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TRADING CULTURAL GOODS IN THE ERA OF DIGITAL PIRACY

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Abstract

The issue of digital piracy is a hot button among governments around the world. Piracy rates may significantly affect both internal and international trade of cultural goods. This paper aims to empirically assess the effect of digital piracy on bilateral trade in cultural goods. We focus on trade in music, films and media. Analysing an 11-year panel of 25 countries, we find that piracy does affect bilateral trade, but to varying extents.

JEL codes: F1, C23, Z11

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1. Introduction

While there is agreement on the need for new policies on the cultural goods market, the form these policy instruments will take will differ significantly from one country to another. The development of new information technologies and opening of new markets creates new perspectives for development policies. It is inevitable that the potential benefits and damages of any policy liberalizing cultural industries still give rise to a wide debate, especially within WTO negotiations. So far the debate, as far as the trade flows of cultural goods is concerned, has been confined to the developed world.

The inevitability of a hearty debate about the technicalities of trading cultural goods is attributable to the specific and unusual nature of these goods. The products and services of cultural industries are often characterized by their intangible nature, generally protected by copyright. Copyrights have proven to be an important determinant of the demand for cultural goods. The issue at end is to investigate whether this variable also affects the trade in cultural goods.

As Schulze (1999) claims ‘What do we know about trade in the arts? Relatively little. … This is all the more surprising because art markets are arguably among the most internationalized goods markets: Van Gogh’s paintings can be admired in New York, a large collection of Egyptian art is found in Berlin, Nirvana’s CDs are sold throughout the world, and American movies and books have global coverage.’

There is a shortage of systematic empirical evidence on international trade in art. Thus, the first purpose of the paper is to provide empirical evidence on the part of the art trade that covers digitalized cultural products.

In the art market, there is the need to distinguish between pieces of ‘unique art’, and products of reproducible, which are mostly characterized by scale economies and differentiated products.

We choose the more technology-intensive and service-oriented creative industries, such as music, audiovisuals and new media, which are also the ones more embedded with the piracy issue. And, as far as we are concerned, we use the new dataset created by UNCTAD which provides the most complete world-level data on trade on cultural goods and services.

The products we study (physical goods only, therefore excluding services) are:

- *Music*: defined as ‘recorded laser discs and recorded magnetic tapes, and printed or manuscript music’;

- *Audiovisuals*: defined as 'cinematographic film: 1) width in 35mm or more; 2) other widths':
- *New media*: defined as 'recorded media for sound/image, and video games'.

There is currently no specific legal definition of digital piracy, which would be more accurately described as 'digital infringement of copyright' (OECD 2009). This implies the disembodied and non-physical nature of digital products. The lack of a common definition is reflected in the different treatment of copyright infringement in different jurisdictions, which at varying degrees provide exceptions to the rights of the copyright owner.

The digital piracy market shows very particular features that shape its functioning and dynamics in a unique way: (1) The profit motive can be absent or outclassed by other non-market factors, such as gaining recognition within a peer group, or reciprocating free access to other users. This behavior can be sustained because (2) the marginal cost of reproduction and delivery of digital content is zero or close to zero. Once created, a digital good can in most cases be reproduced with relatively little cost and effort. (3) Moreover, in most cases, a copy of a digital product offers technical quality very similar to the original. Thus, non-price factors (such as legality, availability and quality) become important in allowing suppliers that require payment to continue to operate on the market. In turn, (4) the prices and quantities demanded are not always the key features that link both the demand and supply sides of the market for pirated digital products. In addition, while in normal markets the distinction between suppliers and consumers is unambiguous, in the case of digital piracy (5) there are numerous instances (involving peer-to-peer (P2P) networks) where supply and demand enter the feedback loop. The number of suppliers of pirated digital content has exploded on a global scale, making detection and response much more difficult and costly for copyright owners and law enforcers. Sources of digital material are easy to find, and can extend from local sources (such as family, fellow students or colleagues) to the Internet, and the possibility of digital content to be transmitted with very little loss of quality means that even high-quality source material can be easily obtained. (6) The free-of-charge exchange of pirated digital products is rarely perceived as unethical, given the consumers' perception that no monetary profits are obtained by the infringing parties. (7) The disembodied nature of digital products permits their digital delivery, for example, via the Internet or local area networks. Such digital delivery implies a significant reduction in the cost of acquisition (e.g., through reduction or elimination of searching, transportation and storage costs), which in turn significantly facilitates the distribution process and thus enables suppliers to offer consumers lower prices.

(8) Hardware is a necessary support for the existence of all digital products (e.g., storage on a hard drive, optical disc, server), and the potential utility that digital products offer to an end user cannot be derived without suitable hardware. Consequently, there are strong linkages and complementarities between hardware and digital products, and in fact trends in consumption of digital products follow closely the newest technological developments (OECD 2008, Chapter 6). (9) The digitalization significantly increases the lifespan of digital products and extends their durability. (10) There are increasing returns to scale on both the supply and demand sides (for all consumers and for each consumer). (11) Consumers are heterogeneous in their valuations of the goods: some will be willing to pay for them on the legal market even though they would have the possibility to obtain them for free. As Peitz and Waelbroeck (2003) suggest, the original digital product is often bundled with other non-digital components, such as a printed manual for software and printed booklet (with lyrics, pictures, song and artist information) and CD case for music CDs.

The empirical literature proves that piracy affects sales in cultural goods such as music and film and new media. The question this study seeks to address is whether piracy affects international trade in cultural goods as well. Thus, this study aims to fill a gap in the trade literature in that no previous paper has analysed the influence of piracy on trade of cultural digitalized goods. We select an 11-year panel of 25 Countries drawn from COMTRADE data, and estimate an augmented gravity model of bilateral trade.

Gravity models have been employed to describe the variations in the value of trade across countries and over time (see, e.g., Leamer and Levinsohn 1995). Anderson’s claim (1979, p.106) that the gravity equation is the most successful empirical trade device. Furthermore, one can adopt Everett and Hutchinson’s (2002, p. 489) definition of gravity model as ‘the workhorse for empirical studies’ in international economics. The gravity model has been widely used in estimating the impact of several policy issues, such as regionalism, trade distortion, currency unions, political blocks, and patent rights. In this paper, we use the gravity model both for testing the effect of piracy on trade and for shedding some light on the determinants of cultural goods trade flows.

Furthermore, we use a recently developed estimation approach which provides two advantages: (i) considerable savings in terms of degrees of freedom and (ii) it allows to incorporate in the model spatial effects due to omitted importer- and exporter-specific and bilateral explanatory variables.

The paper is organized as follows: In Section 2, we will describe the trends and features in the international trade contest of the considered goods; Section 3 critically reviews the relevant literature upon its relevance to trade in art and digital piracy; Section 4 explains the model, methodology and data used; Section 5 shows our empirical evidence on trade in cultural goods and concludes.

