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ABSTRACT

In this paper, we develop a simple empirical method to test two alternative versions of the Melitz (2003) model, one with global fixed export costs and one with bilateral fixed export costs. With global costs, import sales per product variety (relative to domestic sales per variety) are decreasing in variable trade barriers, as a result of adjustment occurring along the intensive margin of trade. With bilateral costs, imports per product variety are increasing in fixed trade costs, due to adjustment occurring along the extensive margin. We apply our approach to data on imports of U.S. motion pictures in 46 countries over 1995-2006. Imports per product variety are decreasing in geographic distance, linguistic distance, and other measures of trade costs, consistent with adjustment to these costs occurring along the intensive margin. There is relatively little variation in the number of U.S. movies that countries import but wide variation in the box-office revenues per movie. The data thus appear to reject the bilateral-fixed-export-cost model in favor of the global-fixed-export-cost model.

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I Introduction

Recent literature identifies patterns of export behavior that are inconsistent with traditional models of international trade. Most manufacturing plants in the US and France do not export any output and those that do are larger and more productive than those that do not (Bernard and Jensen, 1999 and 2004; Eaton, Kortum and Kramarz, 2004). Melitz (2003), in widely cited work, develops a model with firm heterogeneity and fixed export costs that can account for these phenomena.[1] Because of fixed trade charges, only more productive plants find it profitable to sell goods abroad.[2]

Fixed trade costs imply adjustment in trade volumes may occur along both the intensive margin (value of trade per product) and extensive margin (number of products traded). In the standard monopolistic competition model, consumer love of variety leads all products to be exported, meaning trade varies at the intensive margin only (Helpman and Krugman, 1985). A fall in transport costs causes exports of all products to increase, consistent with the robust negative coefficient on distance in the gravity model of trade (Anderson and van Wincoop, 2004). With fixed export costs and firm heterogeneity, a fall in transport costs may cause trade volumes to increase both through existing exporters exporting more and new firms beginning to export. Bernard, Jensen, Redding, and Schott (2007) find that most variation in US merchandise exports is at the extensive margin, with smaller countries importing fewer US products.[3] They also find that the negative gravity coefficient for distance is due mostly to adjustment at the extensive margin, with US manufacturers exporting fewer products to more distant countries.

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[1] For other theoretical work on firm heterogeneity and trade see Bernard, Eaton, Jensen and Kortum (2003).
[2] When applied to aggregate data, this framework yields a gravity specification that can account for why many country pairs do not trade (Helpman, Melitz, Rubinstein, 2007; Baldwin and Harrigan, 2007).
[3] In related work, Chaney (2006) finds that variation in trade cost elasticities across sectors is consistent with adjustment to trade occurring at the extensive margin.

Despite abundant indirect evidence that fixed trade costs exist, we know little about their nature. While we can measure variable trade barriers in the form of tariffs or transport fees, no similar data exist for expenses that are fixed. If fixed export costs are bilateral, such that firms incur a charge to enter each new foreign market, small countries will be disadvantaged in global trade. However, if fixed export costs are largely global in nature, such that once firms establish a global distribution network they face only variable charges in adding new markets, small countries are not at a disadvantage and it is only unproductive firms that fail to participate in trade.

In this paper, we develop a simple empirical method to test two alternative versions of the Melitz (2003) model, one with global fixed export costs and one with bilateral fixed export costs. With global fixed export costs, import sales per product variety (relative to domestic sales per variety) are decreasing in variable trade barriers, as a result of adjustment occurring along the intensive margin of trade. With bilateral fixed export costs, however, imports per product variety are increasing in fixed trade costs, due to adjustment occurring along the extensive margin. Both models produce an empirical specification that has sales per foreign variety relative to sales per domestic variety as the dependent variable and trade barriers as independent variables. To test one model against the other, one simply examines the sign of the coefficients on trade costs.

An advantage of our approach is that we need not take a stand on which trade barriers represent fixed impediments and which variable impediments. The empirical literature offers little guidance on this issue. Standard gravity variables – distance, language, colonial history – are likely correlated with variable *and* fixed barriers. We exploit the divergent predictions of the two alternative models for whether adjustment to trade barriers occurs on the intensive or extensive margin, making our approach applicable in a wide variety of empirical settings.

We apply our specification to data on imports of US motion pictures. The characteristics of the film industry are consistent with the assumptions of the Melitz framework. Fixed costs are important in movie production and studios differentiate their film product (De Vany, 2004). There is heterogeneity in movie performance, with box-office revenues for US films being asymptotically Pareto-distributed (De Vany and Walls, 1997 and 2004), matching the distributional assumptions in Melitz (2003) and most extensions. Not all US movies are exported, with no country exhibiting more than two-thirds of the movies the US produces in a given year. Data for the analysis cover box-office revenues for domestic and US movies in 46 countries over 1995-2006, as collected by ScreenDigest.com, an entertainment industry consultancy. We also make use of data on national trade barriers in motion pictures from various sources.

A broader motivation for studying motion pictures is that the vast majority of empirical work on trade is for manufacturing, with relatively little work to date on services. Movies are representative of other information services, including music, publishing, software, television, and video games, which are responsible for a growing share of US trade. These "copyright" industries tend to have large fixed production costs (associated with creating an initial film print, music recording, or software program) and small marginal production costs (associated with producing additional copies). In 2005, copyright industries accounted for 7% of US GDP; US movies, TV, and videos had foreign sales plus exports of $20 billion, just below that for US pharmaceuticals.[4] While

[4] Together, US copyright industries had exports plus foreign sales of $110 billion in 2005, exceeding the total for US chemical products and motor vehicles combined (Siwek, 2006).

one might presume copyrighted services can be exported at little expense, we know little about trade barriers for these products.[5] For movies, music, and software, language and culture may affect consumer demand and the cost of marketing goods across borders. While the physical cost of delivering information services may be low, the barriers consumers face in gaining access to them may not be.

Our main findings are that imports per product variety are decreasing in geographic distance, linguistic distance, and other measures of trade barriers, in a manner consistent with adjustment to these barriers occurring along the intensive rather than the extensive margin. There is relatively little variation in the *number* of US movies that countries import but wide variation in the box-office *revenues* per movie, with countries more distant from the US spending less on the US movies that they see. Argentina, for instance, imports roughly the same number of US movies each year as Germany, though the box office revenues per US film there are far lower. The data reject the bilateral-fixed-export-cost model in favor of the global-fixed-export-cost model, implying even small countries have access to a wide variety of US motion pictures.

Interestingly, the specification of the Melitz model preferred by the data is quite similar to that for the standard monopolistic competition model (e.g., Krugman, 1980; Helpman and Krugman, 1985), which has no firm heterogeneity or fixed export costs. This is because in both the monopolistic competition model and the Melitz model with global fixed export costs adjustment to trade costs occurs along the intensive margin. Obviously, the standard monopolistic competition model fails in our data by not accounting for why some US movies are not exported.

[5] There is a growing literature on motion picture trade. See Hanson and Xiang (2008) for references.

II Theory

In this section, we develop two versions of the Melitz model. In one, fixed exports costs are bilateral, incurred each time a producer enters a new export market; in the other, they are global, incurred once, when a producer starts exporting. The two models yield different predictions for how trade costs affect box office revenues per movie. We also explore how fixed production costs impact trade patterns, depending on whether a portion of these costs are incurred after producers learn their type.

IIA Model Setup

There are many sectors, over which consumers have Cobb-Douglas preferences, and many countries, where u indexes the exporter and k indexes the importer. We focus on the movie industry and leave other sectors in the background. As movies are consumed in discrete units, we adopt a discrete choice framework (e.g., Anderson, de Palma and Thisse, 1992; Feenstra, 2004). Our model preserves the main features of Melitz (2003) and allows for endogenous markups, as in Melitz and Ottaviano (2005).[6]

Movies are subject to cultural discount (Waterman, 2005). For a consumer in country k, a movie from country u (the US) reduces utility by δ_{uk} as compared with a domestic movie, where $\delta_{uk} > 0$. δ_{uk} represents the portion of a movie's value that is lost in translation in moving from one country to another. We expect δ_{uk} to be lower the more similar are two countries' culture and language.

Movies are also subject to fixed and variable trade costs. Variable specific trade

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[6] Melitz (2003) assumes a representative consumer with CES preferences. Anderson et al. (1992) show that if goods are consumed in continuous units, a discrete choice model generates the same market demand functions as a representative consumer with CES preferences. As we assume individuals consume either zero or one unit of a movie, the demand functions we derive differ somewhat from Melitz. Even so, our qualitative predictions for the relationship between trade and trade costs are very similar to what obtains under CES preferences, as we show in an Appendix.

fees, defined as $t_{uk} > 0$, include tariffs and surcharges on foreign movie revenues (Marvasti and Canterbery, 2005), transaction costs in negotiating contracts between US movie distributors and foreign movie exhibitors (Gil and LaFontaine, 2007),[7] advertising expenses (which are increasing in the length of time a movie spends in theatres), and film printing expenses (which are increasing in the number of the number of times a movie is shown and the number of theatres in which it appears).[8] Fixed export costs, which we introduce formally below, are associated with allocating the right to distribute a movie in different countries, creating an international marketing campaign, editing movies for foreign audiences, and adding subtitles or dubbing movie dialogue. Fixed costs may be market specific (if each country requires its own marketing campaign) or global in nature (if a single marketing campaign can serve multiple countries). Obviously, fixed and variable trade charges may have common underlying determinants, with distance, language, and the costs of enforcing contracts possibly affecting both.[9]

In country k, consumer o picks one movie from n_k domestic and foreign movies, deriving utility $V_{jk}^o = v_{jk} + \varepsilon_{jk}^o$ if she chooses movie j. ε_{jk}^o is an i.i.d. random variable of the double exponential distribution with mean 0 and variance $\rho^2/6$, and v_{jk} is given by

$$v_{jk} = \lambda_{jk} - \delta_{jk} - t_{jk} - p_{jk}, \quad (1)$$

where p_{jk} is the price of movie j net of policy trade barriers (and we set $\delta_{kk} = t_{kk} = 0$). A demand shifter, λ_{jk}, incorporates heterogeneity in movies. A movie with a high λ_{jk} is

[7] Gil and LaFontaine (2007) find that in the Spanish movie industry distributors sign an initial contract for sharing revenues with movie exhibitors, which may be renegotiated multiple times, as a movie reveals itself to be more or less popular than expected. Contracting costs are thus a function of the *level* of revenues and not simply the discrete outcome of whether or not a movie is shown.
[8] The Motion Picture Association (2003) reports that for the average US movie in 2003, 65% of total costs were due to film production and 35% were due to marketing (which includes making film prints; advertising on radio, TV, newspapers and other media; and other promotional activities).
[9] We take as given the number of movie theatres in each country. While expanding the number of theatres is a fixed cost in distributing movies, it is not one that is specific to individual films.

popular (*E.T., Titanic*) and one with a low λ_{jk} is unpopular (*Ishtar, Gigli*). We assume the popularity of a movie does not depend on the country in which it is shown ($\lambda_{jk} = \lambda_j$ for all k) and that λ_j is drawn from a common distribution, $G(\lambda)$.[10] Introducing heterogeneity in demand rather than in marginal costs, as in Melitz (2003), keeps variation in admission prices for movies within a country compressed, consistent with the data (De Vany, 2004).

Applying results in Anderson et al. (1992), we can show that the box-office revenues (total sales) of movie j produced in country u and shown in country k are

$$s_{juk} = \left(p_{juk} + t_{uk}\right)\exp\left(\lambda_j - \delta_{uk} - t_{uk} - p_{juk}\right)A_k, \tag{2}$$

where $A_k = \alpha Y_k / M_k$ and $M_k = \sum_l \left(p_{lk} + t_{lk}\right)\exp\left(v_{lk}\right)$, Y_k is income, α is the expenditure share for the movie industry, and p_{juk} is the price of movie j net of policy trade barriers in k. M_k captures market competitiveness in country k, similar to the CES price index. Equation (2) resembles a CES demand function with each movie as a product variety. Box-office revenues of domestically produced movie h in country k equal,

$$s_{hkk} = p_{hk}\exp(\lambda_h - p_{hk})A_k\,. \tag{3}$$

We assume movie production occurs in four steps. (i) A producer in country u hires f_E units of country-u labor to produce a master film print, which is a sunk labor input. (ii) The producer draws a λ from the distribution $G(\lambda)$. (iii) The producer uses a variable labor input to exhibit the movie to an audience, with input costs incurred in the country where the audience is located. For each unit of the movie shown in country k, the producer hires one unit of country-k labor. And (iv) the producer collects profits.

