Preference Externalities and the Rise of China: Measuring their Impact on Consumers and Producers in Global Film Markets

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October 27, 2016

Abstract

The preference composition of world movie audiences has changed rapidly over the past few years. China reached half the US total movie revenues in 2014, a tenfold increase since 2008, even as China continued restricting imports. This paper investigates the differential impact of the rise of China on world movie consumers and producers. Using data on box office revenue in 52 countries, along with information on movies' national origins, we first show that, in general, consumers disproportionately prefer domestic as well as US-origin movies. We then develop a structural framework consisting of a flexible nested logit demand model, along with a supply model relating movie production budgets to the appeal of movies to consumers. We characterize equilibrium via a country-level Nash equilibrium in investment. We use the model to investigate two counterfactuals. First, relative to autarky, current movie trade patterns raise revenue of US producers while reducing revenue of other countries, and trade benefits consumers everywhere. Because US consumers import little, the benefit they experience from trade operate through investment. Second, additional Chinese liberalization would raise consumer surplus in both China and, because of increased investment in some countries, elsewhere as well. But preference externalities would lead to a differential effect on firm investments and movie revenues: the US, other Anglophone countries and Asia would invest more, causing the movie industry in Europe to generate less revenue due to the higher quality competition arising from the other locations.

We are grateful to Imke Reimers and Kailin Clarke for excellent research assistance on an earlier version of this paper. All errors are our own.

I. Introduction

In differentiated product markets with high fixed costs, the satisfaction that heterogeneous consumers obtain depends on the number of others sharing their preferences. Larger groups tend to face more, and more appealing, product options; but additional consumers bring forth additional appealing options only to the extent that they share similar preferences. In short, consumers generate "preference externalities" for each other.[1] The motion picture market provides an important context for exploring this phenomenon. First, fixed costs are high: major US producers spend an average of over $100 million per movie.[2] Second, preferences differ substantially among different groups of consumers, for example the movie audiences of different countries.

With the rapid growth of the Chinese economy, the preference composition of world movie audiences is changing substantially. Between 1990 and 2013 China grew from 1.6 to 12 percent of the world's economy, and Chinese movie spending has risen sharply. Between 2008 and 2014, total Chinese box office revenue grew tenfold from $0.5 billion to $4.7 billion, reaching almost half of the 2014 US total of $10.4 billion.[3] Notwithstanding this rapid growth, China's impact on world markets has been muted by a restriction of imports to 34 foreign titles per year, which many observers expect to be relaxed by 2017.[4] UNESCO (2013) predicts that Chinese box office revenue will overtake US revenue by 2020.

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[1] This mechanism has been documented in a various markets, including broadcasting, newspapers, and restaurants. Waldfogel (2003, 2008) documents this mechanism by race for radio broadcasting and restaurants, respectively. George and Waldfogel (2003) presents related evidence for daily newspaper markets.

[2] See Richard Verrier. "MPAA stops disclosing average costs of making and marketing movies." *Los Angeles Times*, April 1, 2009 (http://articles.latimes.com/2009/apr/01/business/fi-cotown-mpaa1), which cites a cost $106.6 million for MPPA member-produced movies in 2007.

[3] http://www.statista.com/statistics/279111/number-of-cinema-screens-in-china/

[4] Clifford Coonan. China Film Import Quota Will Open Up in 2017, Says Top Local Producer. Hollywood Reporter. April 16, 2014. http://www.hollywoodreporter.com/news/china-film-import-quota-increase-696708.

Growing Chinese demand can affect the world movie market in a variety of ways. First, rising expenditure in China directly generates increased revenue for producers of films sold in China. Second, the prospect of greater Chinese revenue can prompt greater investment by producers targeting China. This, in turn, has two indirect effects. First, consumers sharing the preferences of Chinese audiences will face more appealing product choices. Second, producers of repertoires favored less by Chinese consumers will face heightened competition from the producers whose fare appeals to Chinese consumers, with potentially disparate impacts on producers and consumers around the world. This paper explores the impact of China's growth and the consequent change in world movie preference composition on the welfare of consumers and producers of films.

The idea that foreign consumers can affect the welfare of domestic consumers in movie markets raises a series of questions. First, how do preferences vary across countries? For example, how similar are Chinese film preferences to those of US and European audiences? Chinese import restrictions prevent us from inferring Chinese consumers' product preferences from their consumption decisions, but we can examine product choices in Sinophone markets resembling Mainland China but without import restrictions. Second, how do the export appeals of various repertoires vary across origin countries? Simple descriptive answers to these questions may suggest how the growth of China and the relaxation of its import restrictions, would affect consumers and producers in various countries.

We begin by collecting data on the box office revenue and national origins of 19,900 movies in 52 countries, 2002-2014, for a total of 81,914 movie-country observations. We have production budget data on 7,104 of these movies, which account for 68,025 movie-country observations. We see that consumers tend to favor products from their home countries, as well

as US-origin fare. In order to understand the interactions between the rise of China and the welfare of market participants around the world we develop a rich demand model to estimate the gains that consumers and producers in each country derive from foreign audiences. Estimates of the demand model allow us to characterize the consumer surplus in each destination country, as well as the revenue for each origin country, for any set of available products. Thus, we can use the demand model alone to calculate the magnitudes of the cross-country preference externalities, i.e. the benefit that consumers in one country derive from access to products from another country, or all other countries.

However, these exercises undertaken with only the demand model have the limitation that they do not allow for endogenous investment response. For example, without the availability of foreign markets, producers of heavily exported repertoires would earn less revenue and would presumably invest less. Hence, to understand the impact of counterfactuals such as the growth and opening of China (or autarky), it is desirable to employ an equilibrium model that allows for an investment response to changed policies. Accordingly, the last part of the paper combines the rich country-specific demand model with a supply-side investment model, in which the level of investment in movies determines their appeal to consumers. We characterize investment via a Nash equilibrium in origin-country investment levels. We use this model to evaluate the equilibrium effects of trade as well as the growth of China along with the relaxation of its import restrictions. We then compare demand-only and equilibrium results.

We find that consumers in both Europe and Asia have strong preferences for US movies as well as, for the most part, strong home bias. US consumers, by contrast, are interested largely in domestic movies. Hence – and especially outside the US – access to existing foreign products benefits consumers. Selling existing products abroad delivers substantial revenues to US

producers while diverting revenue from the existing products of most other world producers. Given Chinese consumers' preferences for imported movies, relaxing Chinese import restrictions, along with China's continued rapid growth would stimulate demand for movies from various producing countries which, in turn would stimulate higher equilibrium movie investment, both in China itself as well as the US, the UK, Japan, and South Korea. Consumers everywhere would gain, with the largest gains in China, South Korea, the US, Australia, and UK. Revenue would rise for most producers, except those in continental Europe, whose revenues fall due to competition from the higher investments, and higher-quality movies, in other countries.

The paper proceeds in six major sections after the introduction. Section 2 describes the data and documents basic trade patterns, offering suggestive evidence about the effects of trade and the growth of China on world consumers and producers. Section 3 presents an explicit empirical model of movie demand. The demand model is a 2-level nested logit, in which the consumers of each country decide which genre and which movie to consume. Section 4 presents estimates of the demand and production relationships. In section 5 we use the estimated demand model for our two basic counterfactuals: to measure the benefit that consumers and producers in each country experience from trading with other countries, and to assess the impact of the growth and opening of China. Section 6 introduces the supply side and presents our equilibrium model of investment. First, we present an empirical model of the production of quality, and we document that movies with greater investment are more appealing to consumers and that the relationship between investment and appeal varies across origin countries. Second, we. Section 7 combines demand and supply models to calculate our baseline equilibrium. We then calculate equilibrium counterfactuals, the benefits of trade and the effect of China's growth with endogenous investment. A brief conclusion follows.