2. International Trade in Creative Industries: Global Trends and Features of Digital Products

There is no unique, universally agreed set of creative industries, and thus of digital products industries. Countries have different definitions of the creative industries and have adopted diverse groupings of these industries. The statistical analysis is based on the UNCTAD definition and grouping of creative industries, and the items included in each group were jointly classified by UNCTAD and ITC, using as the starting point the UNESCO Framework for Cultural Statistics.

The following international trade figures are underestimated and do not reflect the dynamic reality of the global markets for phonographic, audiovisual and digital products. Current standard statistical classifications remain customs-based and refer only to tangible physical goods. The data collection and classification system are outdated and lacks the level of disaggregation required for an in-depth product-by-product analysis. It also does not reflect the reality of 'connectivity' and the increasing use of e-business and ITC tools for virtual trade and distribution of creative content. Thus electronic trade is not included in the official statistics. We will take this into consideration in interpreting our results. Therefore, it is not yet possible to capture the growing volume of digitalized creative content such as music, films and books traded via the Internet and mobile phones. Moreover, the lack of available statistics for copyrights and the data gaps for creative services, combined with the difficulties in collecting figures at the global level on related marketing and distribution services (box-office revenues of cinemas, theatres, concerts, etc.), contribute to hide the real extent of this dynamic sector in international trade and the world economy.

The global market for traded goods and services of the creative industries has enjoyed a new dynamism in recent years. The value of world exports of creative-industry goods and services reached $424.4.billion in 2006 (accounting for 3.4 per cent of world trade) as opposed to $227.4 billion in 1996 according to UNCTAD. Over the period 1996–2006, the creative industries gained considerable market shares globally, growing at an annual rate of 8.7 per cent for the period 2000–06.

Exports of creative goods from developed countries predominated in world markets. At the same time, exports of creative goods from developing economies accounted for 29 per cent of world exports in 1996, and reached 41 per cent in 2006. This significant growth reflects a remarkable increase in production and trade in China, which became the world's leading exporting country of creative goods in 2006, with an impressive market share of 19 per cent of total world exports of creative goods.

Developed economies were the largest importers of creative goods during the period 1996–2006. More than 50 per cent of total imports of creative goods were accounted for by developed economies, with the world's top importers being Europe [the 27-member European Union (EU- 27)], followed by the United States, Japan and Canada.

We provide below a brief description of each analysed digital product international trade structure.

2.1. Music

Music is a part of the performing arts subgroup of creative industries when considered in terms of live performances and concerts (that we are not considering in this paper), but it may also be included as part of the broader area of audiovisuals when dealing with the creation of sound records and compositions. Music can also be classified under the new-media subgroup when music goods and services are traded virtually as creative content in digitalized form.

Trade of music became very closely linked to the use of new digitalized tools such as the Internet P2P networks, mobile telephones and MP3s. As a consequence, the world market for music has adapted to changing business models emerging from new forms of production, marketing and distribution of music, particularly with regard to digitalized products.

A paradox in the music market is that while more and more music is being consumed worldwide, particularly by the youth, the earnings received by songwriters, producers and performers have been declining. This situation reflects the lacunae in the current regimes of IPRs, and the need for songwriters and the singers to retain greater control over their music and make better use of all ICT tools for accessing global markets. In order to tackle these IPR issues, the music industry is facing a number of challenges. The first is to call for the enforcement of development-oriented copyright legislation by governments and international treaties. The second is to develop a commercially viable and legitimate alternative to the illegal but free downloading of copyrighted content, that is to say finding a way to better commercialize P2P file sharing' and online distribution.

Trade flows in music, based on national reported figures, amounted to $14.9 billion in 2006, whereas private sources such as the International Federation of the Phonographic Industry estimated the market value at about $20 billion. This inconsistency suggests that national statistics are biased.

Sales of compact discs (CDs) are the main figure used for trade analysis of recorded music; they represent more than 99 per cent of world music exports nowadays. International trade in music continues to be dominated by developed economies. Developed countries' exports and imports of music CDs accounted for about 80 to 90 per cent of world trade in music goods.

Germany is the top trader with a market share of 23 per cent, followed by the United Kingdom, the United States, Austria and the Netherlands, each with about 10 per cent. The oligopolistic market structure of the world production and distribution of music is dominated by four vertically integrated major conglomerates that together and through their subsidiaries retain nearly 80 per cent of the world market for recorded music. This situation inhibits music production by independent local producers in developing countries.

A common feature of developing and transition economies with respect to the music industry is that both economies are net importers of recorded music. The main reason is that in most cases, despite the fact that the music – the creative content – is created in developing countries, it is recorded and commercialized by transnational companies. As result, developing countries import not only foreign music but also their own. Copyrights are also collected by the publisher in the country where the music is produced. As a result, export earnings from world sales as well as revenues from royalties and copyrights are retained abroad instead of reverting to the artist's homeland in developing countries.

Asia is the developing region with the best, although small, penetration in global markets for music, reflecting increases in exports, particularly from China and India. India increased its exports from a very low level, reaching $185 million in exports of recorded music in 2006. It is noteworthy that China and India each have a regulatory framework that is less conducive to the penetration of the major conglomerates; therefore, both countries have stronger independent domestic music production.

2.2. Audiovisuals

Definition of Audiovisuals in a broad sense includes motion picture, television, radio and other forms of broadcasting. With the introduction of new ITC tools, the definition becomes more problematic because the cultural and creative contents are mixed together and it is difficult to state that a digitalized cartoon film is part of new media or an audiovisual product. Keeping this in mind, in this paper we consider just the movie industry.

Globally, the value of the film industry is estimated at around $75 billion, of which $55 billion are accounted for by the production and sale of DVDs. Revenue for the film industry are derived from box-office sales domestically and abroad, music rights, television and satellite rights, video and Internet rights, merchandising, CD and DVD rentals plus copyrights for reproduction.

The making, distribution and exhibition of films continue to be dominated largely by a small number of big, vertically integrated groups, inhibiting the expansion of the film industry in developing economies and their presence on the global market. Worldwide, 85 per cent of all films exhibited are Hollywood productions, while many developing economies have never produced a single commercial movie.

In the considered period, developed economies dominated the market for films, retaining nearly 89 per cent of world exports for this subgroup against 8 per cent for developing countries and 2 per cent for the economies in transition. The United States was by far the leading importing country. In our sample of 25 Countries, it is worthwhile pointing out the sharp increase of Italy as an exporter of movies since 2001.

India is the world's largest film producer, making about 1,000 commercial films annually, which however are mostly for the domestic market. Even if more Indian films have been exported recently, there are still distribution issues. Elsewhere in Asia, the expansion of the film industry in China is taking place simultaneously to the decline of the industry in Japan, one of the largest markets for films but one that has turned into a market highly dependent on video rentals.

International trade in audiovisuals world-wide tripled during the period 1996–2006. Exports of audiovisual products (goods and services) increased from $6.7 billion to $18.2 billion, growing on average by 10.5 per cent over eleven years.

