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

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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 liberalizations that could reduce these trade costs. The possibility of these liberalizations 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 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. We find that trade confers substantial benefits on consumers. Effects on producers are also large but more varied, with some countries losing from trade. Nor surprisingly, we find that the additional benefits from liberalization are smaller than the benefit of status quo trade over autarky. Finally, we find that a European single market would bring most of the benefits of worldwide frictionless trade to both consumers and producers alike.

Keywords: Digital Music, Digitization, Copyright, Trade.

JEL classification: L82, F13.

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 available in most other countries (Gomez Herrera and Martens, 2014). For example, of the 45,290 German songs released in 2011, only 6% percent were available in France, and only 14% percent were available for sale 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. 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 and with US policy makers are exploring a transatlantic trade agreement that could, in principle, ease the burden of copyright on 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 model of demand, from which we can calculate the consumer and producer surplus 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. We are able to attribute each song to an origin country; hence we can calculate trade statistics for the universe of digital music sales.

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 producer surplus for producers in each origin country. 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 these consumer and producer surplus measures 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, in essence, equivalent to a copyright licensing regime that eliminates additional state-specific 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 (or, equivalently, a pan-European copyright licensing system) would essentially eliminate these additional costs. 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 raise the number of products available to consumers and must therefore 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 CS in our 17 countries by €198,375,136, or by €0.27 per capita on average. Swiss and Canadian consumers gain roughly €0.8-1.5 per capita annually from music trade, while consumers in Italy, Sweden, and Spain gain less than €0.1 annually per capita. Effects on producers are also large but more varied. In total across 17 countries trade raises producer surplus by €80,200,216, or by an average of €0.11 per capita. Producers in Ireland, Great Britain, and Sweden gain €1.5-2.3 per capita, while producers in the US gain only about €0.26. Producers in Switzerland, Belgium and Germany are the largest

losers under status quo trade relative to autarky, with losses of up to €2 per capita.

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 €16,634,251, or an average of €0.04 per capita, while North American consumers gain €2,459,572, or about €0.01 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 €0.02 per capita for European countries and €0.01 for the US. The largest gainers from worldwide frictionless trade are the producers from Finland, Norway, and Sweden, with gains of roughly €0.1-0.2 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 demand model and the estimates of the model. We also describe the counterfactual exercise. Next, we turn to counterfactual results. 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.[1] We observe the annual sales of each downloaded track in each destination. The dataset originally includes 1,532,095 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

[1] 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.

origin from www.musicbrainz.org, an open music encyclopedia that collects music metadata and makes it available to the public.[2] The MusicBrainz database is sufficiently authoritative that the BBC relies on it to support the artist and music information on their music website.[3] 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.[4]

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.

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. The differential development of the digital market is important for some of our exercises, such as calculating national repertoire shares of collective sales in the 17 sample destination countries. Because the US digital sales share is roughly 2 times

[2]Whenever available in MusicBrainz, the country of origin of each artists corresponds to their country of birth.

[3]See http://www.bbc.co.uk/music/brainz/.

[4]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.

the digital sales share in Europe, any repertoire selling disproportionately in the US will appear to have a large share of world music sales. In the raw data, destination countries with high digital penetration, particularly the US, dominate sales. Our main goal is the counterfactual analysis of digital trade in an anticipated environment with similar levels of digital penetration. Thus, we scale up digital sales in destinations as if they had the US level of digital penetration in 2011. Table 3 shows the 2011 share of origin repertoire sales in each destination using the adjusted data. Austrian 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 dominated 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. 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 - are concerned about trade in cultural products. In music, this concern mainly manifests itself in radio airplay quotas. France, Canada, Australia, New Zealand, [and others] mandate minimum domestic radio airplay shares.[5] Concerns about cultural trade are not limited to music and, indeed, are strong in motion pictures. European governments subsidize roughly a third of European

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

motion picture investment. 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 these countries account for closer to xx percent of world theatrical box office.[6]

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 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

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

[6] See Ferreira et al. (2013).

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.[7] 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 7) 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 $S_{jc} = \frac{e^{\frac{\delta_{jc}}{1-\sigma}}}{D_{J_c}^{\sigma} + D_{J_c}}$, where $D_{J_c} = \sum_{j \in J_c} e^{\frac{\delta_{jc}}{1-\sigma}}$. Inverting out δ_{jc} from observed market shares as in Berry (1994) yields

[7] 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.

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

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. 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.[8] In other words, additional songs will simply cannibalize 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.

3.1 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

[8] 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 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.

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.[9] 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.

3.2 Elasticities

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.[10]

Own price elasticity is given by the following formula, which we call the *song-elasticity*:

$$\begin{aligned} \eta_{jj} &= \frac{\partial S_{jc}}{\partial p_{jc}} \frac{p_{jc}}{S_{jc}} = \alpha p_{jc} \left[\frac{1}{1-\sigma} - \frac{\sigma}{1-\sigma} S_{j|J_c} - S_{jc} \right] \\ &= \frac{\alpha}{1-\sigma} p_{jc} \left[1 - \sigma \left(D_{J_c} \right)^{\sigma-1} S_{jc} - S_{jc} \right]. \end{aligned} \tag{3}$$

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

[10] 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.