By assumption (ii), all fixed production costs are incurred before the popularity of

[10] The top grossing movies tend to be the same across national markets. For 2003 to 2005, our data show the top ten movies by box office revenue for each country. In each year, at least six movies appear in the top ten lists of two thirds or more of the countries. Waterman (2005) provides similar evidence.

a movie is revealed, which we refer to as a *pure sunk cost* setting. This differs from Melitz (2003), in which some fixed production costs are incurred after heterogeneity is revealed, which we refer to as a *partial sunk cost* setting. We first derive results for pure sunk costs and later consider partial sunk costs. Pure sunk costs capture the riskiness and short-lived nature of movies. A strong indicator of a movie's popularity is the box office revenue earned during its first week of release (typically, on the domestic market), by which time production and domestic distribution costs have been incurred. By the end of three weeks, the average movie has earned 66% of its total box-office revenues (De Vany and Walls, 1999). As in Melitz (2003), the role of the sunk entry cost is to pin down N_k, the number of country-k producers that draw from $G(\lambda)$.[11]

In our model, each firm produces a single variety, as in Melitz (2003). However, our setting also has a multi-product-firm interpretation, consistent with Bernard, Redding and Schott (2006). Most movies are distributed by large movie studios, which are often involved in movie production as well.[12] While there are a large number of studios worldwide, a half dozen distribute most high-grossing films.[13] One can think of a movie studio as a multi-product firm. Within a given year, a studio will release many movies, where each movie is a product variety. The short lived nature of movies allows each studio to differentiate its movies in time, avoiding the simultaneous release of two or

[11] In an Appendix we derive N_k assuming m identical countries and each country having one sector, as in Melitz (2003). N_k and its counterparts in other countries are jointly determined.

[12] Making a movie involves four stages: development (securing rights, screen writing, casting, financing), production (filming, special effects, music, editing), distribution (marketing, negotiating with theatres), and exhibition. While studios are usually involved in distribution, they have varying roles in earlier stages, sometimes handling a movie from start to finish (Paramount and *Mission: Impossible II*) and sometimes buying distribution rights to an already finished movie (20th Century Fox and *Little Miss Sunshine*). US antitrust rulings prevent movie studios from owning theatres, meaning studios do not control exhibition.

[13] The major studios (and their corporate parents) are Columbia/MGM (Sony), Paramount (Viacom), 20th Century Fox (News Corp.), Universal Pictures (GE), Disney (Disney), and Warner Bros. (Time-Warner). While there is little entry or exit by studios, changes in studio ownership are frequent (Waterman, 2005).

more films. While a studio may produce multiple movie products, it will only produce one variety per product. In this setting, for each product we can still apply assumptions (i)-(iv) and proceed with the analysis.[14]

Following Melitz (2003), we assume the movie industry is monopolistically competitive.[15] By (2) and (3), the elasticity of demand for domestic movie h is $-p_{hkk}$ and for country-u movie j is $-(p_{ukj} + t_{uk})$. As price increases, demand becomes more elastic and markups decrease, as with linear demands in Melitz and Ottaviano (2005). It follows that,

$$p_{hkk} = w_k + 1,\ \ p_{ukj} + t_{uk} = w_k + 1 + t_{uk} \ \rightarrow p_{hkk} = p_{juk} = w_k + 1 \text{ for all } u, h, j, \quad (4)$$

where w_k is the wage in country k.[16] Because the cultural discount is a source of home bias in demand, it does not affect prices (Anderson and van Wincoop, 2004). Similarly, λ_j affects the quantity demanded but not prices. Equation (4) implies that in market k, the prices of domestic and foreign movies (net of policy trade barriers) are the same.

Once a producer in country k draws its λ, sunk costs have been incurred, implying the movie will be made, with pricing given by (4) and sales by (3). The number of country-k movies produced, n_{kk}, is $N_{k,}$ the number of country-k movies drawn from G(λ),

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[14] Multi-product firms bring two additional elements into consideration. First, the popularity of a movie may depend on the "ability" of its studio. Following Bernard, Redding and Schott (2006), we assume the distribution of studio abilities is independent of λ and that the ability of a given studio is common for all products. With each studio randomly drawing its ability when it enters the market, studio abilities are given for each individual movie. Second, the entry decisions and numbers of studios in the market may depend on studio-level sunk entry costs and per period studio-level fixed costs, as well as studio-level ability. Since we lack data on which movies are distributed by which studios, we leave studios in the background of the analysis and focus on individual movies. Some portion of our product-level sunk entry cost f_E might be indistinguishable from the studio-level fixed cost, but f_E also remains in the background of our analysis. A further reason to leave studios in the background is that the studio that distributes a movie abroad may not be the same one that distributes it domestically. US studios frequently use joint ventures to release movies abroad. See McCalman (2004, 2005) on contractual decisions in foreign movie distribution.

[15] Because the number of major movie studios is small, the assumption of monopolistic competition might seem questionable. However, one can view competition in movies as occurring not between studios but between the top talents involved in a movie, such as actors, directors, and producers, whose numbers far exceed the number of major studios. To secure the star power of these talents, studios bid for their services (Waterman, 2005), driving expected profits toward zero.

[16] The marginal cost of a domestic movie is w_k, with market price $w_k + 1$; the marginal cost of a country-u movie shown in country k is $w_k + t_{uk}$, with market price $w_k + t_{uk} + 1$.

$$n_{kk} = N_k \, . \quad (5)$$

To derive sales of domestic movies in country k, we assume that $G(\cdot)$ is exponential, such that $G(\lambda) = 1 - d^{\kappa}\exp(-\lambda\kappa)$, with $\kappa > 0$ and $\lambda \in [\ln d, +\infty)$. By (3) movie sales, s_{hkk}, are then Pareto-distributed, and total sales of country-k movies in country k are $S_{kk} = N_k \int_{\ln d}^{\infty} s_{hkk} dG(\lambda)$. (In section IV, we examine whether movie revenues are, in fact, Pareto.) For the integrand to be finite, the distribution $G(\lambda)$ must have a sufficiently thin tail, which requires that $\kappa > 1$. It follows that,

$$S_{kk} = N_k \int_{\ln d}^{\infty} s_{hkk} dG(\lambda) = n_{kk}(w_k + 1)e^{-(w_k+1)} A_k \frac{\kappa d}{\kappa - 1} \, . \quad (6)$$

As expenditure for movies by country k, A_k, increases, or the wage in country k, w_k, decreases, the total sale of domestic movies in country-k movies increases.[17]

IIB Global Fixed Export Costs

Consider the producers of country-u movies who would like to export to country k. Exporting requires a global fixed cost of f_G units of country-u labor, incurred after the drawing of the demand shifter λ. We allow producers to observe their type before making the export decision, consistent with the movie industry where producers release films on the domestic market first, and then, if they are sufficiently successful, in theatres abroad.[18] Paying this fixed cost allows a country-u movie to be exported to the rest of the world. By (2), a country-u producer of movie j gets revenue s_{juk} for serving country k. Total sales from exporting movie j is then $\sum_{k \neq u} s_{juk}$; the profit from exporting movie j is

[17] The derivative of $\ln S_{kk}$ with respect to w_k equals $-w_k/(1+w_k)$.

[18] Elberse and Eliashberg (2003) find that US movies with stronger domestic market performance tend to have higher opening-week box-office revenues when they are released in foreign markets. McCalman (2005) shows that movies released simultaneously in the US and a few foreign markets ("day and date" releases) are released in other foreign markets with a lag.

$$\pi_{ju} = e^{\lambda_j} Q_u - f_G w_u, \quad Q_u = \sum_{k \neq u} e^{-(w_k + 1 + t_{uk} + \delta_{uk})} A_k \,. \tag{7}$$

Setting $\pi_{ju} = 0$ yields the cut-off value of λ for a country-*u* movie to be exported:

$$\underline{\lambda}_u = \ln \frac{w_u f_G}{Q_u} \,. \tag{8}$$

Equation (8) says that the cut-off value, $\underline{\lambda}_u$, does not vary across importing countries due to the global nature of the fixed export cost. Once a movie is shown abroad, it is shown around the globe. Country *u* thus produces two kinds of movies: those below the export cut-off ($\lambda_j < \underline{\lambda}_u$), which are domestic films; and those above, which are shown globally.

Using $\underline{\lambda}_u$, we can derive (a) the number of country-*u* movies exported to country *k*, and (b) total sales of country-*u* movies in country *k*:

$$\text{(a) } n_{uk} = N_u \int_{\underline{\lambda}_u}^{\infty} dG(\lambda_j) = N_u d^{\kappa} \exp(-\underline{\lambda}_u \kappa),$$

$$\text{(b) } S_{uk} = N_u \int_{\underline{\lambda}_u}^{\infty} s_{juk} dG(\lambda_j) = n_{uk} (w_k + 1 + t_{uk}) e^{-(w_k + 1 + t_{uk} + \delta_{uk})} A_k \frac{\kappa e^{\underline{\lambda}_u}}{\kappa - 1} \,. \tag{9}$$

To see the intuition behind (9), consider the total sales of country-*u* movies in country *k*, S_{uk}. Equation (9b) is a gravity-like prediction in which S_{uk} responds to country-*k* characteristics, such as expenditure, and variable trade barriers. This variation consists of an extensive margin – the number of country-*u* movies exported to *k* – and an intensive margin – the average sale per country-*u* movie. In (9a), the extensive margin is exporting-country specific and does not vary with importing-country characteristics. As a result, all variation in S_{uk} occurs along the intensive margin. The fixed export cost does not affect the intensive margin because it does not vary across importers.

Together, equations (5), (6) and (9) imply that:

$$\ln\left(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}\right) = -\delta_{uk} - t_{uk} + \ln\left(1+\frac{t_{uk}}{w_k+1}\right) + \ln C_u \approx -\delta_{uk} - t_{uk}\frac{w_k}{w_k+1} + \ln C_u$$
$$\approx -\delta_{uk} - t_{uk} + \ln C_u, \tag{10}$$

where $C_u = \exp(\underline{\lambda}_u)/d$.[19] In equation (10), S_{uk}/n_{uk} and S_{kk}/n_{kk} are the average sales in country k of a movie produced in country u and of movies produced domestically. On the left of (10) are average sales in relative terms, which we refer to as the average sales ratio. By expressing average sales as a log difference, the competitiveness of market k, M_k, and domestic expenditure on movies, αY_k, drop out. With global fixed export costs and pure sunk costs, the average sales ratio is negatively correlated with variable trade barriers between an importer and an exporter.

A result similar to equation (10) holds if we remove firm heterogeneity and fixed export costs from our model (but retain the discrete choice setting), in which case we get,

$$\ln\left(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}\right) \approx -\delta_{uk} - t_{uk}\,. \tag{11}$$

In this model, which is similar to the standard monopolistic competition model, the variation of S_{uk} occurs along the intensive margin, as in (10); however, this model also predicts all movies are exported, contrary to Melitz-type models.

IIC Bilateral Fixed Export Costs

Next, we consider a version of the model with bilateral fixed export costs. To exhibit movies abroad, producers are now subject to a fixed cost that is specific to each destination market. Showing a country-u movie in country k involves a fixed input of f_{uk} units of country-k labor, showing the movie in country l involves an additional f_{ul} units of

[19] The second line of (10) includes two approximations, one is that for small x, $\ln(1+x) \approx x$, and the second is that $-t_{uk} + t_{uk}/(w_k+1) = -t_{uk}\, w_k/(w_k+1) \approx -t_{uk}$. In the estimation, we impose the first approximation, but not the second. Since each of the specifications we derive includes the term, $t_{uk}/(w_k+1)$, we incorporate as regressors interactions between trade barriers and the inverse of wages (see note 32).

country-*l* labor, etc. The other elements of the model are the same. The assumption of bilateral fixed export costs is widely used in the literature on firm heterogeneity (e.g., Chaney, 2006; Helpman, Melitz and Rubinstein, 2007), though Melitz (2003) makes no explicit case for fixed export costs being bilateral or global in nature.

