Trade and Welfare in Motion Pictures

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Trade benefits consumers and producers. Importing consumers benefit from access to a wider variety of products, while exporting sellers experience higher profits by selling their products to a larger population of consumers. The effects of trade can also operate through product quality: larger markets can lead to larger investments in products and therefore higher quality products, so that consumers in both the exporting and importing countries will experience a direct benefit from trade operating through quality. The movie industry is an auspicious context for exploring this phenomenon, as quality is produced exclusively with sunk costs, these sunk costs are high, international revenue is very important, and there are substantial obstacles to movie trade. In this paper we develop a model of the global movie market, including consumers' movie demand (with country-by-movie-specific preferences), the relationship between movie budgets and quality, and the equilibrium yielding the movie budgets. This allows us to quantify the benefit of exporting for US and foreign consumers, as well as the counterfactual impact on consumers and producers of various policies including elimination of European film subsidies and an expansion of the Chinese movie market.

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In the usual way that economists and policymakers think about trade the benefit of importing is that consumers in the importing country get access to a wider variety of products. The benefit of exporting accrues to domestic sellers who generate higher profits by selling their products to a larger population of consumers. So, for example, when Hollywood movies are made available in France, French consumers have access to Hollywood fare as well as domestic French cinema and US film producers gain additional revenues.

This view misses an important feature of products made with investments in sunk costs. With large sunk costs, an enlarged market can lead to larger investments in products and therefore higher quality products.[1] An important benefit of trade is that consumers both at home and abroad can have access to higher quality goods than they otherwise would have without trade.

The movie industry is an auspicious context for exploring this phenomenon for a variety of reasons. First, quality is produced exclusively with sunk costs in this industry and these endogenous sunk costs are high. Major US movie releases cost an average of nearly $100 million dollars per film and the US spent about $20 billion on film production in 2007, nearly two thirds of the world total. Second, international revenue is needed to finance current US investment levels. Most of Hollywood movies' box office revenue is generated outside the United States. In 2009, domestic revenue for major US releases was $10.6 billion while foreign revenue was $19.3 billion. Thus, it seems likely that US and foreign consumers of big-budget movies experience substantial benefits from the quality investments made possible by trade.

[1] See Sutton (1991).

Various public policies around the world seek to affect the movie industry by subsidizing production costs or by directly restricting trade. On the former point one-third of the roughly $5 billion that European nations invest in film production annually is financed with government subsidies. China is an extreme example of the latter point as they restrict imports of foreign movies allowing importation of only 20 movies per year on a revenue-sharing basis.[2]

The goal of this paper is to develop a model that allows quantification of the benefit of trade to both US and world consumers and producers. More specifically, how much do US movie consumers and producers benefit from Hollywood's export activity? How much do consumers gain and producers lose in various foreign countries because of consumers' access to Hollywood movies in addition to their domestic fare? How would the world movie market change if Europe eliminated its substantial production subsidies? Finally, how much would US and other consumers benefit if the Chinese market were to double in size (by, for example, lifting its import restrictions). To our knowledge, we are the first to document these benefits.

We estimate a structural model of movie demand using data on movie-specific box office revenue and country-year data on ticket prices and per capita income. Our data include 6,672 movies in 14 countries over the years 2005-2009, which allows us to estimate country-by-movie specific preferences. We then combine measures of product quality derived from demand estimation with direct data on movie investment – production budgets for major releases – to estimate the quality production function for movies. We combine the production function estimates with the demand model to develop an expression for each country's profits, which depend on both its own movie budgets and the budget levels chosen in other countries. We solve

[2] It is perhaps noteworthy that between 2001 and 2007 China has increased its domestic movie production from 83 to 400 while increasing its investment from $44 million to $454 million.

for a Nash equilibrium in investment – and associated surplus measures – which serves as the model's baseline. We re-solve the model to estimate country-specific changes in consumer and producer surplus across policy regimes.

The paper proceeds in six sections after the introduction. Section 1 provides facts about world movie trade to substantiate the basic idea of the model: a) that the large US investment in movies produces higher product quality in the eyes of US and foreign consumers, and b) that the current level of investment is made possible only by both domestic and foreign revenue. Section 1 also discusses literature relevant to the current project. Section 2 discusses major policy interventions in the movie market. Section 3 offers a model of movie demand, a production function for movie quality as determined by budget levels, the equilibrium notion, and counterfactual exercises, including the change in consumer and producer surplus in each country a) if there were no trade in movies, b) if all US movies disappeared from foreign markets c) if European subsidies were withdrawn, and d) if the Chinese market doubled in size. Section 4 describes the main data sources and Section 5 presents the model estimates, and Section 6 presents the results of the counterfactual exercises.

I. Trade and Investment in Motion Pictures

This section provides background in the forms of a) the magnitude of investment and international revenue, b) the relationship of box office revenue to total industry revenue, and c) the existing literature.

1. Investment and International Revenue

Like other recorded media products – music, books, newspapers – quality of movies is determined by expenditures on sunk costs. Around the world, investments in sunk costs on

movies differ substantially. When compared with the rest of the world, the US motion picture industry spends a large amount making movies, both overall and on a per-movie basis.

There are two different measures of aggregate movie budgets circulated in the movie industry. The Motion Picture Association of America reports the average budgets of its members' movies. These members are the major studios and they collectively release roughly 200 movies per year. For example, the MPAA in 2005 reported an average cost of producing a movie made by an MPAA member was $96.2 million. Members released 198 movies in 2005 leading to an overall investment in US movies that was just over $19 billion in 2005.

Screen Digest provides movie production statistics for both the US, Europe, and Japan using a different set of movies. In 2007, for example, they report that the US produced 656 movies at an average cost of $31.0 million per movie for a total investment of $20.3 billion.[3] As Table 1 shows, the Screen Digest data indicate that worldwide investment in movie production was $32.3 billion in 2007. Of this amount, nearly two thirds ($20.3 billion) was spent in the US. Other countries with relatively high investments in movies include Japan ($2.0 billion), the UK ($1.5 billion), France ($1.6 billion), Germany ($1.1), Spain, ($0.6), Italy ($0.4), Canada (1.0) and South Korea (0.5).

On a per-movie basis, using the Screen Digest data, the US outspends other countries by a substantial margin. In 2007 the average US movie budget was $31 million, compared with $12.8 million in the UK, $14.7 in New Zealand, $9.1 million in Germany, $8.7 million in Canada, and $7.2 million in France. Regardless of the data source used, it is clear that US

[3] The MPAA figure for 2000 = $16.2 billion overall and $10.8 billion including only production costs. Hence the Screen Digest figure includes only production costs.

investment is large relative to the movie investment of other countries, both per movie and overall.

Waterman (2005) explicitly argues that US investment grew as US producers developed ways of generating additional revenue from the price-discriminatory practice of releasing movies in a sequence of exhibition "windows." That is, films are first shown in theaters, then made available for rental and home video purchase, made available to pay television, and finally to free television. Waterman argues that by exploiting this strategy earlier than other countries, the US producers were able to justify larger investments in movie budgets which, in turn, have made US movies appealing in foreign markets as well.

Much of the revenue that US movies generate comes from abroad. According to the MPAA, its members' movies earned $10.6 billion at the US box office – and an additional $19.3 billion abroad - in 2008. Our data demonstrate this point as well both for US repertoire as well as the repertoires of many other countries. Table 2 provides some evidence. For this table we assign each 2008 movie to an origin country based on its first listed country of origin. We then aggregate both domestic and foreign (actually, sample-wide) box office revenue by origin country. The table shows, for example, that US repertoire generated $17.5 billion in box office revenue in 2008, 52 percent of which was generated outside the US. Other countries – notably the UK, Australia, and Hong Kong – generated even larger shares of their revenues abroad: 85, 84, and 83 percent, respectively. Many countries generate a third or more abroad: France, China, Spain, and others.

