.710 | -0.101 | 0.212 | 0.159 |
| | [0.319] | [0.232] | [0.230]*** | [0.279] | [0.192] | [0.177] |
| Common religion | 0.745 | 0.088 | 0.026 | 0.871 | 0.036 | 0.076 |
| | [0.495] | [0.433] | [0.422] | [0.466]* | [0.386] | [0.321] |
| Common language Index | -0.769 | -0.423 | 1.503 | -0.078 | 0.458 | 0.657 |
| | [0.657] | [0.583] | [0.592]** | [0.643] | [0.525] | [0.453] |
| GDP per cap (log) | -0.515 | -0.563 | -0.492 | | | |
| | [0.270]* | [0.231]** | [0.206]** | | | |
| Population (log) | -1.253 | -0.717 | 0.198 | | | |
| | [0.184]*** | [0.144]*** | [0.157] | | | |
| EU | -2.979 | -0.674 | 0.439 | 1.155 | -0.107 | -0.123 |
| | [1.959] | [0.368]* | [0.309] | [4.696] | [0.643] | [0.452] |
| Migrants (log) | 0.194 | 0.171 | 0.042 | 0.089 | 0.107 | 0.051 |
| | [0.076]** | [0.059]*** | [0.044] | [0.070] | [0.057]* | [0.042] |
| Bilateral hyperlinks | 0.960 | 0.666 | -0.052 | 0.974 | 0.514 | 0.516 |
| | [0.176]*** | [0.126]*** | [0.175] | [0.171]*** | [0.139]*** | [0.128]*** |
| Exporter country FE | yes | yes | yes | no | no | no |
| Exporter time dummies | no | no | no | yes | yes | yes |
| Importer time dummies | no | no | no | yes | yes | yes |
| Observations | 372 | 573 | 779 | 578 | 1726 | 2350 |
| R-squared | 0.68 | 0.62 | 0.52 | 0.75 | 0.68 | 0.71 |

*Notes:* The dependent variable is the log ratio of audiovisual services imports to domestic audiovisual services and broadcasting activities (columns 1 and 4), the log ratio of audiovisual services imports to domestic recreational, cultural and sporting activities (columns 2 and 5) or the log ratio of audiovisual services imports to total audiovisual exports (columns 3 and 6). The explanatory variables are distance between capitals (in natural log form), time zone difference (in hours), the bilateral stock of migrants (in natural log form), bilateral hyperlinks for 2009 (com-cracked, in natural log form), dummy variables for common border, common legal origin and EU membership and similarity indices for religion and languages. Columns 1 to 3 include GDP per capita and population of the importing country (both in natural log form). The estimations reported in columns 1 to 3 use exporter fixed effects; the ones reported in columns 4 to 6 include time-varying exporter- and importer dummies. Robust (columns 1 to 3)/clustered standard errors (at the country-pair level, columns 4 to 6) in brackets. * significant at 10% level; ** significant at 5% level, *** significant at 1% level.