2.3. New Media

As far as The Creative Economy Report 2008 states (UNCTAD 2008), 'New media' is the newest subgroup among the creative industries. It emerged as a result of rapid advances in ICTs that started in the 1990s with the purpose of promoting the construction of a global information infrastructure as the basis of the overall globalization process. It is a creative product itself, expressed as a digitalized form of creative content such as software, cartoons and interactive products such as video games. It is an enabler of connectivity used as a tool for the marketing and distribution of other creative products such as music, films, books and news, or creative services such as advertising and architectural services.

At present, it is not yet possible to capture the real dynamism of new media as a driving force of the creative economy. There are two reasons for this: first, the novelty embedded in the constant updating of technologies used for the production and consumption of creative content; and second, the lack of a universally agreed system of data collection of digitalized creative content. Thus, figures presented for new media are believed to be severely underestimated.

Nonetheless the global market for new-media goods grew very fast during the period 1996–2006. The exports of developed economies increased slightly, but their share in world markets for these goods declined sharply from 87 per cent to 54 per cent during the eleven-year period. They faced growing competition from developing economies in particular with regard to video games. Europe supplied a third of global market demand and its exports were more diversified in terms of target markets. The major exporter, however, was the United States, whose exports were more diversified in terms of products than markets.

In developing economies, Asia had a strong, dominant position in the global market for these goods. This resulted in a substantial increase in their share in world markets, from 13 per cent to 46 per cent. In the case of video games, the upturn was even stronger; from 16 per cent in 1996 to 54 per cent in 2006. This development reflected the remarkable increase in the exports of China: its exports of new media reached about 40 per cent of global demand. Videogames constituted the most important exported and imported item in Asia. Aside from Asian developing economies, only Mexico is on the list of top ten exporters.

3. Trade in Art and the Effects of Digital Piracy on Legitimate Sales

There is a shortage of systematic empirical evidence on international trade in art. As far as we are concerned, there are very few empirical papers analysing trade flows in cultural goods.

Schulze (1999) presents the first empirical evidence on the trade in art. Using bilateral trade data for works in art (SITC 8960), he applies a gravity model and finds that trade among reproducible art (characterized by scale economies and product differentiation) takes place mainly between large trading economies, is four times as large for countries with a common language, and is strongly deterred by great distances.

Disdier et al. (2010) utilize the definition and classification of cultural goods made by UNESCO. They find that common language has strong positive influence on trade of cultural goods with a written support, while past colonial relationships affect cultural heritage goods. The consumption of cultural goods is shown to be additive. However, the robustness of their results is undermined by the use of highly unbalanced datasets with very high percentages of missing values with respect to the potential full trade matrix.

Weng et al. (2009) analyse whether and how U.S. information goods[1] exports are sensitive to national differences in IPR protection and to the degree of threat-of-imitation from the dynamic perspective. They adopt piracy rates as a proxy for threat-of-imitation to examine its role on the information goods trade–IPR nexus. Empirical findings validate the prevalence of the market expansion effect wherever the degree of imitation threat of importing countries is high or low, because the technology level and production cost of reproduction are very low. It implies that the existing theory on threat-of-imitation may not apply to the information goods trade.

The movies market has attracted a particular attention. Several studies (Jayakar and Waterman 2000; Lee and Waterman 2007; Fu and Lee 2008) linger on the characteristics of home cinema markets and the cultural distances of the film-exporting countries. Oh (2001) studies the direction and magnitude of influence of the realized market size, the linguistic factor, and the cultural factors on the self-sufficiency ratio, defined as the proportion of domestic films' share in gross box office revenues. Marvasti and Canterbery (2005) analyse the structure and strategies in the U.S. motion picture industry. Their purpose is to identify the relevant variables to explain both industry exports and the failure of protectionism. Over a period of four years (1991–95), they find that besides purchasing power and distance, cultural variables as well as protectionist strategies are important influences on motion picture trade.

On the other hand, the empirical literature is rich in studies concerning the effects of digital piracy on legitimate sales. As Peitz and Waelbroeck (2003) state '…digital products also involve interactions. These interactions can be of two different natures: formal interaction for software that require to exchange standardized/formatted information, and social interaction for music and video files about which people like to talk about with their friends. These formal and social interactions imply that there possibly exist network effects.'

[1] Varian (1999) defines an information good as anything that can be digitized. Primarily, music, movies, and software fall into this category.

The literature is extensive in its analysis of the size of these network effects and their influence on the standardization of software products and the desirability of piracy. Several papers outline the possible profitability for software firms in allowing or even promoting piracy, in the presence of strong network effects (see, e.g., Takeyama 1994; Slive and Bernhardt 1998; Poddar 2002).

The empirical evidence on music and movies prevalently demonstrates a negative effect of piracy on music (Hui and Png 2003; Peitz and Waelbroeck 2004; Zentner 2004; Rob and Waldfogel 2007), but also demonstrates that the real effects of piracy are smaller than the amount claimed by the entertainment industries (Hui and Png 2003). This result is confirmed by Oberholzer and Strumpf (2007). They find that downloads have an effect on sales which is statistically indistinguishable from zero, despite rather precise estimates. Such estimates are of moderate economic significance, thus being inconsistent with claims that file sharing is the primary reason for the recent decline in music sales.

On the other hand, Peitz, and Waelbroeck (2006) show that the negative effect may be overcompensated by a positive effect due to sampling: consumers are willing to pay more because the match between product characteristics and buyers' tastes is improved. Ji (2007) estimates the overall effect of piracy on movie industry revenues using a fixed-effects, two-stage least squares analysis of data on movie sales, admission prices, cable penetrations, and piracy rates of motion pictures, music, and business software in 20 countries over a six-year period from 1999 to 2004. The results show that movie piracy has a positive effect on theatre admissions. Curien and Moreau (2009) suggest another way of reducing or even completely offsetting the negative effect of piracy: namely a sharing of all music revenues between labels and artists, including CD sales, as well as revenues from live music or merchandising.

While the literature shows many empirical examples on the effect of piracy on legitimate sales of digital products, this is the first study that intends estimating the possible influence of piracy on international trade of digital products.

4. Model, Estimation and Data Estimation

4.1. The Model

The most widely used empirical tool for studying the determinants and patterns of bilateral trade is the so-called gravity model of trade. The gravity equation represents one of the greater successes in empirical economics, as it describes the value of bilateral trade as a function of the economic size of the importer and exporter, and of the distance occurring between them. The gravity model has been used for investigating: (i) the main factors affecting the foreign trade of countries; (ii) the presence of natural, as opposed to 'political', trading blocs; (iii) the existence of trade creation or diversion effects due to regional integration; and (iv) the extent of the trade potential of a country. Moreover, a renewed interest has emerged recently over both the theoretical foundations of the gravity model and its correct estimation, as highlighted, for example, in a well-known paper by Anderson and van Wincoop (2003).