For a country-*u* producer, showing movie *j* in country *k* now yields profit

$$\pi_{juk} = e^{\lambda_j - (w_k + 1 + t_{uk} + \delta_{uk})} A_k - f_{uk} w_k . \tag{12}$$

Setting $\pi_{juk} = 0$, the cut-off value of λ_j for a country-*u* producer to serve country *k* is

$$\underline{\lambda}_{uk} = w_k + 1 + t_{uk} + \delta_{uk} + \ln \frac{w_k f_{uk}}{A_k} . \tag{13}$$

An increase in the importing-country wage, w_k, not only increases the fixed export cost for country-u movies, but also makes their demand more elastic and lowers their markup (see (4)). Both effects decrease the profit of showing country-u movies in country k and increase $\underline{\lambda}_{uk}$. These features are reminiscent of Melitz and Ottaviano (2005).

Analogous to (9), we can use $\underline{\lambda}_{uk}$ to derive: (a) the number of country-u movies exported to country k, and (b) the total sales of country-u movies in country k:

$$\text{(a)}\ \ n_{uk} = N_u \int_{\underline{\lambda}_{uk}}^{\infty} dG(\lambda_j) = N_u d^{\kappa} \exp(-\underline{\lambda}_{uk} \kappa),$$

$$\text{(b)}\ \ S_{uk} = N_u \int_{\underline{\lambda}_{uk}}^{\infty} s_{juk} dG(\lambda_j) = \frac{\kappa d^{\kappa} e^{-\underline{\lambda}_{uk}(\kappa - 1)}}{\kappa - 1} N_u (w_k + 1 + t_{uk}) e^{-(w_k + 1 + t_{uk} + \delta_{uk})} A_k$$

$$= \frac{\kappa n_{uk}}{\kappa - 1} (w_k + 1 + t_{uk}) w_k f_{uk} . \tag{14}$$

Equations (5) and (6) continue to hold for the domestic production and sales of country k movies. Together with equation (14) they imply that:

$$\ln\left(\frac{S_{uk} / n_{uk}}{S_{kk} / n_{kk}}\right) = \ln(f_{uk}) + \ln \frac{w_k}{A_k} + w_k + \ln\left(1 + \frac{t_{uk}}{w_k + 1}\right) + C_3$$

$$\approx \ln(f_{uk}) + \ln\frac{w_k}{A_k} + w_k + \frac{t_{uk}}{w_k + 1} + C_3, \tag{15}$$

where $C_3 = 1 - \ln d$. With bilateral fixed export costs and pure fixed costs, the average sales ratio is positively correlated with fixed and variable trade costs, and negatively correlated with importing-country movie expenditure. Equations (10) and (15) highlight the importance of the nature of fixed export costs for the intensive and extensive margin of trade: changing fixed export costs from global to bilateral reverses the sign of correlation between the average sales ratio and trade barriers.

IID Pure versus Partial Sunk Costs

Our treatment of fixed production costs as being entirely sunk (incurred before a producer discovers its type) departs from what is standard in the literature. Next, we allow fixed production costs to be incurred after a producer learns its type.

Suppose a producer of movie *h* in country k incurs fixed production costs of *b* units of country-*k* labor, after she draws the demand shifter λ_h from the distribution $G(\lambda)$. Of all the N_k movies that *could* be made, only $n_{kk} < N_k$ movies will *actually* be made. After the producer observes λ_h, she may decide not to make movie *h* at all, so as to avoid paying the fixed production cost. Analogous to (12)-(14), we can derive (a) the profit of movie *h*, (b) the cutoff value of λ for movie *h* to be made, (c) the number of country-k movies actually made, and (d) the total box-office sales of country-k movies:

(a) $\pi_{hkk} = e^{\lambda_{kh} - w_k - 1} A_k - b w_k, \quad A_k = \frac{\alpha Y_k}{M_k},$

(b) $\underline{\lambda}_{kk} = w_k + 1 + \ln\frac{w_k b}{A_k},$

(c) $n_{kk} = N_k \int_{\underline{\lambda}_{kk}}^{\infty} dG(\lambda_h) = N_k d^{\kappa} \exp(-\underline{\lambda}_{kk}\kappa),$

(d) $S_{kk} = N_k \int_{\underline{\lambda}_{kk}}^{\infty} s_{hkk} dG(\lambda_h) = \frac{\kappa d^{\kappa} e^{-\underline{\lambda}_{kk}(\kappa-1)}}{(\kappa-1)e^{w_k+1}} N_k (w_k+1) A_k \ = \frac{\kappa n_{kk}}{\kappa-1}(w_k+1)w_k b$. (16)

The fraction of movies that are made (n_{kk}/N_k) varies with domestic market conditions, such as national expenditure and the expenditure share on movies, adjustment mechanisms that are absent under pure sunk costs.

To see the importance of these mechanisms, consider domestic movie sales in country *k*, S_{kk}. Suppose the size of country k increases and the number of movies that have their λ's drawn, N_k, remains unchanged.[20] The result will be that S_{kk} rises. From (3), there is a direct effect in that the revenue of each movie is higher. From (16c), there is also an indirect effect in that the variable profit of each movie is higher, causing more movies to be made (n_{kk} rises). Does the number of movies made rise by more or less than total movie sales? The indirect effect on $\ln(S_{kk})$ depends on the box office revenues of the infra-marginal movies relative to the rest of country-k movies (the extra-marginal movies), while the effect on $\ln(n_{kk})$ depends on the *number* of infra-marginal movies relative to the number of extra-marginal movies. Because infra-marginal movies are less popular than extra-marginal ones, they carry more weight in movie numbers than in movie sales. As a consequence, the effect of Y_k on $\ln(n_{kk})$ exceeds the indirect effect on $\ln(S_{kk})$. Given the Pareto distribution of sales, the effect of Y_k on $\ln(n_{kk})$ equals its *total effect* on $\ln(S_{kk})$. This means a change in market size has no effect on the intensive margin, S_{kk}/n_{kk}, and all adjustment in S_{kk} occurs along the extensive margin. In contrast, under pure sunk production costs, market size does not change the number of movies made, forcing adjustment in S_{kk} to occur along the intensive margin.

Using (16), we can derive the average sales ratio under alternative assumptions

[20] By (16), a change in N_k has the same effects on n_{kk} and S_{kk}.

for fixed trade costs. If fixed export costs are global, the sales of country-u movies in country k are described by equation (9) so that:

$$\ln\left(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}\right) = -t_{uk} - \delta_{uk} - w_k + \ln\frac{A_k}{w_k} + \ln\left(1+\frac{t_{uk}}{w_k+1}\right) + C_{u1}$$
$$\approx -t_{uk} - \delta_{uk} - w_k + \ln\frac{A_k}{w_k} + C_{u1}, \qquad (17)$$

where $C_{u1} = \underline{\lambda}_u - \ln b - 1$. The average sales ratio is negatively correlated with variable trade costs, as in (10), and is now correlated with importing country expenditure, unlike (10). Domestic movie production adjusts along the extensive margin but movie exports adjust along the intensive margin so that importing country characteristics now have different impacts on the sales of foreign and domestic movies. If fixed export costs are bilateral, the sales of country-u movies in country k are described by (14) such that:

$$\ln\left(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}\right) = \ln\frac{f_{uk}}{b} + \ln\left(1+\frac{t_{uk}}{w_k+1}\right) \approx \ln\frac{f_{uk}}{b} + \frac{t_{uk}}{w_k+1}. \qquad (18)$$

Equation (18) is similar to the predictions under the original setting of Melitz (2003). The average sales ratio is positively correlated with fixed and variable trade costs, as in (15), but uncorrelated with importing country characteristics, unlike (15). Domestic and foreign movie sales each adjust along the extensive margin only so that importing country expenditure has the same impact on the average sales of both movie types.

Table 1 presents equations (10), (15), (17) and (18) in a two-by-two matrix. Each equation gives the relationship between the average sales ratio, trade costs, and other importing-country characteristics for one of the four models considered. Specifications differ across the columns according to fixed export costs (global versus bilateral) and down the rows according to sunk production costs (pure versus partial).

IIE Empirical Specifications

We use the predictions in Table 1 for our empirical specifications. Let country u be the US, S_{ukt} and n_{ukt} be total box-office revenue for US films and the total number of US films shown in country k in year t, and S_{kkt} and n_{kkt} be the total box office revenue and total number of domestically produced films shown in k in year t. In Table 1, all four models predict that the average sales ratio is correlated with trade barriers. The two models with global fixed export costs (the left column) predict *negative* correlations with variable trade barriers, while those with bilateral fixed export costs (the right column) predict *positive* correlations with fixed trade costs. Let X_{uk} be a vector of covariates for trade barriers between the US and country k. The first regression we estimate is,[21]

$$\ln\left(\frac{S_{ukt}/n_{ukt}}{S_{kkt}/n_{kkt}}\right) = \alpha_t + \beta \mathrm{X}_{\mathrm{uk}} + \varepsilon_{ukt}. \qquad (19)$$

Under global fixed export costs X_{uk} contains variable trade barriers (in levels), with $\beta < 0$; under bilateral fixed export costs X_{uk} contains fixed trade costs (in logs) and variable trade costs (in level ratios with wages), with $\beta > 0$.

Many of the variables one would include in X_{uk} are proxies rather than direct measures of bilateral trade barriers, such as distance, having a common language, sharing a colonial history, etc. It is difficult to determine whether these factors are associated with fixed or variable impediments. An advantage of the specification in (19) is that we do not need to resolve the fixed-versus-variable-trade-barrier dilemma. Since global and bilateral fixed export costs give opposite sign predictions for the correlation between the average sales ratio and trade barriers, testing one against the other simply involves

[21] Recent work examines the correlation between the normalized number of firms exporting to a country and the size of the importing country (e.g., Eaton, Kortum and Kramarz, 2004; Arkolakis, 2007). In an Appendix, we show this correlation does not help us distinguish global versus bilateral fixed cost models.

determining whether the elements of the parameter vector β are positive or negative. Also, the double differencing implicit in the average sales ratio in (19) sweeps out of the estimation market competitiveness, the consumption share of movies, and number of movies that could be made for country *k*, all of which are hard to measure.

The second specification we estimate incorporates predictions from theory for the correlation between the average sales ratio, importing country size, and importing country labor costs. Let Y_{kt} be the vector of variables that measure movie expenditures and wages in country k. We augment the specification in (19) to obtain

$$\ln\left(\frac{S_{ukt}/n_{ukt}}{S_{kkt}/n_{kkt}}\right) = \alpha_t + \beta X_{uk} + \gamma Y_{kt} + \varepsilon_{ukt}. \qquad (20)$$

When the margin of adjustment for movie exports matches that for domestic movie production, importing country expenditure (adjusted by the wage) has symmetric impacts on movie exports and domestic movie output. Expenditure is uncorrelated with the average sales ratio, implying $\gamma = 0$, as occurs along the diagonal of Table 1. Alternatively, where the margins of adjustment for movie exports and domestic movies do not align, we have that $\gamma \neq 0$, as occurs along the off-diagonal of Table 1.

III Data

IIIA Exports of US Motion Pictures

We evaluate the demand for US films and domestically made films using data on box-office revenues by country and year.[22] Box-office revenues are equivalent to the c.i.f. (customs, insurance, freight) value of motion-picture services consumed in cinemas,

[22] Individuals consume services of new movie releases through cinemas and previous movie releases through TV and video rentals or purchases. Distributors release movies to cinemas first, then to the pay per view, home video, cable TV, and broadcast TV markets in sequence, such that for a given film the services do not compete contemporaneously (e.g., for the typical movie there is a 150-200 day lag between the date of release in theatres on the US market and the date of release on the home video market) (Waterman, 2005). Unfortunately, data on film revenues by origin country from non-cinema sources are unavailable.

plus retail markups. These revenues include import duties, transport costs, and other trade costs incurred in delivering the service to the consumer, as well as sales taxes and exhibition fees collected by cinemas. They are consistent with the trade-cost-inclusive measure of sales used in the models developed in section II.