II. Data and Descriptive Analysis

a. Data

The basic data for this study are the yearly US dollar box office revenues of 19,900 movies in 52 distinct countries between 2002 and 2014, for a total of 81,914 movie-country-year observations. The data are collected from Box Office Mojo and cover movies released into theaters. Coverage of some countries is better than others. Box Office Mojo has annual data on China for only 2007-2009, then 2013-2014, of the years in our sample. We have at least ten years of data on 22 countries that account for the vast majority of ticket sales.[5]

We obtain an origin country for each sample movie from the Internet Movie Database (IMDb). We use the first listed production country in the case of movies with cross-border co-producers. We have movies from 124 different origin countries. In 2013 the top 10 origin countries account for 93 percent of revenue: the United States (72.4 percent), China (5.1), Japan (3.3), France (2.8), the United Kingdom (2.8), South Korea (2.4), Germany (2.0), Australia (1.1), Russia (0.8), and Italy (0.8).

In addition, we observe ticket prices by country and year, as well as overall film investment by origin country, from Screen Digest.[6] We also observe per-capita income and population from the Penn World Tables. We observe movie-level budget data for 7,104 major releases (which we match with movies for 68,025 movie-country observations), from IMDb,

[5] These are Argentina, Australia, Bulgaria, Czech Republic, Egypt, Finland, France, Germany, Greece, Hong Kong, Italy, Japan, Mexico, Netherlands, New Zealand, Norway, Poland, Russia, Spain, Thailand, United Kingdom, United States.

[6] Our Screen Digest ticket price data end in 2010. For the following years, we rely on data from three different sources: UNESCO, the French National Center of Cinematography and the moving image (CNC), and the LUMIERE database of the European Audiovisual Observatory.

which reports estimates of production budgets for major films. We also obtain data on genre from IMDb. IMDb classifies movies into 37 distinct genre designations and reports multiple genres for many movies. We aggregate their genres to nine broad categories (action, adventure, animation, biography, comedy, crime, documentary, drama, horror) and other, and we use only the first listed IMDb genre. We choose the year 2013 for our analysis because we have box office data on major countries of interest as well as information on aggregate film investment and ticket prices.

To obtain estimates of the share of population consuming each product in each year we do two things. First, we translate box office revenue into quantity sold using the nominal ticket price. We then create the share of the market consuming by dividing the quantity by the size of the market, which we implement as 12*population, as if members of the population made a monthly decision of whether to attend a movie at a theater.

b. Who Buys from Whom?

Table 1 shows the share of box office revenue in each major destination earned by movies from the major origin countries in 2013. This table, while simple, contains a substantial amount of suggestive evidence on who benefits whom in movie markets. Two striking facts emerge immediately. First, own-country shares – on the main diagonal – are substantial in almost all countries, reflecting "home bias." Second, the origin share for the United States is large in most destination markets. If we think of destination markets as having access to most of the same movies – which is largely true in value terms – then the data on consumption shares attributable to different origin markets reveals information about preferences for different origin

repertoires. The elevated home and US shares thus indicate that much of the satisfaction accruing to consumers around the world comes from domestic and US-origin products.

The Chinese share of US-origin consumption, at 36.6 percent, is low, and while that indicates a modest degree of benefit that Chinese consumers derive from US products, it is important to note that China limits annual imports to 34 films, so their US share may reflect this constraint rather than their preferences. The columns for Hong Kong and Singapore, countries resembling China but without import restrictions ("China surrogates"), show much higher US shares, 63 and 78 percent, respectively, suggesting that Chinese consumers would consume more US movies absent Chinese import restrictions. Finally, the only large entry in the US column is the home share, indicating that US consumers derive most of their benefit from domestic products.

Even without further analyses, Table 1 provides strong suggestions on the answers to our two basic questions, who benefits whom and how would China's growth and opening affect the world market? First, US audiences consume domestic fare almost exclusively, indicating that the main benefit of trade to US consumers operates through the investment made possible by sales to foreign audiences. Second, consumers of many countries share a taste for US movies, indicating that consumers benefit each other by helping to bring forth the US repertoire with substantial general appeal. Third, the large US market shares in the China suggest that the opening and growth of China would deliver a large audience with a substantial appetite for US fare. This would directly raise US revenue and, if the additional revenue elicited more investment, could bring about additional benefits for world consumers and challenges for other countries' producers. By contrast, the small European repertoire shares in Hong Kong and

Singapore (around 5 percent) suggest that Chinese liberalization would have small direct effects on European revenue and investment.

Data on trade patterns tell a suggestive story about which audiences benefit which others in the market for motion pictures. We can develop explicit estimates of via a structural model below, beginning with estimates derived from a demand model alone.

III. Demand Model

This section outlines our model of demand. The choice sets of movies vary both across countries and over time, and not all movies produced each year are available in all countries. Defining J_c as the set of movies available in country c (with *C* total countries), we index movies by j (j=1,…,J_c, c=1,…C) and we suppress the time subscript. We assume that every consumer decides in each month whether to see one movie in the choice set J_c or to consume the outside good (not seeing a movie at a theater). 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:

$$u_{ij} = \beta_0 + \alpha p_c + \varphi y_c + \xi_{cj} + \epsilon_{ij} = \delta_{cj} + \epsilon_{ij},$$

where β_0 reflects taste for movie theater patronage, α is the marginal utility of income, p_c is the price of a movie ticket in country c, y_c is per capita income in country c, and φ measures how tastes for movies vary with income. ξ_{cj} is the unobserved (to the econometrician) quality of movie j from the perspective of country c consumers and can differ across countries for the same movie (so *Avatar* e.g can have different quality to US vs French consumers). ϵ_{ij} is a taste draw that is distributed Type I extreme value and is independent across both consumers and choices.

With outside good utility δ_{c0} normalized to 0 for all $j \in J_c$ the market shares are given by $s_{cj} = \frac{e^{\delta_{cj}}}{1+\sum_{l=1}^{J_c} e^{\delta_{cl}}}$. Inverting out δ_{cj} from observed market shares as in Berry (1994) yields

$$ln(s_{cj}) - ln(s_{c0}) = \delta_{cj} = \beta_0 + \alpha p_c + \varphi y_c + \xi_{cj}.$$

with δ_{cj} linear in the average country-level ticket price, per capita income, and ξ_{cj}.[7] Movie quality δ'_{cj} as measured by demand is then price-adjusted δ_{cj}:

$$\delta'_{cj} = \delta_{cj} - \alpha p_c = \beta_0 + \varphi y_c + \xi_{cj}.$$

In this model one might wish to instrument price because ξ_{cj} may be correlated with p_c.

A well-known drawback of the logit model is that it assumes that $(\epsilon_{i0,}\epsilon_{i1,} \dots, \epsilon_{iJ,})$ are independently drawn across the J_c+1 choices. Full independence of individual tastes precludes the possibility that consumers differ in their taste for watching movies at a theater. If consumers have heterogeneous tastes, then estimated demand elasticities and substitution patterns from the logit model will be biased, and this in turn will bias estimates of competitive response and of consumer and producer welfare (Berry et. al (1995), Petrin (2002), Goolsbee and Petrin (2004)).

One way to allow consumers to differ in their tastes is to put a random coefficient on the intercept of the utility function:

$$u_{ij} = \beta_{i0} + \alpha p_c + \varphi y_c + \xi_{cj} + \epsilon_{ij},$$

where β_{i0} represents a consumer-specific taste for movies relative to the outside good. In this setup strong (weak) taste for one movie implies strong (weak) taste for other movies.

[7] We observe country-specific market shares. This allows us to have the country-specific movie tastes for each product.

