European
Commission

JRC TECHNICAL REPORTS

Institute for Prospective Technological Studies
Digital Economy Working Paper 2014/05

Digitization, Copyright, and the Welfare Effects of Music Trade

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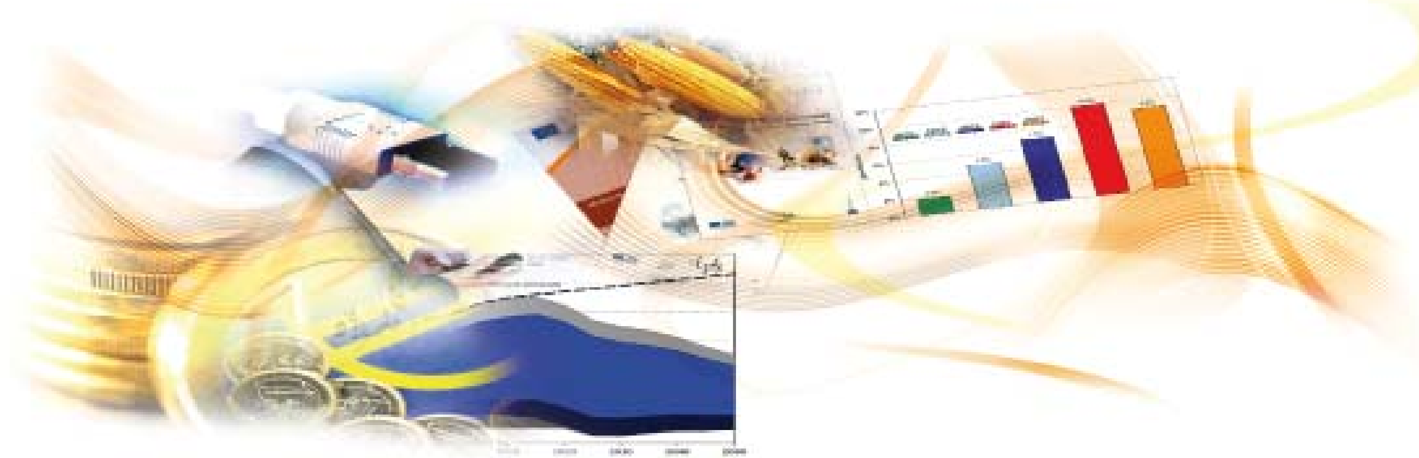
2014



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This publication is a Technical Report by the Joint Research Centre of the European Commission.

JRC89697

ISSN 1831-9408 (online)

Spain: European Commission, Joint Research Centre, 2014

Non-Technical Summary

Since the launch of the iTunes Music Store in the US in 2003 and in much of Europe in the following years, music trade has shifted rapidly from physical to digital products, raising the availability of products in different countries. Despite substantial growth in availability, the available choice sets of digital music have not fully converged across countries. The territorial fragmentation of the EU copyright management regime and related cross-border transaction costs are often perceived as an obstacle to greater availability. However, other factors such as commercial strategies by music producers may also affect availability.

EU policy makers are now contemplating various possibilities to reduce these cross-border trade costs and improve convergence in music availability across countries. This raises the question of how much benefit these policy measures would create for consumers and producers in Europe and around the world. This study calculates the economic benefits for consumers and producers from further trade opening or trade cost reductions in digital music.

We address this question using comprehensive Nielsen data on digital track sales in the US, Canada, 13 EU Member States, and 2 other European countries (Norway and Switzerland) from 2006 to 2011. We estimate a structural model of music demand which allows us to obtain the consumer surplus for consumers in each destination country as well as the revenue for producers in each origin country.

Our model allows us to simulate several scenarios. We first compare the baseline current situation (the "status quo") with full autarky whereby only local music is available in each country - a big step backwards compared to the status quo. We then compare the status quo with a fully open EU Digital Single Market whereby all European music is available in all EU countries. Finally, we simulate worldwide openness in which all music is available in all countries. We estimate both consumer surplus benefits and producer revenue effects for these scenarios.

Not surprisingly, the current status quo music trade benefits consumers everywhere compared to the autarky scenario. Relative to autarky, status quo trade raises aggregate consumer surplus in the 17 countries by about €300 million (a 11.3% increase). Trade also raises producer revenue by €85 million (a 2.8% increase). European consumers benefit more from music trade than North Americans. However, it has large benefits for American producers but on balance small benefits to European producers. American producers have a larger market share in Europe that European producers have in the US.

Moving from the current status quo to an EU Digital Single Market for music would increase consumer surplus from digital music consumption by 1.8 per cent (€19 million) and music producers' revenue by 1.1 per cent (€10 million). Benefits vary considerably across Member States. Under worldwide frictionless trade consumers in 15 European countries gain €31 million (a 3% increase) while North American consumers gain €6.5 million (a 0.35% increase). Most of the gains from fully frictionless trade - about two thirds - are accomplished by a European single market. Annual gains from worldwide frictionless trade for producers, compared to autarky, reach 1.9% in Europe and 0.38% in the US. Clearly, the additional gains from moving beyond a European Digital Single Market to a worldwide open market would be small for European producers and consumers. Digital music production and consumption is only a small part of all media markets covered by copyright. We note that the figures presented here represent only a fraction of the potential benefits from further trade opening in other digital media.

1 Introduction

Since the launch of the iTunes Music Store in the US in 2003 and in much of Europe in the following years, music trade has shifted rapidly from physical to digital products. This transition has substantially reduced trade costs and, by extension, has broadly expanded the options available to consumers of both domestic and imported music. For example, the number of new French songs available in the US grew by more than 30% in between 2006 and 2011. While the growth in available consumption choices has been substantial, choice sets have not converged across countries. The majority of songs released in each country are not sold in most other countries, suggesting restrictions in cross-country availability. For example, of the 45,290 German songs released in 2011, only 6% percent were sold in France, and only 14% percent were sold in the US. Many observers point to transaction costs associated with the copyright systems as an obstacle to greater choice - in effect, freer trade - in music.[1] Even within ostensible free trade zones such as NAFTA or the European Union, digital tracks available in one country are not automatically available in others. Instead, because copyright laws are state-specific, a rights holder must incur separate costs to market a product legally in each country.

Policy makers are now contemplating various liberalizations that could reduce the costs of making products marketed in one country available in others. For example, European policy makers are contemplating a European single market for digital products that could, in principle, ease the burden of copyright on the availability of music products in the European Union. They are also, together with US policy makers, exploring a transatlantic trade agreement that could increase the international availability of music products. The possibility of these liberalizations raises the question of how much benefit they would create for consumers and producers around the world. That is, we want to know how the welfare of market participants would change if the existing products were more readily available globally. Answering questions of this sort requires a structural equilibrium model of supply and demand, from which we can calculate the consumer surplus and producer revenue associated with counterfactual country choice sets.

We study the digital sales of recorded music using comprehensive data on digital track sales in the US, Canada, and 15 major European countries from 2006 to 2011. These 17 countries collectively account for 45% percent of world GDP and, roughly 60% percent of world music sales (IFPI, 2013). Our data show the annual sales of each track sold, and we are able to attribute each song in our final sample to an origin country ; hence we can calculate trade statistics for the universe of digital music sales.

[1]See, for instance, KEA, "Licensing music works and transaction costs in Europe", September 2012, available at http://www.keanet.eu/docs/musiclicensingandtransactioncosts-full.pdf.

In particular, we estimate a nested logit model of music demand: In each country consumers choose whether to buy music then choose among available songs. Given our demand estimates we can estimate the consumer surplus for consumers in each destination country as well as the revenue for producers in each origin country. Given the demand model, we can evaluate counterfactual policies in two ways. First, we can use the demand model alone to simply ask how consumer surplus and revenue would change with different choice sets. While straightforward, this "partial equilibrium" approach does not allow for entry responses that changed choice sets would likely engender. Hence, we also pursue a second approach, an equilibrium model of supply and demand. To this end we can use the demand model along with an assumption of atomistic competitive entry to estimate fixed costs of entry from data on the status quo. We can then perform equilibrium simulations of counterfactual regimes with a model linking the number of products entering to the expected revenue per product. Thus far we have implemented this approach for the autarky counterfactual.

Given the model we can evaluate the impact of possible trade liberalization relative to the status quo. We evaluate the impact of trade by counterfactually estimating consumer surplus and producer revenue under the status quo and two counterfactual liberalizations: worldwide frictionless trade (in which all products are available everywhere) and European frictionless trade (in which any product now available anywhere in the EU 13 becomes available throughout the EU 13). Frictionless trade is a regime that effectively eliminates additional state-specific costs (such as copyright clearance costs) to market products in different countries. Our European frictionless trade counterfactual therefore mimics a European digital single market for music. Take for instance the case of a song with cleared copyright in France. While the current copyright laws imply additional state-specific transaction costs for the song to be marketed in any other EU country, a European digital single market would essentially eliminate these additional costs. It is however important to note that trade costs in digital music may not only be limited to copyright related costs but could include other types of trade costs. Our counterfactual exercises therefore not only simulate the effect of removing copyright related trade costs, but overall trade costs in digital music. Finally, we also simulate autarky (in which current products are available only in their domestic markets) so that we can also calculate the gains from status quo trade.

In our setup, liberalizations tend to raise the number of products available to consumers and generally raise consumer surplus. But the magnitude of the benefit experienced is an open empirical question. Producer surplus for origin countries, by contrast, can rise or fall with liberalization. We find that trade confers substantial benefits on consumers. Relative to autarky, status quo trade raises equilibrium CS in our 17 countries by about €300 million (a 11.3% increase), or by €0.4 per capita on average. Irish and Canadian consumers gain roughly €1.29-1.53 per capita annually from music trade, while consumers in Italy, Portugal, and Spain gain around €0.10 annually per capita. Effects on producers are also substantial but more varied. In total across 17 countries trade raises producer revenue by €85 million (a 2.8% increase), or by an average of €0.11 per capita. Producers in Ireland, Great Britain, and Sweden gain €2.9-4.5 per capita annually, while producers in the US gain only about €0.5. Producers in Switzerland, Belgium and Germany are the largest losers under status quo trade relative to autarky, with losses of up to €5.4 per capita.

We calculate the impact of other liberalizations using the partial equilibrium approach, finding that additional liberalization would confer additional benefits on consumers and producers, but the additional benefits are, not surprisingly, smaller than the benefit of status quo trade over autarky. Under worldwide frictionless trade consumers in 15 European countries gain €31 million (a 3% increase), or an average of €0.08 per capita, while North American consumers gain €6.5 million (a 0.35% increase), or about €0.02 per capita. Most of the gains from fully frictionless trade - about two thirds - are accomplished by a European single market. Annual gains to producers from worldwide frictionless trade average €0.04 per capita for European countries (a 1.9% increase) and €0.02 for the US (a 0.38% increase). The largest gainers from worldwide frictionless trade are the producers from Finland, Norway, and Sweden, with gains of roughly €0.17-0.34 per capita. About half of these gains are realized through a European single market.

The paper proceeds in 5 sections after the introduction. Section 2 starts by presenting the data for the study as well as descriptive facts about music trade. We do this first because the data themselves provide a good deal of background. The section proceeds with a discussion on the literature relevant to our study, including some industry background and some evidence that digitization eases trade effectively (enlarges choice sets). Section 3 sets out the model. Section 4 presents estimation results, and section 5 presents counterfactual simulations. Section 6 concludes and discusses the policy implications of our results.

2 Data and Industry Backgroud

2.1 Descriptive Facts about Music Trade

The data used in our study comes from Nielsen and includes the digital sales of recorded music in the US, Canada, and 15 major European countries between 2006 and 2011.[2] We observe the annual sales of each downloaded track in each destination. The dataset originally includes 1,532,095

[2]The dataset initially includes the following 16 European countries: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. However, given that Poland enters the data in 2008 only, we decided to drop it from the analysis.

distinct artists but unfortunately does not include the artists' country of origin. To overcome this shortcoming of the data, we recovered data on artists' country of origin from www.musicbrainz.org, an open music encyclopedia that collects music metadata and makes it available to the public.[3] The MusicBrainz database is sufficiently authoritative that the BBC relies on it to support the artist and music information on their music website.[4] Unfortunately, there is no unique identifier that permits a straightforward matching between our data and MusicBrainz. We therefore engaged in a tedious matching procedure based on artists' names. In order to reduce the burden of the matching procedure while still obtaining a sufficiently representative set of artists, we decided to focus on the matching of the top 150,000 selling artists in Nielsen, which accounts for 99% of the overall sales. We could obviously not assign a country of origin to illegible artists or to observations that correspond to non standard artists such as movie soundtracks or compilations. On top of that, not all artists appearing in the Nielsen data were present in MusicBrainz, which unfortunately prevented us from recovering the origin of all the artists in our data.[5]

After excluding observations to which no origin country could be assigned, we end up with a sample of 75,239 distinct artists that cover over 91% of the Nielsen total sales. While many artists remain unmatched, it is worth mentioning that over 5,600 of artists sell fewer than 500 copies in the sample, meaning that we are still left with a significant long tail. Our data include 3,987,877 distinct tracks and, because a song can appear in multiple countries and years, 50,870,037 observations. Total track sales in the data are 628.3 million in 2006 and rise to 1512.4 million in 2011. See Table 2.

Digital music markets have developed to different extents across countries. Table 1 provides a comparison of the various countries' digital sales in the Nielsen data, their populations, and total music as well as digital music sales from IFPI (2013). As of 2011 digital sales made up 56 percent of total music sales in the US, compared with 22 percent in France.

While we only observe digital music sales, we treat these rich data as a glimpse into total music sales. Accordingly, we scale up total quantities by country as if the patterns in digital sales were representative of total music sales. Given the replacement of physical by digital sales, our approach provides an accurate characterization of coming sales and trade patterns.

Once we are able to attribute each song to an origin country, we can calculate trade statistics for our sample of digital music sales. We first ask which destination countries consume each origin's repertoire. Table 3 shows the 2011 share of origin repertoire sales in each destination. Austrian

[3] Whenever available in MusicBrainz, the country of origin of each artists corresponds to their country of birth.
[4] See http://www.bbc.co.uk/music/brainz/.
[5] We faced an additional complication in that not all artists matched with MusicBrainz had a country of origin assigned. To partially solve this problem, we looked for these specific artists in Wikipedia in order to recover their country of origin.

repertoire gets nearly 18 percent of sales at home, more than 50 percent in Germany, and only 11 percent in the US. In general the main diagonals in Table 3 are large, indicating that producers derive substantial shares of their world sales at home. France's repertoire gets nearly half of of its sales at home. The US gets over two thirds of its sales at home, in part because the US is a large country.