The cross-price elasticity for $j \neq k$ and $k \in J_c$ is given by:

$$\eta_{jk} = \alpha p_{kc} \left[S_{kc} + \frac{\sigma}{1-\sigma} S_{k|J_c} \right]. \tag{4}$$

The cross-price elasticity for $j \neq k$ and $k \notin J_c$ is what we call the *music-elasticity* and is given by

$$\eta_{jk} = \alpha p_{kc} S_{kc} \tag{5}$$

Notice that when we have only 2 nests (as in our case), then the music-elasticity $\eta_{jk} = \eta_{j0}$ since the good outside the nest is the outside good. This leads to:

$$\eta_{j0} = \alpha p_{0c} S_{0c} = \alpha p_{0c} \left[1 - \frac{D_{J_c}}{D_{J_c} + D_{J_c}^{\sigma}} \right] \tag{6}$$

3.3 Consumer and Producer Surplus

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 surplus (PS) for each origin repertoire. The formula for the CS is given by

$$CS_c = \frac{M_c}{\alpha} \ln \left(\sum_{J_c} D_{J_c}^{1-\sigma} \right) = \frac{M_c}{\alpha} \ln \left(D_{J_c}^{1-\sigma} + 1 \right). \tag{7}$$

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

$$PS_c = p_{jc} M_c \left[\frac{D_{J_c}}{\left(D_{J_c}^{\sigma} + D_{J_c} \right)} \right]. \tag{8}$$

4 Estimation and Results

4.1 Price coefficient

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

$$\ln(S_{jc}) - \ln(S_{0c}) = x_{jc}\beta + \sigma \ln\left(\frac{S_{jc}}{1 - S_{0c}}\right) + \xi_{jc}, \tag{9}$$

where x_{jc} includes a constant and a set of year dummy variables. We get an estimate for σ, $\widehat{\sigma}$, that we can use to calculate the country-specific mean utility of each song $\widehat{\delta}_{jc}$:

$$\widehat{\delta}_{jc} = \ln(S_{jc}) - \ln(S_{0c}) - \widehat{\sigma} \ln\left(\frac{S_{jc}}{1 - S_{0c}}\right). \tag{10}$$

We infer α by assuming that pricing is governed by a revenue maximizing monopolist.[11] Then, assuming that $p = 1$ for all songs in all countries, we have that the elasticity of music is given by

$$\eta_{j0} = \alpha \left[1 - \frac{D_{J_c}}{D_{J_c} + D_{J_c}^{\sigma}}\right]. \tag{11}$$

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

$$\widehat{\alpha} = \frac{1}{\left[1 - \frac{\widehat{D}_{J_c}}{\widehat{D}_{J_c} + \widehat{D}_{J_c}^{\widehat{\sigma}}}\right]}, \tag{12}$$

where $\widehat{D}_{J_c} = \sum_{j \in J_c} e^{\frac{\widehat{\delta}_{jc}}{1-\widehat{\sigma}}}$. 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 PS.

[11] 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.

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 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.

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. 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 7 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 7 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:

$$\delta_{j,c} = A_{c,c'} + B_{c,c'}\delta_{j,c'} + \sum_{c=1}^{17} \phi_c I_c + \mu_{j,c}. \tag{13}$$

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 PS 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 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 PS).[12] 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 (13). 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 PS for this specific draw. We repeat this exercise 50 times to obtain distributions of the CS and PS under the different simulation

[12] Given that the parameters α and δ are directly constructed from the parameter σ (see equations (10) and (12) above), all of our simulation statistics will be solely defined by σ.

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 5 and 6.

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

With autarky, 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 surplus 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 €1.47 per capita in Switzerland to €0.04 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 €0.30-€0.42 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 (€1.47), Canada (€0.84), Belgium (€0.81), Ireland (€0.66), and Austria (€0.57). Except for Canada, these countries also 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 €0.33.

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 €1.99 in Switzerland and €0.87 in Germany to gains of €2.34 in Ireland, €1.67 in Sweden and €1.48 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 PS for Austria, Belgium, France, Germany, Italy, Portugal, and Switzerland.

Status quo trade benefits US producers by €0.26 per capita; it hurts Canadians by €0.24; and it benefits European countries an average of €0.02 per capita.

5.1.2 Worldwide Frictionless Trade

If there was 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 using (7) and (8). The annual gains in consumer surplus in going from the status quo to frictionless trade vary between about €0.17-0.19 in Finland and Belgium to €0.01 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 28 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, Canada and the UK. 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 €0.73 difference between autarky and frictionless Austrian per capita CS, the status quo delivers €0.57, or 78 percent. The average share of full trade benefits achieved by the status quo is .79. 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 PS gains from frictionless trade include Finland (€0.19), Norway (€0.14), and Sweden (€0.10), 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 €0.04 per capita, a decrease of around 5% in their surplus.

5.1.3 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 are unaffected by the European 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 PS 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 €198,375,136 per year across the world, or about €0.27 in per capita terms. See Table 9. Producers gain €80,200,216 on balance, 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, €19,093,824 in total for all countries or €0.026 in per capita terms. Annual gains for European consumers would reach a total of €16,634,251 (about €0.04 per capita). Under a European single market, these gains would reach €10,269,297 or about €0.03 per capita. Per capita benefits of worldwide liberalization to European consumers exceed the benefits to North American consumers, with the latter gaining around €0.01 annually. Effects on producers are mixed. North American producers experience small benefits from worldwide frictionless trade (€0.01 per capita), while European gains average €9,339,038 or €0.02 per capita. Under a European single market, European producers' annual gains would reach €5,513,615 or about €0.014 per capita, while the total gains to North American producers is €2,111,831 or €0.006 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 develop a supply side for the model, allowing for entry and exit of products as markets contract or expand under counterfactual trade regimes.