The nested logit model provides a computationally simple way to allow for this type of random coefficient.[8] Nested logit posits utility

$$u_{ij} = \delta_{cj} + \zeta_i + (1-\sigma)\epsilon_{ij}$$

where for consumer i ζ_i is common to all movies and has a distribution function that depends on σ such that if ϵ_{ij} is distributed extreme value, then [ζ_i + (1-σ) ϵ_{ij}] is also extreme value.[9] When σ=0, the model resolves to the simple logit and ζ_i - the consumer-specific systematic movie-taste component - plays no role in the choice decision. As σ approaches one, the role of the independent taste shocks $(\epsilon_{i0,}\epsilon_{i1,} \dots, \epsilon_{iJ,})$ is reduced to zero, implying consumer tastes – while different for any consumer i across movies – are perfectly correlated within consumer i across movies.

Intuitively, identification of σ is driven by how the total inside share of movies changes as the number of movies in the choice set varies. When σ is close to one, the total inside share will not vary much with the number of movies, as additional movies simply cannibalize other movies' shares.[10] At the opposite extreme, with σ=0, is the logit model, where some consumers of the outside good will always substitute to a new movie when it is added to the choice set.[11]

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[8] It does not require the use of simulation-to-integrate to estimate market shares for different posited parameter values.

[9] The formula for the market share of good j is $s_{cj} = \frac{e^{\delta_{cj}/1-\sigma}}{(D_{J_c}^{\sigma}+D_{J_c})}$, where $D_{J_c} = \sum_{l=0}^{J_c} e^{\delta_{cj}/1-\sigma}$.

[10] For any given set of product qualities σ determines how the total inside good share of movies changes as the number of products increases. Denoting the inside share as $s_I^J = \frac{\sum_{l=1}^{J} e^{\delta_l}}{1+\sum_{l=1}^{J} e^{\delta_l}}$ the change in the inside share that arises from adding a J+1th good with quality δ_{J+1} to the choice set is given by:

$$\Delta s_{Inside} = s_I^{J+1} - s_I^J = \frac{D_J^{\sigma} D_{J+1} - D_{J+1}^{\sigma} D_J}{(D_J^{\sigma}+D_J)(D_{J+1}^{\sigma}+D_{J+1})}.$$

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

[11] In the logit case $\Delta s_{Inside} = \frac{e^{\delta_{J+1}}}{D_J \, D_{J+1}}$ which is always positive.

This simplest version of the nested logit model has consumers choosing between the outside good (no movie consumption) and movies, then among particular movies. This model is estimated via the following equation:

$$ln(s_{jc}) - ln(s_0) = \beta_0 + \alpha p_c + \varphi y_c + \sigma ln(s_{jc} / (1\text{-}s_0)) + \xi_{cj},$$

where s_{jc} is the market share of movie j in country c and s_0 is the share choosing the outside good. In this setup $ln(s_{jc} / (1\text{-}s_0))$ is potentially endogenous and requires an instrument.

We can accommodate two levels of nests. First, consumers choose whether to consume a movie. Then, if they consume a movie, they decide which genre. Finally, within each genre, they decide which movie to consume. The estimating equation for the two-level nested logit splits the term $\sigma ln(s_{jc} / (1\text{-}s_0))$ into two separate terms: $\sigma_1 ln(s_{gc} / (1\text{-}s_0)) + \sigma_{2,g} ln(s_{jc}/ s_{gc})$, where s_{gc} is the sum of the product shares s_{jc} in genre g in country c. The estimating equation takes the form:

$$ln(s_{jc}) - ln(s_0) = \beta_0 + \alpha p_c + \varphi y_c + \sigma_1 ln(s_{gc} / (1\text{-}s_{c0})) + \sigma_2 ln(s_{jc}/ s_{gc}) + \xi_{cj}.$$

The coefficient σ_1 shows the substitution across genres, while the coefficient σ_2 shows the degree of substitution across movies within genres. Here, both $ln(s_{gc} / (1\text{-}s_{c0}))$ and $ln(s_{jc}/ s_{gc})$ are potentially endogenous and require instruments. Price-adjusted movie quality δ'_{cj} is now given as:

$$\delta'_{cj} = \delta_{cj} - \alpha p_c - \sigma_1 ln\left(\frac{s_{cg}}{1-s_{c0}}\right) - \sigma_2 ln(s_{cj}/s_{cg}) = \beta_0 + \varphi y_c + \xi_{cj}.$$

IV. Results

a. Demand

Table 2 reports estimates of the demand models. The first column reports the simple logit model, along with year dummies and origin x destination x genre fixed effects. Columns (2) and (3) move to the one-level nested logit and a common substitution parameter σ. Column (2) uses OLS, while (3) instruments the inside share using the log of the number of products in each market. This is a simple version of what in general are called "BLP instruments" (Berry, Levinsohn, Pakes, 1995), which are functions of the remaining products in the marketplace. The simplest version, used here, is the sum of the number of products in the market. In this specification we find a substitution parameter σ of 0.83 that is precisely estimated, indicating that products are substitutable for one another and that the plain logit is inappropriate.

Column (4) moves to a 2-level nested logit (2NL). The first level is whether to watch a movie (or to consume the outside good). The second level is which genre to watch. The corresponding independent variables in are the log of the genre's share of movie consumption ($ln(s_g/(1-s_0))$) and the log of movie j's share of the genre $ln(s_j/s_g)$. The coefficient on $ln(s_g/(1-s_0))$ is 0.74, while the coefficient on $ln(s_j/s_g)$ is 0.83, indicating that movies within a genre are closer substitutes than movies across genres. Here, we instrumented with terms involving the log of the number of available products by genre. As Verboven (1996) notes, logical consistency requires greater substitutability within genre nests than across them, or that $\sigma_2 > \sigma_1$, which is satisfied here. While the substitution parameters are close, we reject the hypothesis that the two coefficients are equal (p-val=0.034), indicating that we reject the one-level nested logit model.

As shown in section II, estimates of the coefficient on price along with the σ coefficients are sufficient to calculate the quality δ' of each movie in each market. We use the demand estimates in column (4) for our counterfactuals.[12]

V. Demand-Only Estimates

a. Who Benefits Whom?

Our explicit demand model allows us to derive measures of the consumer surplus for each country's consumers – and the revenue generated by each origin's set of products – with any products in the choice set. Using the model we derive direct measures of the preference externalities, the extent to which consumers in each country benefit from foreign products. In short, these measures indicate "who benefits whom" in the global motion picture market.

First, we derive the cross-audience effect by calculating the consumer surplus for a destination country's audience with and without the products from a particular origin country in the destination choice set. If we define CS_c^{sq} as the per capita consumer surplus for consumers in country *c* when facing the status quo choice set, and CS_c^{-o} as the analogous CS for country-*c* consumers without origin country *o*'s products, then $\Delta CS_c^{-o} = \left(CS_c^{sq} - CS_c^{-o}\right)$ is the addition to country *c*'s CS when origin *o*'s products are restored to the status quo choice set. Said another way, this is the additional benefit that country *c*'s consumers derive from country *o*.

[12] We also calculated the demand-only exercises below using the one-level nested logit model of column 3, with very similar results. This is perhaps not surprising given that our column 4 estimate of σ_2 is close to our estimate of σ_1.

Origin countries differ in size, so to make the cross-country effects comparable, we normalize by origin-country population: $\Delta CS_c^{-o}/pop_o$. This shows the average benefit that a country-*c* consumer experiences from an additional country-*o* consumer's presence in the global audience. We choose units to ease this comparison. We calculate the measure as the additional per capita consumer surplus in the destination country with a one-billion person increase in the origin-country population. Table 3 presents these cross-country estimates. For example, the chart labelled "Australia" shows the impact of Australian consumers on consumers in other countries.