In the most elementary gravity model specification, introduced by Tinbergen (1962), the first determinant of bilateral trade considered is market size, which is observed both at the origin and at the destination. Market size represents push and pull factors that influence the value of trade flows, and is usually represented by GDP.[2] Similarly, further importer- and exporter-specific variables may be included in the model, in order to account for the socio-economic and institutional characteristics of the origins and destinations (e.g., their capital-labour ratios; Bergstrand 1989), or other aspects related to natural endowments (total area, landlockedness, remoteness, and so on). The second factor of interest is bilateral trade costs. Real trade costs (mostly unobservable in practice) can depend on – and be proxied by – a multitude of bilateral factors, ranging from transport costs and tariffs to cultural or institutional trade barriers (e.g., common language or colonial history) to geographical characteristics (most prominently, the distance between countries). As with the case of the push and pull factors, a number of different variables may be used to account for trade costs.

As a result of the inclusion of such push-pull and bilateral factors, a generic notation for the equation is:

$$T_{ij} = G \frac{Y_i^{\alpha} Y_j^{\beta}}{D_{ij}^{\theta}}, \tag{1}$$

where the flow between countries i and j (T_{ij}) depends (positively) on their relevant economic sizes Y_i and Y_j (which are given specific weights α and β), and (negatively) on the distance between the two locations D_{ij} (also with a specific weight θ), which represents a primary proxy for trade costs. Further explanatory variables may be introduced similarly in the model.

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[2] Further specifications in the literature have used country population (Linnemann 1966) or per capita income in order to capture the same effects.

The multiplicative nature of this equation implies that it can easily be made linear in parameters by taking natural logs:

$$\ln T_{ij} = \ln G + \alpha \ln Y_i + \beta \ln Y_j - \theta \ln D_{ij}. \tag{2}$$

Typical values for the linear parameters of ln Y_i and ln Y_j lie between 0.7 and 1.1, while the value of θ is instead commonly around 0.6. Leamer and Levinsohn (1995, p. 1384) find that the effect of distance on trade values is one of the 'clearest and most robust empirical findings in economics'. This finding is extensively discussed in Disdier and Head (2008). Possible explanations for the relevance of distance, beyond it proxying for transport costs, are that it indicates the time needed for transporting the goods, and that it may also be a proxy for synchronization, communication and transaction costs, or the costs of searching for trading opportunities.

From the above discussion, we argue that the gravity model of trade is a suitable tool for investigating the research question proposed in this paper, that is, the effects of piracy rates on the trade of audio-visuals and new media. Therefore, we build our model starting from a standard gravity model of trade specification (as seen, e.g., in Anderson and van Wincoop 2003; Feenstra et al. 2005; Santos Silva and Tenreyro 2006), and we subsequently augment it by including key variables related to piracy rates. We focus on three categories of goods (music, films and new media), for which separate models are estimated.

Our dependent variable (T_{ij}) is the value of trade, for the good concerned, from a generic countries i to a generic country j. On the right-hand side, origin- and destination-market size is included by means of GDP (Y_i and Y_j). Then, a set of bilateral variables is included, to take into account the geographical and cultural relationships between countries. This set includes, as a main trade deterrence variable, an indicator of distance (D_{ij}), as well as the following dummy variables:

- contiguity (C_{ij}): indicates if two countries share a border;
- common language (CL_{ij}): indicates if two countries share a common (official) language;
- colony (COL_{ij}): indicates if two countries have ever had a colonial link;
- colonial link after 1945 ($C45_{ij}$): indicates if two countries have had a colonial relationship after 1945;

- common colonizer (CC_{ij}): indicates if two countries had a common colonizer after 1945;
- same country (SC_{ij}): indicates if two countries originally belonged to the same country;
- FTA (FTA_{ij}): indicates if between two countries there is a free-trade agreement.

We could have included a bilateral tariff regarding the considered categories of products. To our best knowledge, the most comprehensive database regarding bilateral tariffs is the World Bank bilateral tariffs database, which is extracted from the TRAINS/WITS and the MACMap databases, developed jointly by ITC (UNCTAD-WTO, Geneva) and CEPII (Paris). Unfortunately, this database does not include any data on the Harmonized System Code category 99, which comprises video production, music production, mixed media, and animation. An alternative solution is including an average of bilateral tariffs, but we have no reason to believe that it would be representative of the categories of goods analysed here. The model presented above has standard explanatory variables, and represents a valid starting point for our analysis. Since our aim is to empirically evaluate if (and to what extent) piracy acts as a deterrent to trade, we enhance our model by introducing, in addition to the aforementioned variables, key variables capturing the level of reliability of the single countries in terms of respect of intellectual property rights (IPR). Two possible approaches could be explored: relying on indicators of the institutional will of the countries to enforce IPR, or including indicators of the level of piracy considered as a consequence of the lack of IPR protection. With regard to the first approach, we considered including dummy variables indicating whether or not a country has signed the Berne Convention for the Protection of Literary and Artistic Works. Unfortunately, this approach appeared not to be feasible in our paper, since all the 25 countries selected for the study (see Section 4.1) have signed the Convention (though at different points in time before the start of our observation period). There are indeed very few countries worldwide nowadays which still do not adhere to it. Therefore, Berne Convention signatories can hardly represent only the countries with higher levels of IPR protection. In practice, one should distinguish between the signing of such an agreement and the actual enforcement of IPR. The alternative approach is to consider empirical indicators that attempt to evaluate the penetration of piracy in the market for audio-visuals and new media. Such indicators are usually computed by supra-national organizations which monitor and estimate the impact of piracy on sales.

Our gravity models of trade are therefore augmented by piracy indicators relating, as in the case of GDP, to importers and exporters (P_i and P_j).[3] In more detail, for the music-related model, we include a variable specifically related to music piracy. For the model concerned with new media, we include a variable pertaining to software piracy, which we consider as a suitable proxy for the new media piracy, which is the category most-strictly linked to hi-tech products and the Internet. For the films model, because of the lack of a specific indicator, we do not specify an a priori preference between the music or software piracy indicators, and we let the data speak, testing both indicators along the way. It turns out the two indicators are moderately correlated (0.42–0.46) and that the music piracy variable is slightly preferable in the case of films.

If we consider the models described above in a log-linear equation form, we can therefore write our generic model as:

$$\begin{aligned}\ln T_{ij} = \alpha_0 + \alpha_1 \ln Y_i + \alpha_2 \ln Y_j + \alpha_3 \ln D_{ij} + \alpha_4 C_{ij} + \alpha_5 CL_{ij} + \alpha_6 COL_{ij} + \alpha_7 C45_{ij} + \\ \alpha_8 CC_{ij} + \alpha_9 SC_{ij} + \alpha_{10} FTA_{ij} + \alpha_{11} \ln P_i + \alpha_{12} \ln P_j .\end{aligned} \tag{3}$$

where all variables are defined as above. We may expect all the coefficients to be positive – as past and current economic and social links (such as colonial links or trade agreements) lead to increased trade – with the exception of the ones of distance and of the piracy variables, for which we hypothesize a negative relationship. While the deterrence effect of distance is an established result in the trade literature, the effect of piracy on trade is the object of interest here. In this regard, a further motive of interest is whether piracy at the importer or exporter locations affects trade to a significantly different extent.