2. Box Office Revenue, Total Revenue, and Investment

In this section we make two points. First, we show that foreign revenue is necessary for covering production costs. If we total our estimates of the studios' net proceeds from domestic box office, home video, and various forms of television, we arrive at roughly $14 billion for 2000, a year in which total production costs for MPAA movies exceeded $16 billion. Second, we document the relationship between what we observe – box office revenue – and another important concept for our exercise, the revenue remitted to the studios from all revenue sources. Worldwide box office revenue in 2000 was roughly $13.8 billion. By contrast, the studios' proceeds from box office, DVD, and television was (very) roughly $20-$25 billion. Arriving at these conclusions requires a brief digression into motion picture accounting.

According to Vogel (2007) and Dale (1997), roughly a third of domestic box office revenue is remitted to the studio. Roughly half of box office receipts are retained by the exhibitor, and a third of the remainder (one sixth overall) is retained by the distributor. Distributors retain slightly more when distributing US movies in foreign markets, 40 percent rather than a third (Dale, 1997). Vogel (2007) estimates that US studios get $0.31 per dollar of domestic box office revenue. Thus, of the $7.7 billion in domestic box office revenue in 2000, the studios received $2.4 billion. Of the $13.8 billion in international box office, the studios received roughly $5 billion.

We lack movie-level DVD data generally, but we were able to obtain revenue on the 100 top-grossing DVDs for each year, 2007-2009, based on US sales, from http://www.the-numbers.com/ . We matched these with US box office revenue from Box Office Mojo. Not all titles match, as the DVDs include some perennial sellers originally released much earlier (The Jungle Book), as well as some movies released only to DVD (such as the BBC series Planet

Earth). Of those that matched, the correlation between domestic box office and domestic DVD sales is 0.76, as Figure 1 shows.

Epstein (2010) emphasizes the large and growing roles of both home video (sales and rental of tapes and now DVDs) and television. Based on confidential MPAA data, he reports DVD sales of $13.1 billion in 2000.[4] Vogel (2007, p. 152) reports that of a $30 retail price, the studio retains $8-$10. Thus, the studios' proceeds from domestic home video in 2000 was roughly $3.5 to $4.4 billion. (Later in the decade – in 2004 – domestic home video revenue peaked at $22.8 billion and has since declined). According to Eurostat (2003), worldwide home video sales totaled $24 billion in 2000. As a rough approximation – using Vogel's estimate of the studio proceeds – it appears that the studios received about $7 billion in proceeds from home video.

Data on television revenue are the most difficult to obtain. Epstein reports worldwide 2000 television revenue of $15.5 billion. Inferring the domestic profit from that gross figure requires deductions for distribution fees, as well as a translation from a worldwide figure to a US figure. Dale (1997, p. 319) reports that for both pay and free television, distributors takes a "30-40 percent distribution fee plus marketing and distribution costs" which, in the case of free television, are "minimal." Putting the studio share of television revenue at two thirds, this suggests that the studios' net proceeds from television in 2000 were $10.3 billion. US box office tends to be roughly double European box office. If that ratio held for television, then the addition of domestic television revenue to variable profit would be roughly $7 billion. Roughly, the worldwide studio proceeds from television is roughly $10 billion.

[4] See http://www.edwardjayepstein.com/MPA2007.htm, accessed May 12, 2010.

These calculations lead us to our two conclusions. First, adding the studio proceeds from domestic revenue sources gives about $14 billion for 2000. Given that costs exceed these revenues, we infer that international revenues are needed to finance current investments. Second, studio proceeds from worldwide activities appear to total about $22 billion (5+7+10) in a year when worldwide box office was almost $14 billion. Hence, as a rough approximation, studio proceeds are about 1.5 times box office revenue.

3. Existing Literature

Perhaps because aspects of its performance are readily observed there is a substantial scholarly literature on the film industry. Waterman has written extensively on many aspects of the movie industry, including features relevant to trade such as the "cultural discount," the extent to which movies from one country appeal to consumers elsewhere. Much of this work is summarized in Waterman (2005). DeVany (2003) has written extensively on the determinants of movie revenues. Chisholm and Norman (2007) have written about aspects of the exhibition industry. Einav (2007) analyzes the release timing game; and Einav and Orbach (2010) study the puzzle of uniform box office prices. Davis (2006ab) studies spatial competition and business stealing in the exhibition market.

There is also a growing body of empirical work on trade in cultural products. Studies include Hanson and Xiang (2008), Disdier et. al (2010)'s gravity model estimates, and Ferreira and Waldfogel (2011). Because of the importance of endogenous sunk costs in movies, this work is related to Sutton (1991), as well as Berry and Waldfogel (2010). Related, movies embody the preference externalities examined in Waldfogel (2003).

Methodologically, this work is related to research documenting the the welfare benefit of new products (Petrin (2002) and Goolsbee and Petrin (2004)). Finally, this work is related to other empirical industrial economic research examining product choices by consumers in different national markets, such as Goldberg (1995) and Verboven (1996).

II. Policy Interventions in the Movie Market

There are three major ways in which public policies do – or could – affect movie trade. First, many countries subsidize domestic movie production, particularly in Europe. Table 3 describes these subsidies. In 2004 European film production totaled $4.8 billion (according to Screen Digest, 2009), and subsidies accounted for nearly a third of the total investment of $1.6 billion. In absolute terms the French spend the most on subsidies: just under half of their $1.3 billion film investment in 2004 was financed by the state. Germany provides the second largest subsidy: just above a third of their $0.7 billion film investment in 2004 came in the form of subsidies. The UK and Italy provided the next two largest in absolute terms, accounting for 10 and 32 percent of those countries' 2004 film investments, respectively.

Second, some countries – such as China – limit the number of foreign movies allowed in each year. The Chinese government allows 20 movies in per year on a revenue-sharing basis. The Chinese government also allows another 30-40 movies in per year on a flat-fee basis.[5] In 2010 Chinese box office revenue reached $1.55 billion according to Screen Digest, "which

[5] See "International Film Trade with China: Chinese Films Move into the World but with Quotas Restrict Imports." Screen Digest, April 2010, p. 107.

makes China one of the world's largest box office markets and with further potential growth to come as new screens open in an under-screened but fast modernising country."[6]

Third, intellectual property rights enforcement affects the extent to which interest in movies translates into expenditure. China is also perceived, along with a number of other countries, as a hotbed of movie piracy (USTR, MPAA). The MPAA estimated $6 billion in lost revenue to their members from piracy in 2005[7]. While this particular estimate should be taken with a grain of salt, it does seem plausible that China could undertake two policies that would have significant effects on movie industry revenue, allowing more foreign movies in, and deterring piracy. Given China's size and rapid growth, the possibility of substantially more revenue from China could have significant effects on movie investment and the welfare of consumers around the world.

Table 4 presents an international comparison that provides suggestive evidence about piracy in China. The table reports GDP, per capita GDP, as well as various measures of expenditure on movie going in 2008. The last column reports revenue per capita, which averages around $25 in Europe, the US, and Canada. Lower-income countries have lower averages: Brazil, Turkey, Mexico and India average $2.07, $2.99, $6.05, and $1.63. China is an outlier, with $0.46 in spending per year. It is perhaps noteworthy that the five countries with the lowest admissions per capita (and revenue per capita) are also on the United States Trade Representative's watch list or priority watch list. Twelve countries, including China, Canada,

[6] From "China and Hong Kong post box office rises." Screen Digest 472 (Jan 2011): p26.
[7] See http://www.archive.org/stream/MpaaPiracyReort/LeksummarympaRevised_djvu.txt .

and India are on the "priority watch list," while 28 countries (including Brazil, Italy, Mexico, Spain, and Turkey) are on the watch list[8].

III. The Model

This section presents a model of the global motion picture industry. Our model has two components, consumers and producers, along with an equilibrium notion.