Table 4 performs a different exercise, showing where destination consumption is from, or to say it another way, showing which repertoires consumers in each destination favor. Domestic fare makes up a large share of consumption in many markets. Germany, Denmark, Spain, France, Finland, Great Britain, Italy, and Sweden all have domestic shares in the neighborhood of 20-40 percent. This indicates that consumers in these countries rely on trade for a big share of their consumption. The US is at an extreme, with more than 75 percent of its consumption domestic. This suggests that US consumers derive less benefit from music trade than do their European and Canadian counterparts.

Our counterfactual exercises explore the implications of liberalized - or no - trade on producers and consumers. The raw data in Table 4 provides hints about these effects. For example, the information in Table 4 can be used to get a sense of how much the people of each destination country like imports from each origin country. Take for example the US row. US consumers allocate 76 percent of their music expenditure to domestic music, while Canadians allocate 62 percent of their expenditure to US music. Hence, the ratio (62/76) provides a measures of the Canadian relative preference for US music. We can analogously calculate every destination country's relative preference for each repertoire. Averaging these across destinations - in Figure 1 - gives us a sense of which repertoires are preferred by consumers. The repertoires most preferred by other countries' consumers are those of the US, Great Britain, and Canada. Those least preferred by others include Portugal, Finland, and Denmark.

We can also use the Figures in Table 4 to get a sense of which countries' audiences most prefer foreign music. Take for example the US. Austrian music accounts for 0.05 percent of US consumption, compared with 6.45 percent of Austrian consumption. The US relative preference for Austrian music is therefore (0.05/6.45), while the US preference for, say, the music of Great Britain is (10.02/37.28). Averaging these relative preferences over the elements of the US column gives the average US relative preference for imports. Figure 2 shows this for each importing country. The countries with the biggest average relative preference for imports include Austria, Switzerland and Belgium, while those with the least relative preference for imports include the US, Great Britain, Italy and Canada.

2.2 Background and Literature

The global recorded music industry has traditionally been led by a shrinking handful of "major" record labels operated by one of 4 major global media companies (Sony, EMI, Time Warner & Vivendi) operating alongside a large fringe of "independent" record labels. By most accounts the majors account for a large share of sales (around 80 percent) and a small share of releases. In the past few decades the number of releases has increased substantially, and this growth has accelerated in the digital era. Between 2000 and 2010 the annual number of new releases in the US tripled from 30,000 to 100,000.

Copyright is generally viewed as a promoter of economic activity. Rights granted to creators and intermediaries are understood to provide rewards - and therefore incentives - to creation. Yet, copyright rules can also serve as obstacles to economic activity (Buccafusco and Heald, 2013; Heald, 2013). For example, the transaction costs in determining the owners of "orphan works" - books has been a major obstacle to their contemporary use, for example through the Google Books Library Project. Here, similarly, the transaction costs of obtaining rights to sell in additional countries stand as a possible obstacle to exchange (Gomez Herrera and Martens, 2014).

Regulators around the world - and particularly in Europe - pay close attention to trade in cultural products. In music, this mainly manifests in radio airplay quotas. France, Canada, Australia, New Zealand, [and others] mandate minimum domestic radio airplay shares.[6] Concerns about cultural trade are not limited to music and, indeed, are strong in motion pictures. European governments subsidize roughly a third of European motion picture investment.[7] Concerns about trade in cultural products - and apprehension about Anglophone repertoire in particular - are not unfounded. The musical repertoires of the US and Britain account for over half of world music sales, and movies from Hollywood alone account for close to 63% percent of world theatrical box office.[8]

A number of existing studies examine world trade in cultural products. Ferreira and Waldfogel (2013) use 50 years of pop charts to create estimates of sales for the top of the sales distribution. They find persistent effects of distance and language as well as strong home bias, even after the diffusion of the Internet and other communication channels. Indeed, they find a heightened home bias in the period 1990-2005. They employ a gravity framework which is well suited to description but which does not lend itself to counterfactual exercises. Following a similar gravity approach and using the same data source as ours, Gomez Herrera et al. (2013) nevertheless find that the home

[6] See Ferreira and Waldfogel (2013) and Richardson (2006).

[7] See Cambridge Econometrics, "Study on the Economic and Cultural Impact, notably on Co-productions, of Territorialisation Clauses of state aid Schemes for Films and Audiovisual Productions." A final report for the European Commission, DG Information Society and Media, 21 May 2008, p. 25.

[8] See http://www.theguardian.com/film/filmblog/2013/apr/02/hollywood-hold-global-box-office.

bias in music consumption has decreased since 2006, so that consumers have become less interested in domestic music. They also find that the market share of the US repertoire has increased in every country, while the market shares of European repertoires have fallen. They attribute these patterns to changes in preferences toward particular repertoires and to changes in the appeal of recent vintages of specific repertoires.

Ferreira et al. (2013) study world trade in movies using a framework whose demand side is similar to the approach we employ here. They estimate a structural model of demand, which they combine with a simple model of movie investment. Equilibrium is determined as countries compete Nash in investment. The authors analyze the effect of trade by comparing the status quo to a simulation of autarky. They find that while free trade helps consumers everywhere, it has more nuanced effects on producers. Free trade helps US producers but harms producers everywhere else. Ferreira et al. (2012) extend the framework to analyze the counterfactual of relaxing the Chinese movie import restrictions.

3 The Model

3.1 Demand

This section presents our model of demand for the digital music industry, which follows Ferreira et al. (2013). In each country, consumers choose whether to buy music and then choose among available songs. The choice sets of songs vary both across countries and over time. Define J_{ct} as the set of songs available in country c at time t, and index songs by j. Suppressing the time subscript, each consumer therefore decides in each month whether to download one song in the choice set $J_c = \{1, 2, 3, \ldots, J_c\}$ or to consume the outside good (not downloading a song). Specifically, every month every consumer i in country c chooses j from the $J_c + 1$ options that maximizes the conditional indirect utility function given by:

$$\begin{aligned} u_{ij} &= x_{jc}\beta - \alpha p_{jc} + \xi_{jc} + \zeta_i + (1-\sigma)\epsilon_{ij} \\ &= \delta_{jc} + \zeta_i + (1-\sigma)\epsilon_{ij}, \end{aligned} \tag{1}$$

where δ_{jc} is therefore the mean utility of song j. The parameter ξ_{jc} is the unobserved (to the econometrician) quality of song j from the perspective of country c consumers and can differ across countries for the same song (song j can for example have different quality to US vs French consumers). ϵ_{ij} is an independent taste shock. As opposed to a simple logit model, the nested logit allows for correlation in consumer's tastes for consuming digital music.[9] The parameter ζ_i therefore represents the individual-specific song taste common to all songs in the nest. Cardell (1997) shows that if ϵ_{ij} is a type I extreme value, then this implies that the error term $\zeta_i + (1-\sigma)\epsilon_{ij}$ is also a type I extreme value. The parameter σ measures the strength of substitution across songs in the choice set J_c. When $\sigma = 0$, the model resolves to the simple logit (see footnote 9) and the parameter ζ_i, the consumer-specific systematic song-taste component, plays no role in the choice decision. As σ approaches 1, the role of the independent shocks $(\epsilon_{i0}, \epsilon_{i1}, \ldots, \epsilon_{iJ})$ is reduced to zero and the within group correlation of utility approaches one. This implies that consumer tastes, while different for any consumer i across songs, are perfectly correlated within consumer i across songs.

Normalizing the utility of the outside good δ_{0c} to 0, the market shares for all $j \in J_c$ are given by $S_{jc} = \frac{e^{\frac{\delta_{jc}}{1-\sigma}}}{D^{\sigma}_{J_c} + D_{J_c}}$, where $D_{J_c} = \sum\limits_{j \in J_c} e^{\frac{\delta_{jc}}{1-\sigma}}$. Inverting out δ_{jc} from observed market shares as in Berry (1994) yields

$$
\begin{aligned}
\ln(S_{jc}) - \ln(S_{0c}) &= \delta_{jc} + \sigma \ln\left(\frac{S_{jc}}{1 - S_{0c}}\right) \\
&= x_{jc}\beta - \alpha p_{jc} + \sigma \ln\left(\frac{S_{jc}}{1 - S_{0c}}\right) + \xi_{jc}, \qquad (2)
\end{aligned}
$$

so that an estimate of β, α and σ can be obtained from a linear regression of differences in log market shares on product characteristics, prices and the log of within group share. Here, x_{jc} includes a constant, a set of year dummy variables, and a host of country level controls. In particular, we include a direct measure of digital share of music expenditure in each destination and year, GDP per capita, the urban share of the total population, the percentage of fixed broadband Internet subscribers, the percentage of mobile cellular subscriptions, and the percentage of Internet users. The estimate of σ will be positive if variation in a song's share relative to the total inside share $(1 - S_{0c})$ explains $\ln(S_{jc}) - \ln(S_{0c})$ conditional on the other explanatory variables.

Intuitively, σ depends on how the total inside share of songs (i.e. the total share of the entire digital market for downloading of music) changes as the number of songs in the choice set varies. When σ is close to one, the total inside share does not vary much with the number of songs since in this case the within group substitution is high.[10] In other words, additional songs will simply cannibalize

[9] In the logit model the individual taste ϵ_{ij} is independent across both consumers and choices and the conditional indirect utility function is given by $u_{ij} = \delta_{jc} + \epsilon_{ij}$. This prevents the possibility that consumers have heterogeneous tastes, i.e. differ in their taste for consuming music.

[10] Denoting the total inside share as $S_{J_c} = \frac{D_{J_c}}{D_{J_c} + D^{\sigma}_{J_c}}$, the change in the total inside share that arises from adding

other songs' shares since consumers will substitute old songs for new songs (business stealing). At the opposite extreme is the case where $\sigma = 0$. In this case adding new songs to the choice set will lead some consumers of the outside good to substitute to a new song when it is added to the choice set. In this case the total inside share of songs will therefore increase.

3.2 Identification of σ

Since the inside share of each song j is, by construction, endogenous in equation (2), we need to find an instrument in order to consistently estimate σ. Given that identification of σ is related to how the inside shares change and the number of songs available in a market change, and since we observe variation in the number of songs available over time and across markets, one potential instrument is J_c, the number of songs available in a given country. Figure 3 graphs the relationship between the number of products (songs) and the total inside share across countries for the year 2011. For each country c, the total inside share is defined as $S_{J_c} = \frac{1}{M_c} \sum_{j \in J_c} q_{jc}$, where M_c is a measure of market size and q_{jc} is the number of downloads for song j in country c.[11] Figure 3 shows a positive relationship between the number of songs available in a given country and the share of the population consuming music in the form of digital downloads. There is, however, reason for concern that the number of songs entering each market is endogenous. In particular, we would expect entry to be larger in markets with greater unobserved demand for music. An alternative instrument is country population. If more songs are made available in larger markets simply because of market size and not because of demand intensity, consumers in larger markets would face larger choice sets of music. Figure 4 presents the relationship between the number of songs available and the population of each country for the year 2011 and shows that larger countries do indeed offer larger choice sets. The descriptive evidence from figures 3 and 4 therefore suggest a positive relationship between the number of available downloadable songs and the total share of population consuming music in the form of digital downloads. This suggests a substantial benefit from additional songs (market expansion) and therefore an estimate of σ lower than 1.

a $(J+1)$th song with quality δ_{J+1} to the choice set is given by

$$\Delta S_{Tot\_Inside} = S_{(J+1)_c} - S_{J_c} = \frac{D^{\sigma}_{J_c} D_{(J+1)_c} - D^{\sigma}_{(J+1)_c} D_{J_c}}{\left(D^{\sigma}_{J_c} + D_{J_c}\right)\left(D^{\sigma}_{(J+1)_c} + D_{(J+1)_c}\right)}.$$

On the interval $\sigma \in [0, 1)$, $\Delta S_{Tot\_Inside}(\sigma)$ is everywhere positive and decreasing in σ.

[11] For each country c, we define the market size as 12 times its population.

3.3 Supply and Equilibrium

Entry has fixed costs. Atomistic firms add products if they expect those products to cover fixed costs. Products obtain revenue both at home and abroad. Calculating equilibrium requires us to do two things. First, we must calculate the fixed costs of entry based on the observed "status quo" pattern of entry. Second, we need to calculate the expected revenue schedule for entrants in (and from) each country under autarky. Autarky has two competing effects on the revenue to domestic entrants. First, these products no longer have foreign revenue, which of course reduces revenue. But second, domestic products no longer face foreign competition, which raises revenue. Which force predominates will vary by origin country

3.3.1 Inferring Fixed Costs from Status Quo Entry

The observed set of world products is understood to be an equilibrium that obtains from products entering as long as their expected revenue exceeds their fixed costs. For concreteness, consider a particular origin country. Define songs from that country as "endogenous" songs, while songs from elsewhere are "exogenous." If an origin country contributes N songs to the world market, then we infer that the expected revenue for each of those N songs covers their constant fixed cost, while $N + 1$ songs would not. When we observe a world product configuration with N songs from a particular origin country, each of those N endogenous songs coexists along with $N - 1$ other endogenous songs from the origin country (along with a large number of songs from the rest of the world). Hence, the observed revenue of each of the N endogenous songs provides an estimate of the expected revenue of the Nth song from the origin country. There are, of course, N different expected revenue measures for the Nth song: of the $N!$ total sequences of songs, there are $(N-1)!$ different sequences ending with each of the N songs. Hence, the simple average of the observed revenue of the N observed songs provides a direct measure of the expected revenue and therefore fixed costs as well.[12] Thus we estimate the fixed cost of entry as the average worldwide revenue of songs from each origin country.[13] Define this as K_o, where K denotes fixed cost and o refers to origin country.

[12]If one were making fine distinctions, one would note that the observed average revenue of the N endogenous songs provides an upper-bound estimate of the expected revenue of the Nth entrant. With a few thousand endogenous products from each of our origin countries, the difference between the expected revenue of the Nth and the $(N+1)$st entrant is trivial, and we ignore it.