Data on box-office revenues for 46 countries over the period 1995-2006 are available from Screendigest.com.[23] In each country, Screendigest reports the number of films screened, total film attendance, and total box-office revenues for films imported from the United States and films produced domestically.[24] Data cover first-run theatrical releases, which excludes older films, pornographic films, and movies shown only on TV or through the home video market. For Europe, coverage begins in 1995, while for other regions it begins later.[25] Data are compiled from government agencies, national film bodies, film exhibitor and distributor associations, and company spokespeople.[26]

One concern about the Screendigest data is it may represent a sample of countries selected for having large film markets. Were the company to avoid countries that import

[23] We use data from an industry source because government sources do not collect data on global film revenues. The US government does not publish trade flows for movies. UN Comtrade lists motion-picture trade as a commodity, Cinematographic Film Exposed or Developed (SITC 883), which is the reported value of physical shipments of film prints across borders. Physical film shipments vastly understate film revenues. Comtrade reports 2000 US film exports of $0.5 million to France, $0.5 million to Germany, and $6.5 million to the U.K., while Screendigest reports 2000 box-office revenues for US films of $513 million in France, $615 million in Germany, and $429 million in the U.K. (Hancock and Jones, 2003).

[24] Most box-office revenues are earned shortly after a film is released (De Vany and Walls, 1999), suggesting that revenues reported in a given year match the movies released in that year. Some revenue data are available for films imported from countries other than the US, but the countries covered vary across destinations (e.g., while the UK is a major importer of movies from India, other countries are not).

[25] Screendigest covers a total of 56 countries (including the US). For nine countries, however, data are available for box office revenues of US movies but not the number of US movies released.

[26] One issue is how to classify the nationality of a film. Screendigest defines the origin country for a film by the location of the company that produces the film. For a given movie, filming may occur in multiple locations. *Titanic* (1997), for instance, was shot in Canada, Mexico and the United States, with most other production activities occurring in Los Angeles. Screendigest considers the movie to be US in origin because the production companies, 20th Century Fox and Paramount, are US based. Despite *Titanic*'s filming locations, it is clearly a US movie. The dialogue is in English, it was first released in the US market, and its cultural themes were targeted to a US audience. The cultural discount involved in exporting *Titanic* to, say, Italy would logically have the US as the reference point.

few foreign films, our results on the extensive and intensive margins of trade would not be globally representative. The Screendigest data include all of Europe and North America, and most of Asia, South America, and the more secular states in North Africa and the Middle East (see Table A2). Missing are the Caribbean and Central America, Central Asia, most Islamic republics, Pacific island nations, and Sub-Saharan Africa, which are regions dominated by small developing countries. To determine whether film imports in these economies differ from the Screendigest sample, we examined film listings in major newspapers covering 25 markets in the missing regions.[27] In these countries, 1.4 new US movies are released on average each week, equivalent to 72 US movies a year, a level of imports roughly comparable to those by the Baltic counties, which are among the smaller markets in the Screendigest sample. While we do not have information on box office revenues in these 25 countries, they are importing large numbers of US films, suggesting the countries excluded from Screendigest are not importing only a handful of movies.

IIIB Trade Barriers in Motion Picture Trade

The method for testing the Melitz model that we develop in section II calls for all relevant trade barriers to be included in the estimation. We include measures of geographic distance, cultural distance, levies on film imports, quantitative restrictions on film imports, and the protection of intellectual property rights.

For cultural trade barriers between the United States and its trading partners, we use indicators of linguistic dissimilarity between countries. Following Fearon (2003) and

[27] These countries are Bangladesh, Cambodia, Costa Rica, the Dominican Republic, El Salvador, Ethiopia, Ghana, Honduras, Ivory Coast, Jamaica, Jordan, Kazakhstan, Kenya, Mozambique, Nigeria, Panama, Pakistan, Peru, Qatar, Senegal, Sri Lanka, Tanzania, Uganda, Uruguay, and Vietnam.

Wacziarg and Spolare (2006), we calculate linguistic distance as 1 minus the expected value of a linguistic similarity factor between a person randomly drawn from the United States and one randomly drawn from country *k*:

$$LD_{uk} = 1 - \sum_l \sum_o p_{lu} p_{ok} \sqrt{G_{lo}/15}, \qquad (21)$$

where *l* indexes the ethnic groups that speak different languages in the US, *o* indexes those in country *k* and p_{lu} and p_{ok} are the population shares of language groups *l* and *o* in the US and country k. The linguistic similarity factor is $\sqrt{G_{lo}/15}$, where G_{lo} is the number of branches of the language tree that groups *l* and *o* share and 15 is the maximum number of branches. We make linguistic similarity concave with respect to G_{lo} because early divergence in the language tree (e.g., Indo-European vs. Japanese language families) is likely to signify greater cultural difference than later divergence (e.g., Italic vs. Germanic languages). In section IV, we compare linguistic distance to other language variables. As another measure of culture dissimilarity, we use a related metric of religious distance. Data on the global language tree is from Fearon (2003) and on the global religion tree is from Fearon and Mecham (2007). For additional measures of cultural distance, we use three indices of national values from Hofstede (2001): an individualism index (intensity of perception that social ties between individuals are loose), a masculinity index (strength of belief that men should have assertive roles in society), and a power distance index (willingness to accept an unequal distribution of power).[28]

One measure of policy trade barriers for the film industry is a country's MFN

[28] These indices are based on surveys IBM conducted of its global employees in 70 countries in the 1960s and 1970s. US values (country averages) are 91 (44) for the individualism index, 62 (51) for the male dominance index, and 40 (59) for the power distance. Relative to other countries, US respondents tend to be more likely to perceive social ties as being weak, to have stronger beliefs that men should have assertive roles in society, and to be more willing to accept an unequal distribution of power.

tariff on Cinematographic Film Exposed and Developed (HS 3706), which is the product category that covers trade in film prints across borders, from the UN Trains dataset. Since tariff data are unavailable in later years and reported inconsistently across countries in earlier years, we measure tariffs as the average value over the 1990-1998 period. For the countries in our sample, the average MFN tariff on film imports is 5.6%.

A second source of data on trade barriers is an annual report by the Motion Pictures Association of America (MPAA) to the US Trade Representative. The MPAA report covers over 100 countries, listing for each the policies its members claim adversely affect their business. Policies include tariffs and levies (tariffs on film imports, taxes on royalties for foreign films, levies on foreign video sales), quantitative restrictions (import quotas on foreign films, minimum screen time for domestic films, requirements that domestic short subjects be shown with foreign films), and other restrictions (subsidies to domestic movie producers, requirements that foreign films be printed locally, mandates that foreign-language movies be dubbed, restrictions on foreign investment in film or TV). Since these measures are collected by an industry association, they may be subject to upward bias (if the MPAA exaggerates protection) and compressed variance (if the MPAA portrays all countries as restricting imports of US films). Given heterogeneity in how countries define barriers, we use dummy variables to indicate whether a specific type of barrier is in place, averaged over 1991, 1999, and 2006. Some film industry observers suggest that by the 1990s national industry barriers were insignificant in most countries, except China and a handful of former communist states (Waterman, 2005).

The protection of intellectual property rights (IPRs) may also be important for exports of motion pictures. Movie producers complain that many countries devote insufficient effort to preventing individuals from selling pirated DVDs of US movies (Siwek, 2006). McCalman (2005) finds that while moderate IPR protection encourages the spread of US movies, either very weak or very strong IPR protections decrease the speed with which US movies are released abroad.[29] The measures of IPR protection we use are (i) the Ginarte-Park (1997) index of patent protection in 2000; (ii) the Global Competitiveness Report measure of the strength of IPR protection, averaged over 2003 and 2004; (iii) an indicator for whether the US Trade Representative has placed a country on the Priority Watch List for inadequate protection of intellectual property rights in a given year (under a congressionally mandated annual review process known as Special 301); and (iv) an indicator for whether a country has entered into force the World Copyright Treaty of the World Intellectual Property Organization.[30]

IIIC Preliminary Data Analysis

For the countries in our sample, the US is by far and away the largest source for movie imports. For 2001-2006, the years for which we have complete data for most countries, Figure 1 shows that US movies account for over 60 percent of total box office revenues (domestic plus foreign movie sales) in all countries except China, France, the Philippines, and Korea. In all but six countries, the US accounts for over 40 percent of the numbers of movies exhibited. China is clearly an outlier. Its government permits no more than 20 foreign films to be released in the country each year. While other countries also place limits on film imports, they tend to be much less restrictive. Between 2001 and 2006, 12 countries set minimum requirements for the amount of screen time devoted

[29] In related work, McCalman (2004) finds that while Hollywood studios are more likely to use licensing arrangements in countries with moderate IPR protection, they tend to use more integrated governance structures in countries with either high or low IPR protection.
[30] The WIPO Copyright Treaty (adopted in 1996) commits signatories to abide by specific definitions of copyrighted material and to enforce property rights over this material. See http://www.wipo.int/.

to domestic films. In only four countries are time limits in excess of 30% and even in these cases theatres can often circumvent limits by showing domestic features in the afternoon, on weekdays, or other times when demand is slack (Chung and Song, 2008). An alternative strategy is to take on a passive domestic partner for the distribution of a movie, which allows a film to qualify for domestic treatment (Waterman, 2005).

Table 2 gives summary statistics for the key variables used in the analysis and an Appendix Table A2 shows the mean values for the numbers of US and domestic films exhibited and box office revenues per film for US and domestic films over 2001-2006. During this period, 327 new domestically produced movies were shown on average in the US each year. Consistent with the presence of fixed exports costs of some kind, the typical country in our sample imports less than half of US movies produced annually, with the mean number of US movies exhibited equal to 142. Most countries are clustered around this mean, with the country at the 20th percentile (Hungary) importing 106 US movies annually and the country at the 80th percentile (Singapore) importing 162 movies. In contrast, box-office revenues per movie show wide variation. Mean revenues per movie are $1.24 million (in 2007 US dollars), with the country occupying the 20th percentile (Slovenia) at $0.10 million and the country occupying the 80th percentile (Italy) at $2.37 million. While the ratio of the 80th to the 20th percentile for number of US movies imported is 1.5, for box office revenues per US film it is 23.7. This suggests that variation in US film exports occurs more at the intensive margin (revenues per film) than the extensive margin (number of films). The wider variation in the intensive over the extensive margin is also seen in Figure 2, which plots log revenues per US movie against log number of US movies (each expressed as the deviation from sample means), averaged by country over 2001-2006. The standard deviation for revenues per movie is 1.39 compared to 0.38 for the number of movies.

As is the case with most products, the value of film imports is strongly increasing in the importer's GDP. Most of the variation in imports associated with market size occurs along the intensive margin. Figures 3a and 3b plot the number of US movies imported and box-office revenues per US movie against importing-country GDP.[31] There is a weak positive relationship between the number of US films and GDP (slope coefficient of 0.04), and a strong positive relationship between revenues per US film and GDP (slope coefficient of 0.90). Figures 3c and 3d show that GDP is positively correlated with both revenues per domestic movie (slope coefficient 0.68) and number of domestic movies exhibited (slope coefficient 0.73). Not surprisingly, larger countries produce more movies and have higher sales per movie.

To examine the intensive and extensive margins more formally, we follow Eaton, Kortum and Kramarz (2004) and use the identity, $N_{uit} \times \left(R_{uit} / N_{uit}\right) \equiv \left(R_{uit} / R_{it}\right) \times R_{it}$, where R_{uit} is box office revenues for US movies in country i at time t, N_{uit} is the number of US movies shown in i at t, and R_{it} is aggregate box office revenues in i at t. We then estimate the following two regressions (with robust t statistics in parentheses):

$$\begin{aligned} ln\, N_{uit} &= \ \ 4.5 + .32\, ln\left(R_{uit}/R_{it}\right) + .12\, ln\, R_{it} + \varepsilon_{it} \\ & \qquad\qquad (1.74) \qquad\qquad\quad (12.60) \end{aligned}$$

$$\begin{aligned} ln\, R_{uit} / N_{uit} &= -4.5 + .68\, ln\left(R_{uit}/R_{it}\right) + .88\, ln\, R_{it} - \varepsilon_{it} \\ & \qquad\qquad (3.67) \qquad\qquad\quad (95.06) \end{aligned}$$

By the logic of least squares, across the two regressions the constant and error terms sum to zero and the coefficients on each variable sum to one. The relative magnitude of the

[31] All variables are expressed relative to the mean value across countries.

coefficients indicates how aggregate shocks affect the number of movies (the extensive margin) and revenues per movie (the intensive margin). In response to a 10% increase in US market share in a country, revenue per US movie increases 6.8% and the number of movies 3.2%; in response to a 10% increase in total market size in a country, revenues per US movie increase 8.8% and the number of movies only 1.2%. This is further evidence most adjustment in US movie exports occurs at the intensive margin.