Who benefits whom in global movie markets? The basic answer is that members of domestic audiences benefit each other: most origin countries' figures contain a single spike for the home market. These vary between $0.40 for China and $119 for South Korea, with half between $8 and $30. With some notable exceptions, cross-country effects are small, indicating a lack of cross-audience effects. The strong within-group effect, and zero cross-group effects, recall the relationship between blacks and whites – and between Hispanics and non-Hispanics – in US media markets (Waldfogel, 2003). But not all cross-country effects are zero. The effect of US products on the CS of other countries' consumers average $14 per billion US population. Analogous figures for the UK and France and the UK are $2.6 and $2.1 respectively. The largest beneficiaries of the US audience include Australia and the UK. Smallest beneficiaries include Japan and China (which, again, restricts imports).

b. Demand-Only Counterfactuals

Our main counterfactual exercises involve lifting Chinese import restrictions along with growth in Chinese film expenditure. We also use the model to quantify the benefit of imported products on each country. Here, we simulate impacts of these changes without endogenous investment, in part as a precursor to the full equilibrium modeling. This allows us to see what part of the equilibrium results depend on the supply side responses.

i. The Effect of External Audiences on CS and Revenue

The effect of foreign audiences – and associated products – provides a second "who benefits whom" exercise that asks how the additional audiences external to each country affect the consumer surplus of each country. If we define CS_c^c as the per capita consumer surplus in country *c* when only domestic products are in the choice set (autarky), then the full effect of external audiences is $\Delta CS_c^c = \left(CS_c^{sq} - CS_c^c\right)$. The first column of Table 4 reports these estimates. Australia and the UK experience the largest per capita CS losses from eliminating foreign audiences, about $17 and $9, respectively. France and Spain experience losses around $6. The audiences who experience the smallest benefits from foreign products are the US, Japan, and China (reflecting their restricted imports as opposed to their differing preferences).

We can also use the demand model to calculate the impact of foreign products on each country's producers. That is, we compare status quo revenue to each producing country's revenue if it – and all other producers – only sold their products domestically. We divide revenue by producing-country population for comparability, so the changes in revenue are in per capita terms for origin countries. As the second column of Table 4 shows, relative to autarky, trade reduces revenue for all origin countries except the US. Trade raises US revenue by $31 per capita.

ii. An Open and Growing China

We would like to know how worldwide film demand and production would change if China relaxed its restriction on imports. To answer this question we would ideally observe consumption choices made by Chinese consumers when facing an unconstrained choice set. Answering this question requires information on the sorts of movies, by national origin, that Chinese consumers would patronize, if their choice set were relaxed. Our efforts at this are handicapped by the fact that so few movies are imported into China.

Although we lack direct measures of the appeal of untraded movies in China, we can get some highly relevant information from the consumption choices in countries that strongly resemble China but which do not restrict imports. Three examples are Hong Kong, Taiwan, and Singapore. We have box office data for two of these countries, Hong Kong and Singapore, for 2013. Hong Kong has been – and is again since 1997 – part of China. Singapore is three quarters Chinese, and Mandarin is its most commonly spoken language.[13]

The import restrictions affect availability. Our data for 2013 show a total of 164 movies in China, of which 48 were from the US, according to the first listed origin. While this exceeds the number of allowable imports, some of these movies are Chinese co-productions which do not count as imports. By contrast, our 2013 data show 288 movies in Hong Kong and 310 in Singapore. Of these, 123 and 154, respectively are from the US.

Simulating the effects of a wider choice set of foreign films in China requires estimates of the movies' quality in China. We create these estimates as follows. Define δ_j^{ch} as the quality of movie j in China and δ_j^{hk} as its quality in Hong Kong. For movies available in both countries,

[13] See https://www.cia.gov/library/publications/the-world-factbook/geos/hk.html and https://www.cia.gov/library/publications/the-world-factbook/geos/sn.html.

we can regress δ_j^{ch} on δ_j^{hk} as well as a dummy for whether the movie appears in the other Sinophone country. We can then use the regression to forecast δ_j^{ch} for the movies that appear in Hong Kong but not in China. We can run the analogous regression for Singapore. Then for the movies appearing the at least one of the other Sinophone countries, we have one or more estimates of its quality in China. We average these estimates for each movie not in China to arrive at a prediction of its quality in China.[14]

Table 5 reports this regression evidence. Column (1) reports a regression of the quality in China on the quality in Hong Kong, along with year dummies and a dummy for whether the movie was also available in Singapore. Column (2) reports an analogous regression replacing Hong Kong with Singapore. In both regressions, quality is highly related across Sinophone countries, and the R-squared is 0.82. The last column reports a regression of quality in China on predicted quality (based on the average predicted value from the other two regressions). Not surprisingly the coefficient on predicted quality is unity, and other coefficients are statistically zero.

We model the relaxation of China's import restriction by adding the movies available in the other Sinophone countries to China's choice set with the China-specific qualities predicted above. In Table 4's demand-only estimates, the simulation labelled "China x 1" opens China to imports but does not increase China's market size. Opening China affects only Chinese consumers, whose CS rises by $0.52 per capita, while leaving choice sets for other countries' consumers unchanged. Chinese producers' revenue falls as they face more foreign competition

[14] Aguiar and Waldfogel (2014) use a similar approach to develop estimates of the quality of untraded recorded music products.

in their home market. Revenue also falls for France (and slightly for Australia), while revenue to all other repertoires rises, with the largest increase for the US ($1.48 per capita).

When China both eliminates its import restrictions and doubles its movie expenditure ("China x 2"), the per capita impact on Chinese consumers is the same as in the previous case. With a doubling of Chinese expenditure (which we model as a doubling of Chinese market size through population), all producers outside China now gain, and the gains are larger. The US gains $6.60 per US population, while the UK gains $3.16 per UK population, and the Japanese gain $2.78.

While the demand-only counterfactual simulations above are interesting, they neglect the potentially important possibility of investment responses to changed demand. This is well illustrated by the potential understatement of the demand-only gains that US consumers experience from the existence of foreign audiences. The demand-only estimates put the gain to US consumers at $0.57 per capita, presuming that the existing slate of US-origin movies would continue to be produced at their current quality levels even if foreign audiences did not exist. Yet, the status quo movies are created in part based on anticipated revenue from the foreign audiences who contribute roughly half of US revenue. If we added a supply side to the model so that the investment level in each country responded to demand, then movies available to US consumers without trade could contract. By extension, the demand-only estimates would then mis-state the growth in consumer surplus with the addition of foreign audiences. Addressing concerns along these lines requires an equilibrium model including a supply side, which we incorporate below.

VI. Model of Supply and Equilibrium.

Film producers have two possible margins of adjustment. They can make more movies, or they can spend more on the movies that they make. One way to model supply is through the entry of products. This would require a method for describing the nature of the additional products that entry would deliver. For example, one might assume that entry draws products from the historical distribution of product qualities.[15] Our model below makes the simplifying assumption that budgets are the only margin employed, an assumption that is consistent with our historical data. For example, in the United States, the total budgets of major MPAA releases has grown from $35 million to $100 million per film in constant 2005 dollars between 1980 and 2005, while the number of releases has been roughly stable, fluctuating around 200 major releases per year.