1. Demand

Movies, indexed by j (j=1,…,J) are available in each of C countries (indexed by c) in each year. The choice sets of movies will vary both across countries and over time. Not all movies produced each year are available in all countries. Define J_c as the set of movies available in country c. 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).[9]

Specifically, every month every consumer i in country c chooses movie j in J_c 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 is autonomous tastes 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, φ shows 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 ϵ_{ij} is an iid taste draw across

[8] See http://www.ustr.gov/about-us/press-office/reports-and-publications/2011/2011-special-301-report for the priority watch list and the watch list.
[9] We are exploring how the estimates change with different definitions of market size.

individual and movies that is distributed Type I extreme value.[10] We use the approach from Berry, Levinsohn, and Pakes (1995) to invert out δ_{cj} from observed market shares. We regress δ_{cj} on country-level ticket prices and per capita income. The resulting residual term ξ_{cj} includes the influence of all movie characteristics observed by consumers. It bears emphasis that because we observe country-specific market shares, so we can allow ξ_{cj} to differ across consuming countries for the same product. That is, *Avatar* can have different quality to US vs French consumers.

A drawback of the logit IIA assumption is that the derivative of the inside share with respect to the number of goods is strictly positive. The nested logit specification, which follows Berry (1994), loosens the IIA assumption by allowing for the possibility that movies are closer substitutes for one another (relative to the simple logit). In this setup consumers first choose whether to watch a movie. If they choose to watch a movie, they choose among the movies available in their country that year, and these movies are potentially substitutable for one another. Specifically, the utility function is now:

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

where, following Berry (1994), 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 a random variable, then $[\zeta_i + (1\text{-}\sigma)\, \epsilon_{ij}]$ is also extreme value. In this model the derivative of the inside share with respect to the number of goods approaches zero as σ approaches 1.

We implement this by including the product's share among inside goods $\ln(s_j/(1\text{-}s_0))$ as an explanatory variable. Suppressing time subscripts, we estimate:

[10] We currently estimate two particular versions of this general setup: simple logit and nested logit.

$$ln(s_{jc}) - ln(s_0) = \beta_0 + \alpha p_c + \varphi y_c + \sigma ln(s_{jc}/(1-s_{0c})) + \xi_{cj}.$$

The coefficient on the variable is the parameter σ, which indicates the degree of substitutability. When σ=0, the model resolves to the simple logit; when σ=1, inside products are perfect substitutes for another. We instrument this variable using the log of the number of movies in released in the country per year, along with the number of movies in each country, from each country, per year.[11] We also include a specification with price instruments based on the logic of Hausman (1994). We use the average ticket price in other countries, along with higher-order terms, as instruments for the ticket price.

One shortcoming of the nested logit specification is that it is not able to accommodate rotations in the demand curve due, for example, to advertising.[12] Specifically, a separable demand error does not allow unobserved advertising to affect the marginal utility of income. We know that advertising budgets, while omitted from our measured budgets, are about half as large as observed production budgets in the US (Vogel, 2007). If unobserved advertising does rotate the demand curve, then our standard IV approach is no longer consistent because the instrumented price is correlated with the demand error, which now includes an interaction term between price and the error. Gandhi, Kim, and Petrin (2011) show an example in which price elasticities increase by 60% when the demand framework is generalized to allow for non-separable errors.

[11] We obtain virtually identical results using only the log of the total number of movies released in the country per year as an instrument.

[12] A large empirical literature demonstrates that advertising can both shift and rotate the demand curve. See Pakes' (1987) review of Mueller (1986).

We explore this extension in the movie demand data here by estimating a nested logit specification that allows price to interact with the demand error. We generalize the nested logit utility specification to include an interaction term between price and the demand error:

$$ln(s_{jc}) - ln(s_0) = \beta_0 + \alpha p_c + \varphi y_c + \sigma ln(s_{jc}/(1-s_{0c})) + \xi_{cj} + \lambda p_c \xi_{cj}.$$

This allows unobserved to both shift and rotate the demand curve.

2. Supply: the Production of Quality

In principle film producers have two margins of adjustment. They can make more movies, or they can spend more on the movies that they make. 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 budget on 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 (see Figure 2).[13] The use of this assumption also allows us to sidestep the problem of how to model the quality of as-yet non-existent goods. This generic problem is not yet solved in the literature.

While our demand side estimates depend in no way on the supply side model, we require a characterization of supply in order to conduct our counterfactuals. Each year the movie industries of each country invest in slates of movies. The quality of the movies depend in part on the size of the production budgets. Larger investments bring about movies with more appeal to consumers. In our setup, quality is price-adjusted δ. That is, quality is:

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

[13] The number of releases grew from 160 in to 200 in 2005. See Vogel (2007).

That is, $\delta'_{cj} = \delta'_{cj}(B_j)$, where B_j is the budget for movie j, and the investment choice affects the movie's quality in each country. We recover the production relationship by relating the estimated δ' terms to observed budgets (for the subset of movies with observed budgets).

3. Equilibrium

Define r_{cj} as revenue from movie j in destination country c. Writing this in terms of the firms' choice variables (budgets), it is $r_{cj}(\delta'_{cj}, \delta'_{-cj})$; that is, the revenue for movie j depends on its quality as well as the qualities of all other movies. These qualities in turn depend on the size of j's budget, as well as the size of all other movies' budgets. The worldwide profit for movie j is then:

$$\sum_{c=1}^{C} r_{cj}\left(\delta'_{cj}(B_j), \delta'_{-cj}(B_{-j})\right) - B_j.$$

In practice – and as discussed above – box office is one of three major revenue sources, along with home video and television. Because we do not observe all of these, we need to estimate the relationship between box office revenue and producers' net proceeds from all sources. We do this by allowing a producer-specific scale factor W_j. Total profits for movie j are given by

$$\sum_{c=1}^{C}\left[W_j r'_{cj}\left(\delta'_{cj}(B_j), \delta'_{-cj}(B_{-j})\right) - B_j\right],$$

where r'( ) contains only box office revenue. In practice, producers may have multiple products. For a decision maker responsible for a set of movies F, profit from box office revenues is given by:

$$\sum_{j\in F}\sum_{c=1}^{C}\left[W_j r'_{cj}\left(\delta'_{cj}(B_j), \delta'_{-cj}(B_{-j})\right) - B_j\right].$$

Given the ticket price and market size in each country, along with the preferences of consumers for the set of products , we assume that firms compete Nash in budgets, and we solve for the W_j's that satisfy the Nash equilibrium conditions at the box office revenues and budgets in the data. We then use these estimated values of W_j in the profit functions for policy counterfactuals. For our policy counterfactuals we modify either the revenue or budget function (or both) and resolve for the new Nash equilibrium.

IV. Data

The basic data for this study are the market shares of 6,672 movies in 14 distinct countries between 2005 and 2009, for a total of 16,189 movie-country-year observations. In addition we observe ticket prices and per capita income by country and year, not at the level of the individual movie. The market shares are derived from box office revenue data which, in turn were obtained from Box Office Mojo (boxofficemojo.com). The ticket price data, along with data on overall country film investment are obtained from Screen Digest.

Movie-level budget data for 770 major releases (and 5223 movie-country observations) are obtained from www.thenumbers.com, which reports estimates of production budgets for

major films.[14] Data on European film subsidies in 2004 are obtained from Cambridge Econometrics (2008).

Before turning to the modeling, the simple tabulations from the data are of some interest. Tables 5 and 6 show patterns of world trade in movies in 2008. Table 5 shows where each origin country sells its repertoire. Table 6 shows the national origins of each destination country's consumption. These two tables answer the respective questions, "who buys my repertoire?" and "whose products do our consumers like?" that are central to the way that, say, trade policies would affect equilibrium trade patterns.