4.2. The Estimation Approach

The modelling framework defined in the preceding section is estimated, in this paper, for a panel of 25 countries and 11 time periods (years), summing up to a potential panel size of 11 * 25 * (25 – 1) = 6600, when excluding internal trade. From an estimation perspective, and considering the time dimension, we can now express Equation (3) as:

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[3] As an alternative to the specification including P_i and P_j, we tested models employing a lone piracy variable P, obtained as the product of P_i and P_j, in order to investigate the conjoint effect of piracy at the importer and at the exporter. This specification has been discarded, since it did not lead to improvements in statistical inference while maintaining virtually unchanged parameter estimates for the remaining covariates.

$$\ln T_{ijt} = \alpha_{ij} + \alpha_t + \alpha_1 \ln Y_{it} + \alpha_2 \ln Y_{jt} + \alpha_{10} FTA_{ijt} + \alpha_{11} \ln P_{it} + \alpha_{12} \ln P_{jt} + \varepsilon_{ijt}, \qquad (4)$$

where α_{ij} is the vector of coefficients of the typically employed individual fixed effects (when random effects are excluded, as it is in our case by Hausmann tests), α_t is the vector of time fixed effects (as in Baldwin and Taglioni 2006), and time-varying variables have acquired the subscript t. Time-invariant variables cannot be identified and are excluded because of the presence of individual fixed effects. It is an established tradition, in the trade literature, to estimate the (panel) gravity model as in Equation (4), that is, in its log-linear form (e.g., see recently Cheng and Wall 2003; Martínez-Zarzoso and Nowak-Lehmann 2003; Brun et al. 2005). In this specification, the individual fixed effects surrogate for the excluded and the missing explanatory variables and most importantly for unobserved price indices (Anderson and van Wincoop 2003).

In this paper, we propose an alternative approach to the estimation of the gravity model of trade, which offers three advantages: we estimate the gravity model by means of count data regression techniques, which allow to estimate it in its multiplicative form (i) in order to account for Jensen’s inequality and overdispersion; we propose a substitute for the individual fixed effects, where unobserved (bilateral) price indices are approximated by means of spatial filtering techniques (ii) for the first time in a panel framework. Additionally, these techniques allow to identify (iii) bilateral and time-invariant variables while saving degrees of freedom.

The first element relates to recent developments in the trade/econometrics literature, and in particular to Santos Silva and Tenreyro (2006). In their popular article, Santos Silva and Tenreyro point to the many problems that can arise from estimating log-linearized versions of multiplicative models, such as the gravity model, in the presence of heteroskedasticity, and suggest the use of count data regression models. Following Santos Silva and Tenreyro, a high number of applied papers in trade using Poisson regression techniques have emerged (see, e.g., Tenreyro 2007; Henderson and Millimet 2008; Boulhol and de Serres 2009), as well as methodological extensions (Burger et al. 2009), where a larger family of Poisson-type models is considered. Among the models considered by Burger et al., negative binomial estimation is suggested as a tool for curing overdispersion in the data due to unobserved heterogeneity (from omitted variables), which hinders the hypothesis at the basis of Poisson regression of equal sample mean and variance. The overdispersion phenomenon is indeed typical of trade data, which have a multitude of small flows and a small number of much bigger flows. On the basis of these considerations, in the first part of this paper we choose to carry out negative binomial estimations. As a result of our choice, the model to be estimated is obtained by rewriting Equation (4) as:

$$T_{ijt} = \exp(\alpha_{ij} + \alpha_t + \alpha_1 \ln Y_{it} + \alpha_2 \ln Y_{jt} + \alpha_{10} FTA_{ijt} + \alpha_{11} \ln P_{it} + \alpha_{12} \ln P_{jt}) + \varepsilon_{ijt}, \tag{5}$$

where all symbols are as before. Differently from what happens in a standard Poisson regression, dispersion in a negative binomial model is not assumed to be equal to 1, but is iteratively estimated. As a consequence, while the expected value $E(T_{ijt}|\ldots)$ is the same as for Poisson, the regression variance is a function of both the conditional mean and the dispersion parameter (see Burger et al. 2009, p. 174, Equation (5)).

The model shown in Equation (5) above, incorporates a fixed effects component α_{ij}. The second element of novelty of the paper is the substitution of this component with a spatial filter, which incorporates spatial and network dependence of omitted variables, and a spatially unstructured random effects component, which captures non-spatial (idiosyncratic) omitted information, as well as (partially) serial correlation. With regard to the spatial/network dependence, we may expect unobserved variables to have a non-random distribution from a spatial viewpoint: for example the actual price indices usually surrogated in the trade literature by fixed effects, As we are dealing with countries and flows between countries, which have an obvious embedded geographical component, these variables may exhibit either spatial dependence (in the case of origin- or destination-specific variables) or network dependence (in the case of bilateral variables). In the case of the gravity model of trade, trade flows are usually considered, from an estimation perspective, to be independent one from another (independence assumption). However, because of the doubly-constrained nature of the theoretical gravity model of trade (Anderson and van Wincoop 2003), trade flows are indeed *not* independent[4] but also related to price indices,

The result of such omitted variables will be the failure in the independence assumption, and a possible correlation of residuals. Correlation between flow data is often referred to as 'network autocorrelation' (Black 1992; Chun 2008), meaning that the flow between country A and country B may be correlated with the flow between country A and a neighbour (however

[4] The same rationale holds for other applications of the gravity model (or spatial interaction model, as it is called in regional economics) in migration, commuting, and so on.

defined) of country B (or vice versa), or with the flow between a neighbour of country A and a neighbour of country B (see, e.g., Figure 2 in Chun 2008, p. 322).

An increasing body of literature in trade is recently emerging on the exploration and treatment of spatial and network autocorrelation in trade models (see, e.g., Porojan 2001; Behrens et al. 2007; Egger and Larch 2008), although mostly in a cross-sectional context. In this paper, we adapt the spatial filtering approaches suggested by Chun (2008) and Griffith (2009) for migration and commuting to the trade case, and for the first time, to a panel data framework. We stress that this approach can be a suitable surrogate for the individual fixed effects, covering the main unexplained spatial/network dependence structures in the data. As suggested by Griffith (2008) and Patuelli et al. (2010), in the panel case the spatial filter can be employed in conjunction with a random effect, in order to capture both spatially structured and unstructured omitted variables. The approach proposed here allows for considerable savings in terms of degrees of freedom, and to account for the share of excess zeros in the dependent variable. With regard to the latter, the share of (potential) excess zeros that can be attributed to network dependence will be approximated by the spatial filter, while the remaining purely idiosyncratic zeros will be mostly taken into account by the random effects term.