In order to perform equilibrium counterfactuals we need to incorporate a supply response and an equilibrium. In this section we introduce a simple empirical model of supply. We then develop a model in which each country chooses its level of investment to maximize its profit given other countries' investment levels. We compare the equilibrium results to those produced using only the demand model to clarify the role of the equilibrium model in our results below.

a. Supply model and estimate

Each year the movie industries of each country invest in slates of movies. We posit that the quality of the movies depends in part on the size of the production budgets. Using the estimated price-adjusted qualities from the demand system as the dependent variable, we recover

[15] Aguiar and Waldfogel (2013, 2014) develop a model endogenizing the number of songs produced to simulate counterfactual environments with more or less entry.

the production relationship by relating $\delta'_{cj}$to observed budgets and various fixed effects. For example we can estimate:

$$\delta'_{cj} = \gamma_o \log(b_j) + \mu_c + \mu_o + \mu_g + \mu_t + \epsilon_{cj}$$

Where b_j is the budget of movie j, γ_o is the return to budget investment for movies from origin o, and the fixed effects for destinations, origin countries, genre, and time are given as μ_c , μ_o, μ_g, *and* μ_t, respectively. We are interested in the effect of investment on quality. Yet, it is possible that movies from some origin countries – or in some genres – are more appealing to consumers, conditional on budget. To avoid confounding preferences for genres or origin country repertoires for investment effects, we include fixed effects for origins and genres. Similarly, destination country tastes for movies may be correlated with the budgets of movies appearing there. Inclusion of destination fixed effects avoids treating this possible correlation as a source of identification. Instead, in effect, we only use the variation in budgets across movies of the same origin, destination, and genre (in specifications below that include the origin x destination x genre fixed effects). That is, we include a fixed effect of for origin x destination x genre (μ_{cog}), as well as a separate fixed effect for years.

A key relationship in our model is the link between budgets and quality. We have country-specific measures of each movie's quality (δ') from the demand model, and we have budget data on 7,104 major releases (and 68,025 movie x destination observations). Figure 1 presents the relationship between quality and log budget, separately for four major origin markets with estimated δ', derived from the 2NL demand model. The relationships are positive, indicating that movies with higher production budgets tend to have higher perceived quality. The relationships are also potentially different, suggesting that flexibility might be desirable.

The first column of Table 6 reports an estimate of the regression on estimated quality on the movie's log budget, including year dummies as well as fixed effects for genre x origin x destination. The resulting estimate of γ is 0.136. In column (2) we allow γ to vary across 11 origin countries, and the estimates vary between 0.06 for Italian-origin movies to roughly 0.15 for movies from the US, the UK, Australia, and France. These estimates, in Figure 2, are statistically significantly different across origin markets.[16] We use these destination-specific estimates of γ from this flexible specification for the equilibrium simulations below.

We observe movie-specific revenue in each sample country but we observe movie-specific budgets only for a subset of films. We do observe aggregate annual country-level investment in movies, however. We adapt our implementation accordingly by modeling the decision making at the level of eleven groups of countries: Australia, China, France, Germany, Italy, Japan, South Korea, Spain, the UK, the US, and a composite rest-of-the-world.

Thus, we model δ'_{cj} as observed quality (δ'_{cj0}) plus the percent change in budget for that origin country ($\lambda_o \equiv log(B_j/B_{j0})$) times the common production function parameter linking investment to quality (γ). That is, $\delta'_{cj} = \delta'_{cj0} + \gamma_o \lambda_o$. The term δ'_{cj0} is the status quo quality of movie j in country c, The term γ_o is the estimated production function parameter for origin-country o. The term λ_o is the endogenous origin-specific percent change in investment in our counterfactuals.

b. Nash Equilibrium and Revenue Weights

[16] The F-test for the hypothesis that the eleven origin-specific production function parameters are equal is F(10, 45938) = 25.50 with a prob-value below 0.00001.

A film maker's payoff from making a movie j is the revenue the movie generates in each destination country market (r_j^c) , less the cost of the making the movie, its budget (b_j). Budget and revenue are related via the production function that maps investment into realized quality (δ'_{cj}). The revenue a movie earns also depends on the quality of the other movies in their country choice sets $\{\delta'_{c,-j}\}$. These other movies' qualities also depend on their budgets $\{ b_{-j}\}$.

Hence, the revenue to the producer of movie j is a function of his investment choice b_j , as quality depends on budget: $\delta'_{cj} = \delta'_{cj}(b_j)$. We can write the revenue to movie j in country c as $r_j^c(\delta'_{cj}; \{\delta'_{c,-j}\})$, where $\{\delta'_{c,-j}\}$ is the vector of qualities of the other movies in country c. Some countries subsidize movie production at rate s.[17] If movie j is subsidized at rate s_j, then the profit to the producer of j is thus:

$$\pi_j = \sum_c r_j^c(\delta_{cj}; \{\delta_{c,-j}\}) - (1 - s_j)b_j.$$

If we observed all movie revenue (from box office as well as other sources such as home video), then we could in principle find a Nash equilibrium in the budgets of all movies: b_j^*, $j=1,\ldots,J$.

We face two complications in our context. First, we observe only box office revenues, not total revenue (including such sources as home video and premium television).[18] Second, we do not observe budgets for all of the movies in our sample, nor could we solve for a movie-specific budget for thousands of movies. We address these problems with two simplifications. First, we assume that total revenue is proportional to box office revenue, with a factor of proportionality (W_o) to be estimated that is common across movies from a particular origin

[17] See Cambridge Econometrics (2004) for estimates of the share of European film investment financed by governments.
[18] Epstein (2010) provides evidence on the sources of movie revenue showing that box office revenue makes up roughly a third.

country *o*. Thus, $r^c_{j(o)} = W_o \rho^c_{j(o)}$, where ρ is box office revenue for movie j (which is from origin country *o*) in destination country *c*.

Second, we assume that budget adjustments are made proportionally at the origin-country level. Recall that the quality of movie *j* in destination country *c* is given by $\delta'_{cj} = \delta'_{cj0} + \gamma_c \lambda_o$, where λ_o is a factor of proportionality ($log(b_j/b_{j0})$) such that aggregate investment in movies from origin country *o* is $e^{\lambda o} B_o$, where B_o is aggregate investment in movies from country *o*. When λ_o =0, the budgets – and quality – of movies from origin *o* are at their status quo levels. Because the origin-specific vector of movies' status quo qualities is given, while the investment adjustments λ_o are endogenous, we can re-write revenue to movie j in country c as $\rho^c_j(\lambda_o; \lambda_{-o})$ rather than ρ^c_j (δ'_{cj}; $\{\delta'_{c,-j}\}$). With these simplifications we can find the baseline equilibrium of the model such that each origin country is choosing its budget adjustment to maximize its movie industry profit, given the choices of other countries; while others are doing the same. The profit for a country *o* is given by:

$$\pi_o = \sum_{j \in o} \sum_c W_o \rho^c_j(\lambda_o; \lambda_{-o}) - e^{\lambda_o}(1 - s_o) B_o.$$

The demand model, along with the production function delivers the box office revenue function in terms of the realized qualities of movies $\rho(.;.)$. The first task for solving the baseline is to find the weights W_o that scale box office revenue into total revenue. To do this, we set the budget adjustments (λ_o) to zero, reflecting the idea that the status quo is an equilibrium. We then find the weights such that the status quo is a Nash equilibrium, or that $\frac{\partial \pi_o(\lambda_o : \lambda_{-o})}{\partial \lambda_o}$=0 for all origin countries.

The intuition of our identification of the weights can be illustrated with a simplified version of the model. Suppose that a movie *j* is distributed in only one country. Then its profit is $\pi_j = W_j\rho_j(\lambda_j;\lambda_{-j}) - e^{\lambda_j}(1-s_j)B_j$; and $\frac{\partial \pi_j}{\partial \lambda_o} = W_j \frac{\partial \rho_j(\lambda_j;\lambda_{-j})}{\partial \lambda_j} - e^{\lambda_j}(1-s_j)B_j = 0$. Evaluating this at λ=0 (for all movies) gives

$$W_j = {(1-s_o)B_j} \Big/ \frac{\partial \rho_j(0;0)}{\partial \lambda_j}$$

That is, the weight is the ratio of the change in cost with an increase in λ_j to the change in revenue with an increase in λ_j. If we observed all revenue (and not just theatrical box office), then this ratio – marginal cost over marginal revenue – would equal one, reflecting profit maximization. To the extent that box office falls short of total revenue, the weights will exceed one.