For example, Table 5 shows that domestic markets are important outlets for all repertoires. Domestic sales account for three quarters of sales for the repertoires from Brazil, France, Germany, India, Italy, Japan, Mexico, South Korea, and Turkey. The Anglophone countries (Australia, the UK, and US) are different: domestic sales account for half of US sales and under a fifth of Australian and UK sales. Those repertoires instead achieve substantial sales in the other Anglophone countries, chiefly the US. They also obtain atypically high shares of their sales in other countries.

Table 6 shows which repertoires consumers in each destination market choose. Two patterns are clear. First, there is a home market effect: the main diagonal entries are large. Countries with particularly large apparent preferences for domestic product include India (77 percent), Japan (59), Turkey (52), and the US (90). Second, Anglophone countries' – especially the US and the UK – have high market shares everywhere. France, too, has relatively high market shares, particularly in Europe.

[14] Budget data are also reported at boxofficemojo.com. Both data sources report production budget information for only a subset of movies. It appears to be essentially the same subset.

The information in Tables 5 and 6 is interesting and provides some hints about how counterfactual policies might affect welfare outcomes. Consider, for example, a counterfactual doubling of Chinese expenditure on movies. Table 6 shows that the Chinese spend a large share on domestic movies, as well as movies from the US and the UK. One might therefore expect that growth in Chinese movie expenditure to raise Chinese producer surplus, as well as US and UK producer surplus. It seems plausible that, in turn, China, the US, and the UK would raise their investment, which would benefit consumers in those countries (as well as consumers elsewhere who favor those repertoires). What's less clear is the optimal investment response of other countries. They might, or might not, optimally raise their investment to better compete with improved foreign competition. Hence the need for an explicit model simultaneously endogenizing all countries' investment decisions.

V. Empirical Implementation

We estimate the demand model two basic ways, via simple logit and nested logit. All models include countries' average income as an explanatory variable to capture unobserved heterogeneity in tastes that is correlated with income, as suggested by see McFadden (1982), along with the average ticket price in the country and year. Note that even though the demand specification is parsimonious, we carry forward each movie's estimated δ' in each market, which incorporates the true quality of the movie, whatever its cause.

Table 7 reports estimates of the demand models. The first column reports simple logit. The income coefficient is positive, and the price coefficient is negative. As Table 8 indicates, the implied mean (median) movie-level price elasticity of demand is -2.25 (-2.43); and the price

elasticity for movies when considered together (the inside elasticity) is -1.87 (-2.00). Column (2) of Table 7 reports an estimate of the nested logit model, instrumenting for the inside share with the number of movies from each origin country in each destination market.[15] Again, the price coefficient is negative, and the income coefficient is positive. The substitution parameter (σ) is 0.795, indicating a high degree of substitutability of among movies. The resulting mean (median) movie-level price elasticity is higher in absolute value at -6.57 (-7.14), far more elastic than the simple logit estimates.

In the third column of Table 7 we treat both price and the inside share as engodenous. We use prices in other countries, along with higher-order terms, as additional instruments for price and the inside share. In doing so we follow the logic of Hausman (1994): we assume that prices elsewhere contain cost shocks but not the endogenous demand shock specific to each country. The resulting coefficients and elasticities are similar in columns (2) and (3). Column (4) uses the approach described in Gandhi, Kim, and Petrin (2011). Coefficients are similar. The resulting elasticities in Table 8 are somewhat larger in absolute value. We use the column (2) estimates for the simulations in this version of the paper.[16]

2. The Quality Production Function

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 logit models, and we have budget data on 770 major releases (mostly from the US). Figure 3 presents the relationship

[15] Under the assumption that product characteristics are exogenous, the number of products is a valid instrument for the inside share. See BLP (2005).
[16] We plan to calculate counterfactuals using the column (3) (and (4) estimates as well.

between quality and log budget derived from the nested logit model. The relationship is positive, indicating that movies with higher production budgets tend to have higher perceived quality. Because of our strong rejection of the simple logit demand model, we proceed with only the nested logit model.

Because of the importance of this relationship, we explore its robustness to different regression specifications and data. Table 9 reports regressions of country-specific movie quality (δ'_{cj}) on the movies' log budget. Column (1) presents a regression without any controls, producing a coefficient of 0.0873 (se=0.0125). Column (2) allows sample movies to have different levels of quality in different destination countries and years, adding year and destination-country dummies. The resulting log budget coefficient is larger, 0.1663 (0.0041). We are concerned about endogeneity of the budget level, and while we explore this further, it is worth noting here our budget measure is the production budget alone (not including advertising expenditure). While both production and advertising budgets are in principle potentially endogenous, the latter budget is chosen after the movie is finished and its quality is therefore largely realized.

As an alternative to OLS, we also use the average origin-country budgets by year as instruments for the individual movie budgets. We implement this in columns (3) and (4). Instrumenting reduces the size of the coefficients relative to the uninstrumented results in columns (1) and (2). The no-controls coefficient is -0.0584 and insignificant, while the log budget coefficient with year and destination-year dummies is 0.1163 (0.0288). Note that we cluster standard errors in the last two columns by origin country and year, since that's the unit of aggregation where the instrument varies.

Given the way we estimate this parameter, we solve for the new budgets in the counterfactuals by assuming that scaling budgets scales movie quality according to the production function parameter. Specifically, for any new budget B_j', the new quality depends on the extent to which the new budget differs from the old:

$$\delta'_{cj}(B_j') = \delta'_{cj} + \gamma \log(B_j'/B_j).$$

As our baseline estimate of γ, we use roughly the midpoint between the estimates in columns (2) and (4).[17]

4. Implementation

We observe movie-specific revenue in each sample country. We observe movie-specific budgets only for the major releases, most of which are from the US.[18] For the remainder of the world, we observe aggregate annual country investment in movie budgets. In the estimation section we adapt our implementation accordingly.[19] In our current implementation, we model the decision making at the level of eleven groups of countries: the Australia, China, France, Germany, Italy, Japan, South Korea, Spain, the UK, the US, and a composite rest-of-the-world. The weights W that translate box office revenue into producer revenue are calculated at the level of the decision maker in our current specifications. We are currently exploring more flexible specifications in which additional countries and/or firms make these choices.

Before turning to the counterfactuals, we first calculate the weights W that translate box office revenue into studio proceeds. As discussed above, overall studio proceeds are roughly 1.5

[17] We currently use $\gamma = 0.13$. We plan to calculate counterfactuals with a range of γ's including the range in Table 9.
[18] We have recently obtained access to some movie-specific budget data for France, which we plan to explore.
[19] In the current implementation, we have 11 decision-making entities, 10 countries (Australia, China, France, Germany, Italy, Japan, South Korea, Spain, the UK, and the US) and a rest-of-world.

times box office receipts. If we observed all costs in the budget data, and if we observed all of the world's box office revenue, then we would expect W's of roughly 1.5. Our actual data deviate by covering only production budgets but not marketing. According to Vogel (2007), ads and prints together add about 50 percent to total costs for major US releases. Thus, for the US, we expect W to be about 2.25; and the W we estimate for 2008 is 2.23.

Weights for other countries may deviate for a variety of reasons. First, the extent of advertising costs – and therefore the extent to which observed budgets understate actual budgets – may deviate across repertoires. If the US advertises more, then we would expect smaller weights elsewhere. It is possible that advertising plays a smaller role for non-US releases. Second, repertoires may differ in the revenue generated in home video and television per dollar in the box office. For example, if US repertoire were aired on international television more than the reverse, then foreign weights would be lower than the US weight, all else equal. For six of our 11 countries we find weights below 2.5 (Australia: 0.66; France: 1.43; Italy: 1.31; Mexico: 1.23; South Korea: 1.01; and United Kingdom: 0.48). Third, because we only observe box office revenue for 14 countries and not the entire world, we are missing some of theatrical box office for those repertoires. For example, Germany is the only German-speaking countries in the sample; because we lack Austrian and Swiss box office, we are understating German revenue, which may explain its higher weight of 4.14.[20]

VI. Counterfactual Simulations

[20] The remaining weights we infer for 2008 are: China: 2.26; Japan: 3.28; and rest-of-world: 2.28.