[13]More specifically, we compute the fixed cost of entry - for each origin country - as the average worldwide revenue of songs that are traded in their own origin country.

3.3.2 Entry and Expected Revenue

Once we have an estimate of the fixed costs of product entry for each origin country, we can calculate the equilibrium if we have a way to determine the expected revenue associated with a set of entering products. Given the large number of endogenous products (tens of thousands from each country), there is an enormous number of possible combinations of products for a particular number of entrants. To make the problem tractable, we assume that songs' appeal is unpredictable and, more important, equal across songs ex ante. While not strictly true, this assumption does reflect the common understanding in cultural industries that "nobody knows anything" about which products will be commercially successful at the time of investment (Caves, 2000). Because songs are ex ante identical, we can reduce this problem to a choice of the number of songs that enter from each country. We explain our method for calculating the expected autarky revenue to N products in detail below, but the intuition is simple. Think of randomly choosing N products, then calculating the average revenue that each product receives in that configuration. Repeat the process with many draws of N products. The average revenue per product for N-product configurations is the expected revenue associated with Nth entrants. Then do this process for every possible N to see how expected revenue varies with N.

To calculate the expected revenue of the nth entrant under autarky, we first remove all foreign songs from a country's choice set. Define $\{\delta_1, \delta_2, \ldots, \delta_N\}$ as the set of product mean utilities for, say, the songs from France in France as a particular sequence. If we take the products in this order, autarky revenue of the first product in France is:

$$R_o(1) = \frac{e^{\frac{\delta_1}{1-\sigma}}}{D_1^{\sigma} + D_1} M_o p_o, \tag{3}$$

where $D_n = \sum_{i=1}^{n} e^{\frac{\delta_i}{1-\sigma}}$, M_o is market size of France and p_o is the price of the product in France. We can obtain the expected revenue by averaging across all of the N songs that could occur first. For a particular sequence, the autarky revenue of the second song is

$$R_o(2) = \frac{e^{\frac{\delta_2}{1-\sigma}}}{D_2^{\sigma} + D_2} M_o p_o. \tag{4}$$

We can now obtain the expected revenue of the second song by averaging across all $N(N-1)$ combinations of $\{\delta_1, \delta_2\}$. In general the autarky revenue of the nth entrant in a particular sequence is

$$R_o(n) = \frac{e^{\frac{\delta_n}{1-\sigma}}}{D_n^\sigma + D_n} M_o p_o. \qquad (5)$$

Obtaining the expected revenue of the nth song now requires averaging across all $\frac{N!}{(N-n)!}$ combinations of $\{\delta_1, \delta_2, \ldots, \delta_n\}$. A challenge is therefore that the number of sequences over which one must in principle average grows large quickly. Instead of averaging across all possible sequences, we can sample. That is, we can draw, say, 1000 sequences $\{\delta_1, \delta_2, \ldots, \delta_N\}$ (where, say, δ_1 takes on a different value in each sequence). For each set of n entrants in a given sequence, we then compute the average revenue per entrant (i.e. the average revenue that each song receives in that configuration). We finally compute the expected revenue of the nth entrant as the average of the nth entrant's revenue across sequences:

$$\mathrm{E}\left[R_o(n)\right] = \frac{1}{1000}\sum_{s=1}^{1000} R_o(ns) = \frac{1}{1000}\sum_{s=1}^{1000}\left(\frac{\frac{D_{ns}}{D_{ns}^\sigma + D_{ns}} M_o p_o}{n}\right), \qquad (6)$$

where s denotes a specific random sequence. We find the equilibrium number of entrants in, say, France under autarky by finding the number of products n such that

$$\mathrm{E}\left[R_o(n)\right] > K_o > \mathrm{E}\left[R_o(n+1)\right]. \qquad (7)$$

Define this particular n as n_o , or the autarky equilibrium for origin country o.

For that n, we can calculate expected consumer surplus and revenue in France as averages across the CS and revenue associated with the nth element of the drawn sequences. Given our estimate of fixed costs we can calculate producer surplus as

$$PS_o = p_o M_o \left[\frac{D_{n_o}}{\left(D_{n_o}^\sigma + D_{n_o}\right)}\right] - n_o K_o. \qquad (8)$$

Given our assumption of atomistic free entry, producer surplus will equal zero in equilibrium. In principle, if we drew enough sequences the expected revenue function would become arbitrarily smooth. In practice, we can trade off between the number of draws on sequences and the extent of averaging across values of k. In what we have done, we take 1,000 sequences, then we experiment with bandwidth until we find expected revenue functions with that cross the country's fixed entry cost no more than once. For example, France has just below 100,000 songs, and we obtain a smooth expected revenue function with a bandwidth of 0.001 or a moving average computed over about

100 songs.

3.4 Consumer Surplus and Producer Revenue

Given our estimates of σ and α, we can calculate the mean utility of each song in each country, and given these estimates of δ_{cj} we can calculate the consumer surplus (CS) in each destination market and the producer revenue for each origin repertoire. The formula for the CS is given by

$$CS_c = \frac{M_c}{\alpha} \ln\left(\sum_{J_c} D_{J_c}^{1-\sigma}\right) = \frac{M_c}{\alpha} \ln\left(D_{J_c}^{1-\sigma} + 1\right). \tag{9}$$

While CS is experienced by consumers in each country, revenue is enjoyed by origin country producers whose products are available in each destination country. Hence the revenue is the sum of the origin country share in each destination weighted by the destination market sizes.

4 Estimation and Results

4.1 Price coefficient

We don't observe variation in price, but if we knew the average price as well as the marginal cost, then we could infer α from a profit maximizing assumption, as is customary in the literature. In this draft we treat the price as €1 per song in each country and we treat zero as the marginal cost.[14]

Because the price is constant, the term αp_{jc} in (2) simply becomes part of the constant term. We therefore start by estimating

$$\ln(S_{jc}) - \ln(S_{0c}) = x_{jc}\beta + \sigma \ln\left(\frac{S_{jc}}{1 - S_{0c}}\right) + \xi_{jc}. \tag{10}$$

We get an estimate for σ that we can use to calculate the country-specific mean utility of each song δ_{jc}:

$$\delta_{jc} = \ln(S_{jc}) - \ln(S_{0c}) - \sigma \ln\left(\frac{S_{jc}}{1 - S_{0c}}\right). \tag{11}$$

[14] While Apple pays \$.70 for each song in the US, it is far from clear that they price in a double marginalized way. Shiller and Waldfogel (2011) find a revenue maximizing uniform song price that is close to the actual iTunes song price, suggesting that zero marginal cost is a reasonable assumption.

We infer α by assuming that pricing is governed by a revenue maximizing monopolist.[15] Then, assuming that $p = 1$ for all songs in all countries, we have that the elasticity of music is given by

$$\eta_Q = \alpha \left[1 - \frac{D_{J_c}}{D_{J_c} + D_{J_c}^{\sigma}} \right]. \tag{12}$$

Solving for the α that makes the demand for music unit elastic, we therefore obtain

$$\alpha = \frac{D_{J_c} + D_{J_c}^{\sigma}}{D_{J_c}}. \tag{13}$$

At this point we therefore have estimates of σ, α and mean utilities for traded songs j in destination countries c (δ_{jc}), which allow us to calculate CS and revenue.

4.2 Estimates

The key parameter that we estimate is σ which, intuitively, is identified from the relationship between the number of products and the share of the population consuming. The expansion of the digital markets which proceeds at different rates in different countries produces a threat to identification. The growth in the number of digital products and digital consumption both arise from the diffusion of digital technology and may give the appearance that a growing number of products expands the market, or that σ is low. We employ two strategies to avoid this sort of mistaken inference. First, we instrument the inside share with cross sectional variation in measures of market size (population or its logarithm) for the destination country. Second, we employ direct and indirect controls for digital diffusion. We include a direct measure of digital share of music expenditure in each destination and year. We also include a host of other country level controls, including GDP per capita, the urban share of the total population, the percentage of fixed broadband internet subscribers, the percentage of mobile cellular subscriptions and the percentage of internet users.

Table 5 reports estimates of the demand model when using the natural logarithm of population as the instrumental variable for the inside share in equation (2). Column (1) includes GDP per capita as well as the share of digital music expenditure (our measure of digital diffusion). On top of these control variables, specification (2) uses the logarithm of population interacted with time dummies as instruments for the inside share. Specification (3) builds on (2) and adds interactions

[15] Note that this way of inferring α is not uncommon among practitioners. As noted by Björnerstedt and Verboven (2013), one may want to verify whether elasticities are consistent with external industry information as opposed to relying too heavily on econometric estimates. While our motivation is driven by lack of data on product prices, we basically follow the same type of approach.

between the control variables and time dummies. Finally, specifications (4) to (6) include the same explanatory variables and instruments as, respectively, specifications (1) to (3) and add other country-specific control variables: the urban share of the total population, the percentage of fixed broadband internet subscribers, the percentage of mobile cellular subscriptions and the percentage of internet users. We find estimates of σ ranging between .67 and .8. We also estimate the same specifications with different instrumental variables for the inside share, using the country population in levels, the number of products in the market, and the logarithm of the latter. Table 6 presents the estimates of σ for each specification and each set of instruments. The second row of the table therefore corresponds to the estimates already presented in the first row of Table 5. Overall we find estimates of σ ranging between .4 and .8.

Our preferred specification uses the logarithm of population interacted with time dummies as instruments for the inside share and includes all the control variables interacted with time dummies (specification (6) in Table 5). This specification gives the highest estimate of sigma and therefore the most conservative estimate of the gains from trade liberalization. We will use these demand estimates for our counterfactuals, noting that the estimates from other specifications are very similar.

Table 10 provides estimates of fixed costs by country, based on sample-wide revenue per song, for songs from each origin country. These vary between €58 for Finland and €810 for the US.

5 Simulations

We consider four different trade regimes, each of which is characterized by different products in the country choice sets. The first one is the autarky regime, in which only domestic products are available in each destination's choice set. We analyze this in both equilibrium and demand-only simulations. Second, we consider the status quo, where the choice sets of each country are simply defined by the currently traded products. To analyze the impact of possible trade liberalizations relative to the status quo, we consider two other trade regimes: worldwide frictionless trade and European frictionless trade. In the former, every destination has every product available in its choice set. That is, all products are available in all destinations. Finally, European frictionless trade is the equivalent of a European single market where all products currently available anywhere in the EU13 are also available in all EU 13 countries.

Simulating the liberalizations - worldwide frictionless trade and the European single market - presents a technical challenge. They require estimates of the mean utility of songs in destinations where they are not currently traded. For example, of the 3,126,647 distinct songs sold in our 17 countries in 2011, only 826,729 are observed to be sold in France. Fortunately, the appeal of songs is systematically related across countries. Denote by $\delta_{j,c}$ the mean utility of song j in country c. Figure 5 shows a scatter plot of $\delta_{j,France}$ against $\delta_{j,Germany}$ for songs appearing in both country choice sets, along with a 45-degree line and a best-fit line. The positive slope of the best-fit line indicates that songs that are more popular in Germany are also generally more popular in France. The evidence in Figure 5 is not atypical. For each pair of countries c and c', we can follow Ferreira et al. (2012) and regress $\delta_{j,c}$ on $\delta_{j,c'}$ to get a sense of the relationship between songs' appeal across each country pair. The mean (median) R-squared for these 272 regression is 0.38 (0.39). We have 17 destination countries and can therefore use songs' appeals in up to 16 countries to form estimates of their appeal in the country in question.

We are concerned that non-traded songs are a selected sample of songs and that whether they are traded to a particular destination is correlated with more than simply their appeal in another destination. To capture this heterogeneity, we augment the forecasting model to include dummies for whether the song appears in each of the other countries.

If I_c is an indicator for whether the song appears in destination c, then for each pair of countries c and c' we run the following regression:

$$\delta_{j,c} = A_{c,c'} + B_{c,c'}\delta_{j,c'} + \sum_{c=1}^{17} \phi_c I_c + \mu_{j,c}. \tag{14}$$

For a song j that is not traded in country c but is traded in (some) other countries, our estimate of $\delta_{j,c}$ is the average of the predicted $\delta_{j,c}$ from models for each of the countries c' in which it is traded. With these estimates, along with the observed $\delta_{j,c}$ for songs traded in destinations, we have the inputs needed to calculate each country's CS and revenue for the simulations.

5.1 Counterfactual Results

We use the estimated demand model to perform four simulation exercises: the status quo, two liberalizations (worldwide frictionless trade and a European single market), and autarky for calculating the gains from status quo trade.

For all of our partial equilibrium counterfacual statistics, we calculate standard errors by bootstrapping using the following procedure. The results from our demand estimation in column (6) of Table 5 provides us with the estimated distribution of σ. By taking random draws from this distribution, we can compute alternative simulation statistics (i.e. CS and revenue).[16] That is, for each draw σ_d we can compute a new vector of mean utilities $\delta_d(\sigma_d)$ for songs that are currently traded. For the non-traded songs, we follow the same procedure as above to forecast their mean utility in destinations where they are not currently traded - see equation (14). Once equipped with the full vector of mean utilities and the draw-specific parameter $\alpha_d(\sigma_d)$, we can calculate the corresponding levels of CS and revenue for this specific draw. We repeat this exercise 100 times to obtain distributions of the CS and revenue under the different simulation regimes. The results of our simulations are reported in Tables 7 and 8 below, along with their standard errors. We now turn to the discussion of our results, whose graphical representation is provided in Figures 6a and 7a.

5.1.1 The Gains from Trade: from Autarky to the Status Quo

We begin with the partial equilibrium approach to autarky. To this end, we eliminate imported songs from each country's choice set, then calculate the consumer surplus of each country's consumers. We calculate origin country producer revenue as the sales of each origin repertoire in each destination country. We calculate the status quo gains from trade as the difference between the status quo and autarky, and we report results in per capita euro terms for comparability across countries. Column 5 of Table 7 reports the annual gains to consumers from status quo trade, and these gains vary from €2.62 per capita in Switzerland to €0.08 per capita in Spain. Column 6 presents the annual gains in percentage terms.

Gains to consumers depend on a few factors. First, the magnitude of gains to consumers depend on how much a country imports. Gains are generally larger for countries where domestic songs make up a smaller share of consumption (see Table 4). Second, the gains from trade depend on the extent to which a country's consumers like songs from abroad, as in Figure 2.