Approaches based on eigenvector spatial filtering techniques (Griffith 2003) allow to define a set of surrogate variables, to be included in the model, which represent orthogonal and independent correlation structures in the data. We start by defining, for each country, a set of neighbours, obtained for example by means of k-nearest neighbours techniques (we set $k = 2$), therefore obtaining a so-called spatial weights matrix $\mathbf{V}$ (n-by-n, forced to be symmetrical) defining neighbourhood relationships between countries. We can transform $\mathbf{V}$ into:

$$(\mathbf{I}-\mathbf{11}'/n)\mathbf{V}(\mathbf{I}-\mathbf{11}'/n), \tag{6}$$

where $\mathbf{1}$ is a vector containing just 1's, and n is the number of countries considered. The range of values of Moran's I – the most common measure of spatial autocorrelation (Cliff and Ord 1973) – is constrained between the largest and smallest eigenvalue of this transformed matrix (De Jong et al. 1984), which is equivalent to the numerator of Moran's I. Extracting the eigenvectors from the above matrix provides a set of spatial-autocorrelation-maximizing, mutually orthogonal and independent, zero-centred map patterns implied by the relationships of neighbourhood between the countries.

Because we are dealing with flow data and the correlation structures – as shown in **Figure 1** – can be bi-dimensional, the procedure above can be extended to a matrix **M** = **V** ⊗ **V**, which will consequently be of size n^2-by-n^2. A subset of the n^2 eigenvectors extracted from the modified **M** matrix may be selected on the basis of a minimum-correlation threshold, for example given by MI(e_i)/max(MI) > 0.25, where MI(e_i) is the Moran's I value of the generic *i*th eigenvector and max(MI) corresponds to the Moran's I of the first extracted eigenvector.[5] We refer to the selected subset of eigenvectors as the 'candidate' eigenvectors. 58 candidate eigenvectors are obtained for our sample of 25 countries.

The candidate eigenvectors' length is equal to the potential cross-sectional dimension of the data, and in order to match the data in a panel framework they have to be piled vertically T times, where T is the number of time periods. They may then be included in the model to be estimated and further selected – for example in a backward, general-to-specific stepwise regression – strictly on the basis of statistical significance or according to other model selection criteria (see, e.g., Tiefelsdorf and Griffith 2007). In this paper, we carry out model selection on the basis of the Schwartz Bayesian information criterion (BIC), because of the maximum-likelihood nature of the negative binomial estimation.[6] Finally, correcting Equation (5), the generic model to be estimated can be written as:

$$\begin{aligned} T_{ijt} = \exp(&\alpha_t + \alpha_1 \ln Y_{it} + \alpha_2 \ln Y_{jt} + \alpha_3 \ln D_{ij} + \alpha_4 C_{ij} + \alpha_5 CL_{ij} + \alpha_6 COL_{ij} + \\ &\alpha_7 C45_{ij} + \alpha_8 CC_{ij} + \alpha_9 SC_{ij} + \alpha_{10} FTA_{ijt} + \alpha_{11} \ln P_{it} + \alpha_{12} \ln P_{jt} + \textstyle\sum_k \beta_k e_{k,ij} + b_{ij}) + \varepsilon_{ijt}, \end{aligned} \tag{7}$$

where α_t is the vector of coefficients for the set of dummy variables included to control for year-specific shocks, β_k is the regression coefficient of eigenvector e_k, and b_{ij} is the random effects component for country pair (i, j). The resulting linear combination of selected eigenvectors is defined as our 'spatial filter', and acts as a surrogate for omitted – and spatially correlated – variables. The final model is estimated as a generalized linear mixed model (GLMM), by means of Laplace approximation (see, e.g., Raudenbush et al. 2000).[7, 8]

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5 According to Griffith (Griffith 2003), such a threshold corresponds to about 95 per cent explained variance in a spatial autoregressive model.

6 Chun (2008) and Tiefelsdorf and Griffith (2007) suggest an alternative objective function, based on the minimization of residual spatial autocorrelation and stress the usability of both approaches.

7 In the final GLMM estimation, a Poisson regression is estimated, since mixed negative binomial models are still somehow underdeveloped in the literature. In this regard, the overdispersion that was previously

4.3. The Data

The measurement of trade in relation to the creative economy is challenging. Trade in physical products of the creative economy is composed by relatively low value materials. However, these products contain their real value in intellectual property. Conventional trade measures focus on the flow of material goods, either registering their (free-onboard) price or weight, but it is impossible to disentangle the IPR value from such data or even to recognize it. Moreover, digitization is increasingly facilitating the transfer and trade in IPR goods online, a means currently not monitored. It is for these reasons that trade in the creative economy is relatively invisible.

There are two other reasons explaining why a significant proportion of the creative economy does not register in trade or economic statistics. First, much of the activity takes place at the informal economy level. Arguably, this issue is more acute in the developing world, where arts and crafts and visual arts are produced under such conditions. This data problem is a general one, and there is no simple way to resolve it. In the case of the creative economy, another issue is that many cultural activities are carried out on a voluntary or recreational basis. However, they become an important resource as they support the formal and traded economy.

On the basis of the above discussion, the dependent variable we choose to analyse in this paper is trade value – for each studied good (music, films, and new media) defined in Section 1 – in millions of US$ between two generic countries i and j. We use COMTRADE data, which are available through the UNCTAD 'Global databank on world trade in creative products',[9] and for consecutive years from 1996 to 2006 (therefore covering 11 years). In order to reduce the high number of missing values in the data, we compute the value of the trade from a generic country i to a country j as the average between the flows registered as the imports of j from i, and the ones registered as the exports of i to j. When only one of the two records is available, it is assumed to be representative of the real value. We select 25

accounted for by the negative binomial estimation, as well as any residual non-spatial component of the fixed effects, is now accounted for by the random effects. A comparison between the SF estimation and the random effects estimation in a Poisson model is discussed in Chun (2008).

[8] For comparison purposes, Table 3 in the Appendix provides the results for conventional two-ways fixed effects estimations, estimated for a negative binomial functional specification.

[9] Available at http://www.unctad.org/Templates/Page.asp?intItemID=4564〈=1.

countries,[10] which guarantees, over the three datasets, an acceptable amount of missing values (with respect to a full trade matrix), around 20–25 per cent. We are aware of the fact that there exists a bias due to the lack of bilateral data regarding many countries. There is a trade off between the representativeness of the sample (in terms of number of selected countries) and the reliability of the inference of the selected countries. We preferred to privilege the second one. Moreover, the choice is supported by the fact that the analysed countries cover from 87 to 95 per cent (depending on the three datasets considered in this paper) of the recorded world trade in cultural goods.

Figure 1 shows the distribution of our dependent variable for the music, films and new media data sets, respectively. The density plots show that, in logs, trade flows tend to follow a fairly normal distribution. In particular, the distribution of film trade values (centre of Figure 1) appears to have a second (minor) peak above the average, suggesting a (numerically) intense exchange of movies between a reduced number of countries, while the distributions of music and new media values are slightly more symmetric but have fatter tails. It can be noted that all three distributions show a long left tail, implying flows of goods of very small entity between a subset of countries.