# Appendix

## Table I: Variables, definitions, data sources and summary statistics

| Variable | Definition/unit | Source | Obs. | Mean | Stand. Dev. |
|---|---|---|---|---|---|
| Audiovisual services | Audiovisual services imports, in natural log | Eurostat, OECD, UN (2014) | 1,431 | -0.57 | 2.90 |
| Distance | Bilateral physical distance between two countries' capitals (in kilometre), in natural log | CEPII dataset | 1,431 | 7.82 | 1.13 |
| Common border / contiguous | Dummy = 1, if countries share a common border | CEPII dataset | 1,431 | 0.09 | 0.29 |
| Time zone difference | Time zone differences between two countries, in hours | CEPII dataset | 1,411 | 3.12 | 3.36 |
| Common law | Dummy =1, if countries share a common legal origin | CEPII dataset | 1,411 | 0.26 | 0.44 |
| Common language index | Similarity index - measure summarising linguistic influences | Melitz and Toubal (2014) | 1,252 | 0.23 | 0.20 |
| Common religion | Similarity index - measure of religious proximity | Melitz and Toubal (2014) / CIA Factbook | 1,272 | 0.16 | 0.22 |
| Migrants stock | Stock of migrants data, in natural log | World Bank International Bilateral Migration Stock database | 1,264 | 7.32 | 3.08 |
| EU | Dummy =1, if countries have joint EU membership | CEPII dataset | 1,431 | 0.32 | 0.46 |
| Common colony | Dummy =1, if countries have common colonial history | CEPII dataset | 1,431 | 0.01 | 0.11 |
| Regional trade agreements | Dummy =1, if regional trade agreements are in place between countries | CEPII dataset | 1411 | 0.52 | 0.50 |
| Common currency | Dummy =1, if countries are in Common currency zone | CEPII dataset | 1,411 | 0.08 | 0.26 |
| Cultural distance | Constructed based on Hofstede (2013) | Hofstede (2013) | 1,215 | 2.08 | 1.55 |
| Bilateral hyperlinks 2003 | bilateral Data for 2003, number of inter-domain hyperlinks from .xx to .yy and vice versa | Chung (2011) | 827 | 11.89 | 1.88 |
| Bilateral hyperlinks 2009 (.com cracked) | bilateral inter-domain hyperlinks for 2009 with uniquely identified host country of .com domain | Chung (2011) | 950 | 12.56 | 2.02 |
| Bilateral hyperlinks 1998 | Further bilateral hyperlink data for 1998 | OECD Communications Outlook 1999 | 472 | 7.48 | 1.63 |
| Unique visitors | Bilateral data, visitor average across three most-visited websites of country A from country B, each visitor is counted once, in natural log | GoogleAd Planner | 238 | 8.43 | 3.49 |
| Overall visitors | Bilateral data, visitor average across three most-visited websites of country A from country B, each visitor is counted every time he/she visits, in natural log | GoogleAd Planner | 239 | 10.13 | 3.60 |
| GDP per capita | Gross domestic product per capita, current USD, in natural log | World Development Indicators | 1,420 | 9.89 | 0.91 |
| Population | Population of importing country, in natural log | World Development Indicators | 1,425 | 16.72 | 1.64 |
| Internet users | Share of internet users in the total population in % | World Development Indicators | 1,424 | 58.67 | 21.95 |
| Share urban population | Share of urban population in % | World Development Indicators | 1,425 | 73.04 | 13.54 |
| Domestic audiovisual production | Gross production of audiovisual and broadcasting activities, in natural log | OECD STAN DATABASE (2014) | 495 | 7.92 | 1.27 |
| Recreation, cultural and sporting | Gross production of recreation, cultural and sporting activities, in natural log | OECD STAN DATABASE (2014) | 809 | 8.94 | 1.53 |

*Notes*: The summary statistics refer to 2009 values for the time-varying variables (conditional on availability of audiovisual services imports, in natural logs).

## Table II: Country sample for 2009

| | | | |
|---|---|---|---|
| Argentina | France | Luxembourg | Singapore |
| Australia | Germany | Malaysia | Slovakia |
| Austria | Greece | Malta | Slovenia |
| Belgium | Hong Kong | Mexico | South Africa |
| Brazil | Hungary | Moldova | South Korea |
| Bulgaria | Iceland | Netherlands | Spain |
| Canada | India | New Zealand | Sweden |
| China | Indonesia | Nigeria | Switzerland |
| Croatia | Iran | Norway | Taiwan |
| Cyprus | Ireland | Panama | Thailand |
| Czech Republic | Israel | Poland | Turkey |
| Denmark | Italy | Portugal | United Arab Emirates |
| Egypt | Japan | Romania | United Kingdom |
| Estonia | Latvia | Russia | United States |
| Finland | Lithuania | Serbia | |

## Table III: Largest audiovisual exporters in 2009

| United States | | United Kingdom | | Canada | |
|---|---|---|---|---|---|
| United Kingdom | 3,687 | France | 404 | United States | 1,514 |
| Canada | 1,568 | Germany | 393 | France | 166 |
| Germany | 1,156 | United States | 308 | Germany | 61 |
| Japan | 1,075 | Netherlands | 207 | Russian Federation | 6 |
| France | 829 | Norway | 193 | Ireland | 6 |

| Luxembourg | | Germany | |
|---|---|---|---|
| Germany | 121 | United States | 400 |
| France | 100 | Switzerland | 207 |
| Belgium | 81 | Austria | 197 |
| Switzerland | 50 | Netherlands | 114 |
| Russia | 8 | France | 103 |

*Notes:* Data are expressed in USD millions. Countries below headline country are the respective main trading partners.

## Table IV: Largest audiovisual importers in 2009

| Germany | | France | | United States | |
|---|---|---|---|---|---|
| United States | 1,156 | United States | 829 | Canada | 1,514 |
| Switzerland | 409 | United Kingdom | 404 | Germany | 400 |
| United Kingdom | 393 | Switzerland | 226 | Australia | 377 |
| Netherlands | 343 | Netherlands | 213 | United Kingdom | 308 |
| France | 170 | Canada | 166 | Ireland | 134 |

| Canada | | United Kingdom | |
|---|---|---|---|
| United States | 1,568 | United States | 3,687 |
| France | 6 | France | 135 |
| Netherlands | 3 | Netherlands | 110 |
| Germany | 3 | Sweden | 86 |
| Romania | 2 | Germany | 49 |

*Notes:* Data are expressed in USD millions. Countries below headline country are the respective main trading partners.