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7 Figures and Tables

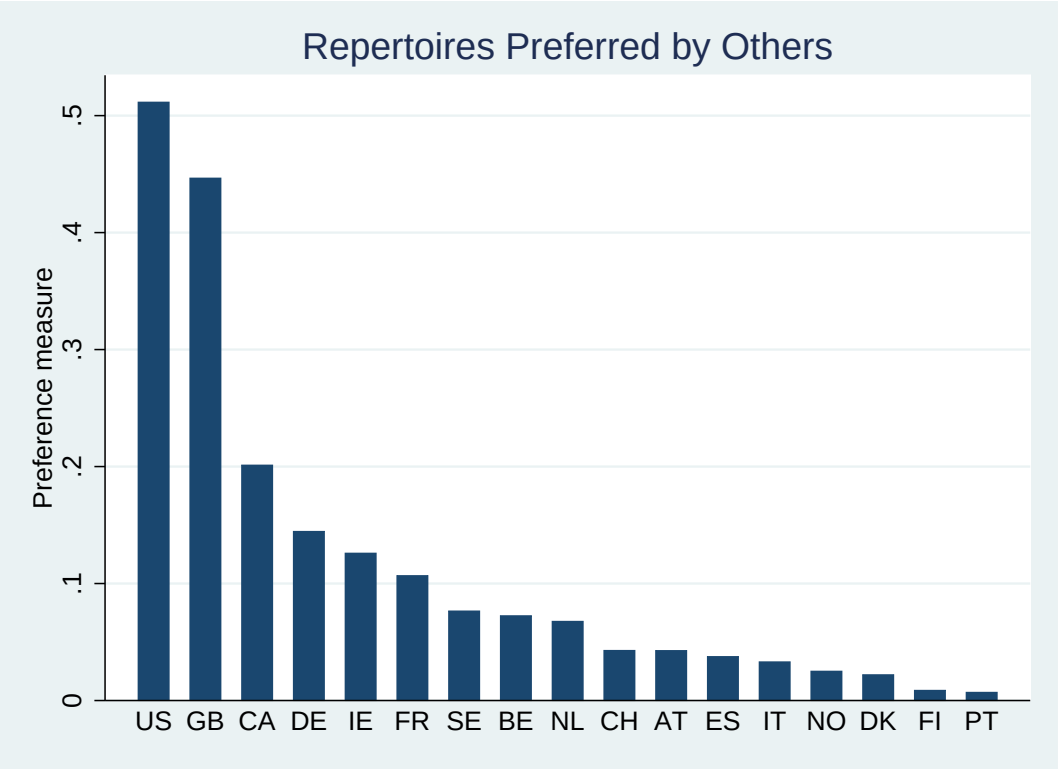


Figure 1: Which repertoires are preferred by consumers?