So, for example, US consumers with the largest domestic consumption share of 76 percent, experience small gains from trade, around €0.22 per capita. Other countries whose consumers experience small gains from trade include Spain, Sweden, and Italy, all of which experience smaller per capita gains than the US. Spain and Italy have relatively high domestic shares - see Table 4 - but experience small gains from trade because of their low preference for imports (in Figure 2).

Countries with the largest consumer gains from trade include Switzerland (€2.62), Canada (€1.5), Belgium (€1.45), Ireland (€1.19), and Austria (€1.02). Except for Canada, these countries also

[16] Given that the parameters α and δ are directly constructed from the parameter σ (see equations (11) and (13) above), all of our simulation statistics will be solely defined by σ.

have low domestic consumption shares (10% or less). And except for Canada and Ireland, these countries have high preferences for imports in Figure 2. Europeans gain an average of €0.58 (see column 2 in Table 12).

While the move from autarky to the status quo benefits consumers everywhere, its effects on producers are more nuanced. Trade harms producers in their home markets by exposing them to competition from imported products. The extent of this harm depends on the home consumers' preference for imported products (Figure 2). Trade benefits producers from an origin country by making their products available to foreign consumers. The extent of this benefit depends on the appeal of the repertoire in foreign markets (Figure 1). Related to these factors, of course, is the home share of a repertoire.

Per capita effects of status quo trade on producing countries range from losses of €3.56 in Switzerland and €1.55 in Germany to gains of €4.18 in Ireland, €2.97 in Sweden and €2.63 in Great Britain. As Figure 2 shows, consumers in Switzerland, Belgium, Austria, Germany, Norway, and Portugal have the highest relative preferences for imports. Hence, when trade is feasible, consumers in those countries turn to imported products, and this explains the producer losses from trade in Switzerland and Germany. Particularly when a country has a repertoire that is not particularly appealing to foreign audiences (such as Portugal, Finland, Denmark, Norway, and Austria), trade's revenue-reducing effects at home are less offset with sales abroad. Combinations of these effects explain the small or negative effects of trade on the revenue for Austria, Belgium, France, Germany, Italy, Portugal, and Switzerland.

Status quo trade benefits US producers by €0.47 per capita; it hurts Canadians by €0.43; and it benefits European countries an average of €0.03 per capita (see column 6 in Table 12).

5.1.2 Autarky Equilibrium

A shortcoming of the partial equilibrium approach is that the set of products available in the status quo may be inconsistent with equilibrium under a counterfactual regime such as autarky. We can check for this directly by comparing fixed costs for each origin country (as described above) against the expected revenue of the N^{th} status quo entrant under autarky (the average revenue per endogenous product evaluated under autarky). For example the fixed cost of entry is €666 in Austria (see Table 13). The expected revenue of the last status quo entrant under autarky is €1276 for Austria, indicating that more entry is needed to equilibrate the Austrian market under autarky. Ireland, a country whose repertoire exports well, provides a stark contrast. The Irish fixed cost is €2163, while the expected autarky revenue of the last status quo entrant is only €919, indicating that autarky would sustain fewer Irish songs.

Table 9 compares the change in consumer surplus from trade (the difference between the status quo and autarky) using both the equilibrium and non-equilibrium approaches. Figure 6b provides a graphical representation of this comparison. The column labeled N in Table 9 shows the number of songs from each country under the status quo while Neqm shows the autarky equilibrium number. Autarky engenders entry in 11 of our 17 countries and exit in the remainder, the countries that export substantially in the status quo (especially Ireland, Sweden, Great Britain, and the US, among others). In some countries the difference between entry under the status quo and the autarky equilibrium is large: Neqm falls over two thirds short of N in Ireland and Sweden.

Columns labeled ΔAUT and ΔAUTeqm show per capita changes in consumer surplus with the two approaches. While not as large as the differences in entry, they are nevertheless systematically different. The non-equilibrium calculation tends to overstate the gains from trade in countries whose status quo domestic entry understates their equilibrium autarky entry. The non-equilibrium model understates consumers' gains from trade in countries where autarky equilibrium would have produced exit (e.g. Ireland, Great Britain, etc.).

Table 10 and Figure 7b provide the analogous comparison of equilibrium and non-equilibrium calculations for revenue. In the countries where trade raises revenue on balance, the increases are higher with the equilibrium model.

Regardless of which modeling approach we use - as Table 12 summarizes - status quo trade has raised revenue for North American (by about 6%) but not for European producers. On the other hand, the non-equilibrium model overstates European consumers' per capita gains from trade while understating North American consumers' gains from trade. In equilibrium, status quo trade raises per capita consumer surplus more for European consumers (about 20%) than for North Americans (about 7%).

5.1.3 Worldwide Frictionless Trade

This draft presents only demand-based estimates of the effects of trade liberalizations. That is, we use the demand model to evaluate consumer surplus and revenue with counterfactual choice sets without calculating an equilibrium entry response. We note that calculating equilibrium entry is substantially more complicated for liberalization than for autarky. Autarky required us to generate expected total revenue to an origin country as a function of the number of songs entering in that country, or $\mathrm{E}\left[R_o(n_o)\right]$. We then found equilibrium by solving $\frac{\mathrm{E}[R_o(n_o)]}{n_o} = K_o$. With counterfactuals involving trade across countries, we need a model generating expected revenue to each origin country not just as a function of its own product offerings but also the offerings of other countries: $\mathrm{E}\left[R_o(n_o; n_{-o})\right]$. Equilibrium is then a set of n_o for each origin country such that $\frac{\mathrm{E}[R_o(n_o;n_{-o})]}{n_o} = K_o$. For now, we use the demand model alone.

If there were a worldwide copyright regime, then products available in any country would be available in all countries. We simulate this counterfactual by augmenting each country's choice set to include all of the products available elsewhere (a total of 3,126,647 products in 2011) and calculating the surplus available to each country's consumers and producers. The annual gains in consumer surplus in going from the status quo to frictionless trade vary between about €0.32-0.35 in Finland, Belgium, and Ireland to €0.02 in the US and in Great Britain - see Table 7. In percentage terms, consumers from Portugal and Finland are the biggest winners with 34 and 29 percent increase in their surplus, respectively. Notice that these two countries are the ones with the smallest status quo choice sets (see Table 2). Consumers who benefit the least from worldwide frictionless trade are individuals from the US and Canada. Not surprisingly, these countries are also the ones with the largest status quo choice sets.

The difference between autarky and frictionless trade provides a measure of the full possible benefit of trade to consumers. It is interesting to note that status quo trade produces the majority of the possible benefits of trade. For example, of the €1.3 difference between autarky and frictionless Austrian per capita CS, the status quo delivers €1.01, or 78 percent. The average share of full trade benefits achieved by the status quo is .78. Gains to producers in per capita terms from frictionless trade are varied. Small gains to producers can arise if a country's products are already ubiquitously available, or if their products are unappealing to foreign consumers. Countries with larger annual revenue gains from frictionless trade include Finland (€0.34), Norway (€0.24), and Sweden (€0.17), whose products are less available in the status quo . Products from the US and Canada are widely available in the status quo, which shows in their low gains from frictionless trade (only 0.2% and 3.1%, respectively) despite the important appeal of their repertoires. Countries with unappealing repertoires unsurprisingly gain little from frictionless trade. This is the case for countries like Portugal, Italy, and Spain - see Table 1.

Producers can also lose from frictionless trade if their gains from larger market availability are offset by the losses implied by facing more competition. This is the case of Belgian producers who lose €0.07 per capita, a decrease of around 5% in their surplus.

5.1.4 Endogenizing Entry with Trade

5.1.4.1 Frictionless counterfactual

In the frictionless counterfactual, any song from origin-country o is available in all destinations c. Hence, we can refer to the number of songs from o available in c as N_o. Define the expected "D" for origin-o songs in destination country c as $\mathrm{E}[D_{oc}] = \psi_{oc} N_o$. As it turns out, the linear approximation is extremely good.

Then in destination c, the full "D" is given by the songs from all origins:

$$\mathrm{E}[D_c] = \sum_{o=1}^{O} \psi_{oc} N_o \tag{15}$$

Hence, the origin-o share of the market in destination c is given by

$$s_{oc} = \frac{\mathrm{E}[D_{oc}]}{[\mathrm{E}[D_c]]^{\sigma} + \mathrm{E}[D_c]}. \tag{16}$$

Or, in terms of N's:

$$s_{oc} = \frac{\psi_{oc} N_o}{\left[\sum_{o=1}^{O} \psi_{oc} N_o\right]^{\sigma} + \sum_{o=1}^{O} \psi_{oc} N_o} \tag{17}$$

The revenue to origin o songs is

$$Rev_o = \sum_{c=1}^{17} s_{oc} p_c M_c \tag{18}$$

Or, in terms of N's:

$$Rev_o = \sum_{c=1}^{17} \left[\frac{\psi_{oc} N_o}{\left[\sum_{o=1}^{O} \psi_{oc} N_o\right]^{\sigma} + \sum_{o=1}^{O} \psi_{oc} N_o} \right] p_c M_c \tag{19}$$

Per-song revenue for origin-o songs is a simple variant:

$$\frac{Rev_o}{N_o} = \frac{\sum_{c=1}^{17} \left[\frac{\psi_{oc} N_o}{\left[\sum_{o=1}^{O} \psi_{oc} N_o \right]^{\sigma} + \sum_{o=1}^{O} \psi_{oc} N_o} \right] p_c M_c}{N_o} \tag{20}$$

This last equation thus specifies the revenue per song for origin-o songs as a function of the number of songs from each origin country:

$$\frac{Rev_o}{N_o} = f_o(N_1, \ldots, N_o). \tag{21}$$

Frictionless equilibrium is the set of $\{N_o\}$ such that $f_o(N_1, \ldots, N_o) = K_o$ for all origin countries. This is O nonlinear equations with O unknowns, which are easy to solve.

The magnitude of the equilibrium adjustment in entry is related to the difference between the revenue to the marginal entrant under the status quo - which we calculate as FC - and the revenue to the marginal entrant in the couterfactuals. Table 13 shows the revenue to the marginal entrants under frictionless trade. While not equal to fixed costs, they are quite close (particularly compared with the revenue to marginal entrants under autarky). Hence, our partial equilibrium counterfactuals for frictionless and ESM trade will not be too inaccurate. We will fully endogenize entry in a subseqent draft.

5.1.5 European Single Market

We next consider the case of a pan-European copyright regime, where any product available in any EU13 country would also be available in all EU13 countries. This is like worldwide frictionless trade, except that the choice sets of the US, Canada, Norway, and Switzerland are unchanged. In other words, this is essentially equivalent to considering the EU13 as a digital single market for music. Thus consumers outside of the EU13 (i.e. consumers from US, Canada, Norway, and Switzerland) are unaffected by the European Digital Single Market. US, Canadian, Norwegian, and Swiss producers are affected, however, in two senses. First, their products become more widely available because if they were available anywhere in the EU13 under the status quo, they become available throughout the EU13 in the simulation. Second, their products in European markets face more European competition in the simulation.

Gains to European consumers with the European Single Market are roughly two thirds of their gains from frictionless trade, while North American as well as Swiss and Norwegian consumers - by construction - experience no benefits.

There are important country differences in the proportion of revenue gains from frictionless trade that is achieved by the European single market. Under the ESM, gains to producers from the US, Denmark, Italy, France, Germany and the Netherlands are more than 73% of their gains from frictionless trade. This proportion hovers around 50% for the remaining countries. One exception is Canada, which only gains 14% of its overall frictionless trade benefits from the ESM, presumably because much of its small frictionless trade gains stem from the US market.

6 Conclusion

We develop a structural model of demand for music in 17 European and North American countries that we use to evaluate the gains from status quo trade as well as possible trade liberalizations. We find that the benefit of current (status quo) trade to consumers is about €300 million per year across the world (a 11.3% increase), or about €0.4 in per capita terms. See Table 12. Producers gain €85 million on balance (a 2.8% increase), although producers in some countries lose more from increased competition than they gain from sales in foreign markets. Worldwide liberalization relative to the status quo would deliver additional benefits to consumers, €38 million in total for all countries (a 1.3% increase) or €0.051 in per capita terms. Annual gains for European consumers would reach a total of €31 million (a 3% increase, or about €0.08 per capita). Under a European single market, these gains would reach €19 million (a 1.8% increase) or about €0.05 per capita. Per capita benefits of worldwide liberalization to European consumers exceed the benefits to North American consumers, with the latter gaining around €0.02 annually. Effects on producers are mixed. North American producers experience small benefits from worldwide frictionless trade (€0.02 per capita, or a 0.4% increase), while European gains average €17 million (a 1.8% increase) or €0.04 per capita. Under a European single market, European producers' annual gains would reach €10 million (a 1.1% increase) or about €0.025 per capita, while the total gains to North American producers is €3.7 million (a 0.17% increase) or €0.01 per capita. Therefore, it seems that a European single market would bring most of the benefits of worldwide frictionless trade to both consumers and producers alike.

While we have developed a useful tool for analysis of trade policy, we anticipate a few important extensions. First, it would be useful to explore a richer demand model, possibly involving a more extensive nesting structure (domestic vs foreign, etc.). Second, it would be desirable to extend our supply side for the frictionless trade and European single market counterfactual trade regimes.