## Table V: Top 10 bilateral hyperlinks

|    | Country        | Partner        | Bilateral hyperlinks 2009 (in millions, .com-cracked) |
|----|----------------|----------------|------------------------------------------------------|
| 1  | United States  | United Kingdom | 48.9 |
| 2  | United States  | Japan          | 43.9 |
| 3  | United States  | Germany        | 40.8 |
| 4  | China          | United States  | 34.9 |
| 5  | Japan          | United States  | 34.1 |
| 6  | United States  | China          | 32.5 |
| 7  | United Kingdom | United States  | 31.3 |
| 8  | United States  | Italy          | 22.1 |
| 9  | France         | United States  | 21.0 |
| 10 | Germany        | United Kingdom | 20.8 |

## Table VI: Bottom 10 bilateral hyperlinks

|    | Country        | Partner  | Bilateral hyperlinks 2009 (.com-cracked) |
|----|----------------|----------|------------------------------------------|
| 1  | Slovakia       | Uruguay  | 154   |
| 2  | Panama         | Israel   | 246   |
| 3  | Israel         | Panama   | 257   |
| 4  | Russia         | Bahrain  | 344   |
| 5  | Czech Republic | Uruguay  | 648   |
| 6  | Russia         | Yemen    | 653   |
| 7  | Russia         | Kenya    | 974   |
| 8  | Russia         | Sudan    | 1,075 |
| 9  | Russia         | Guatemala| 1,389 |
| 10 | Russia         | Jordan   | 1,444 |

## Table VII: Sample of news websites

| Country        | Website 1       | Website 2       | Website 3           |
|----------------|-----------------|-----------------|---------------------|
| Australia      | smh.com.au      | news.com.au     | heraldsun.com.au    |
| Belgium        | nieuwsblad.be   | hln.be          | standaard.be        |
| Brazil         | globo.com       | r7.com          | estadao.com.br      |
| Canada         | cbc.ca          | ctv.ca          | canoe.ca            |
| China          | sina.com.cn     | sohu.com        | 163.com             |
| France         | linternaute.com | lefigaro.fr     | lemonde.fr          |
| Germany        | bild.de         | spiegel.de      | focus.de            |
| Hong Kong      | nextmedia.com   | on.cc           | rthk.org.hk         |
| Italy          | repubblica.it   | corriere.it     | ilsole24ore.com     |
| Japan          | yomiuri.co.jp   | sponichi.co.jp  | nikkeibp.co.jp      |
| Netherlands    | nu.nl           | telegraaf.nl    | nos.nl              |
| Poland         | money.pl        | wyborcza.pl     | tvn24.pl            |
| Russia         | rbc.ru          | novoteka.ru     | kp.ru               |
| South Korea    | chosun.com      | mt.co.kr        | mk.co.kr            |
| Spain          | elmundo.es      | elpais.com      | eltiempo.es         |
| Switzerland    | blick.ch        | 20min.ch        | tagesanzeiger.ch    |
| Taiwan         | udn.com         | nownews.com     | libertytimes.com.tw |
| Thailand       | sanook.com      | manager.co.th   | thairath.co.th      |
| Turkey         | hurriyet.com.tr | milliyet.com.tr | haberturk.com       |
| United Kingdom | bbc.co.uk       | dailymail.co.uk | guardian.co.uk      |
| United States  | cnn.com         | nytimes.com     | foxnews.com         |

### Table VIII: Top 10 bilateral website visits

|    | Country        | Partner        | Overall visitors (average, 3 top news websites) |
|----|----------------|----------------|-------------------------------------------------|
| 1  | United States  | United Kingdom | 15,701,284                                       |
| 2  | Canada         | United States  | 8,466,667                                        |
| 3  | United States  | South Korea    | 3,706,667                                        |
| 4  | Germany        | Turkey         | 2,466,667                                        |
| 5  | Germany        | United Kingdom | 1,800,412                                        |
| 6  | United States  | Japan          | 1,743,333                                        |
| 7  | United Kingdom | United States  | 1,680,000                                        |
| 8  | Netherlands    | United Kingdom | 1,650,750                                        |
| 9  | Russia         | United Kingdom | 1,650,155                                        |
| 10 | France         | United Kingdom | 1,533,919                                        |