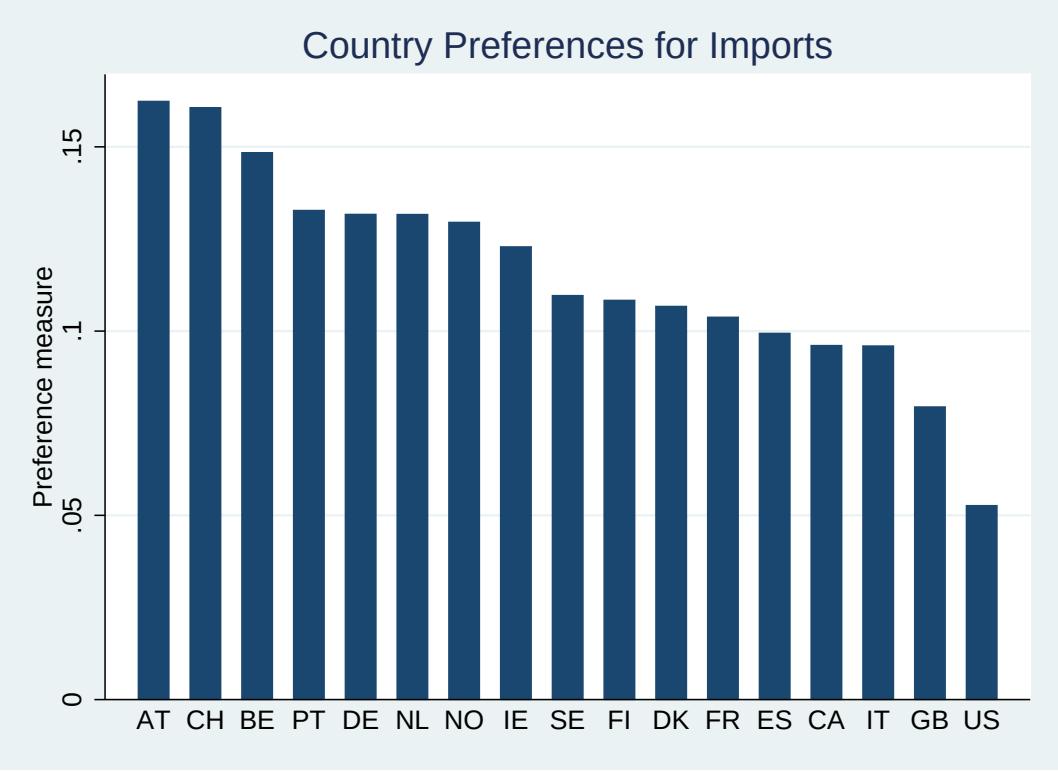


Figure 2: Relative preferences for imported music

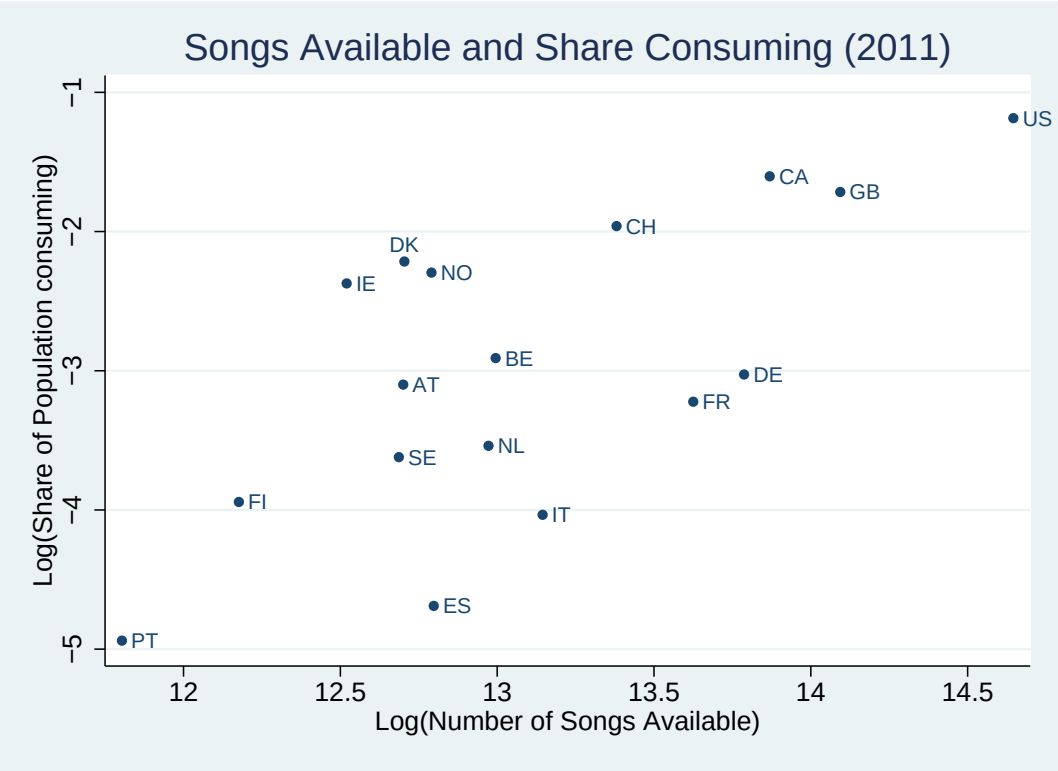


Figure 3: Number of songs available and share of the population consuming, 2011.