Currently, we explore four policy counterfactuals, autarky, the elimination of US exports, the elimination of European subsidies (which currently account for one third of European film budgets), and an expansion of the Chinese market.

The first two counterfactuals are broadly addressed the benefits that consumers derive from trade. We first examine autarky. Consumers everywhere lose access to foreign products. Sellers gain from the loss of foreign competition but lose revenue from foregone access to foreign markets. In addition, given that quality is produced by investments in sunk costs, both effects induce producers to change their investment levels, which gives rise to additional impacts on consumers. As Table 10 shows, under autarky, consumers lose access to movies from abroad, and producers (except in Mexico) substantially reduce their investment; and both mechanisms reduce consumer surplus in every country. The loss of access to US movies particularly affects Australia and the UK (where CS declines $10.90 and $6.64 per capita, respectively). Effects on producers are more varied. While producers in most countries gain, US producers – who absent autarky have large shares of most countries – lose substantially from autarky.

The second question we address with the model is the benefit that consumers and producers experience from the ability of the US industry to export (see Table 11). To implement this, we eliminate US exports. This differs from autarky in that all other countries continue to export, and the US continues to import. Thus, US revenue is derived entirely from domestic consumption, and US movies are eliminated from the choice sets of foreign consumers. US and foreign budgets are then optimally readjusted. In the new equilibrium, US budgets fall by over half, while profit maximization leads European budgets to rise in response to the US budget

contraction. In particular, French budgets rise by 15 percent, German by 32 percent, and UK by 65 percent.

The biggest impact benefit of US exporting is, not surprisingly, experienced by US producers. Loss of the ability to export reduces producer surplus by $11.0 billion. It is also perhaps not surprising that foreign producers gain from no longer competing with US movies. Producer surplus rises by $177 million in France, by $164 million in Germany, and by $306 million in the UK.

More novel are the impacts on consumers. First, US consumers lose substantially: $517 million ($1.70 per person) annually. Despite the fact that the withdrawal of US exports tends to induce other countries to invest more in quality, consumers elsewhere also lose as this additional investment does not compensate for the loss of US products. On a per-capita basis, the Australians lose $1.19, the French and Germans lose about $0.28, the Italians lose $0.15, the Mexicans lose $0.45, the residents of the UK lose $0.69.

Table 12 examines the elimination of European subsidies. The major impact of the withdrawal of these subsidies is to reduce investment in Europe. French film investment falls by 62 percent, German investment falls by 36 percent, and UK investment falls by 18 percent. In response, US investment remains constant. As a result of their reduced investment – and given their consumers' tastes for domestic fare – consumers in France, Germany, the UK, and Italy suffer losses in surplus as a result of the loss of subsidies. The reduction in European investment leads US producers to reduce their investment, which causes US consumers to lose $8 million. Effects on producers are more pronounced. European producers lose substantially: France loses

$291 million, Germany loses $167 million, and the UK loses $39 million. US producers gain nearly as much at $354 million.

It is interesting to note that the vast majority of the benefits of the European subsidies are experienced by European producers. While this is in some sense not surprising, it is interesting against the backdrop of the usual rationale for cultural policy. Cultural policies are generally framed as protection of consumers with atypical tastes. Since Spence (1977) and Dixit and Stiglitz (1977) it has been well understood that in the absence of perfect price discrimination, markets can fail to adequately provide products for small groups with intense preferences. Our measures of the change in consumer surplus should pick up this intensity of preference. One might expect a cultural policy to be justified by an effect on consumer surplus that cannot be appropriated by sellers. This justification appears unavailable in this instance.

We implement an expansion of the Chinese market by simply doubling their expenditure (see Table 13). Recalling Table 3, this still leaves China with lower per-capita box office expenditures than any other sample country. Doubling China's expenditure causes China to substantially increase its movie investment (by 133 percent). Most other countries also increase their investment. Notable exceptions are the major European producers, France and Germany, that reduce their investment by about half. Consumers everywhere, except France and to a lesser extent Germany, experience higher surplus. Effects on producer surplus are more varied. Not surprisingly, Chinese producers gain substantially, as do UK and especially US producers (recall that US movies have roughly a third of the Chinese market). Producers elsewhere, especially France, Germany, and Japan lose from the growth in the Chinese market as movies that compete with their movies increase in quality.

VII. Conclusion

We develop a parsimonious model of the global movie industry consisting of consumer response to movies, producers' quality investment decisions, and an equilibrium condition for producers' investment decisions. The model allows us to quantify the welfare consequences of foreign trade, the impact of European subsidies, and the possible impact of an expansion of the Chinese movie market, among others.

We confirm that consumers abroad provide benefits to consumers at home. Selling movies abroad makes possible substantially larger investments in quality that, in turn, benefit US consumers by $461 million per year. The ability of US producers to sell abroad helps foreign consumers as well, although (not surprisingly) it hurts foreign producers. We find that EU subsidies have their largest impacts on EU producers and have rather modest impact on EU consumers, suggesting that they function more like trade policy that cultural policy. Finally, we find that an increase in Chinese movie expenditure would not only benefit Chinese and US producers, but would also – by stimulating investment in movies also appealing to the US – produce substantial benefits for US consumers.

Additional tasks remain as this research continues. First, we plan to calculate standard errors for the policy simulation results. Second, we will explore the sensitivity of results to the number of decision-makers, for example replacing countries with movie studios. Third, we plan to collect additional data on movie budgets to see if the productivity of investment varies across countries. An additional task for future work is to endogenize the set of products chosen for export to each country.

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Table 1: Movie Production around the World in 2007

Country	number	budget ($mil)	investment ($mil)
USA	656	31.0	20,336
Japan	407	5.0	2,039
France	228	7.2	1,646
UK	117	12.8	1,495
Germany	122	9.1	1,104
Canada	111	8.7	965
Spain	172	3.5	595
Korea, S	124	4.2	517
China	402	1.1	454
Italy	121	3.5	428
Hong Kong	50	6.3	315
Australia	30	7.6	229
India	1164	0.2	221
Switzerland	76	2.7	202
Brazil	117	1.5	180
N Zealand	12	14.7	177
Belgium	32	4.2	135
Mexico	70	1.5	103
Netherlands	26	3.8	100
Turkey	43	2.0	85
Austria	32	2.6	82
Argentina	80	0.9	75
Ireland	14	5.4	75
Denmark	24	3.0	72
Sweden	28	2.5	71
Thailand	54	1.0	55
Norway	22	2.4	53
Poland	31	1.7	51
Egypt	42	1.0	43
Hungary	41	0.9	35
South Africa	15	2.3	34
Czech Republic	18	1.5	27
Finland	17	1.5	26
Portugal	15	1.6	24
Taiwan	30	0.7	20
Singapore	11	1.8	20
Indonesia	77	0.2	18
Israel	18	1.0	17
Philippines	47	0.4	16

Greece	20	0.8	16
Slovakia	10	1.3	13
Bulgaria	13	1.0	12
Malaysia	28	0.4	12
Slovenia	8	1.4	12
Romania	10	1.0	10
Iceland	4	2.4	10
Latvia	6	1.5	9
Estonia	10	0.8	8
Chile	10	0.6	6
Colombia	14	0.2	3
Vietnam	12	0.2	3
Lithuania	2	1.1	2
Venezuela	8	0.3	2
Russian Federation	200	na	na
Total	5051	175.9	32,259

Source: Screen Digest, various issues.