### Table IX: Bottom 10 bilateral website visits

|    | Country        | Partner     | Overall visitors (average, 3 top news websites) |
|----|----------------|-------------|-------------------------------------------------|
| 1  | Israel         | Canada      | 8                                               |
| 2  | Israel         | Australia   | 9                                               |
| 3  | Netherlands    | Taiwan      | 14                                              |
| 4  | Netherlands    | Australia   | 20                                              |
| 5  | Belgium        | Switzerland | 26                                              |
| 6  | Italy          | Australia   | 30                                              |
| 7  | Romania        | France      | 33                                              |
| 8  | Czech Republic | Germany     | 34                                              |
| 9  | Netherlands    | Switzerland | 36                                              |
| 10 | Ireland        | Germany     | 38                                              |

Table X: Annual cross-sections: total services & virtual proximity

| Log (imports) | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2009 IV | 2009 IV | 2012 | 2012 |
| Distance (log) | -0.605 | -0.734 | -0.649 | -0.721 | -0.575 | -0.349 | -0.746 | -0.749 |
| | [0.061]*** | [0.072]*** | [0.073]*** | [0.070]*** | [0.060]*** | [0.113]*** | [0.089]*** | [0.089]*** |
| Common border | 0.147 | 0.157 | 0.182 | 0.182 | 0.008 | 0.087 | 0.060 | 0.063 |
| | [0.103] | [0.108] | [0.107]* | [0.106]* | [0.108] | [0.115] | [0.153] | [0.153] |
| Time zone difference | 0.004 | 0.025 | -0.024 | 0.026 | -0.007 | -0.015 | 0.043 | 0.044 |
| | [0.024] | [0.031] | [0.031] | [0.028] | [0.020] | [0.034] | [0.031] | [0.031] |
| Common legal origin | 0.314 | 0.300 | 0.269 | 0.267 | 0.240 | -0.060 | 0.059 | 0.061 |
| | [0.080]*** | [0.080]*** | [0.077]*** | [0.079]*** | [0.080]*** | [0.089] | [0.104] | [0.104] |
| Common religion | 0.192 | 0.057 | 0.043 | 0.031 | 0.165 | 0.243 | 0.047 | 0.045 |
| | [0.135] | [0.140] | [0.127] | [0.136] | [0.145] | [0.147] | [0.253] | [0.254] |
| Common language Index | 0.191 | 0.280 | 0.330 | 0.322 | 0.266 | -0.235 | 0.980 | 0.991 |
| | [0.190] | [0.209] | [0.200]* | [0.194]* | [0.214] | [0.295] | [0.329]*** | [0.325]*** |
| GDP per cap (log) | 0.818 | 0.771 | 0.856 | 0.866 | 0.796 | 0.450 | 0.693 | 0.696 |
| | [0.060]*** | [0.074]*** | [0.069]*** | [0.069]*** | [0.070]*** | [0.163]*** | [0.085]*** | [0.088]*** |
| Population (log) | 0.516 | 0.482 | 0.545 | 0.511 | 0.441 | -0.024 | 0.681 | 0.684 |
| | [0.052]*** | [0.059]*** | [0.058]*** | [0.059]*** | [0.059]*** | [0.162] | [0.049]*** | [0.049]*** |
| EU | -0.167 | -0.145 | -0.247 | -0.081 | -0.220 | 0.013 | 0.082 | 0.083 |
| | [0.118] | [0.161] | [0.149]* | [0.141] | [0.108]** | [0.121] | [0.182] | [0.182] |
| Migrants (log) | 0.116 | 0.070 | 0.069 | 0.077 | 0.067 | 0.043 | 0.113 | 0.114 |
| | [0.020]*** | [0.019]*** | [0.020]*** | [0.018]*** | [0.018]*** | [0.030] | [0.032]*** | [0.033]*** |
| Bilateral hyperlinks | 0.198 | 0.282 | 0.214 | 0.224 | 0.340 | 0.871 | | |
| | [0.064]*** | [0.074]*** | [0.069]*** | [0.074]*** | [0.065]*** | [0.208]*** | | |
| Unique visitors (log) | | | | | | | 0.003 | |
| | | | | | | | [0.039] | |
| Overall visitors (log) | | | | | | | | -0.005 |
| | | | | | | | | [0.039] |
| Exporter country FE | yes | yes | yes | yes | yes | yes | yes | yes |
| Observations | 831 | 763 | 737 | 782 | 677 | 416 | 193 | 193 |
| R-squared | 0.87 | 0.84 | 0.85 | 0.86 | 0.86 | 0.85 | 0.837 | 0.837 |