It is helpful to explicitly describe how the counterfactuals change the producing countries' maximands. The baseline profits for a country o are given by:

$$\pi_o = \sum_{j\in o}\sum_c W_o\rho_j^c(\lambda_o;\lambda_{-o}) - e^{\lambda_o}(1-s_o)B_o \qquad (*)$$

Eliminating trade barriers in China means that a movie *j* from country *o* trades to China. So the set of countries where some additional origin movies become available is augmented to include China for those movies. Hence AUG_j is the set of countries in which movie j is available, plus China, if the movie was available in at least one of the Sinophone countries. Accordingly, equation (*) becomes

$$\pi_o = \sum_{j\in o}\sum_{c\in AUG} W_o\rho_j^c(\lambda_o;\lambda_{-o}) - e^{\lambda_o}(1-s_o)B_o.$$

Expansion of China's expenditure on movies is accomplished by raising China's market size. Note that the box office revenue function for a movie *j* in destination country *c* is the product of the product's share of population consuming, the price, and population. For example, to raise the size of China's market by a factor of two, we simply multiply its market size (population) by two.

Analyzing the effect of foreign audiences requires a counterfactual simulation without them. This scenario, also known as autarky, means that a movie from o is available only in o. Hence equation (*) becomes

$$\pi_o = \sum_{j \in o} W_o \rho_j^o(\lambda_o; \lambda_{-o}) - e^{\lambda_o}(1 - s_o)B_o.$$

Calculating equilibrium budget adjustments (λ) for the no-foreign audience (autarky) simulation is simplest; because other countries' movies are eliminated from every destination's choice sets, the solution involves only one country's investment level. The other simulations are slightly more complicated, as the profits to each country depend not only on their own budget adjustments (λ's) but also those of other countries. We solve the model by searching over λ's recursively. First, we find the best λ for one country, holding the others constant at the baseline (0). We then hold the first constant at its (temporary) best, while optimizing on a second. We do this for each country. We then start over for the first, and we continue until iterations yield no changes. We tried a variety of starting values and step sizes for the search to ensure that we found the same optimal values.

VII. Counterfactual Simulations with Supply Responses

a. Baseline Simulation

Before running the full-blown counterfactuals, we first calculate the origin weights W that translate box office revenue into studio proceeds. We estimate the following weights: Australia, 0.86; China, 0.22; France, 0.55; Germany, 1.56; Italy, 2.13; Japan, 2.03; South Korea, 0.38; Spain, 2.87; United Kingdom, 2.13; the United States, 1.43; and 1.94 for the rest-of-world. Although precise revenue data are hard to come by, it is clear that box office revenue falls short of total revenue. Hence, weights above unity would be reasonable.

b. Equilibrium Effect of Foreign Audiences

Table 7 repeats the exercises in Table 4, now with endogenous investment. This section discusses the equilibrium results, with emphasis on ways that endogenizing investment changes the results. For each simulation we report both the change in investment for each origin country (e^{λ} -1), as well as the changes in per capita CS and revenue relative to the status quo.

In the demand-only results, access to foreign products expanded choice sets everywhere and by construction raised CS in all countries, with the smallest increase in the US. With endogenous investment, autarky reduces investment substantially everywhere. Hence, trade raises investment and quality and gives rise to larger increases in CS in the equilibrium counterfactuals. The upper left panel of Figure 3 compares demand-only with equilibrium impacts of trade on per capita CS. The equilibrium estimates are uniformly larger. For most countries the equilibrium estimates are roughly a third larger. The US is different: trade raises US CS by $13 per capita rather than $0.5.

The upper left panel of Figure 4 compares the demand-only and equilibrium impacts of trade on per capita revenue in producing countries. Estimates are broadly similar across approaches, although the equilibrium gain is larger for the US, and the equilibrium losses are smaller in other countries.

c. Growth of the Chinese Market

In the demand-only model, opening China ("China x 1") raises Chinese CS and raises revenue elsewhere. With endogenous investment responses, some countries – the US, the UK, Australia, South Korea, and Japan - invest more with greater access to the Chinese market. This, in turn, raises the quality of their movies. Others, notably China but also continental Europe – reduce their investment, depressing their investment and the quality of their movies. Given the balance of effects, as Table 7 shows, CS rises everywhere. In the equilibrium simulations, opening China raises revenue in the countries that invest more.

The second and third panels of Figure 3 compare the demand-only and equilibrium impacts of relaxing China's import restrictions – and growth – on consumers. While by construction the demand-only approach affects only Chinese consumers, equilibrium simulations shows benefits to consumers in all countries. Revenue effects differ by origin country: revenue rises for the US, the UK, Australia, Japan, and South Korea. Revenue is unaffected or declines for the remaining, continental European, countries.

Opening China and doubling its effective market size ("China x 2") brings about an increase in Chinese movie investment, along with increased investment in the US, the UK, South Korea, Japan, and Australia. Consumer surplus rises everywhere, while revenue rises

substantially in the US the UK (by $5 per capita) and less in Japan and South Korea. Revenue falls by $2 per capita in France, by $0.32 in Australia and is flat in the remainder of continental Europe.

VIII. Conclusion

When fixed costs are substantial, the satisfaction that consumers derive from markets depends on the number of others sharing their preferences. As we have shown, preferences for movies vary substantially across the audiences in different countries. Most audiences enjoy US movies as well as, to varying extents, domestic products. Consequently, the consumers of different countries create different-sized preference externalities for the various audiences of different countries.

China has recently grown from a few percent to about a tenth of the world economy, and its economy and its movie spending are predicted by many to surpass the US by 2020. The impact of Chinese growth on consumers and producers depends on the similarity of Chinese movie preferences with those of other audiences. We develop a model of demand and supply in the world motion picture market, which we use to movie trade generally as well as Chinese growth and import liberalization in particular.

By drawing demand for consumers around the world, trade in movies directly benefits consumers everywhere, with the largest direct benefit arising from imports of foreign movies. Because US consumers watch mainly domestic fare, US consumers derive small direct benefits from trade, while consumers in countries that import derive large direct benefits from importing. Yet, these direct benefits understate the full equilibrium benefits of trade, since foreign sales

motivate investment. Our model allows quantification of the equilibrium benefit that consumers derive from trade and, by extension, from foreign consumers. Equilibrium benefits exceed direct benefits everywhere, and the difference is largest for US consumers who, while they import little, experience higher-investment movies as a result of trade.

Chinese liberalization provides a particular source of growth in the size of the market. Growth is not neutral, however; its effects on world consumers and producers depend on how Chinese preferences relate to those of various other country audiences. We provide evidence that Chinese consumers facing unrestricted import opportunities would substantially increase their spending on movies from Anglophone and Asian countries. Chinese import liberalization would thus directly raise revenue to producers outside of China. Our equilibrium model shows that Anglophone and Asian producers would raise their investment in response, benefiting consumers in audiences around the world but depressing demand – and revenue – for movies produced in continental Europe.

Motion pictures provide one of many possible examples of high fixed cost differentiated product markets whose participants may be affected by sharp growth in one group of consumers. With the rise of India, Brazil, and Russia – as well as China – shifts in the distribution of world consumer preferences may have effects on many markets, including automobiles, pharmaceuticals, and other consumer goods, along with cultural products. These strike us as fruitful topics of future research.