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7 Figures and Tables

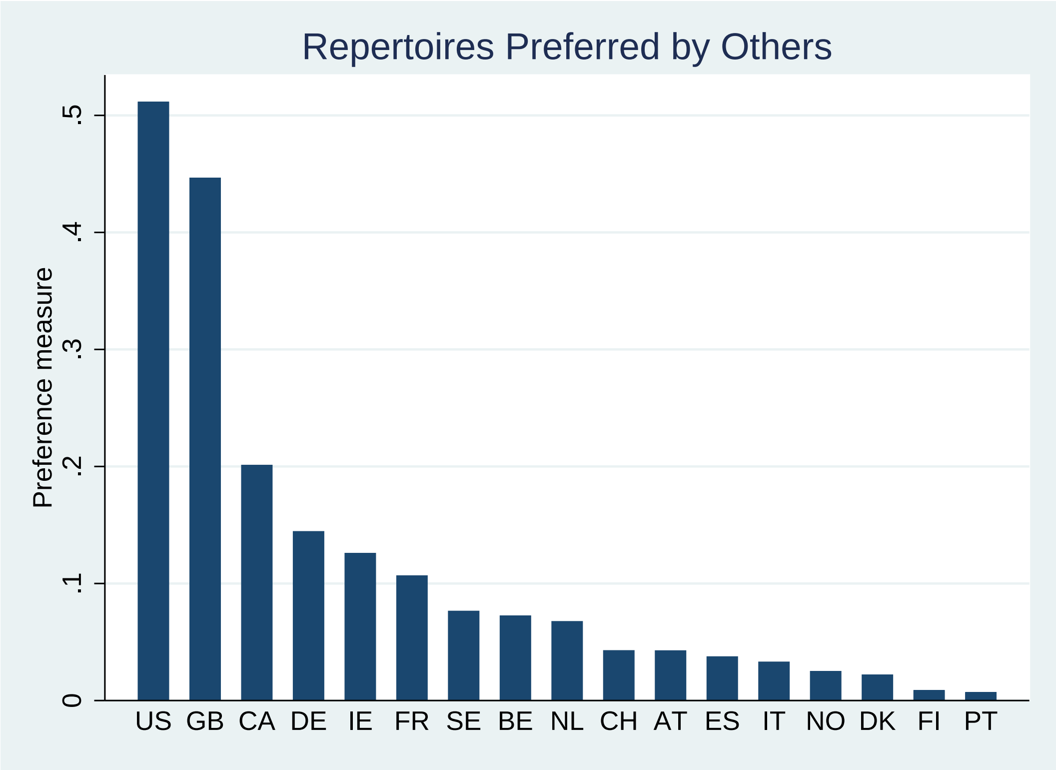

Figure 1: Which repertoires are preferred by consumers?

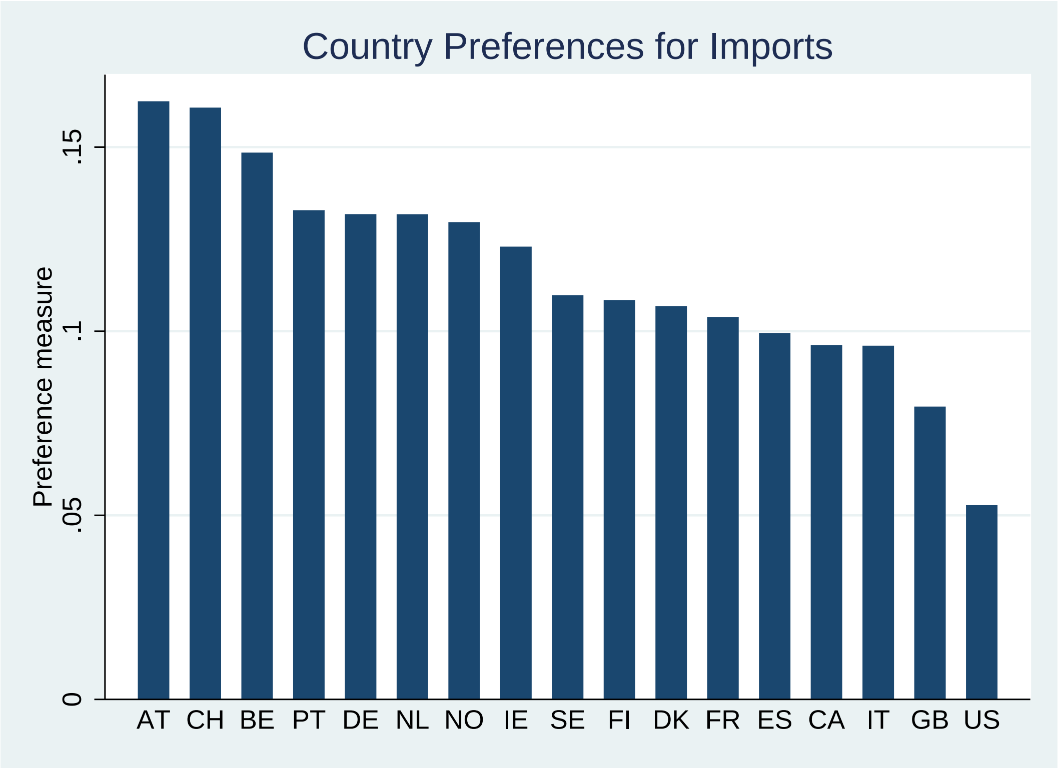

Figure 2: Relative preferences for imported music

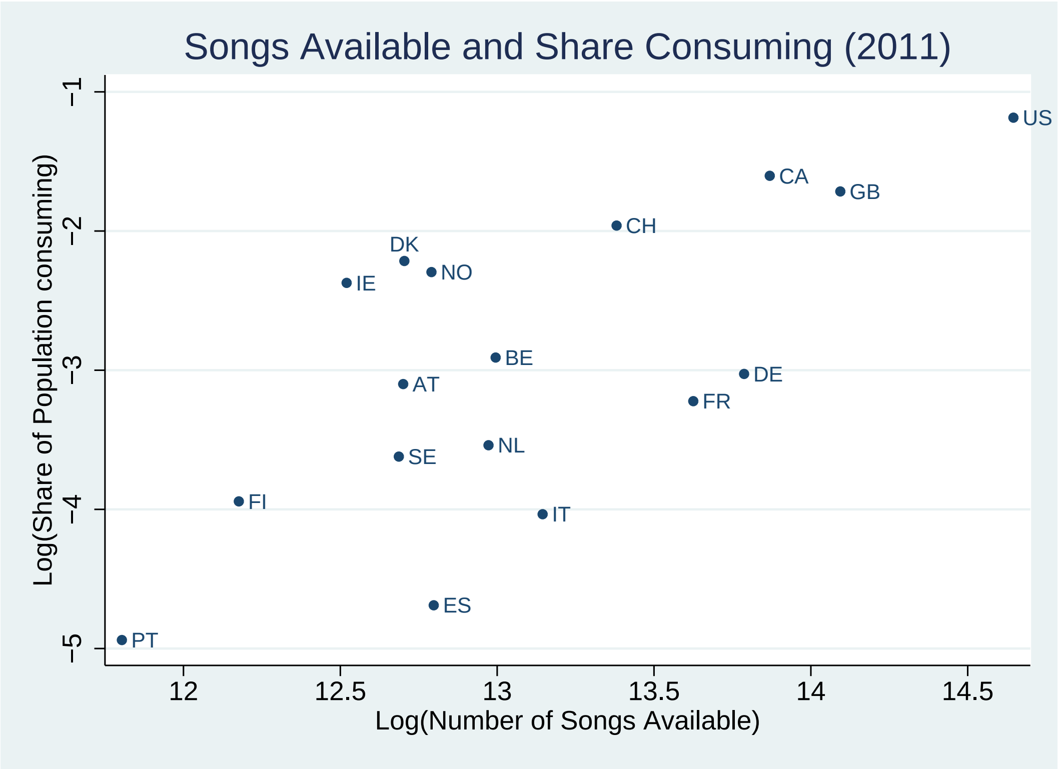

Figure 3: Number of songs available and share of the population consuming, 2011.

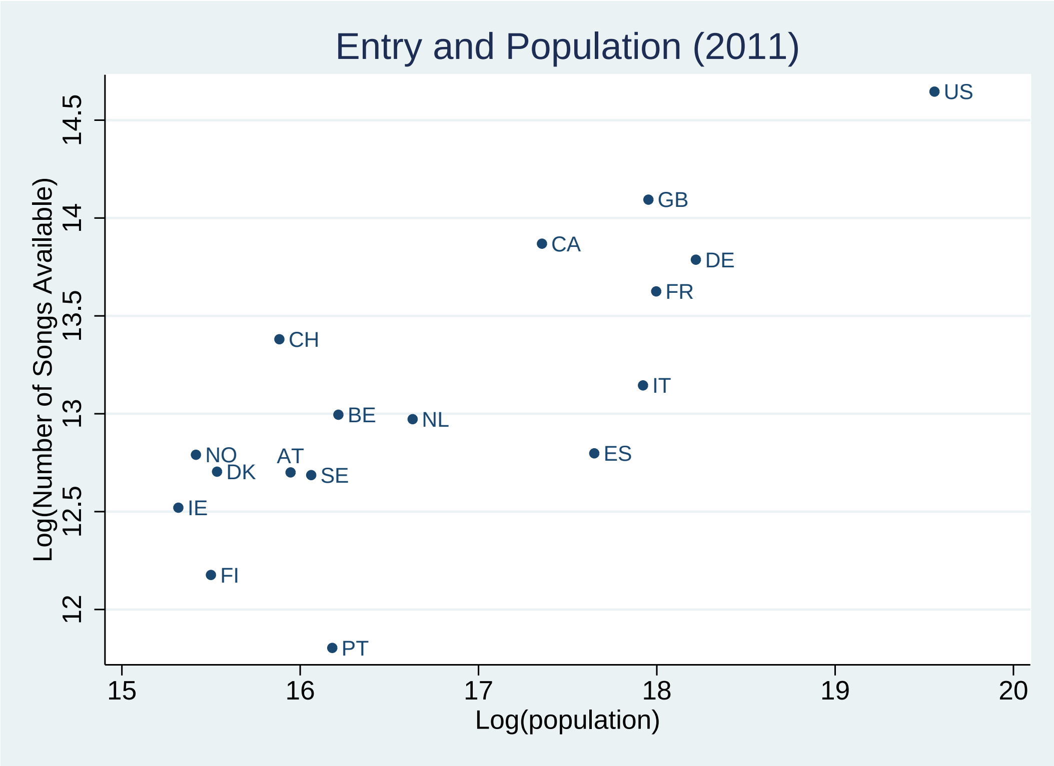

Figure 4: Population and number of songs available, 2011.

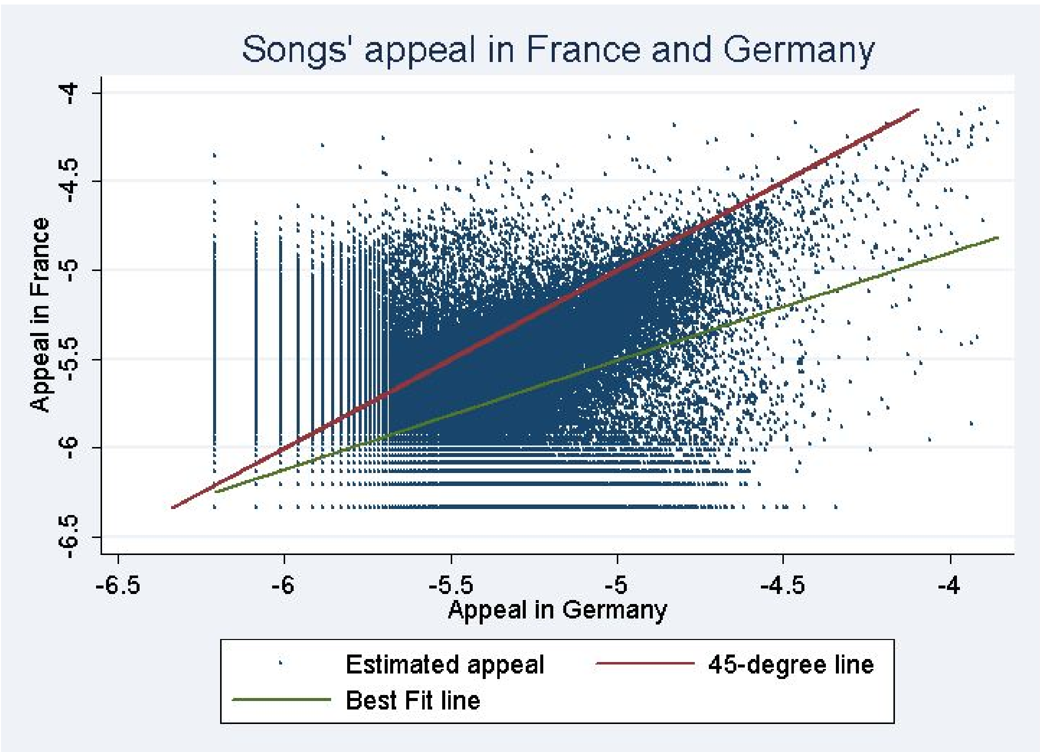

Figure 5: Cross-country relationship between songs' appeal: France vs Germany.

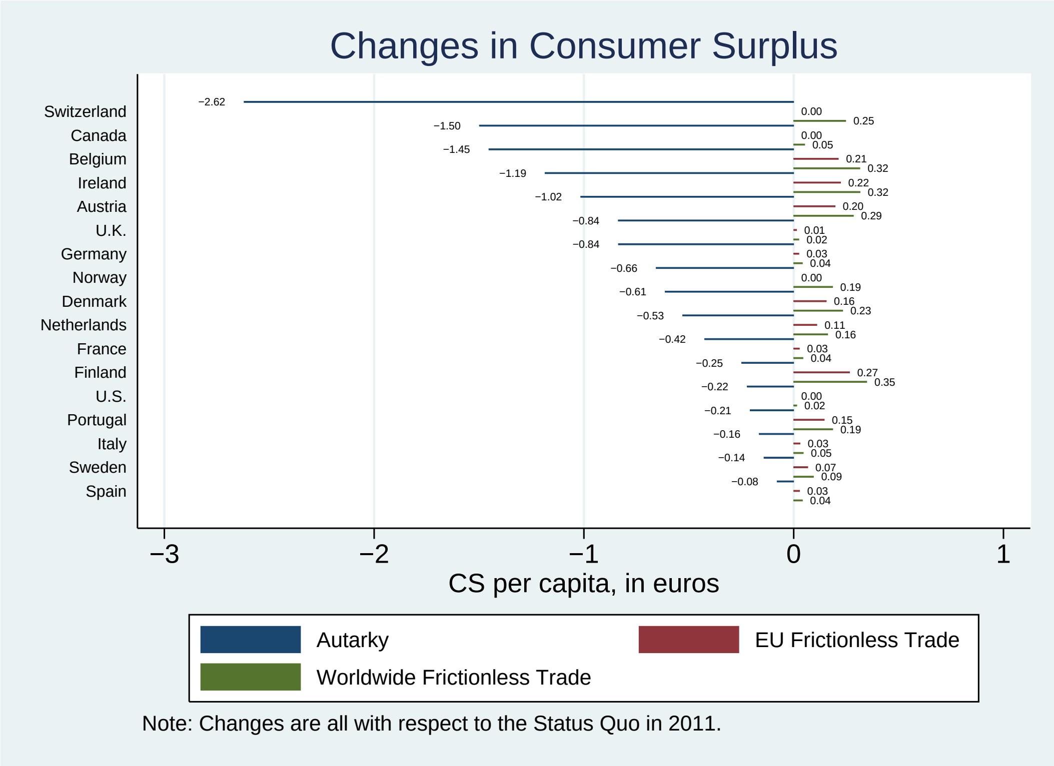

Figure 6a: Changes in CS following autarky and trade liberalization.