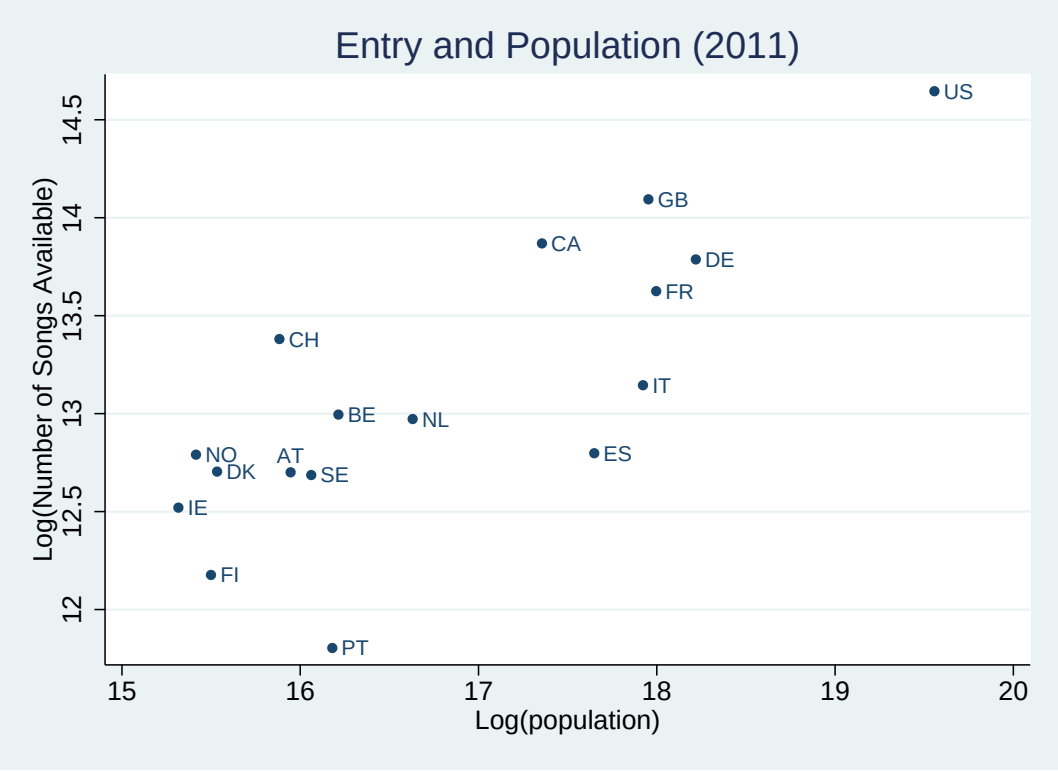
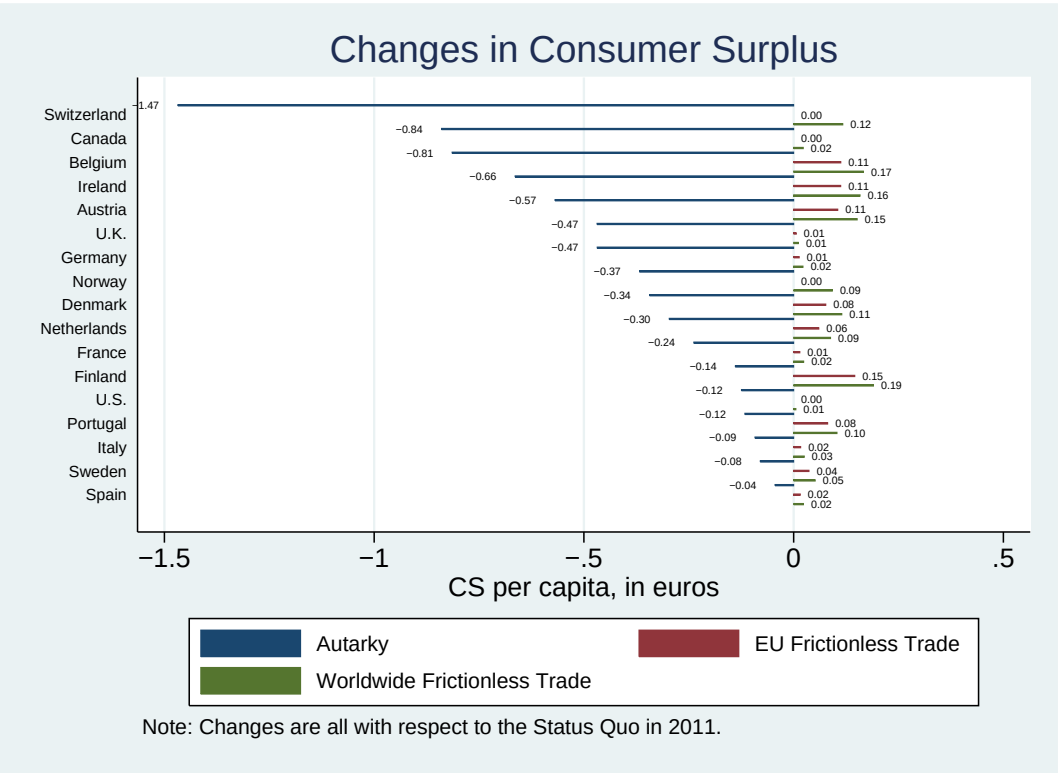


Figure 4: Population and number of songs available, 2011.



Note: Changes are all with respect to the Status Quo in 2011.

Figure 5: Changes in Consumer Surplus following autarky and trade liberalization.