Some caveats are in order. Even though we allow movie quality to be endogenous and permit flexible substitution patterns across and within different movie genre, future work could make an extra data push in order to disentangle what aspects of a *película*, such as type of scenarios, dialogues, etc. contribute to overall quality. Moreover, one could argue that

endogenous changes in movie investments mainly increase the rents taken by superstars, such as Tom Cruise and Julia Roberts, as opposed to improving "real" aspects of movie quality. That debate might be interesting, as it relates more generally to the compensation inequality literature, but it beyond the scope of this paper. Finally, we also do not test what types of marketing strategies are more efficient at attracting wide audiences, independent of movie quality.

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Table 1: Who Trades with Whom?

	Australia	China	France	Germany	Hong Kong	Italy	Japan	Singapore	South Korea	Spain	United Kingdom	United States	rest
Australia	**3.8%**	0.4%	1.1%	1.2%	0.7%	1.2%	0.7%	0.7%	0.7%	0.9%	1.3%	1.3%	0.9%
China	0.0%	**47.7%**	0.0%	0.0%	12.8%	0.0%	0.0%	4.4%	1.3%	0.0%	0.0%	0.0%	0.2%
France	2.1%	1.3%	**29.6%**	1.9%	2.1%	2.9%	0.6%	1.6%	1.3%	3.4%	1.2%	1.1%	2.0%
Germany	1.0%	1.4%	0.9%	**23.8%**	1.2%	1.4%	0.1%	1.3%	0.4%	2.6%	0.5%	0.5%	2.1%
Hong Kong	0.0%	4.4%	0.2%	0.0%	**10.0%**	0.0%	0.4%	2.7%	0.2%	0.0%	0.0%	0.1%	0.3%
Italy	0.2%	0.0%	0.0%	0.1%	0.1%	**30.2%**	0.0%	0.0%	0.0%	1.0%	0.1%	0.0%	0.2%
Japan	0.0%	0.0%	0.5%	0.0%	3.1%	0.1%	**60.1%**	0.5%	0.4%	0.3%	0.0%	0.0%	0.2%
Singapore	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	**6.0%**	0.0%	0.0%	0.0%	0.0%	0.0%
South Korea	0.0%	0.8%	0.5%	0.0%	0.6%	0.0%	0.0%	0.3%	**52.0%**	0.0%	0.0%	0.0%	0.1%
Spain	0.5%	0.3%	0.4%	0.1%	0.9%	1.4%	0.0%	0.7%	0.4%	**8.2%**	1.5%	0.0%	1.2%
United Kingdom	**4.5%**	**2.3%**	**1.7%**	**1.8%**	**1.7%**	**3.8%**	**0.3%**	**1.7%**	**2.4%**	**2.7%**	**9.0%**	**2.6%**	**2.1%**
United States	**86.4%**	**36.6%**	**62.7%**	**68.6%**	**63.4%**	**57.1%**	**34.2%**	**78.0%**	**37.6%**	**76.8%**	**83.9%**	**92.0%**	**74.0%**
rest	1.5%	4.9%	2.3%	2.5%	3.5%	1.8%	3.7%	2.2%	3.4%	4.0%	2.5%	2.3%	**16.6%**
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Notes: box office revenue in each destination country, by movie origin countries. Box office revenue data are from Box Office Mojo. Movie origin countries are derived from IMDb.

Table 2: Demand Model Estimates

	(1)	*(2)*	*(3)*	*(4)*
	OLS	OLS	IV	IV
Per capita gdp (000)	0.0302	0.0146	0.0173	0.0172
	(0.0061)**	(0.0036)**	(0.0031)**	(0.0043)**
price	-0.1551	-0.0926	-0.1034	-0.1023
	(0.0326)**	(0.0202)**	(0.0187)**	(0.0219)**
$\ln(s_j/(1-s_0))$		0.9979	0.8276	
		(0.0012)**	(0.0592)*	
$\ln(s_g/(1-s_0))$				0.7421
				(0.0995)**
$\ln(s_j/s_g)$				0.8267
				(0.0692)**
instruments	None	None	Logarithm of total products	Logarithm of total products by genre

Robust standard errors in parentheses (clustered on country – year). All regressions include year dummies, as well as origin x destination x genre effects.
All regressions include 81,922 observations. * significant at 5%; ** significant at 1%

Table 3: How Much Do Different Countries' Consumers Benefit Each Other?

	Australia	China	France	Germany	Italy	Japan	South Korea	Spain	United Kingdom	United States
Australia	11.85	0.00	4.92	0.82	0.19	0.00	0.00	0.77	4.70	36.32
China	0.16	0.40	0.46	0.16	0.00	0.00	0.14	0.05	0.33	1.21
France	2.56	0.00	30.04	0.56	0.02	0.23	0.51	0.45	1.34	15.86
Germany	1.71	0.00	1.91	10.41	0.04	0.00	0.00	0.04	0.86	10.35
Italy	1.75	0.00	2.44	0.57	20.22	0.02	0.00	1.01	2.00	8.62
Japan	0.64	0.00	0.63	0.02	0.00	11.20	0.00	0.00	0.10	2.88
South Korea	2.58	0.00	2.98	0.38	0.02	0.07	119.05	0.81	3.30	12.30
Spain	1.28	0.00	2.77	1.13	0.57	0.08	0.00	6.03	1.44	13.81
United Kingdom	3.12	0.00	2.72	0.31	0.09	0.01	0.01	1.73	7.70	25.97
United States	5.15	0.00	4.42	0.56	0.04	0.01	0.02	0.03	3.44	53.88

Note: each row shows the per capita CS benefit to the row country from a billion additional consumers in the column country.

Table 4: Demand-Only Counterfactuals

	gains from trade		**China x 1**		**China x 2**	
country	CS	rev	CS	rev	CS	rev
Australia	16.62	-10.30	0.00	-0.04	0.00	0.50
China	0.52	-0.93	0.52	-0.51	0.54	-0.52
France	5.50	-5.55	0.00	-0.30	0.00	1.05
Germany	3.46	-5.53	0.00	0.00	0.00	0.58
Italy	3.59	-5.97	0.00	0.11	0.00	0.23
Japan	0.92	-4.01	0.00	1.38	0.00	2.78
South Korea	4.56	-10.26	0.00	0.50	0.00	1.50
Spain	5.92	-6.07	0.00	0.20	0.00	0.61
United Kingdom	9.24	-6.83	0.00	0.98	0.00	3.16
United States	0.57	31.29	0.00	1.48	0.00	6.60

Notes: “Gains from trade” is the difference between autarky and the status quo. “China x 1” adds the movies in Singapore and Hong Kong to the Chinese choice set. “China x 2 adds the movies to China and doubles Chinese movie spending.

Table 5: Predicting the Chinese Quality of Movies Not Available in China

	quality in China	quality in China	quality in China
quality in Hong Kong	0.5351		
	(0.0590)**		
quality in Singapore		0.5695	
		(0.0652)**	
Available in Singapore	-0.0594		-0.0136
	(0.0819)		(0.0758)
Available in Hong Kong		0.0374	-0.0047
		(0.0827)	(0.0897)
predicted quality in China			1.0196
			(0.1006)**
2008	0.2886		-0.0010
	(0.0904)**		(0.0810)
2009	-0.4729	-0.6969	-0.0201
	(0.1070)**	(0.0987)**	(0.1162)
2013	1.1988	1.0373	-0.0010
	(0.0877)**	(0.0565)**	(0.1302)
Constant	-4.5834	-4.4901	0.1207
	(0.1518)**	(0.1687)**	(0.6209)
R^2	0.82	0.82	0.83
N	184	121	198