The theoretical results presented in Table 1 suggest a simple way to identify the nature of fixed trade costs is to examine the sign of the correlation between trade barriers and the average sales ratio (average revenue per US movie/average revenue per domestically made movie). Figures 4a and 4b plot the average sales ratio against geographic distance to the US and linguistic dissimilarity with the US. Geographic and linguistic distance each has a negative correlation with the average sales ratio, which is consistent with global fixed export costs (first column of Table 1) and inconsistent with bilateral fixed export costs (second column of Table 1).

We do not know whether geographic and linguistic distance affect variable or fixed trade barriers. Yet, from the predictions in Table 1, it appears distance affects bilateral trade along the intensive margin, such that in motion pictures the relevance of distance for trade is in how it affects variable trade barriers.

IV Estimation Results

IVA Main Results

Table 3 presents estimation results for equation (19). The dependent variable is the log average sales ratio (average box office revenue per US movie relative to average box office revenue per domestic movie). The specifications include correlates of trade barriers in levels (as consistent with column (1) of Table 1) and logs (as consistent with column (2) of Table 1).[32] Our sample consists of 46 countries for the years 1995-2006, with data for some countries not beginning until after 2000.

We first examine the role of linguistic distance. In columns 1 and 2, the linguistic dissimilarity index (from equation (21)), is negative and precisely estimated (in logs or levels), indicating that the more linguistically different a country is from the US the less it spends per U.S movie it imports, relative to domestic movies.[33] Simply by adding linguistic distance to a regression with year dummies, the explained variation rises from 5% to 27%. The coefficient estimates imply that a country with linguistic dissimilarity one standard deviation below the mean (Switzerland) would have sales per US movie that are 66 log points higher than a country at one standard deviation above the mean (Estonia). To see whether this result is driven by use of English, column 3 includes a dummy variable that equals 1 if a country has English as its primary language.[34] The English dummy is positive and precisely estimated, meaning that English-speaking countries spend more per US movie than non-English speaking countries. In columns 4 and 5, which include both language variables, the English dummy loses significance while linguistic dissimilarity remains precisely estimated. It appears linguistic distance is about more than whether two countries speak the same language, also capturing other

[32] The expressions in column (2) of Table 1 specify that the ratio of variable trade costs to wages (in levels) be included as regressors. In unreported regressions, these ratios were jointly statistically insignificant, with p-values on the F-statistic for the hypothesis that they are jointly different from zero always greater than 0.5. To limit the number of tables, we do not report regressions with these interactions.

[33] Since the index is close in value to 1, its value in logs is similar to its value in levels, which accounts for the similar coefficient estimates in columns (1) and (2). The US has two major linguistic groups, English and Spanish. English goes down to branch-level 6 (out of 15) on the language tree and Spanish goes down to level 10. By construction, the linguistic similarity index for the US never reaches the minimum value, meaning we might exaggerate true linguistic distance. We tried two alternative metrics (aggregating the language tree up to 10 or 6 levels) and in both cases obtained very similar results to those in Table 3.

[34] In unreported results, we experimented with alternative language variables (whether a country has English as an official language, English as an open circuit language, English as a commonly spoken language, the fraction of the population speaking English). The results were similar to those in Table 3.

aspects of cultural dissimilarity and divergent national experience. In subsequent specifications, we use linguistic dissimilarity to measure linguistic distance.

Columns 6-11 of Table 3 examine the role of geographical distance. Coefficients on linguistic dissimilarity become smaller in magnitude with the inclusion of geographic distance but remain highly significant. The first geographic distance variable is a dummy that equals 1 if a country is an island (and so is likely to have a long history of trade with culturally distinct nations); its coefficient is positive and precisely estimated in all specifications. We then consider two sets of variables, great circle distance to the US (in logs or in levels with a quadratic term) and the absolute values of longitudinal and latitudinal differences with the US. For both sets of variables, the coefficients are negative and precisely estimated, meaning countries farther away from the US spend less per US movie. In columns 10 and 11, which include both sets of distance variables together, great circle distance loses significance while longitude and latitude remain precisely estimated. Distance in latitude matters about twice as much as distance in longitude, suggesting that barriers to trade in US movies are greater in going from the northern to southern hemisphere than in crossing the Atlantic or Pacific Oceans. In later specifications, we use longitude and latitude to measure geographic distance.

In accordance with Figure 4, the regression results in Table 3 show that the average sales ratio is negatively correlated with common measures of trade barriers. Countries more distant from the US – in terms of geography or language – have lower sales per US movie (relative to sales of domestic movies). This suggests geographic and linguistic distance affect trade through their impact on variable trade barriers, rather than through their impact on fixed trade costs. These results confirm that adjustment in motion picture trade primarily occurs along the intensive margin. With respect to Table 1, the data prefer the specifications in the first column over the second.

Table 4 presents estimation results for equation (20). The specifications add correlates of movie expenditures and wages in importing countries: GDP, population, and income at the 20th percentile (to capture wages for low skilled labor hired to exhibit movies),[35] the fraction of the population living in urban areas, and the number of cinemas in the country. Columns 7 and 8 show that none of these variables has a precisely estimated coefficient (they are also jointly insignificant). The average sales ratio appears to be uncorrelated with national income, labor costs, and the size of the domestic movie market. Refering back to Table 1, the data appear to prefer the model in the upper-left cell over the other specifications. From section II, this case is one in which the margin of adjustment for domestic movie production matches that for movie exports. Given the negative and significant coefficients on the trade barrier variables, the results in Table 4 imply that both domestic movie production and movie exports adjust primarily along the intensive margin, consistent with global fixed export costs and pure sunk costs.

In Tables 5-7, we introduce additional trade barriers into the estimation. Given the data appear to prefer the specification in the upper left of Table 1, we include measures of trade barriers in levels. In all specifications, geographic and linguistic distances continue to be negative and significant (except for latitude distance in two instances). Table 5 includes indicators of the protection of intellectual property rights.

[35] Consistent with column (2) of Table 1, we include GDP and population in logs and wages in levels (results are similar with all variables in logs). We use Grogger and Hanson's (2008) estimates of income at the 20th percentile to measure low skill wages in a country, which they construct by assuming that income has a log normal distribution. With log normality, one can use the Gini coefficient and mean income (e.g., GDP per capita) to back out the variance of income and then use the mean and variance of income to estimate income at any percentile. In unreported regressions, we used wages for low skill industries from the UNIDO industrial data base and obtained similar results. In further unreported regressions, we included income at the 80th percentile and wages in high skill UNIDO industries, also with similar results.

When entered individually, each of the indicators – the Ginarte-Park patent protection index, the Global Competitiveness Report measure of the strength of IPR protection, an indicator for whether a country is on the US Priority Watch List (for inadequate protection of IPRs), and an indicator for whether a country has signed the World Copyright treaty – is imprecisely estimated. When entered jointly, one measure, the strength of IPR protection, is statistically significant at the 10% level. It is positive, suggesting that stronger IPR protection leads to higher revenues per US film. Overall, we find some support for the idea that IPR protection is a barrier to US movie exports, similar to McCalman's findings that the strength of IPRs affects how US studios distribute movies abroad. In unreported results, we found zero correlation between the average sales ratio and other measures of the importing country's institutional environment, including the strength of enforcement of commercial contracts and the transparency of government policy (as measured by the World Economic Forum); financial development (the share of private credit to the private sector in GDP); and whether a country's legal system has its origins in common law (as in the US).

Moving on to policy barriers on movie imports, Table 6 adds tariffs on imports of exposed film and indicators constructed from the MPAA for whether a country imposes levies on foreign film revenues, has quantitative restrictions on movie imports, or has other restrictions on film imports. The variables are imprecisely estimated, either individually or jointly. The statistical insignificance of the tariff on exposed film is unsurprising, given that the value of *physical* film imports bears little relation to revenues earned by foreign movies (see note 23). The lack of significance for the MPAA measures of trade barriers is perhaps more surprising. It could reflect the ease with which movie distributors and exhibitors circumvent restrictions on movie imports (e.g., taking on a passive domestic partner to distribute a movie) or that many barriers are no more than token attempts to prop up the domestic film industry (e.g., requirements in Argentina that a domestic short subject be shown with each full length foreign film or in Brazil that dubbing of foreign language films occur in the country). It could also reflect a tendency of the MPAA to exaggerate trade barriers (to provoke USTR into action), which could bias up measures for countries in which actual barriers are small.[36]

Finally, Table 7 introduces additional measures of national culture into the estimation in the form of the Hofstede indices. Of the three indices, masculinity is statistically significant while individualism and power distance are not. When the three indices are entered together, the masculinity index retains significance. It appears that US movie sales are stronger in countries in which traditional beliefs favor men having assertive roles in society. Action films with dominant male characters (e.g., *Dirty Harry, James Bond, Rambo*, *The Terminator, Gladiator*) have long been a staple of US movie studios, consistent with this finding. The introduction of the cultural measures has no affect on the results for geographic or linguistic distance.

IVB Alternative Distributional Assumptions

In deriving Table 1, we followed the literature by having the distribution of movie sales be Pareto. Specifically, by (3), the distribution of domestic movie sales, s_{hkk}, is Pareto with the pdf $\kappa a^{\kappa} / s^{\kappa+1}$ for s $\in$ $[a, \infty)$, where $a = d(w_k+1)\exp(-w_k-1)A_k$ is common across movies. This assumption is not innocuous. In an Appendix, we derive the average

[36] We constructed the three MPAA indicator variables from a larger number of indicators for whether a country has specific types of trade barriers (see the descriptions in section III). In unreported results, we entered these indicators into the regression individually. None was significant, except for an indicator of having a highly restrictive quota, which applied only to China.

sales ratio for our four models, without specifying a distribution for λ. Reassuringly, under global fixed export costs and pure sunk costs – the case supported by the data – the relationship between the average sales ratio and trade costs is the same as in column 1 of Table 1. Under bilateral fixed export costs, however, the results depend on the Pareto assumption. Without it, variable trade costs may not drop out of the average sales ratio. Fixed and variable trade barriers may work against each other, making the correlation between trade barriers and the average sales ratio ambiguous.

To see if the data support the Pareto assumption, Figure 5 plots log box office revenues against log rank for movies exhibited on the U.S. market for even years in our sample period.[37] Across all movies, the rank-size relationship is nonlinear, meaning the Pareto assumption is violated. Yet, it appears the rank-size relationship is linear for the upper and lower tails of the distribution, as in De Vany and Walls (1997, 2004). In an Appendix, we show that we can approximate the empirical rank-size relationship with a spline function,[38] as would be consistent with a two-segment Pareto distribution, with one segment applying to the upper tail and one applying to the lower tail. With a two-segment Pareto, the rank-size relation has two linear segments joined at a kink.

With a two-segment Pareto distribution for movie sales, the distribution of movie *types*, λ, is a two-segment exponential, the pdf of which is illustrated in Figure 6. The shape parameters for the upper segment (more popular movies) and lower segment (less popular movies) are κ_1 and κ_2, with $\kappa_1 > \kappa_2$. The kink point is λ_T. The pdf for λ is given by $g_2(\lambda) = \kappa_2 d^{\kappa_2} /(e^{\lambda\kappa_2} P_A)$ for $\lambda \in [\ln(d), \lambda_T]$ and $g_1(\lambda) = \kappa_1 d^{\kappa_1} /(e^{\lambda\kappa_1} P_A)$ for $\lambda \in [\lambda_T, +\infty)$,

[37] Data on US movie revenues are from AC Nielsen. We lack box office revenues for individual movies in foreign countries and so can only examine the distribution of movie revenues for the US domestic market.

[38] For each year from 1997 to 2006, the R^2 in the spline function regressions is 0.99 or higher. While some nonlinearity remains even with a spline, the additional explanatory power from accounting for this nonlinearity is minimal, as the spline alone explains over 99% of the variance in log revenues.

where $P_A = 1+(d/e^{\lambda_T})^{\kappa_1} - (d/e^{\lambda_T})^{\kappa_2}$.[39] When $\kappa_1 = \kappa_2$ the two-segment exponential reduces to the one-segment exponential considered in section II.