Table 2: Foreign and Domestic Revenue by Repertoire ($mil), 2008

country	foreign	domestic	total	foreign percent
United States	9,056.3	8,433.7	17,490.1	51.8%
Japan	79.4	1,085.2	1,164.7	6.8%
France	353.5	677.4	1,030.9	34.3%
South Korea	14.1	394.2	408.3	3.5%
United Kingdom	1,931.2	347.1	2,278.4	84.8%
India	31.0	341.5	372.5	8.3%
Italy	35.6	256.5	292.1	12.2%
Germany	60.9	190.2	251.1	24.3%
Russia	18.7	187.8	206.5	9.0%
China	103.3	173.0	276.3	37.4%
Turkey	13.9	109.6	123.5	11.2%
Spain	104.7	84.1	188.8	55.5%
Mexico	24.3	62.3	86.6	28.1%
Denmark	16.7	55.2	71.9	23.2%
Poland	3.4	53.2	56.6	6.0%
Norway	1.9	39.5	41.4	4.6%
Australia	189.2	35.0	224.2	84.4%
Thailand	6.6	34.8	41.4	16.0%
Netherlands	2.0	33.1	35.1	5.8%
Philippines	0.2	28.5	28.7	0.6%
Brazil	10.5	28.2	38.7	27.2%
Hong Kong	116.8	24.8	141.6	82.5%
Sweden	4.9	22.4	27.3	18.0%
Greece	0.7	22.1	22.7	3.0%
Czech Republic	6.1	21.4	27.4	22.2%
Belgium	44.0	17.2	61.1	71.9%
Taiwan	1.4	16.9	18.3	7.6%
Malaysia	0.5	16.5	16.9	2.7%
Finland	11.0	12.7	23.8	46.3%
Argentina	7.0	12.2	19.3	36.5%
Singapore	39.6	9.3	48.8	81.0%
Austria	11.7	8.6	20.3	57.6%
South Africa	0.0	5.2	5.2	0.1%
Hungary	0.2	4.9	5.1	3.8%
Chile	2.2	4.1	6.2	35.1%
Venezuela	0.0	2.3	2.3	0.5%
New Zealand	1.6	1.9	3.5	44.8%
Iceland	1.1	1.6	2.7	40.4%
Peru	0.2	1.5	1.7	11.8%

Serbia	1.7	1.5	3.2	52.9%
Portugal	2.6	1.4	4.1	64.4%
Ukraine	0.4	1.3	1.7	23.7%
Romania	3.0	0.5	3.5	85.3%
Uruguay	0.8	0.3	1.1	74.1%
Estonia	0.1	0.3	0.4	32.1%
Slovakia	0.0	0.2	0.2	9.7%
Latvia	0.0	0.1	0.1	25.5%

Notes: authors' calculation from movie-level box office database, with repertoire classification based on first listed origin country

Table 3: European Film Investment and Government Subsidies, 2004

country	investment ($mil)	subsidy $mil	share subsidized
Austria	57.9	34.6	59.8%
Belgium	74.9	30.1	40.2%
Czech Republic	14.0	2.4	17.0%
Denmark	79.7	44.9	56.3%
Estonia	2.8	4.0	142.9%
Finland	25.6	17.5	68.4%
France	1,303.5	640.1	49.1%
Germany	702.7	254.0	36.1%
Greece	15.0	7.5	50.0%
Hungary	10.3	24.9	241.5%
Ireland	75.6	14.3	18.8%
Italy	353.7	112.5	31.8%
Latvia	0.8	1.4	171.9%
Lithuania	0.8	1.4	171.9%
Luxembourg	3.7	4.9	131.8%
Netherlands	85.1	50.4	59.2%
Poland	16.2	4.4	27.0%
Portugal	29.9	22.3	74.4%
Slovakia	2.2	0.0	0.0%
Slovenia	6.1	2.9	47.1%
Spain	392.0	89.9	22.9%
Sweden	78.4	69.8	89.0%
UK	1,486.6	147.9	9.9%
Europe Total	4,817.5	1,581.8	32.8%
USA	14,716.0		
Japan	1,562.2		
Canada	336.5		
Korea, S	297.9		
China	136.3		
World Total	22,765.8		

Notes: Sources for budgets is "Global Film Production Falls: Key Territories Hold Firm but World Production Levels Drop Off." Screen Digest, July 2009, p. 205. Source for European subsidies is Cambridge Econometrics, "Study on the Economic and Cultural Impact, notably on Co-productions, of Territorialisation Clauses of state aid Schemes for Films and Audiovisual Productions." A final report for the European Commission, DG Information Society and Media, 21 May 2008, p. 25.

Table 4: Movie Markets in 2008

country	GDP ($bil)	GDP per capita	Pop (mil)	ticket price $	admissions (mil)	admissions per capita	rev ($mil)	Rev per capita $
Australia	1,040	48,499	21	9.54	84.6	4.03	807.10	37.66
Brazil	1,640	8,532	190	4.46	89.1	0.47	397.00	2.07
Canada	1,500	45,003	33	8.01	107.8	3.27	863.00	25.91
China	4,520	3,414	1300	2.89	209.8	0.16	606.70	0.46
France	2,770	44,471	62	8.89	188.8	3.05	1,677.90	26.94
Germany	3,630	44,264	82	9.04	129.4	1.58	1,170.30	14.25
India	1,210	1,065	1100	0.56	3330.3	3.03	1,856.20	1.63
Italy	2,300	38,385	60	8.80	99.3	1.66	874.30	14.61
Japan	4,890	38,268	130	11.74	160.5	1.23	1,884.50	14.76
Mexico	1,090	10,248	110	3.53	182.4	1.66	643.60	6.05
Russian Federation	1,670	11,743	140	6.76	118.5	0.85	800.90	5.64
South Korea	931	19,162	49	5.95	150.8	3.08	896.80	18.45
Spain	1,590	35,000	46	8.46	107.8	2.34	912.00	20.02
Turkey	730	9,881	74	6.10	36.2	0.49	221.00	2.99
United Kingdom	2,660	43,361	61	9.65	164.2	2.69	1,584.50	25.80
United States	14,400	47,209	300	7.20	1248.2	4.16	8,987.10	29.53

Notes: GDP and population are from the Penn World Tables. Ticket prices and admissions are from Screen Digest.

Table 5: Where Does Origin Repertoire Sell, 2008?

	Destination														
Origin	Australia	Brazil	China	France	Germany	India	Italy	Japan	Mexico	South Korea	Spain	Turkey	UK	US	total
Australia	18.7%	0.1%	0.9%	8.3%	8.7%	14.1%	0.2%	0.1%	2.5%	2.7%	9.1%	0.7%	7.6%	26.4%	100.0%
Brazil	.	79.4%	.	2.3%	.	.	1.8%	.	12.2%	0.0%	2.7%	0.1%	1.5%	.	100.0%
China	1.4%	.	69.4%	0.3%	.	.	.	21.2%	.	7.5%	.	0.1%	0.1%	.	100.0%
France	1.5%	0.6%	0.3%	75.0%	4.8%	0.0%	2.8%	0.3%	1.0%	2.0%	3.8%	0.4%	3.9%	3.5%	100.0%
Germany	0.3%	1.3%	0.3%	2.5%	86.0%	.	0.7%	0.1%	0.9%	0.2%	3.7%	0.8%	3.1%	.	100.0%
India	0.9%	.	0.0%	.	0.0%	93.5%	.	.	.	.	.	.	5.5%	.	100.0%
Italy	0.1%	0.2%	.	3.8%	1.5%	.	90.9%	.	0.1%	0.0%	2.0%	0.7%	0.8%	.	100.0%
Japan	.	0.1%	0.1%	0.1%	0.1%	0.0%	0.1%	95.0%	0.3%	1.5%	0.2%	0.1%	0.2%	2.4%	100.0%
Mexico	0.8%	0.6%	.	3.0%	1.2%	.	2.8%	.	82.0%	2.9%	1.8%	0.1%	4.6%	.	100.0%
South Korea	.	0.0%	1.2%	0.3%	0.0%	.	0.0%	0.6%	0.0%	97.7%	0.0%	0.0%	0.0%	.	100.0%
Spain	1.2%	1.9%	0.0%	14.6%	4.0%	.	6.8%	0.2%	5.9%	0.5%	49.7%	0.7%	0.7%	13.7%	100.0%
Turkey	0.0%	0.0%	.	0.2%	8.0%	.	0.2%	.	.	.	.	91.3%	0.2%	.	100.0%
United Kingdom	6.1%	1.6%	2.5%	5.8%	7.4%	0.8%	3.0%	3.7%	2.2%	3.3%	4.4%	0.4%	18.6%	40.2%	100.0%
United States	4.2%	2.3%	1.2%	4.5%	4.6%	0.3%	3.5%	4.0%	3.3%	2.5%	4.2%	0.5%	8.4%	56.4%	100.0%
other	2.2%	3.3%	30.0%	16.2%	6.2%	1.5%	3.3%	5.3%	3.0%	5.2%	5.7%	0.8%	3.5%	13.7%	100.0%