* $p<0.05$; ** $p<0.01$

Table 6: Production Function Estimates

	(1)	(2)
	delta	delta
Log budget	0.1360	
	(0.0014)**	
Log budget in:		
Australia		0.1417
		(0.0079)**
China		0.1221
		(0.0189)**
France		0.1490
		(0.0079)**
Germany		0.1099
		(0.0078)**
Italy		0.0615
		(0.0094)**
Japan		0.1082
		(0.0244)**
South Korea		0.0711
		(0.0170)**
Spain		0.0988
		(0.0058)**
United Kingdom		0.1572
		(0.0051)**
United States		0.1417
		(0.0016)**
other		0.0998
		(0.0042)**
Constant	-5.1376	-5.1526
	(0.0251)**	(0.0253)**
Observations	51667	51667
R-squared	0.25	0.25

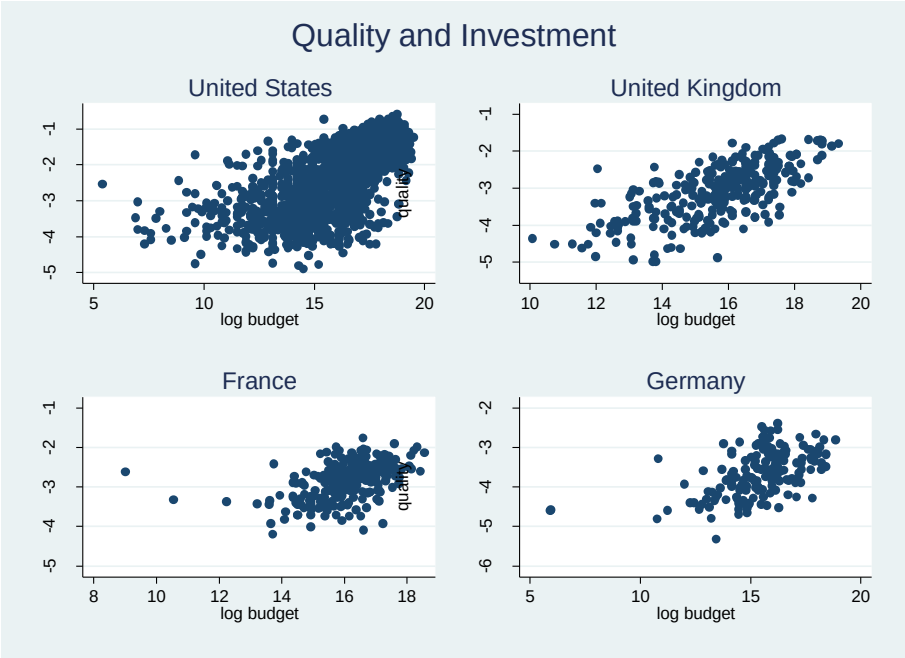
Standard errors in parentheses. * significant at 5%; ** significant at 1%. Both specifications include genre x origin x destination FE as well as year effects.

Table 7: Equilibrium Budget Changes and Impacts on CS and Revenue

	gains from trade			**China x 1**			**China x 2**		
country	Δbudget from autarky	ΔCS	Δrev	Δbudget	ΔCS	Δrev	Δbudget	ΔCS	Δrev
Australia	-76.8%	21.27	-4.75	19.5%	0.15	1.87	0.9%	0.33	-0.32
China	-53.4%	1.24	-0.53	-14.6%	0.53	-0.49	166.7%	0.74	0.57
France	-76.8%	11.25	-1.04	-6.5%	0.00	-1.48	-11.2%	0.06	-2.10
Germany	-70.1%	5.94	-2.96	-2.1%	0.03	-0.10	-5.0%	0.09	-0.08
Italy	-45.0%	4.49	-5.25	-4.4%	0.03	0.02	-2.4%	0.10	0.03
Japan	-54.3%	2.64	-1.94	35.8%	0.27	2.32	22.4%	0.21	2.59
South Korea	-63.7%	10.76	-7.22	10.2%	0.23	0.81	14.3%	0.53	1.05
Spain	-57.8%	7.91	-4.35	-6.2%	0.04	0.05	-7.8%	0.13	0.13
United Kingdom	-79.8%	14.67	-1.33	13.9%	0.12	2.45	35.3%	0.32	5.58
United States	-81.5%	13.30	39.31	2.9%	0.16	2.07	7.2%	0.41	5.21

Note: per capita changes in CS and revenue under various counterfactual policies: autarky vs free trade, the opening of China (so that all films shown in Singapore or Hong Kong are also shown in China), and an opening of China accompanied doubling of its market size.

Figure 1



Note: Scatter plots of delta from the two-level nested logit model and the log budgets. The US figure shows the US value of US-origin movies, etc.

Figure 2

Note: origin-specific coefficients on log budgets in regression of quality on budgets, along with fixed effects for origin x country x genre as well as year dummies.

Figure 3: Impacts on CS

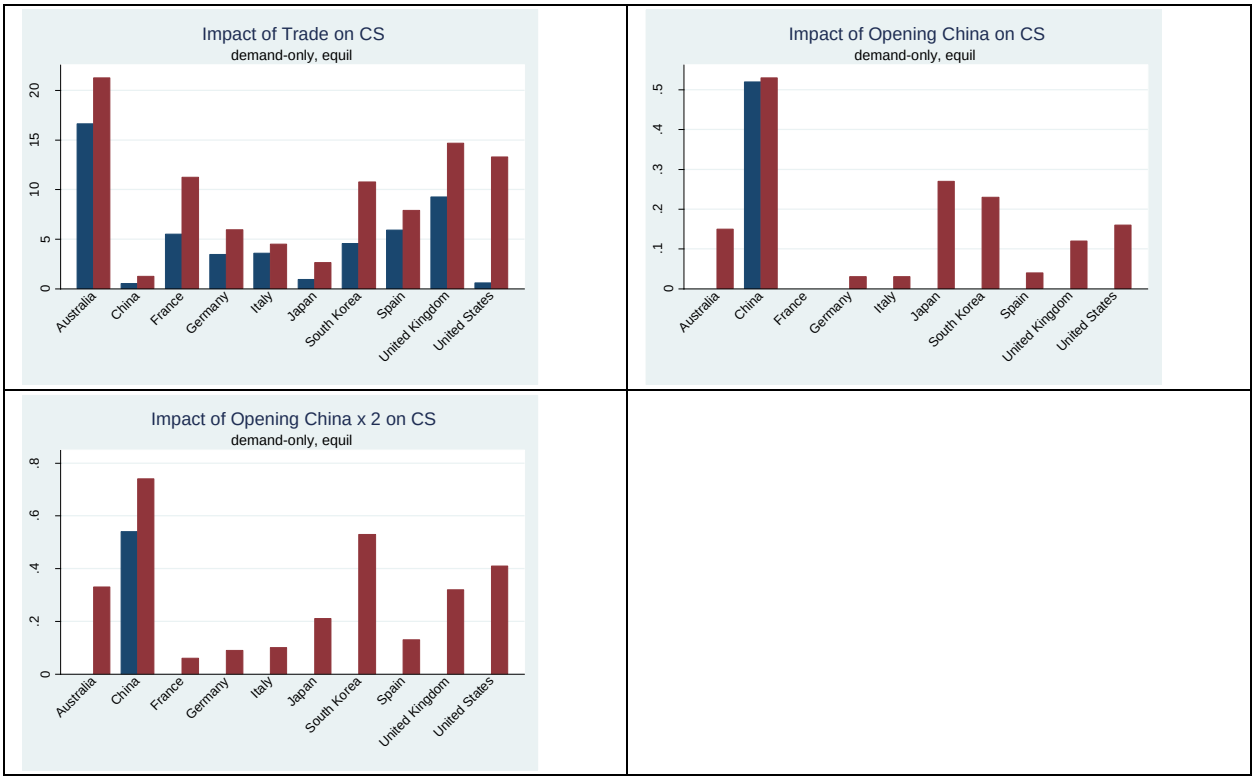


Figure 4: Impacts on Revenue