*Notes:* The dependent variable is total services imports (in natural log form); the explanatory variables are distance between capitals (in natural log form), time zone difference (in hours), the bilateral stock of migrants (in natural log form), bilateral hyperlinks for 2009 (com-cracked, in natural log form, columns 1-6), dummy variables for common border, common legal origin and EU membership and similarity indices for religion and languages. Moreover, the estimation includes GDP per capita and population of the importing country (both in natural log form). Columns 7 and 8 include bilateral amounts of visitors on news websites (in natural log form, unique and overall, respectively). The estimation uses exporter fixed effects. Instrumental variables estimation (2SLS) in columns 5 and 6. Bilateral hyperlinks for 2009 (com-cracked) are instrumented by bilateral hyperlinks for 2003 (column 5) and bilateral hyperlinks for 1998 (column 6). Robust standard errors in brackets. * significant at 10% level; ** significant at 5% level, *** significant at 1% level.

## Table XI: Pooled cross-sections: virtual proximity, previous episodes

| Log (imports) | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | >2003 | >2004 | >2005 | >1999 | >2000 | >2001 |
| Distance (log) | -0.730 | -0.722 | -0.714 | -0.436 | -0.429 | -0.426 |
| | [0.116]*** | [0.117]*** | [0.119]*** | [0.154]*** | [0.154]*** | [0.154]*** |
| Common border | -0.024 | -0.009 | -0.033 | 0.157 | 0.156 | 0.163 |
| | [0.185] | [0.190] | [0.193] | [0.206] | [0.207] | [0.208] |
| Time zone difference | -0.059 | -0.068 | -0.066 | -0.124 | -0.127 | -0.130 |
| | [0.030]** | [0.030]** | [0.031]** | [0.051]** | [0.050]** | [0.051]** |
| Common legal origin | 0.350 | 0.374 | 0.396 | 0.556 | 0.577 | 0.587 |
| | [0.140]** | [0.145]*** | [0.146]*** | [0.183]*** | [0.183]*** | [0.183]*** |
| Common religion | 0.097 | 0.162 | 0.146 | 0.212 | 0.231 | 0.242 |
| | [0.284] | [0.287] | [0.293] | [0.318] | [0.316] | [0.314] |
| Common language Index | 0.709 | 0.582 | 0.600 | 0.496 | 0.500 | 0.507 |
| | [0.407]* | [0.410] | [0.415] | [0.456] | [0.458] | [0.456] |
| EU | -0.283 | -0.290 | -0.208 | -0.394 | -0.361 | -0.383 |
| | [0.278] | [0.286] | [0.288] | [0.423] | [0.416] | [0.423] |
| Migrants (log) | 0.083 | 0.082 | 0.084 | 0.086 | 0.082 | 0.080 |
| | [0.036]** | [0.037]** | [0.038]** | [0.048]* | [0.049]* | [0.049] |
| Bilateral hyperlinks | 0.287 | 0.276 | 0.261 | 0.610 | 0.604 | 0.596 |
| | [0.079]*** | [0.080]*** | [0.082]*** | [0.174]*** | [0.175]*** | [0.175]*** |
| Exporter time dummies | yes | yes | yes | yes | yes | yes |
| Importer time dummies | yes | yes | yes | yes | yes | yes |
| Observations | 6037 | 5491 | 4868 | 4268 | 4141 | 4028 |
| R-squared | 0.72 | 0.72 | 0.71 | 0.76 | 0.75 | 0.75 |

*Notes:* The dependent variable is audiovisual services imports (in natural log form); the explanatory variables are distance between capitals (in natural log form), time zone difference (in hours), the bilateral stock of migrants (in natural log form), bilateral hyperlinks (in natural log form) for 2003 (columns 1 to 3) and for 1998 (columns 4 to 6), dummy variables for common border, common legal origin and EU membership and similarity indices for religion and languages. The estimation includes time-varying exporter- and importer dummies. Clustered standard errors (at the country-pair level) in brackets. * significant at 10% level; ** significant at 5% level, *** significant at 1% level.

**Christiane Hellmanzik**
University of Hamburg, Department of Economics, Hamburg, Germany;
e-mail: christiane.hellmanzik@wiso.uni-hamburg.de

**Martin Schmitz**
European Central Bank, Frankfurt am Main, Germany;
e-mail: Martin.Schmitz@ecb.int