Table 6: Where is Destination Consumption From, 2008?

	Destination													
Origin	Australia	Brazil	China	France	Germany	India	Italy	Japan	Mexico	South	Spain	Turkey	UK	US
Australia	4.3%	0.0%	0.3%	1.0%	1.4%	6.0%	0.0%	0.0%	0.7%	0.6%	1.9%	0.6%	0.8%	0.5%
Brazil	.	6.5%	.	0.1%	.	.	0.1%	.	0.7%	0.0%	0.1%	0.0%	0.0%	.
China	0.4%	.	32.3%	0.0%	.	.	.	2.9%	.	2.0%	.	0.1%	0.0%	.
France	1.7%	1.3%	0.5%	42.6%	3.8%	0.0%	2.8%	0.2%	1.5%	2.0%	3.9%	1.9%	2.1%	0.3%
Germany	0.1%	0.7%	0.1%	0.3%	16.8%	.	0.2%	0.0%	0.3%	0.0%	0.9%	0.8%	0.4%	.
India	0.4%	.	0.0%	.	0.0%	77.7%	.	.	.	.	.	.	1.2%	.
Italy	0.0%	0.1%	.	0.7%	0.4%	.	28.9%	.	0.0%	0.0%	0.6%	0.9%	0.1%	.
Japan	.	0.1%	0.3%	0.0%	0.1%	0.0%	0.1%	59.0%	0.6%	1.9%	0.3%	0.3%	0.1%	0.3%
Mexico	0.1%	0.1%	.	0.1%	0.1%	.	0.2%	.	9.8%	0.2%	0.2%	0.0%	0.2%	.
South Korea	.	0.0%	0.9%	0.1%	0.0%	.	0.0%	0.1%	0.0%	43.3%	0.0%	0.0%	0.0%	.
Spain	0.3%	0.8%	0.0%	1.6%	0.6%	.	1.3%	0.0%	1.6%	0.1%	9.4%	0.6%	0.1%	0.2%
Turkey	0.0%	0.0%	.	0.0%	0.9%	.	0.0%	.	.	.	.	52.3%	0.0%	.
United Kingdom	14.1%	6.8%	8.7%	6.8%	12.2%	3.4%	6.4%	3.8%	6.4%	6.9%	9.3%	3.2%	20.4%	8.0%
United States	77.6%	80.5%	34.5%	42.6%	61.5%	11.5%	58.4%	32.8%	76.5%	40.7%	70.9%	37.6%	73.6%	90.0%
other	1.1%	3.0%	22.3%	4.1%	2.2%	1.3%	1.5%	1.1%	1.9%	2.3%	2.5%	1.6%	0.8%	0.6%
	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%	100.0%

Table 7: Demand Model Estimates

	(1) logit	(2) Nested logit Exog price	(3) NL Other-country price IV	(4) NL With price interactions (GKP)
income	0.7330	0.6223	0.5854	0.6321
	(0.2310)**	(0.0783)**	(0.1416)**	(0.0759)**
ticket price	-0.2925	-0.1763	-0.1509	-0.1831
	(0.1260)*	(0.0323)**	(0.0814)*	(0.030)**
$\text{Log}(s_j/(1-s_0))$		0.7950	0.8151	0.7888
		(0.0634)**	(0.0616)**	(0 .0630)**
Constant	-9.6290	-4.0602	-3.983	-4.087
	(0.3643)**	(0.5329)**	(0.518)**	(0.4983)**
λ				-0.00146
				(0.0070)
Observations	16189	16189	16189	16189
R-squared	0.04			

Notes: Robust standard errors in parentheses. * significant at 10%; ** significant at 1%. Logit model estimated by OLS. Nested logit model estimated via 2SLS. Instruments for $\log(s_j/(1-s_0))$ include the log number of movies released in the exhibition country each year, along with the log of the number of movies released in the exhibition country, from each origin country, each year. In the third column we add average prices in other countries, and higher-order terms, as instruments and treat both the inside share and price as endogenous. The fourth column reports estimates from the model with the column (3) instruments as well as a price interaction with the error term. Standard errors are clustered by market.

Table 8: Mean (Median) Elasticities of Demand

	logit	Nested logit Exog price	NL Other-country price IV	NL With price interactions (GKP)
Elasticity	-2.25 (-2.43)	-6.57 (-7.14)	-6.24 (-6.78)	-6.62 (-7.23)
Inside Elasticity	-1.87 (-2.00)	-1.13 (-1.20)	-0.97 (-1.03)	-1.17 (-1.25)

Table 9: Quality and Investment

	(1)	(2)	(3)	(4)
Log Budget	0.0873	0.1663	-0.0584	0.1163
	(0.0125)**	(0.0041)**	(0.1336)	(0.0288)**
Constant	-3.2209	-3.6034	-0.6854	-2.5802
	(0.2174)**	(0.0721)**	(2.2759)	(0.5016)**
Observations	5223	5223	3847	3847
R-squared	0.01	0.90		
Estimation	OLS	OLS	IV	IV
Dest FE	no	Yes	No	Yes
Year FE	no	yes	No	yes

Notes: Standard errors in parentheses. * significant at 5%; ** significant at 1%. Dependent variable is our measure of quality, defined in text. Columns (1) and (2) report regressions of quality derived from Table 8 regressions on log movie budgets. Columns (3) and (4) report regressions of quality derived from Table 8 regressions on log movie budgets, instrumenting the individual log movie budget with the average budget of movies from the movie's origin country in the year. Standard errors in (3) and (4) are clustered on origin country years.

Table 10: Autarky, Nested Logit Estimates

	change in budget	change in CS	change in PS	total change in welfare
Australia	-58.6%	-229.0	178.0	-51.0
China	-62.8%	-265.0	385.0	120.0
France	-67.9%	-241.0	705.0	464.0
Germany	-23.7%	-196.0	2,010.0	1,814.0
Italy	-44.5%	-136.0	457.0	321.0
Japan	-53.7%	-141.0	1,580.0	1,439.0
Mexico	9.6%	-319.0	340.0	21.0
South Korea	-53.2%	-176.0	347.0	171.0
United Kingdom	-89.6%	-405.0	54.4	-350.6
United States	-76.3%	-1,230.0	-7,890.0	-9,120.0

Note: all figures are millions of US $.

Table 11: Eliminate US Exports, Nested Logit Estimates

	change in budget	change in CS	change in PS	total change in welfare
Australia	231.8%	-75.6	108.0	32.4
China	40.0%	-19.3	132.0	112.7
France	38.8%	-46.3	564.0	517.7
Germany	94.5%	-59.8	683.0	623.2
Italy	30.6%	-57.6	245.0	187.4
Japan	-12.8%	-61.0	1,040.0	979.0
Mexico	192.5%	-143.0	149.0	6.0
South Korea	1.3%	-58.1	138.0	79.9
United Kingdom	90.5%	-142.0	722.0	580.0
United States	-54.9%	-461.0	-11,300.0	-11,761.0

Note: all figures are millions of US $.