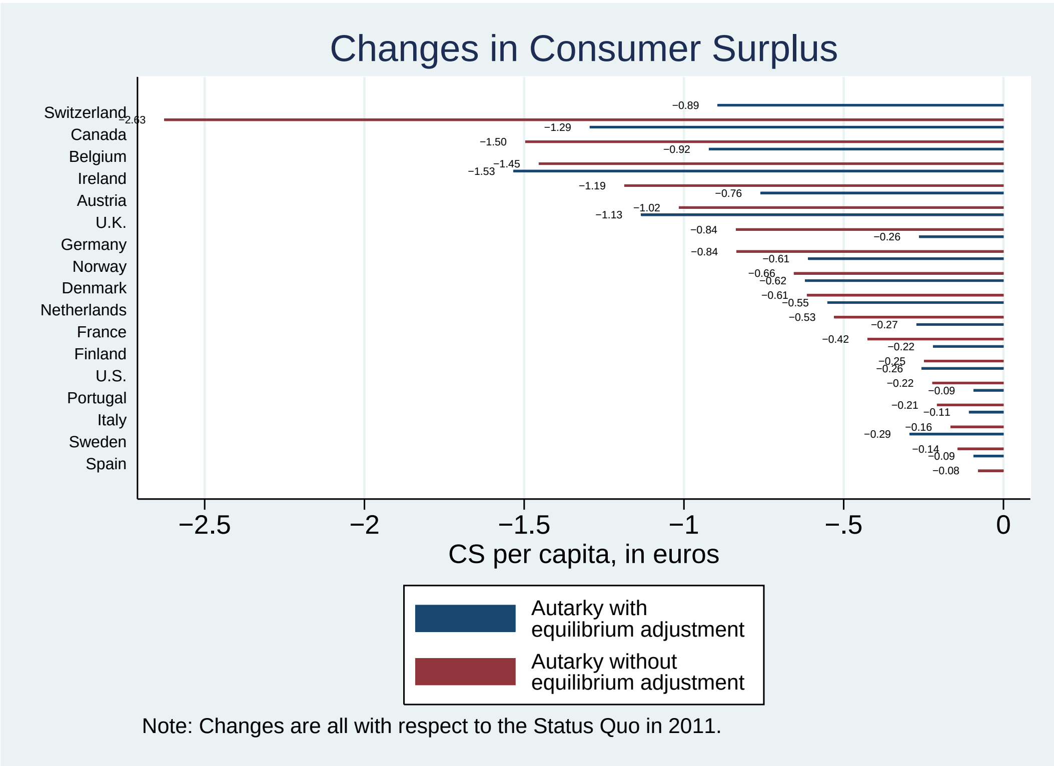

Figure 6b: Changes in CS following autarky: Equilibrium vs Non-Equilibrium Model.

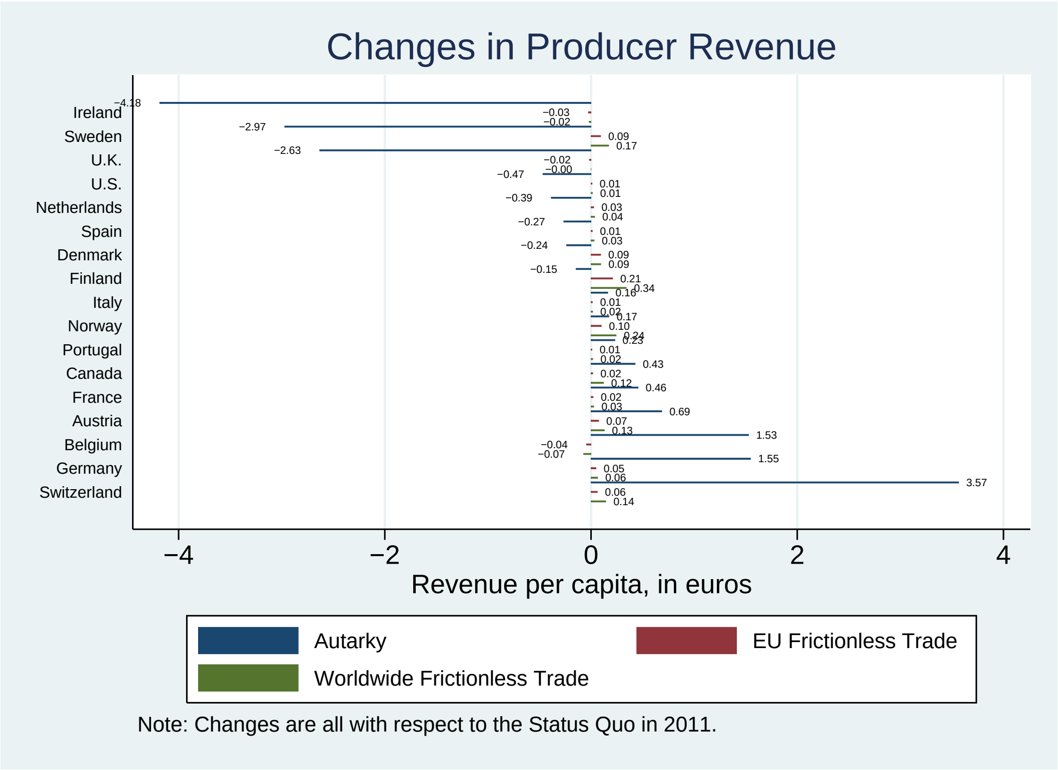

Figure 7a: Changes in Revenue following autarky and trade liberalization.

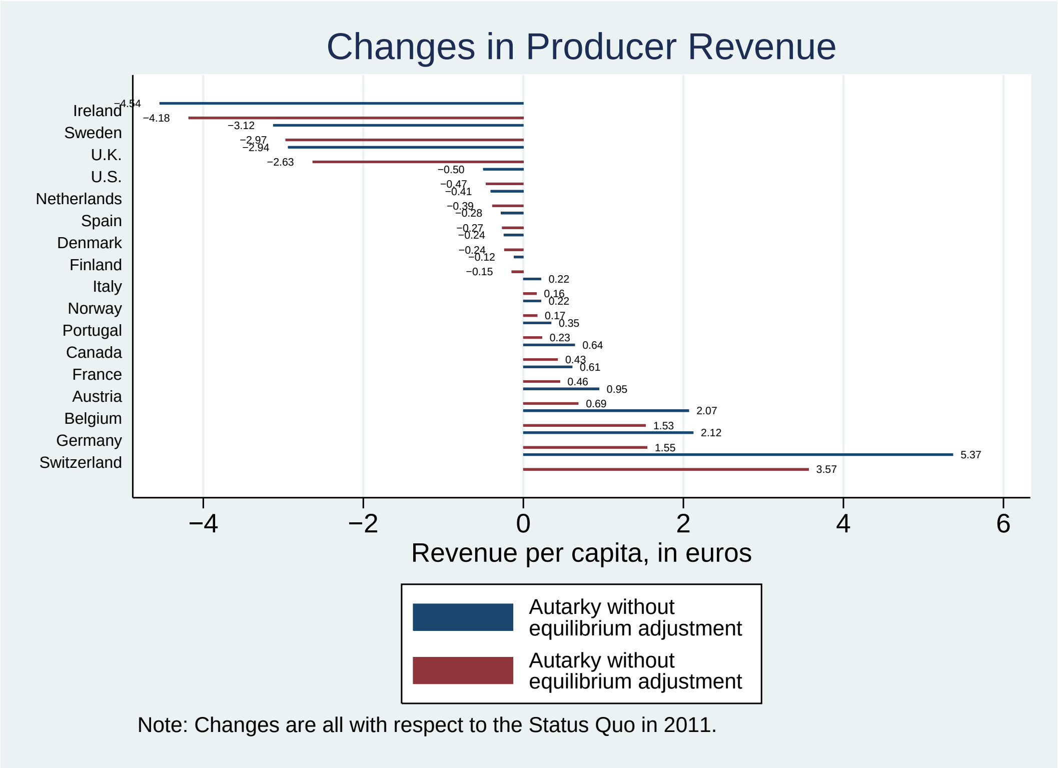

Figure 7b: Changes in Revenue following autarky: Equilibrium vs Non-Equilibrium Model.

Table 1: Recorded Music Revenue (US$ million, trade value) and Population, 2011.†

Country	Population	Physical	Digital	Total (US$)	Digital share	Scaling Factor
Canada	34,482,779	232.5	161.3	393.8	40.96%	2.44
USA	311,591,917	1,841.7	2,344.7	4186.3	56.01%	1.79
Austria	8,419,000	77.0	19.5	96.5	20.23%	4.94
Belgium	11,008,000	97.2	16.5	113.7	14.55%	6.87
Denmark	5,574,000	48.8	30.3	79.1	38.28%	2.61
Finland	5,387,000	44.7	10.8	55.5	19.47%	5.14
France	65,436,552	653.1	186.7	839.7	22.23%	4.50
Germany	81,726,000	1,057.1	208.1	1265.1	16.45%	6.08
Ireland	4,487,000	32.2	16.2	48.4	33.52%	2.98
Italy	60,770,000	152.0	44.1	196.1	22.47%	4.45
Netherlands	16,696,000	158.2	35.5	193.6	18.32%	5.46
Norway	4,952,000	47.0	49.8	96.8	51.41%	1.95
Poland	38,216,000	64.0	4.0	68.0	5.81%	17.21
Portugal	10,637,000	25.0	4.7	29.8	15.92%	6.28
Spain	46,235,000	97.8	42.6	140.4	30.35%	3.30
Sweden	9,453,000	66.4	65.9	132.2	49.80%	2.01
Switzerland	7,907,000	108.3	33.4	141.7	23.59%	4.24
UK	62,641,000	815.5	447.8	1263.3	35.45%	2.82

† Source: IFPI, Recording Industry in Numbers (2013).

Table 2: Evolution of the number of sales and number of tracks

	Total Sales (in millions units)						Number of tracks (in thousands)					
Country	2006	2007	2008	2009	2010	2011	2006	2007	2008	2009	2010	2011
Austria	1.08	1.78	2.55	3.42	3.90	4.55	144.60	205.31	261.49	311.39	320.61	327.88
Belgium	2.85	4.63	4.65	5.90	6.57	7.20	223.22	309.88	338.81	404.47	434.31	440.25
Canada	13.94	23.93	37.50	53.57	61.77	83.29	372.86	558.37	728.07	897.65	975.31	1054.95
Denmark	1.94	4.12	5.31	6.39	6.61	7.30	156.25	249.88	283.85	328.94	329.15	329.10
Finland	0.40	0.72	0.89	0.98	0.93	1.25	81.40	122.82	148.49	168.04	158.91	194.16
France	5.21	8.96	18.87	28.32	30.79	31.29	294.51	417.33	600.88	754.79	802.43	826.73
Germany	9.90	23.29	32.92	36.34	41.02	47.53	413.87	661.05	808.85	887.28	920.92	972.09
Ireland	1.28	3.05	3.99	4.53	4.67	5.02	121.50	202.51	241.66	266.54	268.66	273.78
Italy	2.60	4.42	5.74	9.78	10.73	12.90	199.52	284.30	338.93	469.91	495.53	511.39
Netherlands	2.17	2.49	2.81	3.78	4.50	5.82	208.34	279.17	302.52	370.61	402.12	430.36
Norway	1.12	2.85	4.15	5.07	5.49	5.99	146.95	235.16	293.83	344.95	346.82	358.79
Portugal	0.20	0.32	0.65	0.68	0.82	0.91	56.36	81.85	108.43	122.53	130.07	133.74
Spain	1.58	6.23	6.13	5.40	4.85	5.10	149.21	245.26	304.30	341.94	348.50	361.41
Sweden	1.57	2.63	2.96	3.67	3.63	3.04	178.31	261.01	294.35	349.58	349.76	323.36
Switzerland	2.82	4.42	5.79	8.47	10.24	13.36	260.34	352.16	425.09	540.75	573.88	647.41
U.K.	38.21	65.98	96.46	124.07	128.37	135.20	558.11	853.45	1043.27	1223.68	1297.18	1321.07
U.S.	541.44	786.31	994.21	1112.26	1083.70	1142.66	1130.37	1477.00	1787.77	2079.96	2249.62	2294.01

Table 3: Who Buys my Repertoire in 2011?