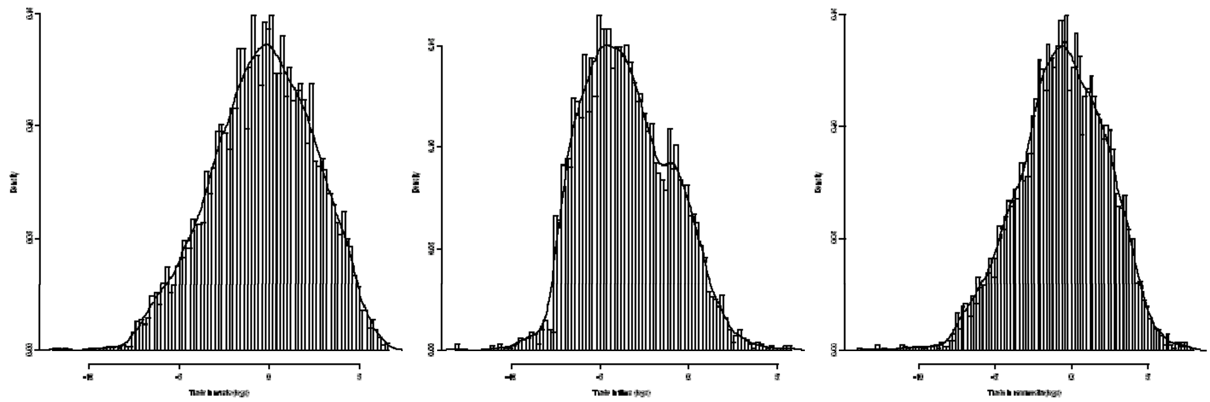

Figure 1. Densities of trade values, in logs of millions of US$, for music, films and new media, from left to right, respectively

[10] The countries included in our analysis are: Australia, Austria, Belgium, Canada, China, Czech Republic, Denmark, France, Germany, Hong Kong, India, Italy, Japan, Mexico, The Netherlands, Norway, Russian Federation, South Africa, South Korea, Spain, Sweden, Switzerland, Thailand, United Kingdom, United States.

With regard to the explanatory variables included in our model, GDP (in PPP terms) is taken from the Penn World Table, FTA is from the WTO,[11] while all the variables relating to distance, contiguity and all colonial history information are obtained from CEPII (see Mayer and Zignago 2006). In particular, the variable ‘distance’ is computed (according to the Great Circle criterion) between each country’s ‘most important cities/agglomerations (in terms of population)’ (Mayer and Zignago 2006, p. 4).

Finally, the two variables pertaining to piracy, in the music and software industries, are obtained from IFPI[12] and BSA[13], respectively. The former is expressed as a categorical variable indicating the mean of the range and the latter is a continuous variable; both represent percentages. The figures these piracy variables represent have been criticized as biased to specific-industry interests. Png (2010) claims that: (i) BSA estimates are biased on a cross-country basis, (ii) with regard to the years before 2002, cross-country studies on software piracy were mispecified; and (iii) from 2003 onward, following a change in the BSA consultant and methodology, piracy rates across countries were inflated by an average of almost four percentage points. Nevertheless, the considered piracy variables are the only ones existing at the world level. Taking into account these problems, we will carefully interpret our results.

Table 1 reports descriptive statistics for all (dependent and explanatory) variables employed in the paper. The quartiles for the dependent variables (value of trade for music, films and new media, separately) show that at least 50 per cent of the pairs of countries considered (and 75 per cent in the case of films) exchange less than one million US$ yearly, while a few countries exhibit much larger amounts, such as Canada and the US, or China and the US in the case of new media. Noteworthy are the distributions of the dummy variables included in our models. While the ‘contiguity’, ‘common language’ and ‘FTA’ variables identify common characteristics of a moderate number of country pairs, the colonial variables are

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[11] Available at http://stat.wto.org/StatisticalProgram/WSDBStatProgramSeries.aspx?Language=E.

[12] International Federation of Phonographic Industries, ‘The Recording Industry in Numbers’, various years. Piracy is measured as a percentage of total (legitimate and pirate) sales.

[13] Business Software Alliance, Seventh Annual BSA Global Software Piracy Study (for the years 1996–01) and Fifth Annual BSA and IDC Global Software Piracy Study (for the years 2001–06). The difference between software applications installed (demand) and software applications legally shipped (supply) equals the estimate of software applications pirated. The piracy rate is defined as the volume of software pirated as a percent of total software installed in each country.

instead relevant for a very limited number of country pairs, and – though potentially important – maybe not be expected to explain a highly relevant share of the total variance.

Table 1. Descriptive statistics

Variable	Min	1Q	Mean	Median	3Q	Max	St.Dev.
Trade (music, millions US$)	0.00	0.10	12.37	0.77	5.55	694.02	41.76
Trade (films, millions US$)	0.00	0.00	0.88	0.02	0.18	322.68	9.13
Trade (new media, millions US$)	0.00	0.09	14.01	0.60	4.44	2718.90	85.97
Distance (km, in logs)	5.15	7.34	8.34	8.84	9.15	9.78	1.12
GDP (importer, PPP US$, in logs)	11.75	12.44	13.47	13.50	14.25	16.40	1.12
Piracy (IFPI, importer, in logs)	1.61	1.61	2.50	1.61	3.62	4.32	1.04
Piracy (BSA, importer, in logs)	3.04	3.43	3.72	3.66	3.95	4.56	0.37
Dummy variables	# 1*	# 0					
Contiguity	500	5896					
Common language	777	5619					
Colony	274	6122					
Common colonizer	22	6374					
Colonial link after 1945	66	6330					
Same country	72	6324					
FTA	1916	4480					

Note: Values of common variables are reported for the music data set.

* The number of 1's may be divided by the number of time periods (11) to obtain the (average) number of 1's per year. Perfect multiples of 11 are not obtained because of missing values.

5. Results

This section presents the empirical findings obtained, for our sample of 25 countries, over the three datasets selected, describing trade flows between 1996 and 2006 in music, films and new media. As mentioned in Section 4.2, we estimate the gravity model of trade by means of a generalized linear mixed model (GLMM), while accounting for omitted spatial- and network-autocorrelated variables by means of a spatial filter. Time dummy variables are added to take into account year-specific global shocks to trade. Seven (highly significant) eigenvectors are selected for the films model, and six for the music and new media models. Each model tends to have its own set of eigenvectors, where only one is common between model pairs, suggesting that relevant omitted variables are case-specific and hardly generalizable to the whole three contexts. The panel numerosity is satisfying, with the films dataset being the one with the highest share of missing values (about 22 per cent), which decreases to 3 and 6 per cent for music and new media. Only a limited number of degrees of freedom is used for estimation, with considerable savings if compared with a fixed effects choice. The movie dataset appears to provide the best fit, according to McFadden's pseudo-R^2.

Table 2 presents the estimates obtained for the three datasets studied. The variables typical of a gravity model are significant and show all the expected sign. In particular, GDP, both for importing and exporting countries, is positive. In the music case, the elasticity of trade with respect to income of the importing country is high (0.9), while in the case of films and new media the elasticity of trade with respect to income is higher for the exporting country, interestingly supporting the idea that these two markets are more technologically embedded and supply-driven.