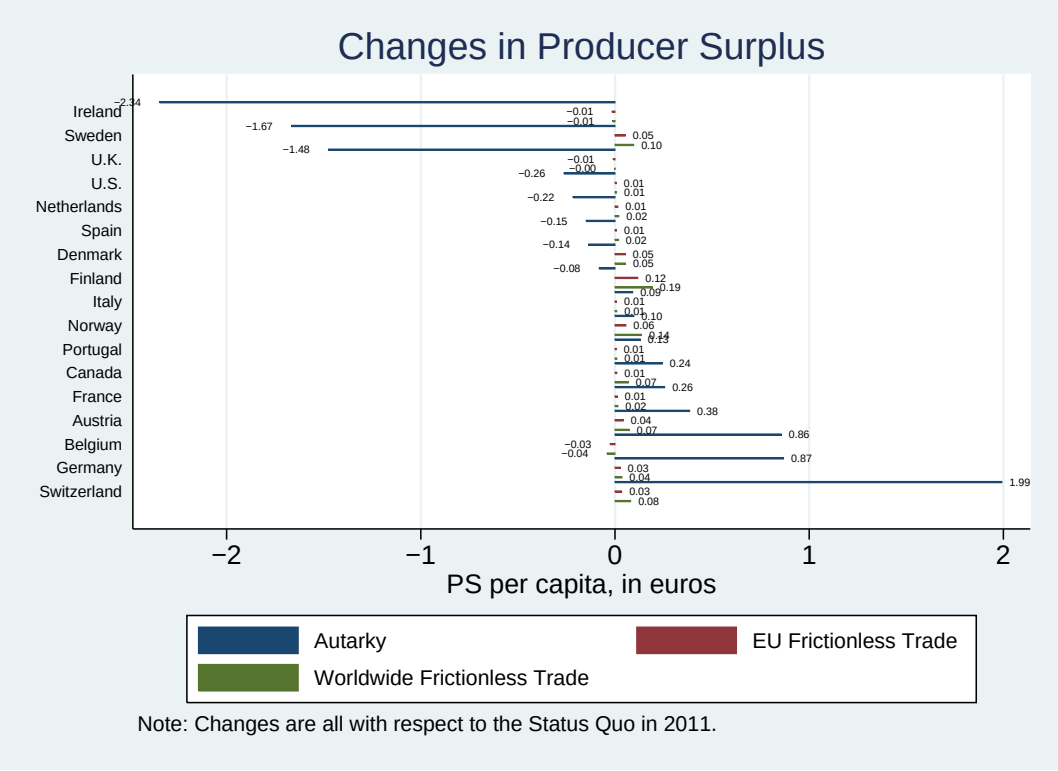


Figure 6: Changes in Producer Surplus following autarky and trade liberalization.

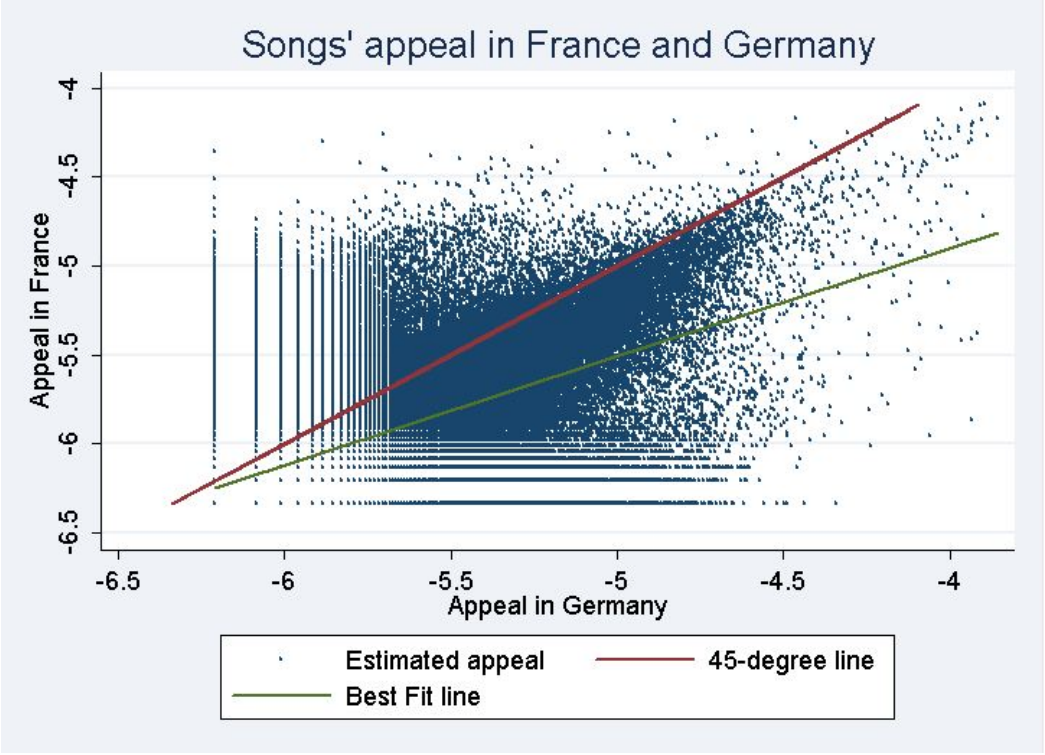


Figure 7: Cross-country relationship between songs' appeal: France vs Germany.

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%	1.37
USA	311,591,917	1,841.7	2,344.7	4186.3	56.01%	1.00
Austria	8,419,000	77.0	19.5	96.5	20.23%	2.77
Belgium	11,008,000	97.2	16.5	113.7	14.55%	3.85
Denmark	5,574,000	48.8	30.3	79.1	38.28%	1.46
Finland	5,387,000	44.7	10.8	55.5	19.47%	2.88
France	65,436,552	653.1	186.7	839.7	22.23%	2.52
Germany	81,726,000	1,057.1	208.1	1265.1	16.45%	3.41
Ireland	4,487,000	32.2	16.2	48.4	33.52%	1.67
Italy	60,770,000	152.0	44.1	196.1	22.47%	2.49
Netherlands	16,696,000	158.2	35.5	193.6	18.32%	3.06
Norway	4,952,000	47.0	49.8	96.8	51.41%	1.09
Poland	38,216,000	64.0	4.0	68.0	5.81%	9.64
Portugal	10,637,000	25.0	4.7	29.8	15.92%	3.52
Spain	46,235,000	97.8	42.6	140.4	30.35%	1.85
Sweden	9,453,000	66.4	65.9	132.2	49.80%	1.12
Switzerland	7,907,000	108.3	33.4	141.7	23.59%	2.37
UK	62,641,000	815.5	447.8	1263.3	35.45%	1.58