In an Appendix, we show for a two-segment exponential distribution for λ, that if

$$\lambda_T < \underline{\lambda}_{kk} \text{ and } \lambda_T < \underline{\lambda}_{uk}, \tag{C1}$$

then the predictions in Table 1 hold. The unambiguous results in Table 1 obtain when both the export threshold, $\underline{\lambda}_{uk}$, and the domestic production threshold, $\underline{\lambda}_{kk}$, are above the kink point, λ_T. This is because our analyses of exports and domestic production only concern the movies with type parameters above the thresholds $\underline{\lambda}_{uk}$ and $\underline{\lambda}_{kk}$. If the kink point is below these two values, the analysis in section II goes through. Thus, if (C1) holds, Table 1 is a valid basis for estimation.

However, if (C1) does not hold, the predictions for the average sales ratio differ from Table 1 in all cases except global fixed export costs/pure sunk costs. To see this, suppose $\lambda_T > \underline{\lambda}_{kk}$ and $\lambda_T > \underline{\lambda}_{uk}$. We can derive the average sales ratio by taking a second-order Taylor expansion around $\underline{\lambda}_{uk} = \underline{\lambda}_{kk} = \lambda_T$, as shown in an Appendix. Under bilateral fixed export costs and partial sunk costs, the approximation for the average sales ratio is

$$\ln\left(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}\right) \approx \ln\frac{f_{uk}}{b} + \frac{t_{uk}}{w_k+1} + C(\underline{\lambda}_{uk} - \lambda_T)^2 - C(\underline{\lambda}_{kk} - \lambda_T)^2 \tag{22}$$

where $C = (\kappa_1 - \kappa_2)$. Comparing (22) with (18), we see that under the one-segment exponential distribution, the second order terms of the Taylor expansion collapse to 0 and only the first order terms remain. Similarly, if $\underline{\lambda}_{uk}$ and $\underline{\lambda}_{kk}$ are close the kink, λ_T, the

[39] Since the two segments cross at λ_T, $\kappa_1(d/e^{\lambda_T})^{\kappa_1} = \kappa_2(d/e^{\lambda_T})^{\kappa_2}$. The cdf of λ is $(1-d^{\kappa_2}/e^{\lambda\kappa_2})/P_A$ for $\lambda \leq \lambda_T$ and $(P_A - d^{\kappa_1}/e^{\lambda\kappa_1})/P_A$ for $\lambda > \lambda_T$. The cdf is continuous at λ_T and it converges to 1 as $\lambda \rightarrow \infty$.

second order terms will be close to zero. Regarding the other cases, under bilateral fixed export costs and pure sunk costs, the approximation for the average sales ratio is,

$$\ln\left(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}\right) \approx \ln\frac{f_{uk}}{b} + \frac{t_{uk}}{w_k+1} + C(\underline{\lambda}_{uk} - \lambda_T)^2, \tag{23}$$

and under global fixed export costs and partial sunk costs it is,

$$\ln\left(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}\right) \approx \ln\frac{f_{uk}}{b} + \frac{t_{uk}}{w_k+1} - C(\underline{\lambda}_{kk} - \lambda_T)^2. \tag{24}$$

To test whether (C1) holds, we estimate the average sales ratio augmented by the second order terms in (22)-(24) and see whether the terms enter significantly. Under the null that (C1) is satisfied (or that there are global fixed export costs and pure sunk costs), the second order terms have zero correlation with the average sales ratio.

To derive the estimating equations for a two-segment Pareto distribution, let $\underline{s}_{uk}$ be the US box office revenue of the export cut-off movie with $\underline{\lambda}_{uk}$ and let s_T be the US box office revenue of the movie with λ_T at the kink of the two-segment exponential distribution. By equation (2), $\ln(\underline{s}_{uk}/s_T) = \underline{\lambda}_{uk} - \lambda_T$. And by equations (13) and (16b), $\underline{\lambda}_{kk} - \lambda_T = w_k + \ln w_k - \ln A_k'$, where $A_k' = A_k e^{\lambda_T - 1}/b$, which based on equation (20) implies we can use second-order terms of Y_{kt} to control for $(\underline{\lambda}_{kk} - \lambda_T)^2$. Equation (22) (which nests equations (23) and (24)) can thus be approximated as,

$$\ln\left(\frac{S_{ukt}/n_{ukt}}{S_{kkt}/n_{kkt}}\right) = \alpha_t + \beta X_{uk} + \gamma_1 Y_{kt} + \gamma_2\left(\ln\frac{\underline{s}_{ukt}}{s_{Tt}}\right)^2 + \gamma_3\left(Y_{kt}\right)^2 + \varepsilon_{ukt}\ .\text{[40]} \tag{25}$$

[40] $s_{T,t}$ is US box office revenue in year t for the kink point of the spine log-rank-log-size relationship that we estimate using data on US movies (as shown in an Appendix). $\underline{s}_{ukt}$ is US box office revenue in year t of the movie with rank n_{ukt} (where we implicitly assume that exported movies are more popular than those not exported, and that the movies popular in the US are also popular in country k).

Under the one-segment Pareto distribution (or under global fixed costs/pure sunk costs), $\gamma_2 = \gamma_3 = 0$, while under the two-segment Pareto (for the three cases other than global fixed costs/pure sunk costs) $\gamma_2 \neq 0$ and $\gamma_3 \neq 0$.

Table 8 shows regression results for (25). In all specifications, the interaction terms are individually and jointly insignificant, suggesting the predictions in Table 1 are a valid basis for estimation. These results support the conclusions from section IVA that the data favor a model with global fixed export costs and pure sunk costs.

V Discussion

Fixed export costs figure prominently in recent theoretical trade models. While current empirical research using manufacturing data suggests that these costs exist, it has little to say about their nature. In services, which are undergoing rapid growth in trade, we know little about the impediments to global commerce.

We develop a simple empirical method to test two alternative versions of the Melitz (2003) model, one in which fixed export costs are bilateral and another in which they are global. To apply the Melitz model to trade in motion pictures, we extend it to a discrete choice setting and relax standard distributional assumptions. Data on US film exports reject the bilateral fixed export cost model in favor of the model with global fixed export costs. Trade in movies adjusts primarily along the intensive margin. Even small countries important large numbers of US films, leaving only modest variation in the extensive margin of trade. Along the intensive margin, average revenues per US film vary widely across countries and are negatively correlated with geographic distance, linguistic distance, and other measures of trade barriers. The specification of the Melitz model preferred by the data turns out to be quite similar to that for the standard monopolistic-competition model. While the standard model fails to account for why no country imports the full set of movies the US produces, it characterizes the revenues earned by movies that are exported reasonably well.

Our results depart sharply from the findings in the literature for manufacturing, in which adjustment in trade occurs primarily at the extensive margin. One explanation for the difference in results between sectors is that fixed trade barriers for information services (at least as characterized by motion pictures) are dissimilar to those for manufacturing. For information services, products are delivered through devices consumers already own (TVs, radios, computers, video game consoles, cell phones) or an existing global infrastructure that can be shared by producers (theatre complexes, telephone lines, satellite networks, the worldwide web), with individual products requiring little in the way of post-sale service. Fixed barriers to trading information services include developing a marketing strategy to attract consumers and negotiating contracts over the delivery of intellectual property. Once a marketing strategy and standard contract have been developed for one market, they may be easy to replicate in other markets, making the fixed costs of delivering information services primarily global in nature. If fixed trade costs are global, it turns out that much of our understanding from standard models about how trade adjusts to trade barriers carries over.

References

Anderson, Simon P., Andre de Palma, and Jacques-Francois Thisse, 1992, *Discrete Choice Theory of Product Differentiation,* Cambridge, MA: MIT Press.

Anderson, James E. and van Wincoop, Eric. 2004. "Trade Costs," *Journal of Economic Literature*, 42(3): 691-751.

Antràs, Pol, and Elhanan Helpman, "Global Sourcing," *Journal of Political Economy*, 112 (2004), 552-580.

Arkolakis, Costas. 2007. "Market Penetration Costs and the New Consumers Margin in International Trade." Mimeo, Yale University.

Baldwin, Richard E., and James Harrigan. 2007. "Zeroes, Quality, and Space: Trade Theory and Trade Evidence." NBER Working Paper No. 11471.

Bernard, Andrew, Jonathan Eaton, Bradford Jensen, and Samuel Kortum. 2003. "Plants and Productivity in International Trade." *American Economic Review* 93: 1268-90.

Bernard, Andrew B. and J. Bradford Jensen. 1999. "Exceptional Exporter Performance: Cause, Effect, or Both." *Journal of International Economics* 47: 1-25.

Bernard, Andrew B. and J. Bradford Jensen. 2004. Why Some Firms Export." *Review of Economics and Statistics* 86: 561-569.

Bernard, Andrew B., Stephen Redding, and Peter K. Schott. 2006. "Multiproduct Firms and Trade Liberalization." Mimeo, Yale University.

Bernard, Andrew B., J. Bradford Jensen, Stephen Redding, and Peter K. Schott. 2007. "Firms in International Trade." NBER Working Paper No. 13054.

Chaney, Thomas. 2006. "Distorted Gravity: Heterogeneous Firms, Market Structure and the Geography of International Trade," mimeo, University of Chicago.

Chung, Chul, and Minjae Song. 2008. "Preference for Cultural Goods: Demand and Welfare in the Korean Film Market." Mimeo, KIEP.

De Vany, Arthur. 2004. *Hollywood Economics*. London: Routledge.

De Vany, Arthur and David W. Walls, 1997. "The Market for Motion Pictures: Rank, Revenue, and Survival". *Economic Inquiry*. October 1997, 35(4): 783-97.

De Vany, Arthur, and W. David Walls. 2004. "Motion Picture Profit, the Stable Paretian Hypothesis, and the Curse of the Superstar," *Journal of Economic Dynamics and Control*, 28(6): 1035-57.

Eaton, Jonathan, Samuel Kortum, and Francis Kramarz. 2004. "Dissecting Trade: Firms, Industries, and Export Destinations," NBER Working Paper No. 10344.

Elberse, Anita and Jehoshua Eliashberg, 2003. "Demand and Supply Dynamics for Sequentially Released Products in International Markets: The Case of Motion Pictures". *Marketing Science*. Summer 2003, 22(3): 329-54.

Fearon, James D. 2003. "Ethnic and Cultural Diversity by Country," *Journal of Economic Growth*, 8(2): 195-222.

Feenstra, Robert C., 2004, *Advanced International Trade, Theory and Evidence*, Princeton and Oxford: Princeton University Press.

Gil, Ricard, and Francine LaFontaine. 2007. "The Role of Revenue Sharing in Movie Exhibition Contracts." Mimeo, UC Santa Cruz.

Ginarte, Juan C. and Walter G. Park. 1997. "Determinants of Patent Rights: A Cross-National Study." *Research Policy* 26: 283-301.