								Destination									
Origin	AT	BE	CA	CH	DE	DK	ES	FI	FR	GB	IE	IT	NL	NO	PT	SE	US	Total
AT	17.92	1.39	1.66	6.70	50.35	0.36	0.28	0.13	2.90	3.77	0.13	1.32	1.18	0.18	0.13	0.10	11.52	100.00
BE	1.64	31.19	2.19	3.60	25.31	0.97	0.59	0.13	13.94	3.58	0.17	1.84	5.23	0.21	0.16	0.14	9.13	100.00
CA	0.44	1.01	20.15	1.14	4.67	0.33	0.25	0.12	2.73	7.07	0.31	0.90	0.53	0.29	0.14	0.13	59.80	100.00
CH	1.36	2.73	2.68	43.16	18.84	0.60	1.45	0.10	8.13	2.24	0.09	1.55	0.55	0.40	0.10	0.13	15.88	100.00
DE	3.55	1.21	2.15	5.32	65.41	0.45	0.35	0.16	2.55	3.63	0.18	1.08	0.88	0.27	0.17	0.14	12.52	100.00
DK	1.38	3.36	3.79	2.28	20.69	33.31	0.30	0.26	2.71	4.94	0.24	1.39	1.16	0.98	0.15	0.43	22.63	100.00
ES	1.03	2.01	5.67	2.38	10.27	1.03	17.12	0.27	4.59	8.82	0.31	1.97	1.81	0.45	0.36	0.20	41.70	100.00
FI	0.96	3.49	3.72	2.86	11.93	0.53	0.36	29.93	3.11	7.03	0.25	1.16	0.73	0.95	0.14	0.93	31.94	100.00
FR	0.91	6.75	4.26	5.60	10.74	0.30	0.66	0.14	48.43	5.11	0.30	1.75	1.02	0.27	0.18	0.12	13.48	100.00
GB	0.77	1.95	4.86	1.91	10.19	0.55	0.44	0.19	3.97	28.83	0.91	1.87	1.26	0.40	0.24	0.19	41.47	100.00
IE	0.68	1.33	5.91	1.59	9.28	0.53	0.45	0.16	3.28	19.14	3.71	1.53	1.15	0.38	0.26	0.21	50.41	100.00
IT	1.06	2.07	1.99	5.39	8.64	0.32	0.91	0.13	4.78	4.97	0.24	52.62	1.04	0.18	0.19	0.12	15.35	100.00
NL	0.99	5.86	4.71	2.36	12.21	0.54	0.30	0.21	3.67	11.27	0.67	1.70	17.24	0.34	0.18	0.19	37.56	100.00
NO	1.64	1.49	2.35	4.04	31.92	1.12	0.45	0.43	3.37	6.88	0.38	1.26	1.61	21.24	0.26	0.53	21.03	100.00
PT	0.48	3.41	3.18	4.91	5.04	0.32	1.49	0.15	12.55	6.80	0.41	4.56	1.73	1.03	37.16	0.14	16.63	100.00
SE	1.17	3.68	5.06	2.94	12.85	1.64	0.64	0.75	5.50	12.05	0.52	1.76	1.60	2.00	0.27	4.53	43.04	100.00
US	0.40	0.79	5.99	0.96	5.01	0.32	0.25	0.11	2.27	8.34	0.33	0.78	0.57	0.23	0.11	0.11	73.44	100.00
r.o.w	0.89	1.91	5.37	2.66	11.09	0.59	1.29	0.21	7.45	11.97	0.45	2.41	1.36	0.44	0.36	0.23	51.32	100.00

Table 4: Where is Destination Consumption From in 2011?

	Destination																
Origin	AT	BE	CA	CH	DE	DK	ES	FI	FR	GB	IE	IT	NL	NO	PT	SE	US
AT	6.45	0.23	0.07	0.96	1.41	0.15	0.13	0.17	0.17	0.08	0.07	0.19	0.30	0.12	0.19	0.13	0.05
BE	1.20	10.43	0.18	1.06	1.45	0.84	0.58	0.33	1.64	0.16	0.19	0.53	2.72	0.30	0.46	0.38	0.07
CA	2.62	2.77	13.39	2.73	2.18	2.34	2.00	2.52	2.62	2.51	2.79	2.12	2.26	3.40	3.39	2.89	3.97
CH	0.42	0.39	0.09	5.37	0.46	0.22	0.60	0.11	0.41	0.04	0.04	0.19	0.12	0.24	0.12	0.15	0.05
DE	14.81	2.30	0.99	8.84	21.24	2.22	1.93	2.35	1.70	0.90	1.10	1.76	2.60	2.14	2.70	2.20	0.58
DK	1.04	1.15	0.31	0.68	1.21	29.62	0.30	0.68	0.33	0.22	0.27	0.41	0.62	1.42	0.44	1.20	0.19
ES	1.17	1.03	0.71	1.07	0.90	1.38	25.82	1.05	0.83	0.59	0.53	0.87	1.45	0.99	1.60	0.85	0.52
FI	0.25	0.42	0.11	0.30	0.24	0.16	0.13	27.34	0.13	0.11	0.10	0.12	0.13	0.48	0.15	0.90	0.09
FR	3.35	11.31	1.73	8.22	3.08	1.33	3.26	1.82	28.55	1.11	1.64	2.53	2.68	1.90	2.64	1.63	0.55
GB	16.76	19.47	11.76	16.66	17.36	14.16	12.95	14.56	13.90	37.28	29.92	16.12	19.57	17.09	20.85	15.20	10.02
IE	0.85	0.76	0.82	0.80	0.91	0.79	0.76	0.70	0.66	1.42	7.02	0.75	1.02	0.91	1.29	0.99	0.70
IT	1.76	1.56	0.37	3.57	1.12	0.62	2.02	0.73	1.27	0.49	0.60	34.37	1.23	0.57	1.23	0.77	0.28
NL	1.28	3.47	0.68	1.23	1.24	0.84	0.53	0.95	0.77	0.87	1.31	0.87	15.92	0.87	0.91	0.90	0.54
NO	0.55	0.23	0.09	0.54	0.83	0.44	0.20	0.50	0.18	0.14	0.19	0.16	0.38	13.66	0.34	0.65	0.08
PT	0.02	0.07	0.02	0.09	0.02	0.02	0.09	0.03	0.09	0.02	0.03	0.08	0.06	0.09	6.89	0.02	0.01
SE	1.70	2.44	0.82	1.71	1.46	2.83	1.25	3.83	1.28	1.04	1.14	1.01	1.65	5.63	1.55	24.53	0.69
US	37.23	33.69	62.19	36.05	36.63	35.35	30.93	35.17	34.07	46.27	46.59	28.85	38.03	41.99	41.87	38.61	76.18
r.o.w	8.53	8.31	5.69	10.14	8.27	6.68	16.52	7.16	11.41	6.77	6.47	9.06	9.25	8.18	13.39	7.99	5.42
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 5: Demand Model Estimates (Nested Logit)[†]

	(1) Coef./s.e.	(2) Coef./s.e.	(3) Coef./s.e.	(4) Coef./s.e.	(5) Coef./s.e.	(6) Coef./s.e.
Ln(inside share)	0.684***	0.680***	0.781***	0.675***	0.672***	0.817***
	(0.06)	(0.07)	(0.07)	(0.06)	(0.07)	(0.11)
GDP per capita	0.029***	0.029***	0.059***	0.020**	0.020***	0.044**
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
Share of Digital Sales	4.385***	4.344***	13.545***	3.789***	3.755***	12.635***
	(0.72)	(0.73)	(2.51)	(0.98)	(0.98)	(3.89)
Urban population				-0.002	-0.002	0.015
				(0.01)	(0.01)	(0.02)
Fixed broadband Internet subscribers				-0.018	-0.018	-0.026
				(0.02)	(0.02)	(0.05)
Mobile cellular subscriptions				-0.005*	-0.005*	-0.005
				(0.00)	(0.00)	(0.01)
Internet users				0.031***	0.031***	0.024
				(0.01)	(0.01)	(0.02)
Instrument-year interactions	✗	✓	✓	✗	✓	✓
Covariates-year interactions	✗	✗	✓	✗	✗	✓
Adjusted-R^2	0.829	0.828	0.870	0.844	0.843	0.896
No. of Obs.	50870037	50870037	50870037	50870037	50870037	50870037

[†] Standard errors in parenthesis and clustered at the country level. Inside share instrumented with log(pop) in columns (1) and (3) and with log(pop) interacted with year dummies in specifications (2), (4), (5) and (6). All specifications include year dummies.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table 6: σ Estimates (Nested Logit)[†]

Instrument	(1) Coef./s.e.	(2) Coef./s.e.	(3) Coef./s.e.	(4) Coef./s.e.	(5) Coef./s.e.	(6) Coef./s.e.
Population	0.644***	0.605***	0.876***	0.602***	0.582***	0.815***
	(0.12)	(0.11)	(0.17)	(0.09)	(0.09)	(0.26)
Log(Population)	0.684***	0.680***	0.781***	0.675***	0.672***	0.817***
	(0.06)	(0.07)	(0.07)	(0.06)	(0.07)	(0.11)
Number of Songs	0.417***	0.396***	0.457***	0.434***	0.425***	0.461***
	(0.07)	(0.06)	(0.06)	(0.07)	(0.06)	(0.11)
Log(Number of Songs)	0.412***	0.411***	0.450***	0.446***	0.446***	0.466***
	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.08)
Full set of covariates	✗	✗	✗	✓	✓	✓
Instrument-year interactions	✗	✓	✓	✗	✓	✓
Covariates-year interactions	✗	✗	✓	✗	✗	✓

[†] Each figure in the table comes from a different estimation of equation (2) and gives the corresponding estimate of σ. Standard errors in parenthesis and clustered at the country level.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table 7: Annual Changes in Consumer Surplus[†]

Country	SQ	AUT	FT	ESM	ΔAUT	ΔAUT(%)	ΔFT	ΔFT(%)	ΔESM	ΔESM(%)
Austria	2.61	1.60	2.90	2.81	1.02	63.6	0.29	10.9	0.20	7.6
	(0.00)	(0.49)	(0.17)	(0.12)	(0.49)	(49.01)	(0.17)	(6.65)	(0.12)	(4.54)
Belgium	4.37	2.92	4.69	4.59	1.45	49.8	0.32	7.2	0.21	4.9
	(0.00)	(0.72)	(0.19)	(0.13)	(0.72)	(36.26)	(0.19)	(4.33)	(0.13)	(2.89)
Canada	5.26	3.76	5.31	5.26	1.50	39.8	0.05	1.0	-	-
	(0.00)	(0.76)	(0.03)	(0.00)	(0.76)	(28.12)	(0.03)	(0.58)	-	-
Denmark	3.23	2.61	3.46	3.38	0.61	23.5	0.23	7.3	0.16	4.8
	(0.00)	(0.33)	(0.14)	(0.09)	(0.33)	(15.30)	(0.14)	(4.35)	(0.09)	(2.87)
Finland	1.18	0.94	1.53	1.45	0.25	26.5	0.35	29.4	0.27	22.5
	(0.00)	(0.13)	(0.23)	(0.17)	(0.13)	(17.38)	(0.23)	(19.48)	(0.17)	(14.46)
France	2.11	1.68	2.15	2.14	0.42	25.2	0.04	2.1	0.03	1.3
	(0.00)	(0.22)	(0.03)	(0.02)	(0.22)	(16.48)	(0.03)	(1.24)	(0.02)	(0.76)
Germany	3.45	2.61	3.49	3.47	0.84	31.9	0.04	1.2	0.03	0.7
	(0.00)	(0.43)	(0.02)	(0.01)	(0.43)	(21.51)	(0.02)	(0.71)	(0.01)	(0.42)
Ireland	3.18	1.99	3.49	3.40	1.19	59.6	0.32	10.0	0.22	7.0
	(0.00)	(0.57)	(0.19)	(0.13)	(0.57)	(45.44)	(0.19)	(6.04)	(0.13)	(4.22)
Italy	0.94	0.77	0.98	0.97	0.16	21.4	0.05	4.9	0.03	3.3
	(0.00)	(0.09)	(0.03)	(0.02)	(0.09)	(13.69)	(0.03)	(2.93)	(0.02)	(1.93)
Netherlands	1.87	1.34	2.04	1.98	0.53	39.3	0.16	8.7	0.11	5.9
	(0.00)	(0.27)	(0.10)	(0.07)	(0.27)	(27.33)	(0.10)	(5.22)	(0.07)	(3.52)
Norway	2.23	1.57	2.42	2.23	0.66	41.6	0.19	8.3	-	-
	(0.00)	(0.33)	(0.11)	(0.00)	(0.33)	(29.42)	(0.11)	(5.02)	-	-
Portugal	0.54	0.33	0.72	0.68	0.21	62.9	0.19	34.6	0.15	27.2
	(0.00)	(0.10)	(0.13)	(0.10)	(0.10)	(48.09)	(0.13)	(23.49)	(0.10)	(17.84)
Spain	0.36	0.28	0.40	0.39	0.08	28.0	0.04	11.6	0.03	7.9
	(0.00)	(0.04)	(0.03)	(0.02)	(0.04)	(18.45)	(0.03)	(7.11)	(0.02)	(4.73)
Sweden	0.64	0.49	0.73	0.70	0.14	28.9	0.10	15.0	0.07	10.6
	(0.00)	(0.07)	(0.06)	(0.04)	(0.07)	(19.17)	(0.06)	(9.29)	(0.04)	(6.48)
Switzerland	6.63	4.01	6.88	6.63	2.63	65.6	0.25	3.8	-	-
	(0.00)	(1.26)	(0.15)	(0.00)	(1.26)	(51.65)	(0.15)	(2.21)	-	-
U.K.	5.51	4.67	5.53	5.52	0.84	17.9	0.02	0.5	0.01	0.3
	(0.00)	(0.45)	(0.01)	(0.01)	(0.45)	(11.39)	(0.01)	(0.26)	(0.01)	(0.15)
U.S.	5.43	5.20	5.44	5.43	0.22	4.3	0.02	0.3	-	-
	(0.00)	(0.13)	(0.01)	(0.00)	(0.13)	(2.54)	(0.01)	(0.16)	-	-

[†] All figures are in € per capita except columns 6, 7 and 10 which are in percent. SQ, AUT, FT and ESM indicate Status Quo, Autarky, worldwide Frictionless Trade and European Single Market regimes, respectively. ΔAUT indicates the change in CS of going from autarky to the Status quo. ΔFT and ΔESM indicate the change in CS of going from the Status Quo to the FT and ESM regimes, respectively. Standard errors are in parentheses and computed via bootstrapping as described in the text.