[†] 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	1.46	0.89	1.62	1.57	0.57	63.6	0.15	10.4	0.11	7.2
	(0.00)	(0.29)	(0.09)	(0.06)	(0.29)	(50.31)	(0.09)	(6.27)	(0.06)	(4.30)
Belgium	2.45	1.64	2.62	2.56	0.81	49.8	0.17	6.8	0.11	4.6
	(0.00)	(0.42)	(0.10)	(0.07)	(0.42)	(36.85)	(0.10)	(4.05)	(0.07)	(2.71)
Canada	2.95	2.11	2.97	2.95	0.84	39.8	0.02	0.8	0.00	0.0
	(0.00)	(0.44)	(0.01)	(0.00)	(0.44)	(28.46)	(0.01)	(0.45)	(0.00)	(0.00)
Denmark	1.80	1.46	1.92	1.88	0.34	23.5	0.11	6.4	0.08	4.3
	(0.00)	(0.18)	(0.07)	(0.05)	(0.18)	(15.34)	(0.07)	(3.78)	(0.05)	(2.51)
Finland	0.66	0.52	0.85	0.81	0.14	26.5	0.19	28.7	0.15	22.0
	(0.00)	(0.07)	(0.13)	(0.09)	(0.07)	(17.43)	(0.13)	(18.88)	(0.09)	(14.05)
France	1.18	0.94	1.20	1.20	0.24	25.2	0.02	2.0	0.01	1.3
	(0.00)	(0.13)	(0.01)	(0.01)	(0.13)	(16.53)	(0.01)	(1.19)	(0.01)	(0.73)
Germany	1.93	1.47	1.96	1.95	0.47	31.9	0.02	1.2	0.01	0.7
	(0.00)	(0.25)	(0.01)	(0.01)	(0.25)	(21.63)	(0.01)	(0.67)	(0.01)	(0.40)
Ireland	1.78	1.11	1.94	1.89	0.66	59.6	0.16	8.9	0.11	6.3
	(0.00)	(0.34)	(0.09)	(0.07)	(0.34)	(46.56)	(0.09)	(5.33)	(0.07)	(3.75)
Italy	0.52	0.43	0.55	0.54	0.09	21.4	0.03	4.8	0.02	3.2
	(0.00)	(0.05)	(0.02)	(0.01)	(0.05)	(13.72)	(0.02)	(2.87)	(0.01)	(1.89)
Netherlands	1.05	0.75	1.14	1.11	0.30	39.3	0.09	8.4	0.06	5.7
	(0.00)	(0.15)	(0.05)	(0.04)	(0.15)	(27.58)	(0.05)	(5.04)	(0.04)	(3.40)
Norway	1.25	0.88	1.34	1.25	0.37	41.6	0.09	7.4	0.00	0.0
	(0.00)	(0.19)	(0.05)	(0.00)	(0.19)	(29.76)	(0.05)	(4.40)	(0.00)	(0.00)
Portugal	0.30	0.19	0.40	0.38	0.12	62.9	0.10	34.3	0.08	26.9
	(0.00)	(0.06)	(0.07)	(0.05)	(0.06)	(49.29)	(0.07)	(23.31)	(0.05)	(17.68)
Spain	0.20	0.16	0.23	0.22	0.04	28.0	0.02	11.5	0.02	7.8
	(0.00)	(0.02)	(0.01)	(0.01)	(0.02)	(18.52)	(0.01)	(7.02)	(0.01)	(4.68)
Sweden	0.35	0.28	0.41	0.39	0.08	28.9	0.05	14.5	0.04	10.3
	(0.00)	(0.04)	(0.03)	(0.02)	(0.04)	(19.25)	(0.03)	(8.95)	(0.02)	(6.26)
Switzerland	3.71	2.24	3.82	3.71	1.47	65.6	0.12	3.2	-0.00	-0.0
	(0.00)	(0.74)	(0.07)	(0.00)	(0.74)	(53.26)	(0.07)	(1.85)	(0.00)	(0.00)
U.K.	3.08	2.61	3.09	3.09	0.47	17.9	0.01	0.4	0.01	0.2
	(0.00)	(0.26)	(0.01)	(0.00)	(0.26)	(11.40)	(0.01)	(0.21)	(0.00)	(0.12)
U.S.	3.04	2.91	3.04	3.04	0.12	4.3	0.01	0.2	0.00	0.0
	(0.00)	(0.07)	(0.00)	(0.00)	(0.07)	(2.54)	(0.00)	(0.10)	(0.00)	(0.00)

[†] 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 Surplus[†]