Table 12: Eliminate European Subsidies, Nested Logit Estimates

	change in budget	change in CS	change in PS	total change in welfare
Australia	65.0%	-1.3	1.9	0.6
China	3.5%	0.8	2.0	2.8
France	-67.1%	-44.0	-278.0	-322.0
Germany	-59.1%	-13.7	-139.0	-152.7
Italy	-40.5%	-11.2	-45.0	-56.2
Japan	0.1%	-1.0	19.6	18.6
Mexico	38.9%	0.9	1.2	2.1
South Korea	3.6%	-1.1	5.2	4.1
United Kingdom	-18.1%	-6.8	-26.2	-33.0
United States	-1.3%	-21.4	718.0	696.6

Note: all figures are millions of US $.

Table 13: Double the Chinese Market, Nested Logit Estimates

	change in budget	change in CS	change in PS	total change in welfare
Australia	0.2%	1.4	-1.6	-0.2
China	115.4%	40.0	376.0	416.0
France	-0.8%	2.0	-10.8	-8.8
Germany	-1.5%	1.5	-7.7	-6.1
Italy	-0.8%	1.1	-3.2	-2.1
Japan	0.3%	4.0	-59.5	-55.5
Mexico	0.7%	3.0	-1.1	1.9
South Korea	1.0%	3.8	-3.6	0.2
United Kingdom	1.3%	2.6	2.8	5.4
United States	2.3%	19.1	119.0	138.1

Note: all figures are millions of US $.

Figure 1: US Box Office and DVD Revenues

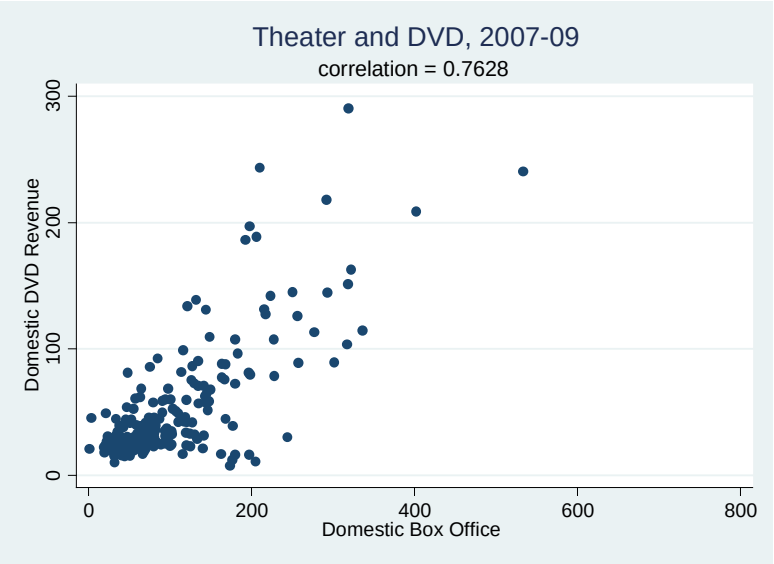


Figure 2

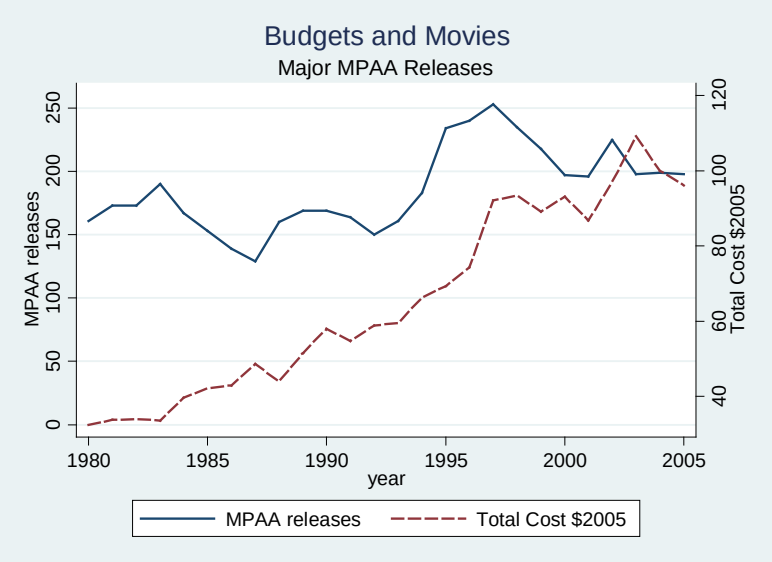
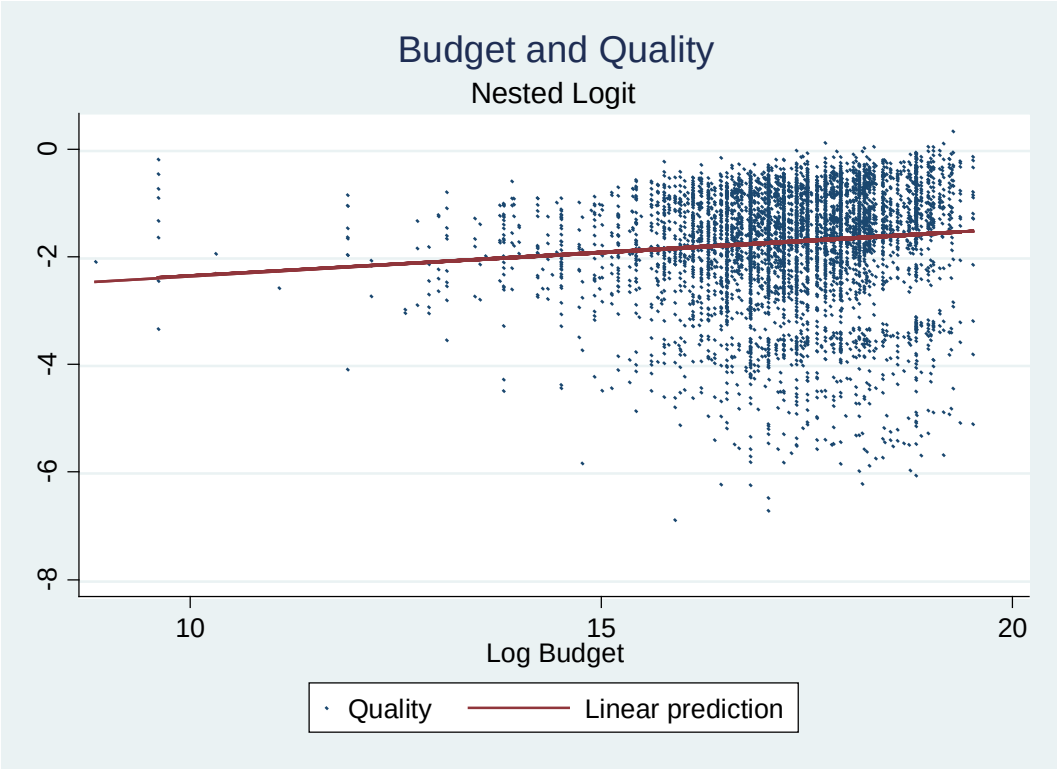

Budgets and Movies
Major MPAA Releases
MPAA releases
0
50
100
150
200
250
Total Cost $2005
40
60
80
100
120
1980
1985
1990
1995
2000
2005
year
MPAA releases
Total Cost $2005

Figure 3


Budget and Quality
Nested Logit
0
-2
-4
-6
-8
10
15
20
Log Budget
Quality
Linear prediction