Table 8: Annual Changes in Producer Revenue[†]

Country	SQ	AUT	FT	ESM	ΔAUT	ΔAUT(%)	ΔFT	ΔFT(%)	ΔESM	ΔESM(%)
Austria	0.96	1.65	1.09	1.04	-0.69	-41.6	0.13	13.5	0.07	7.8
	(0.00)	(0.49)	(0.02)	(0.01)	(0.49)	(17.24)	(0.02)	(2.22)	(0.01)	(1.40)
Belgium	1.50	3.03	1.43	1.46	-1.53	-50.4	-0.07	-4.8	-0.04	-3.0
	(0.00)	(0.73)	(0.03)	(0.02)	(0.73)	(11.78)	(0.03)	(1.98)	(0.02)	(1.37)
Canada	3.92	4.35	4.05	3.94	-0.43	-9.8	0.12	3.1	0.02	0.4
	(0.00)	(0.80)	(0.02)	(0.01)	(0.80)	(16.72)	(0.02)	(0.59)	(0.01)	(0.22)
Denmark	3.04	2.80	3.13	3.13	0.24	8.5	0.09	3.1	0.09	3.1
	(0.00)	(0.33)	(0.06)	(0.04)	(0.33)	(12.82)	(0.06)	(2.06)	(0.04)	(1.41)
Finland	1.09	0.95	1.44	1.30	0.15	15.4	0.34	31.3	0.21	19.2
	(0.00)	(0.13)	(0.04)	(0.03)	(0.13)	(15.73)	(0.04)	(3.73)	(0.03)	(2.87)
France	1.27	1.72	1.30	1.29	-0.46	-26.5	0.03	2.1	0.02	1.7
	(0.00)	(0.23)	(0.02)	(0.01)	(0.23)	(9.52)	(0.02)	(1.50)	(0.01)	(0.93)
Germany	1.15	2.70	1.21	1.20	-1.55	-57.4	0.06	5.6	0.05	4.2
	(0.00)	(0.44)	(0.02)	(0.01)	(0.44)	(6.82)	(0.02)	(1.32)	(0.01)	(0.80)
Ireland	6.31	2.13	6.29	6.29	4.18	196.4	-0.02	-0.3	-0.03	-0.4
	(0.00)	(0.59)	(0.05)	(0.03)	(0.59)	(81.85)	(0.05)	(0.75)	(0.03)	(0.44)
Italy	0.62	0.78	0.63	0.63	-0.16	-20.9	0.02	2.6	0.01	2.3
	(0.00)	(0.09)	(0.01)	(0.01)	(0.09)	(8.86)	(0.01)	(2.23)	(0.01)	(1.49)
Netherlands	1.76	1.37	1.79	1.78	0.39	28.2	0.04	2.0	0.03	1.5
	(0.00)	(0.27)	(0.03)	(0.02)	(0.27)	(24.88)	(0.03)	(1.57)	(0.02)	(1.04)
Norway	1.51	1.69	1.76	1.61	-0.17	-10.3	0.24	16.1	0.10	6.6
	(0.00)	(0.34)	(0.03)	(0.01)	(0.34)	(17.94)	(0.03)	(2.30)	(0.01)	(0.75)
Portugal	0.10	0.33	0.12	0.11	-0.23	-69.8	0.02	17.1	0.01	9.5
	(0.00)	(0.10)	(0.00)	(0.00)	(0.10)	(8.88)	(0.00)	(4.10)	(0.00)	(3.28)
Spain	0.55	0.28	0.58	0.56	0.27	93.2	0.03	5.6	0.01	2.4
	(0.00)	(0.04)	(0.01)	(0.01)	(0.04)	(27.75)	(0.01)	(1.74)	(0.01)	(1.17)
Sweden	3.47	0.50	3.64	3.57	2.97	592.3	0.17	4.9	0.09	2.7
	(0.00)	(0.07)	(0.05)	(0.03)	(0.07)	(101.88)	(0.05)	(1.36)	(0.03)	(0.84)
Switzerland	0.89	4.45	1.03	0.95	-3.57	-80.0	0.14	16.1	0.06	6.9
	(0.00)	(1.32)	(0.02)	(0.01)	(1.32)	(5.95)	(0.02)	(2.16)	(0.01)	(0.68)
U.K.	7.87	5.24	7.87	7.86	2.63	50.2	-0.00	-0.0	-0.02	-0.2
	(0.00)	(0.47)	(0.06)	(0.03)	(0.47)	(13.33)	(0.06)	(0.72)	(0.03)	(0.41)
U.S.	6.79	6.32	6.80	6.80	0.47	7.4	0.01	0.2	0.01	0.2
	(0.00)	(0.13)	(0.03)	(0.01)	(0.13)	(2.18)	(0.03)	(0.47)	(0.01)	(0.19)

[†] All figures are in € per capita except columns 6, 7 and 10 which are in percent. SQ, AUT, FT and ESM indicate Status Quo, Autarky, worldwide Frictionless Trade and European Single Market regimes, respectively. ΔAUT indicates the change in revenue of going from autarky to the Status quo. ΔFT and ΔESM indicate the change in Revenue of going from the Status Quo to the FT and ESM regimes, respectively. Standard errors are in parentheses and computed via bootstrapping as described in the text.

Table 9: Annual Changes in Consumer Surplus: Equilibrium vs Non-Equilibrium Model†

	SQ	AUT	AUTeqm	ΔAUT	ΔAUTeqm	ΔAUT(%)	ΔAUTeqm(%)	N	Neqm
Austria	2.61	1.60	1.85	1.02	0.76	63.6	41.0	10872	24065
Belgium	4.37	2.92	3.45	1.45	0.92	49.8	26.7	12595	32281
Canada	5.26	3.76	3.97	1.50	1.29	39.8	32.6	71205	95424
Denmark	3.23	2.61	2.61	0.61	0.62	23.5	23.8	18625	18806
Finland	1.18	0.94	0.96	0.25	0.22	26.5	22.8	23118	27308
France	2.11	1.68	1.84	0.42	0.27	25.2	14.8	99413	161812
Germany	3.45	2.61	3.19	0.84	0.26	31.9	8.3	126369	372746
Ireland	3.18	1.99	1.64	1.19	1.53	59.6	93.2	10396	3667
Italy	0.94	0.77	0.83	0.16	0.11	21.4	13.0	60303	89640
Netherlands	1.87	1.34	1.32	0.53	0.55	39.3	41.6	24141	21888
Norway	2.23	1.57	1.62	0.66	0.61	41.6	37.7	15263	19021
Portugal	0.54	0.33	0.45	0.21	0.09	62.9	20.8	3954	20354
Spain	0.36	0.28	0.27	0.08	0.09	28.0	34.7	33087	24898
Sweden	0.64	0.49	0.34	0.14	0.29	28.9	85.7	27091	3549
Switzerland	6.63	4.01	5.74	2.63	0.89	65.6	15.6	12242	97796
U.K.	5.51	4.67	4.37	0.84	1.13	17.9	25.9	268136	182783
U.S.	5.43	5.20	5.17	0.22	0.26	4.3	4.9	1142896	1095643

† All figures are in € per capita except columns 6 and 7 which are in percent. SQ, AUT and AUTeqm indicate Status Quo, Autarky (without equilibrium adjustment) and Autarky (with equilibrium adjustment), respectively. ΔAUT indicates the change in CS of going from autarky to the Status quo. Standard errors are in parentheses and computed via bootstrapping as described in the text.

Table 10: Annual Changes in Producer Revenue: Equilibrium vs Non-Equilibrium Model[†]

	SQ	AUT	AUTeqm	ΔAUT	ΔAUTeqm	ΔAUT(%)	ΔAUTeqm(%)	N	Neqm
Austria	0.96	1.65	1.91	-0.69	-0.95	-41.6	-49.6	10872	24065
Belgium	1.50	3.03	3.57	-1.53	-2.07	-50.4	-57.9	12595	32281
Canada	3.92	4.35	4.57	-0.43	-0.64	-9.8	-14.1	71205	95424
Denmark	3.04	2.80	2.79	0.24	0.24	8.5	8.7	18625	18806
Finland	1.09	0.95	0.98	0.15	0.12	15.4	12.0	23118	27308
France	1.27	1.72	1.88	-0.46	-0.61	-26.5	-32.5	99413	161812
Germany	1.15	2.70	3.27	-1.55	-2.12	-57.4	-64.9	126369	372746
Ireland	6.31	2.13	1.77	4.18	4.54	196.4	257.0	10396	3667
Italy	0.62	0.78	0.84	-0.16	-0.22	-20.9	-26.3	60303	89640
Netherlands	1.76	1.37	1.35	0.39	0.41	28.2	30.2	24141	21888
Norway	1.51	1.69	1.73	-0.17	-0.22	-10.3	-12.7	15263	19021
Portugal	0.10	0.33	0.45	-0.23	-0.35	-69.8	-77.6	3954	20354
Spain	0.55	0.28	0.27	0.27	0.28	93.2	103.4	33087	24898
Sweden	3.47	0.50	0.35	2.97	3.12	592.3	893.9	27091	3549
Switzerland	0.89	4.45	6.26	-3.57	-5.37	-80.0	-85.8	12242	97796
U.K.	7.87	5.24	4.93	2.63	2.94	50.2	59.6	268136	182783
U.S.	6.79	6.32	6.29	0.47	0.50	7.4	8.0	1142896	1095643

[†] All figures are in € per capita except columns 6 and 7 which are in percent and column 10 which is in €. SQ, AUT and AUTeqm indicate Status Quo, Autarky (without equilibrium adjustment) and Autarky (with equilibrium adjustment), respectively. ΔAUT indicates the change in Revenue of going from autarky to the Status quo. Standard errors are in parentheses and computed via bootstrapping as described in the text.

Table 11: Annual Changes in Consumer and Producer Revenue: Europe vs North America

	Consumer Surplus						Producer Surplus					
	SQ		FT		ESM		SQ		FT		ESM	
	Total	p.cap.	Total	p.cap.	Total	p.cap.	Total	p.cap.	Total	p.cap.	Total	p.cap.
World	354,046,240	0.474	38,132,984	0.051	19,288,726	0.026	143,090,800	0.191	25,212,460	0.034	13,610,763	0.018
	(185,921,522)	(0.249)	(22,926,150)	(0.031)	(11,587,655)	(0.016)	(190,014,853)	(0.254)	(20,557,715)	(0.028)	(10,350,166)	(0.014)
Europe	233,191,872	0.581	31,613,620	0.079	19,288,726	0.048	12,272,922	0.031	16,666,388	0.042	9,841,786	0.025
	(120,312,889)	(0.300)	(19,140,518)	(0.048)	(11,587,655)	(0.029)	(122,396,663)	(0.305)	(9,893,277)	(0.025)	(5,976,768)	(0.015)
North America	120,854,384	0.349	6,519,362	0.019	-	-	130,817,888	0.378	8,546,073	0.025	3,768,978	0.011
	(65,658,003)	(0.190)	(3,787,257)	(0.011)	-	-	(67,677,875)	(0.196)	(10,664,489)	(0.031)	(4,373,399)	(0.013)

† All figures are in €. The Total columns present absolute numbers while p.cap. columns present figures in per capita terms. Columns SQ indicate the gains of going from autarky to Status Quo. Columns FT indicate the gains of going from Status Quo to Frictionless Trade. Columns ESM indicate the gains of going from Status Quo to a European Single Market. Standard errors are in parentheses and computed via bootstrapping as described in the text.

Table 12: Annual Changes in Consumer and Producer Revenue: Europe vs North America

	Consumer Surplus				Producer Surplus			
	No-Equilibrium Model		Equilibrium Model		No-Equilibrium Model		Equilibrium Model	
	Total	p.cap.	Total	p.cap.	Total	p.cap.	Total	p.cap.
World	354,046,240	0.474	296,559,104	0.397	143,090,800	0.191	84,956,432	0.114
Europe	233,191,872	0.581	172,296,512	0.429	12,272,922	0.031	-49,010,288	-0.122
North America	120,854,384	0.349	124,262,592	0.359	130,817,888	0.378	133,966,720	0.387

† Figures indicate the changes of going from autarky to Status Quo. All figures are in €. The Total columns present absolute numbers while p.cap. columns present figures in per capita terms.

Table 13: Fixed Cost of Entry and Average Revenues.[†]

Country	Entry Cost	AR-Aut	AR-ESM	AR-FT
Austria	666.30	1276.82	667.48	650.01
Belgium	1219.90	2649.43	1160.33	1114.79
Canada	1647.11	2107.82	1646.45	1683.58
Denmark	830.86	837.82	845.35	825.60
Finland	193.10	220.72	225.55	239.32
France	760.51	1135.34	763.66	747.16
Germany	715.55	1743.52	734.50	725.17
Ireland	2163.84	919.35	2125.96	2104.91
Italy	567.58	785.38	564.36	546.98
Netherlands	1029.13	947.95	1020.15	998.30
Norway	453.50	547.17	468.18	495.99
Portugal	233.92	892.66	233.06	233.19
Spain	501.62	397.35	505.14	494.86
Sweden	930.76	175.06	936.95	929.69
Switzerland	506.41	2877.22	525.94	561.51
U.K.	1690.05	1223.93	1676.40	1657.42
U.S.	1788.80	1724.06	1788.77	1777.11

[†] Entry Cost are the average revenue for the origin products traded at home. AR-Aut is the average revenue per product for the status quo set under autarky. AR-ESM is the average revenue per origin product traded at home for the SQ choice set available throughout the EU. AR-FT is the average revenue per origin product traded at home for the SQ choice set available worldwide.

European Commission
Joint Research Centre – Institute for Prospective Technological Studies

Title: **Digitization, Copyright, and the Welfare Effects of Music Trade**

Author(s): Luis Aguiar, Joel Waldfogel

Spain: European Commission, Joint Research Centre

2014 – 42 pp. – 21.0 x 29.7 cm

Scientific and Technical Research series – ISSN 1831-9408 (online)

Abstract

Since the launch of the iTunes Music Store in the US in 2003 and in much of Europe in the following years, music trade has shifted rapidly from physical to digital products, raising the availability of products in different countries. Despite substantial growth in availability, choice sets have not converged across countries; and observers point to copyright-related transaction costs as an obstacle to greater availability. Policy makers are now contemplating various copyright reforms that could reduce these trade costs. The possibility of these changes raises the question of how much benefit they would create for consumers and producers around the world. We address these questions with a structural model of supply and demand for music in 17 countries, which we employ to counterfactually simulate the effect of a European digital single market on the welfare of consumers and producers. We also simulate autarky and worldwide frictionless trade - in which all products are available in all countries - allowing us to quantify both the conventional gains from status quo trade as well as the maximum possible gains available to free trade. Existing and additional trade have different patterns of benefit to consumers and producers. Status quo trade benefits consumers everywhere, but European consumers have benefited more than North Americans. Existing trade has had large benefits to American producers but on balance small benefits to European producers. Additional trade would continue the pattern of consumers' benefits with larger gains to European consumers but would reverse the pattern for producers. Greater availability of digital music resulting from easing of copyright restrictions would raise per capita gains to producers in Europe more than in North America. A European digital single market for music would bring total benefits of €19 million to European consumers and €10 million to European producers. Finally, we find that a European digital single market would bring most of the benefits of worldwide frictionless trade to both consumers and producers alike.

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