Distance is negative and significant (at the 5% level) for films, music and for new media, reflecting the fact that the considered figures are underestimated with respect to the dynamic reality of the global markets for phonographic, audiovisual and digital products. Current standard statistical classifications remain customs-based and only refer to physical goods. Thus electronic trade is not included in our data.

Membership in free trade agreements (FTA) is positive e significant in both the music and new media dataset; on the contrary, the movie market is not influenced by regional trade agreements and is dominated by its own internal mechanisms. Common language proves to be very important both for films and music, demonstrating that cultural proximity matters [as confirmed in Schulze (1999) and Disdier et al. (2010)]. In particular, in the films case, it can explain the role played by dubbing in many countries.

Table 2. Empirical results from spatial filtering estimation

	Music			Films			New media		
	Estimate	Std. error	p-value	Estimate	Std. error	p-value	Estimate	Std. error	p-value
Contiguity	0.4889	0.3725	0.1893	–0.3887	0.3734	0.2979	–1.7551	0.9079	0.0532
Common language	1.1539	0.2818	0.0000	1.4810	0.2817	0.0000	1.4396	0.6967	0.0388
Colony	0.4628	0.4825	0.3374	0.7444	0.4463	0.0953	–1.7157	1.2183	0.1591
Common colonizer	0.2291	1.4080	0.8708	–1.1399	1.4372	0.4277	2.0076	3.4562	0.5613
Colonial link after 1945	–0.8390	0.9253	0.3646	–0.1522	0.8010	0.8493	0.0352	2.2840	0.9877
Same country	–2.3762	0.8256	0.0040	–0.9587	0.7793	0.2187	1.8958	1.9812	0.3386
Distance	–0.8068	0.0866	0.0000	–0.7571	0.1100	0.0000	–1.2349	0.2063	0.0000
GDP importer	0.9095	0.0560	0.0000	0.5996	0.0843	0.0000	0.0352	0.0875	0.6877
GDP exporter	0.1327	0.0620	0.0323	0.8612	0.0875	0.0000	4.7926	0.0444	0.0000
FTA	0.3024	0.0432	0.0000	–0.1158	0.1674	0.4892	0.6724	0.0291	0.0000
Piracy importer	–0.0441	0.0131	0.0008	–0.1876	0.1786	0.2936	0.8969	0.0494	0.0000
Piracy exporter	–0.0062	0.0167	0.7087	0.8028	0.1679	0.0000	0.0724	0.0499	0.1465
BIC	13593			3021			35708		
Residual dof (/Null dof)	6367/6396			5120/5150			6173/6201		
McFadden's pseudo-R^2	0.63047			0.7335			0.4062		
Eigenvectors (out of 58)	8, 14, 15, 45, 53, 57			2, 18, 31, 33, 34, 44, 45			9, 11, 13, 15, 44, 56		

Note: Regression coefficients for time dummies and eigenvectors are omitted.

As far as the other dummies representing the common history and colonial links between the countries, they are not significant. With regard to contiguity is concerned, this finding has an explanation in our limited sample (25 countries), where Europe is over-represented and the rest of the countries have almost no contiguous neighbour.

Our key variable – piracy – proves to be a suitable choice. In the music model, the level of piracy of the importing country affects negatively international trade, while in the new media and films sectors piracy rates have positive effects. This finding relates prevalently to the demand side for the new media sector and the supply side for the movie sector, since file-sharing procedures flourish mostly in the countries where the majors dwell, thus where most of the digitalized items are produced (even if the artists come from developing countries).

As confirmed by Peitz, and Waelbroeck (2006) and Lionetti (2006), there is a positive externality and network effect played by piracy: the increased consumption due to copying makes the consumer more aware and fond of the product, thus making it more likely that he/she will buy its legal version. Overall, our estimates show that it is possible to identify the general determinants of trade in audio-visual and digital content. Our findings are consistent over all the analyses carried out, suggesting a network positive effect of piracy on trade.

6. Conclusions

The purpose of the paper was to examine the main features inherent to the trade of the creative industries concerned with the production of audio-visual and digital content. Attention is devoted to the role played by piracy in this context.

Piracy, in particular with regard to digitalized and easily reproducible creative content, represents a critical issue for supranational organizations and governments worldwide. Task forces are created to fight illegal reproduction and selling of contents protected by intellectual property rights (IPR), mostly on the basis of reports suggesting that (internal) sales suffer from such phenomena. On the other hand, no efforts have been made, to our knowledge, in evaluating the effect of piracy rates on international bilateral trade in audio, video and multimedia creative content. This paper focused on analysing the determinants of bilateral trade in such cultural goods, and on evaluating whether piracy (both at the importer and the exporter location) has a significant effect on trade. Using a much under-utilized creative industries dataset from UNCTAD, we estimated a set of gravity models of trade, by also taking into account recent econometric developments in the field of flow data analysis. We found evidence that piracy affects negatively bilateral trade in music, but positively in films and new-generation media. In particular, piracy rates of the consumer countries tend to deter the demand for music. The movie and particularly new media industries, instead, appear to be influenced in terms of trade by on-site piracy as well, most likely due to issues related to developing countries.

Despite the promising results obtained, many questions remain open, as the research question tackled in this paper was virtually unexplored until now. From a theoretical viewpoint, future research should focus on the search or development of a proper indicator of the level of enforcement of IPRs. From a methodological viewpoint, it is desirable to extend the estimation framework proposed here, moving from implicitly to explicitly accounting for the autocorrelation of trade flows in a panel framework. From an empirical viewpoint, availability of more complete records on the trade of cultural goods would allow to expand the group of countries considered, and to include more transition and developing countries. Such an improvement would also open the door to sensitivity analyses on the possible different effects of piracy in structurally different economies, as suggested above. Finally, from a policy viewpoint, it would be desirable to implement a more accurate and flexible system of IPR enforcement (especially in consumer countries). In this manner, it would be possible to be competitive with the evolution of technology. This paper intended to open a discussion in order to assist policy makers in assessing the actual and potential economic impact of these creative industries for trade and development gains.

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Appendix

Table 3. Empirical results for the estimation of two-ways fixed effects negative binomial models

	Music			Films			New media		
	Estimate	Std. error	p-value	Estimate	Std. error	p-value	Estimate	Std. error	p-value
GDP importer	1.8028	0.1639	0.0000	1.9799	0.6058	0.0011	–0.6395	0.2432	0.0086
GDP exporter	0.6771	0.1961	0.0006	–3.2913	0.5843	0.0000	3.3985	0.2058	0.0000
FTA	0.4541	0.0718	0.0000	–0.3087	0.2434	0.2048	0.8568	0.1023	0.0000
Piracy importer	–0.0626	0.0267	0.0193	0.2914	0.3082	0.3443	0.0485	0.1510	0.7481
Piracy exporter	0.0845	0.0300	0.0048	1.8797	0.3295	0.0000	–0.0307	0.1550	0.8432
BIC	26137.0			9703.2			26639.6		
Residual dof (/Null dof)	6367/6395			4540/5150			5588/6202		
McFadden's pseudo-R^2	0.425			0.567			0.373		