Girma, Sourafel, Holger Gorg, and Eric Strobl. 2004. "Exports, International Investment, and Plant Performance: Evidence from a Non-Parametric Test,"

Economics Letters 83: 317-324.
Girma, Sourafel, Richard Kneller, and Mauro Pisu. 2005. "Exports versus FDI: An Empirical Test," *Review of World Economics* 141: 193-218.
Grogger, Jeffery, and Gordon Hanson. 2008. "Income Maximization and the Selection and Sorting of International Migrants." NBER Working Paper No. 13821.
Hancock, David, and Charlotte Jones, 2003. *Cinema Distribution and Exhibition in Europe, 2nd Edition*. London: Screendigest.
Hanson, Gordon H., and Chong Xiang. 2008. "International Trade in Motion Picture Services." In Marshall Reinsdorf and Matthew Slaughter, eds., *International Flows of Invisibles: Trade in Services and Intangibles in the Era of Globalization*, Chicago: University of Chicago Press, forthcoming.
Harrigan, James. 2005. "Airplanes and Comparative Advantage." NBER Working Paper No. 11688.
Helpman, Elhanan and Krugman, Paul. 1985. *Market Structure and Foreign Trade*. Cambridge, MA: MIT Press.
Helpman, Elhanan, Marc J. Melitz, and Yona Rubinstein. 2007. "Estimating Trade Flows: Trading Partners and Trading Volumes," NBER Working Paper No. 12927.
Helpman, Elhanan, Marc J. Melitz, and Stephen R. Yeaple. 2004. "Export versus FDI with Heterogeneous Firms," *American Economic Review* 94: 300-316.
Hofstede, Geert. 2001. *Culture's Consequences, Comparing Values, Behaviors, Institutions, and Organizations Across Nations.* Thousand Oaks CA: Sage.
Krugman, Paul. 1980. "Scale Economies, Product Differentiation, and the Pattern of Trade," *American Economic Review* 70: 950-959.
Marvasti, Akbar, and E. Ray Canterbery. 2005. "Cultural and Other Barriers to Motion Pictures Trade," *Economic Inquiry* 43(1): 39-54.
Motion Picture Association. 2003. "US Entertainment Industry: 2003 Market Statistics." Mimeo, MPA.
McCalman, Philip. 2004. "Foreign Direct Investment and Intellectual Property Rights: Evidence from Hollywood's Global Distribution of Movies and Videos," *Journal of International Economics*, 62(1): 107-23.
McCalman, Phillip, 2005. "International Diffusion and Intellectual Property Rights: An Empirical Analysis". *Journal of International Economics*.
Motion Picture Association of America. 2002. "Trade Barriers to Exports of US Filmed Entertainment." Report to the US Trade Representative.
Melitz, Jacques. 2002. "Language and Foreign Trade." CEPR Discussion Paper No. 3590.
Melitz, Marc J. 2003. "The Impact of Trade on Intra-industry Reallocations and Aggregate Industry Productivity," *Econometrica*, 71(6): 1695-1725.
Melitz, Marc J. and Gianmarco I.P. Ottaviano. 2005. "Market Size, Trade, and Productivity," NBER Working Paper No. 11393.
Rauch, James E., and Trindade, Vitor. 2006. "Neckties in the Tropics: A Model of International Trade and Cultural Diversity". Mimeo, UCSD.
Siwek, Stephen E. 2006. "Copyright Industries in the US Economy: The 2006 Report," Economists Incorporated for the International Intellectual Property Alliance.
Waterman, David. 2005. *Hollywood's Road to Riches.* Cambridge, MA: Harvard University Press.

Appendix

(A1) Predictions under CES Preferences

Suppose the sub-utility for movies for the representative consumer in country k is $u_k = \{\sum_j \theta_{kj} c_{kj}{}^{(\sigma-1)/\sigma} + \sum_{u\neq k}\sum_j \theta_{uj}[\delta'_{uk} c_{uj}]^{(\sigma-1)/\sigma}\}^{\sigma/(\sigma-1)}$, where θ represents the popularity of movie j and is drawn from the Pareto distribution whose cdf is $1 - a_0{}^{\varsigma}/\theta^{\varsigma}$, with $a_0, \varsigma > 0$ and $\theta \in [a_0, +\infty)$. $\theta_{kj} = \theta_j$ for all k. Movies are subject to ad valorem policy trade barriers, specified as $t_{uk} > 1$. Other elements of the model are the same as in section II.

CES preferences imply that the total sales of a country-u movie in country k are $s_{juk} = \theta_j^{\sigma-1}\delta_{uk}^{'\sigma-1}t_{uk}^{'1-\sigma}p_{juk}^{1-\sigma}A'_k$, for $A'_k \equiv \alpha Y_k / P_k^{1-\sigma}$, where j indexes the movie, p_{juk} is the price of movie j net of policy trade barriers and P_k is the CES price index in country k. The total sales of domestically produced movie h in country k equal $s_{hkk} = \theta_h^{\sigma-1}p_{hkk}^{1-\sigma}A'_k$. Price is a constant markup over marginal cost, w_k.

The intermediate steps for deriving the numbers and total sales of domestic and foreign movies are similar to section II and they are available upon request. Under pure sunk costs/global fixed export costs,

$$\ln\left(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}\right) = (1-\sigma)\ln\frac{t'_{uk}}{\delta'_{uk}} + \ln C_u\,,\quad C_u = \frac{B\sigma\varsigma\underline{\theta}_u^{\sigma-1}}{\varsigma-(\sigma-1)}\,,\quad B = \frac{(\sigma-1)^{\sigma-1}}{\sigma^{\sigma}}\,, \qquad \text{(X1)}$$

where $\underline{\theta}_u$ is the cut-off for exports and $\underline{\theta}_u = \left(f_G w_u / BQ'_u\right)^{1/(\sigma-1)}$, $Q'_u = \sum_{k\neq u}\delta_{uk}^{'\sigma-1}t_{uk}^{'1-\sigma}A'_k w_k^{1-\sigma}$. Under pure sunk costs/bilateral fixed export costs,

$$\ln\left(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}\right) = \ln f_{uk} + \ln\frac{w_k^{\sigma}}{A'_k} + C_3\,, \qquad C_3 = \text{constant.} \qquad \text{(X2)}$$

Under partial sunk costs/global fixed export costs,

$$\ln\left(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}\right) = (1-\sigma)\ln\frac{t'_{uk}}{\delta'_{uk}} + \ln\frac{A'_k}{w_k^{\sigma}} + C_{u1}, \qquad C_{u1} = \ln\left[\frac{B}{b}(\underline{\theta}_u)^{\sigma-1}\right]. \qquad \text{(X3)}$$

Under partial sunk costs/bilateral fixed export costs,

$$\ln\left(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}\right) = \ln\frac{f_{uk}}{b}\,. \qquad \text{(X4)}$$

Equation (X1) is similar to the prediction of the standard monopolistic competition model, with no firm heterogeneity or fixed export costs. Equation (X4) is the prediction of the original setting of Melitz (2003). Results under alternative distributional assumptions for θ can be derived using steps that are similar to section IVB and are available upon request.

(A2) Derivation of N_k with Pure Sunk Cost and Global Fixed Export Cost

Suppose there is only one sector, movies. There are $m + 1$ countries identical in size and wage, all with one sector, movies. Variable trade costs are symmetric for every country pair; i.e. $t_{uk} = t$ and $\delta_{uk} = \delta$ for all u, k. By symmetry,

$w_k = w$, $A_k = A$ for all k, (X5)

where A_k is defined in equation (2). In a country k, after firm h draws its types, it makes profits $\pi_{hkk} = s_{hkk} / p_{hkk}$ if the movie is not exported, where s_{hkk} is by equation (3). Movie h makes additional variable profits $\pi_{hkl} = s_{hkl} /(p_{hkl} + t_{kl})$ in every export market l if it is exported, where s_{hkl} is by equation (2). By symmetry, the expression for the export cutoff $\underline{\theta}_u$, equation (8), becomes

$$\underline{\lambda}_u = \ln(\frac{wf_G}{mA}) + (w+1+t+\delta)\,. \quad \text{(X6)}$$

The expected profit of a movie net of entry cost, prior to entry, is $\bar{\pi} = \int_{\ln d}^{\underline{\lambda}_u} \pi_{hkk} dG(\lambda_h)$ + $\int_{\underline{\lambda}_u}^{\infty} [\pi_{hkk} + (m\pi_{hkl} - w_k f_G)] dG(\lambda_h)$. As entry and exit drive expected profits to zero, $\bar{\pi} = w_k f_E$. Plugging in the expressions for π_{hkk}, π_{hkl} and $\underline{\lambda}_u$:

$$\frac{\kappa d}{\kappa - 1} e^{-(w+1)} A(1 + md^{\kappa-1} e^{-\underline{\lambda}_u(\kappa-1)-t-\delta}) = f_E + f_G p_x,\ p_x = 1 - G(\underline{\lambda}_u)\,, \quad \text{(X7)}$$

where p_x is the (ex ante) probability that movie h is exported and p_x is a function of $\underline{\lambda}_u$ and A. The expected revenue of a movie, prior to entry, is $\bar{r} = \int_{\ln d}^{\underline{\lambda}_u} s_{hkk} dG(\lambda_h) +$ $\int_{\underline{\lambda}_u}^{\infty} [s_{hkk} + ms_{hkl}] dG(\lambda_h) = (w+1)(\bar{\pi} + wf_G p_x) + t\int_{\underline{\lambda}_u}^{\infty} \pi_{hkl} dG(\lambda_h)$. The total sale of movies is $S_{kk} = N_k \bar{r}$. Since expected profits are 0, total revenue equals total payments to labor; i.e. $S_{kk} = w_k L_k$. Therefore,

$$N_k(w+1)(f_E + f_G p_x) + N_k \frac{\kappa d^{\kappa} tA}{w(\kappa-1)} e^{-\underline{\lambda}_u(\kappa-1)-(t+\delta+w+1)} = L_k. \quad \text{(X8)}$$

Equations (X5)-(X7) determine the values of $\underline{\lambda}_u$, w, A and p_x as we can choose A as the numeraire. Equation (X8) then determines the value of N_k.

(A3) Correlation between (Normalized) Number of Exports and Importer Size

Let μ_{uk} denote the market share of country-u movies in country k; i.e. $\mu_{uk} = S_{uk}/Y_k$, where Y_k is the size of country k. Then $n_{uk}/\mu_{uk} = Y_k /(S_{uk} / n_{uk})$. For the global fixed export cost (FEC) model, by equation (9b), $\frac{n_{uk}}{\mu_{uk}} = \frac{M_k e^{w_k+1+t_{uk}+\delta_{uk}}(\kappa-1)}{(w_k+1+t_{uk})\alpha\kappa e^{\underline{\lambda}_u}}$, where M_k is defined in equation (2). M_k tends to increase as more movies are shown in country k. In general equilibrium, the number of movies shown in country k is likely to increase with Y_k and so n_{uk}/μ_{uk} is likely to be positively correlated with Y_k. However, it is difficult to derive the exact correlation between n_{uk}/μ_{uk} and Y_k without solving the full general equilibrium model. For the bilateral FEC model, by equation (14b), $\frac{n_{uk}}{\mu_{uk}} = \frac{Y_k(\kappa-1)}{\kappa(w_k+1+t_{uk})w_k f_{uk}}$, and so n_{uk}/μ_{uk} is also positively correlated with Y_k.

(A4) Average Sales Ratio with No Distributional Assumptions

We summarize the results in Table A1. Below we derive the average sales ratio for the model with bilateral FEC and partial sunk costs, as well as its derivative with respect to fixed trade costs. The proofs for the rest of the results in Table A1 are similar and available on request. By equation (14), the number of movie exports is n_{uk} = $N_u\int_{\underline{\lambda}_{uk}}^{\infty} dG(\lambda_j)$ and the total sales are $S_{uk} = N_u(w_k+1+t_{uk})e^{-(w_k+1+t_{uk}+\delta_{uk})}A_k\int_{\underline{\lambda}_{uk}}^{\infty} e^{\lambda_j}dG(\lambda_j)$. By equation (16), $n_{kk} = N_k\int_{\underline{\lambda}_{kk}}^{\infty} dG(\lambda_h)$ and $S_{kk} = N_k(w_k+1)A_k e^{-(w_k+1)}\int_{\underline{\lambda}_{kk}}^{\infty} e^{\lambda_h}dG(\lambda_h)$. Thus $\ln(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}) = -\delta_{uk} - \frac{t_{uk}w_k}{1+w_k} + \ln\left(\frac{\int_{\underline{\lambda}_{uk}}^{\infty} e^{\lambda_j}dG(\lambda_j)}{\int_{\underline{\lambda}_{uk}}^{\infty} dG(\lambda_j)}\right) - \ln\left(\frac{\int_{\underline{\lambda}_{kk}}^{\infty} e^{\lambda_j}dG(\lambda_j)}{\int_{\underline{\lambda}_{kk}}^{\infty} dG(\lambda_j)}\right)$, where we have used the approximation $\ln(1+t_{uk}/(1+w_k)) = \frac{t_{uk}}{1+w_k}$. Let g(.) denote the pdf of the distribution of λ. Then $\partial\ln(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}})/\partial f_{uk}$ = $[M_r(\underline{\lambda}_{uk})$-$M_n(\underline{\lambda}_{uk})]\left(-\frac{\partial\underline{\lambda}_{uk}}{\partial f_{uk}}\right)$, where $M_r(\underline{\lambda}_{uk})$ = $\frac{\exp(\underline{\lambda}_{uk})g(\underline{\lambda}_{uk})}{\int_{\underline{\lambda}_{uk}}^{\infty}\exp(\lambda_j)dG(\lambda_j)}$ is the share of the marginal movie ($\underline{\lambda}_{uk}$) in total revenues S_{uk}, and $M_n(\underline{\lambda}_{uk})$ = $\frac{g(\underline{\lambda}_{uk})}{\int_{\underline{\lambda}_{uk}}^{\infty} dG(\lambda_j)}$ is the share of $\underline{\lambda}_{uk}$ in the number of movies n_{uk}. The marginal movie carries more weight in numbers than in revenues (see also section II.C.) and so $M_r(\underline{\lambda}_{uk})$ - $M_n(\underline{\lambda}_{uk}) < 0$ (the rigorous proof is available on request). Since $\left(-\frac{\partial\underline{\lambda}_{uk}}{\partial f_{uk}}\right) < 0$ by equation (13), we have that $\partial\ln(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}})/\partial f_{uk} > 0$.