Country	SQ	AUT	FT	ESM	ΔAUT	ΔAUT(%)	ΔFT	ΔFT(%)	ΔESM	ΔESM(%)
Austria	0.54	0.92	0.61	0.58	-0.38	-41.6	0.07	13.5	0.04	7.8
	(0.01)	(0.29)	(0.03)	(0.02)	(0.30)	(18.09)	(0.01)	(2.11)	(0.01)	(1.44)
Belgium	0.84	1.70	0.80	0.82	-0.86	-50.4	-0.04	-4.8	-0.03	-3.0
	(0.02)	(0.42)	(0.04)	(0.03)	(0.43)	(12.36)	(0.01)	(1.75)	(0.01)	(1.29)
Canada	2.20	2.44	2.27	2.21	-0.24	-10.0	0.07	3.1	0.01	0.4
	(0.03)	(0.46)	(0.05)	(0.04)	(0.46)	(17.02)	(0.01)	(0.61)	(0.00)	(0.22)
Denmark	1.70	1.56	1.75	1.75	0.14	8.7	0.05	3.1	0.05	3.1
	(0.04)	(0.19)	(0.07)	(0.06)	(0.20)	(13.67)	(0.03)	(1.92)	(0.02)	(1.42)
Finland	0.61	0.53	0.80	0.73	0.08	15.3	0.19	31.3	0.12	19.2
	(0.01)	(0.07)	(0.04)	(0.03)	(0.08)	(16.45)	(0.03)	(3.80)	(0.02)	(3.16)
France	0.71	0.97	0.73	0.72	-0.26	-26.5	0.02	2.1	0.01	1.7
	(0.02)	(0.13)	(0.03)	(0.02)	(0.13)	(10.13)	(0.01)	(1.39)	(0.01)	(0.93)
Germany	0.64	1.51	0.68	0.67	-0.87	-57.4	0.04	5.6	0.03	4.2
	(0.02)	(0.25)	(0.02)	(0.02)	(0.26)	(7.19)	(0.01)	(1.24)	(0.01)	(0.84)
Ireland	3.54	1.19	3.53	3.52	2.34	196.6	-0.01	-0.3	-0.01	-0.4
	(0.06)	(0.34)	(0.09)	(0.08)	(0.35)	(84.56)	(0.03)	(0.73)	(0.01)	(0.43)
Italy	0.35	0.44	0.35	0.35	-0.09	-20.8	0.01	2.6	0.01	2.3
	(0.01)	(0.05)	(0.02)	(0.01)	(0.05)	(9.54)	(0.01)	(2.09)	(0.01)	(1.49)
Netherlands	0.98	0.77	1.00	1.00	0.22	28.1	0.02	2.0	0.01	1.5
	(0.02)	(0.15)	(0.03)	(0.03)	(0.16)	(25.66)	(0.02)	(1.54)	(0.01)	(1.07)
Norway	0.85	0.94	0.98	0.90	-0.10	-10.3	0.14	16.1	0.06	6.6
	(0.02)	(0.19)	(0.04)	(0.03)	(0.20)	(18.73)	(0.02)	(2.23)	(0.01)	(0.82)
Portugal	0.06	0.19	0.07	0.06	-0.13	-69.9	0.01	17.1	0.01	9.4
	(0.00)	(0.06)	(0.00)	(0.00)	(0.06)	(9.68)	(0.00)	(0.67)	(0.00)	(0.63)
Spain	0.31	0.16	0.32	0.32	0.15	92.8	0.02	5.6	0.01	2.4
	(0.01)	(0.02)	(0.01)	(0.01)	(0.03)	(29.71)	(0.00)	(1.30)	(0.00)	(0.90)
Sweden	0.29	0.07	0.31	0.30	0.13	170.2	0.04	2.2	0.03	1.4
	(0.04)	(0.04)	(0.06)	(0.05)	(0.05)	(105.61)	(0.03)	(1.35)	(0.02)	(0.87)
Switzerland	0.50	2.49	0.58	0.53	-1.99	-80.0	0.08	16.2	0.03	6.9
	(0.01)	(0.76)	(0.02)	(0.01)	(0.76)	(6.21)	(0.01)	(2.46)	(0.00)	(0.79)
U.K.	4.41	2.93	4.41	4.40	1.48	50.3	-0.00	-0.0	-0.01	-0.2
	(0.08)	(0.26)	(0.11)	(0.09)	(0.28)	(13.78)	(0.03)	(0.71)	(0.02)	(0.40)
U.S.	3.80	3.54	3.81	3.81	0.26	7.4	0.01	0.2	0.01	0.2
	(0.06)	(0.07)	(0.08)	(0.07)	(0.13)	(3.82)	(0.02)	(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 PS of going from autarky to the Status quo. ΔFT and ΔESM indicate the change in PS 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 and Producer Surplus: 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	198,375,136	0.265	19,093,824	0.026	10,269,297	0.014	80,200,216	0.107	14,123,622	0.019	7,625,446	0.010
	(106,160,923)	(0.142)	(11,483,385)	(0.015)	(6,164,590)	(0.008)	(137,757,068)	(0.184)	(11,413,427)	(0.015)	(5,775,718)	(0.008)
Europe	130,634,384	0.326	16,634,251	0.041	10,269,297	0.026	6,872,256	0.017	9,339,038	0.023	5,513,615	0.014
	(68,941,207)	(0.172)	(10,054,961)	(0.025)	(6,164,590)	(0.015)	(79,665,945)	(0.199)	(5,469,951)	(0.014)	(3,368,054)	(0.008
North America	67,740,760	0.196	2,459,572	0.007	-	-	73,327,960	0.212	4,784,584	0.014	2,111,831	0.006
	(37,219,715)	(0.108)	(1,428,424)	(0.004)	-	-	(58,091,123)	(0.168)	(5,943,476)	(0.017)	(2,407,664)	(0.007)

† All figures are in €. The Total columns present absolute numbers while p.cap. columns present figures in per capita terms. SQ, AUT, FT and ESM indicate Status Quo, worldwide Frictionless Trade and European Single Market regimes, respectively. Standard errors are in parentheses and computed via bootstrapping as described in the text.