(A5) Estimating the Log Rank-Size Relation for US Movies

Let s_j denote the US box office revenue of movie j and r_j denote its rank. By equation (3) $s_j = \exp(\lambda_j)D_0$ where $D_0 = (w_u+1)\exp(-w_u-1)A_u$ is common across movies. Since the distribution of λ is a two-segment exponential as specified in section IVB, the distribution of s is the following two-segment Pareto. The cdf is $G_s(s) = [1 - (a/s)^{\kappa_2}]/P_A'$ for $s \in [a, s_T]$ and $G_s(s) = [P_A' - (a/s)^{\kappa_1}]/P_A'$ for $s \in [s_T, \infty]$, where $a = D_0 d$, $s_T = \exp(\lambda_T)D_0$, $\kappa_1 > \kappa_2$, $P_A' = 1 + (a/s_T)^{\kappa_1} - (a/s_T)^{\kappa_2}$ and $\kappa_1(a/s_T)^{\kappa_1} = \kappa_2(a/s_T)^{\kappa_2}$. For a movie with $s_j \geq s_T$, P(US box office revenue $\geq s_j$) = $1 - G_s(s_j)$ = $(a/s_j)^{\kappa_1}/P_A'$. In a sample of size n there are exactly r_j movies with US box office revenues $\geq s_j$ and so empirically, P(US box office revenue $\geq s_j$) = r_j/n. Thus $r_j/n = (a/s_j)^{\kappa_1}/P_A$. Taking logs and re-arranging we get $lns_j = \alpha_{s1} - \beta_{s1}\, lnr_j$, where α_{s1} is a constant and $\beta_{s1} = 1/\kappa_1$. This is the first segment of the spline function. Analogously, for movies with $s_j < s_T$ we get $r_j/n = (1 - 1/P_A') + (a/s_j)^{\kappa_2}/P_A'$. When $(1 - 1/P_A')$ is small relative to r_j/n, this expression can be approximated as $lns_j = \alpha_{s2} - \beta_{s2}\, lnr_j$, where α_{s2} is a constant and $\beta_{s2} = 1/\kappa_2$. This is the second segment of the spline function. Let r_T denote the rank of the movie whose US box office revenue is s_T. Let I_T be the indicator variable that equals 1 if $lnr_j > lnr_T$ and 0 otherwise. Then the spline function is $lns_j = \alpha_{s1} - \beta_{s1}\, lnr_j - (\beta_{s2} - \beta_{s1}) I_T(lnr_j - lnr_T)$. Estimating this function using data on box office revenues for US movies we get (t-statistics in parentheses):

year	α_{s1}	$-\beta_{s1}$	$-(\beta_{s2}-\beta_{s1})$	N	R^2	$\ln r_T$
1995	21.124	-0.947	-7.658	308	0.957	5.220
	(88.63)	(-17.90)	(-25.78)			
1996	20.794	-0.827	-5.412	318	0.955	5.011
	(145.13)	(-23.83)	(-24.70)			
1997	20.647	-0.758	-4.47	324	0.991	4.852
	(13.00)	(-20.77)	(-55.96)			
1998	20.99	-0.854	-3.891	324	0.992	4.860
	(126.67)	(-22.32)	(-52.04)			
1999	20.937	-0.833	-3.985	324	0.993	4.875
	(145.37)	(-24.99)	(-58.88)			
2000	20.438	-0.684	-3.397	310	0.994	4.727
	(135.79)	(-18.92)	(-50.45)			
2001	20.649	-0.734	-3.593	291	0.993	4.710
	(126.26)	(-18.68)	(-49.22)			
2002	20.884	-0.786	-3.944	318	0.994	4.875
	(136.37)	(-22.13)	(-56.21)			
2003	20.531	-0.681	-3.687	321	0.995	4.745
	(167.70)	(-23.26)	(-68.73)			
2004	20.782	-0.777	-3.723	350	0.995	4.844
	(166.67)	(-26.48)	(-64.94)			
2005	20.537	-0.724	-3.964	354	0.997	4.836
	(162.95)	(-24.72)	(-76.77)			

(A6) Derivation of Condition 1 (C1)

If $\lambda_T < \underline{\lambda}_{kk}$, the movies above $\underline{\lambda}_{kk}$ follow a one-segment exponential distribution, and so $\int_{\underline{\lambda}_{kk}}^{\infty} dG(\lambda_{kj}) = d^{\kappa}\exp(-\underline{\lambda}_{kk}\kappa)$ and $\int_{\underline{\lambda}_{kk}}^{\infty} e^{\lambda_{uj}} dG(\lambda_{kj}) = \frac{\kappa d^{\kappa} e^{-\underline{\lambda}_{kk}(\kappa-1)}}{\kappa-1}$. This means that $\ln\left(\frac{\int_{\underline{\lambda}_{kk}}^{\infty} e^{\lambda_{uj}} dG(\lambda_{kj})}{\int_{\underline{\lambda}_{kk}}^{\infty} dG(\lambda_{kj})}\right) = \ln[\frac{\kappa e^{\underline{\lambda}_{kk}}}{\kappa-1}] = \ln[\frac{\kappa w_k}{(\kappa-1)A_k}] + w_k + 1 + \ln b$, where the last equality is by equation (16b). Likewise, if $\lambda_T < \underline{\lambda}_{uk}$, $\ln\left(\frac{\int_{\underline{\lambda}_{uk}}^{\infty} e^{\lambda_{uj}} dG(\lambda_{uj})}{\int_{\underline{\lambda}_{uk}}^{\infty} dG(\lambda_{uj})}\right) = \ln[\frac{\kappa e^{\underline{\lambda}_{uk}}}{\kappa-1}] = \ln[\frac{\kappa w_k}{(\kappa-1)A_k}]$ $+w_k + 1 + t_{uk} + \delta_{uk} + \ln f_{uk}$, where the last equality is by equation (13). Plug these expressions into Table A1 and we can show that the expressions for the average sales ratio are the same as in Table 1.

(A7) Average Sales Ratio for a Two-Segment Pareto Distribution

Below, we treat $\underline{\lambda}_{uk}$ and $\underline{\lambda}_{kk}$ as two independent variables (i.e. $\partial \underline{\lambda}_{uk} / \partial \underline{\lambda}_{kk} = 0$). We have also considered expressing $\underline{\lambda}_{uk}$ as a function of $\underline{\lambda}_{kk}$ and trade costs using equations (13) and (16b). This alternative approach produces the same results.

By Table A1, $\ln(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}) = -\delta_{uk} - \frac{t_{uk} w_k}{1+w_k}$ +h($\underline{\lambda}_{uk}$, $\underline{\lambda}_{kk}$), where h(.) = $\ln\left(\frac{\int_{\underline{\lambda}_{uk}}^{\infty} e^{\lambda_{uj}} dG(\lambda_{uj})}{\int_{\underline{\lambda}_{uk}}^{\infty} dG(\lambda_{uj})}\right)$ $-\ln\left(\frac{\int_{\underline{\lambda}_{kk}}^{\infty} e^{\lambda_{kj}} dG(\lambda_{kj})}{\int_{\underline{\lambda}_{kk}}^{\infty} dG(\lambda_{kj})}\right)$. The Taylor expansion around $\underline{\lambda}_{uk} = \underline{\lambda}_{kk} = \lambda_T$ is

$$-\delta_{uk} - \frac{t_{uk} w_k}{1+w_k} + h(\lambda_T, \lambda_T) + \frac{\partial h}{\partial(\underline{\lambda}_{uk})}(\underline{\lambda}_{uk} - \lambda_T) + \frac{\partial h}{\partial(\underline{\lambda}_{kk})}(\underline{\lambda}_{kk} - \lambda_T) + \frac{\partial^2 h}{\partial(\underline{\lambda}_{uk})^2}(\underline{\lambda}_{uk} - \lambda_T)^2 + \frac{\partial^2 h}{\partial(\underline{\lambda}_{kk})^2}(\underline{\lambda}_{kk} - \lambda_T)^2 + \frac{\partial^2 h}{\partial(\underline{\lambda}_{uk})\partial(\underline{\lambda}_{kk})}(\underline{\lambda}_{uk} - \lambda_T)(\underline{\lambda}_{kk} - \lambda_T), \qquad \text{(X9)}$$

where all the first and second order derivatives are evaluated at the point of expansion**.**

(P1) $h(\lambda_T, \lambda_T) = 0$.

(P2) $$\partial h / \partial \underline{\lambda}_{uk} = \kappa_2 \left[1 - \frac{\kappa_1 - \kappa_2}{\kappa_1} e^{(\underline{\lambda}_{uk} - \lambda_T)\kappa_2}\right]^{-1} - \left[\frac{1}{\kappa_2 - 1} - (\frac{1}{\kappa_2 - 1} - \frac{1}{\kappa_1 - 1}) e^{(\underline{\lambda}_{uk} - \lambda_T)(\kappa_2 - 1)}\right]^{-1}.$$

$\partial h / \partial \underline{\lambda}_{uk} = 1$ when $\underline{\lambda}_{uk} = \underline{\lambda}_{kk} = \lambda_T$.

(P3) $$\partial h / \partial \underline{\lambda}_{kk} = -\kappa_2 \left[1 - \frac{\kappa_1 - \kappa_2}{\kappa_1} e^{(\underline{\lambda}_{kk} - \lambda_T)\kappa_2}\right]^{-1} + \left[\frac{1}{\kappa_2 - 1} - (\frac{1}{\kappa_2 - 1} - \frac{1}{\kappa_1 - 1}) e^{(\underline{\lambda}_{kk} - \lambda_T)(\kappa_2 - 1)}\right]^{-1}$$

which equals -1 when $\underline{\lambda}_{uk} = \underline{\lambda}_{kk} = \lambda_T$.

(P4) By (P2), $\partial h / \partial \underline{\lambda}_{uk}$ does not depend on $\underline{\lambda}_{kk}$; so $\frac{\partial^2 h}{\partial(\underline{\lambda}_{uk})\partial(\underline{\lambda}_{kk})} = 0$.

(P5) $$\frac{\partial^2 h}{\partial(\underline{\lambda}_{uk})^2} = \frac{\kappa_2^2 (1 - \frac{\kappa_2}{\kappa_1}) e^{(\underline{\lambda}_{uk} - \lambda_T)\kappa_2}}{[1 - (1 - \frac{\kappa_2}{\kappa_1}) e^{(\underline{\lambda}_{uk} - \lambda_T)\kappa_2}]^2} - \frac{(\kappa_2 - 1)(\frac{1}{\kappa_2 - 1} - \frac{1}{\kappa_1 - 1}) e^{(\underline{\lambda}_{uk} - \lambda_T)(\kappa_2 - 1)}}{[\frac{1}{\kappa_2 - 1} - (\frac{1}{\kappa_2 - 1} - \frac{1}{\kappa_1 - 1}) e^{(\underline{\lambda}_{uk} - \lambda_T)(\kappa_2 - 1)}]^2}$$

by (P2). When $\underline{\lambda}_{uk} = \underline{\lambda}_{kk} = \lambda_T$ $\frac{\partial^2 h}{\partial(\underline{\lambda}_{uk})^2} = C = \kappa_1 - \kappa_2$.

(P6) $$\frac{\partial^2 h}{\partial(\underline{\lambda}_{kk})^2} = -\frac{\kappa_2^2 (1 - \frac{\kappa_2}{\kappa_1}) e^{(\underline{\lambda}_{kk} - \lambda_T)\kappa_2}}{[1 - (1 - \frac{\kappa_2}{\kappa_1}) e^{(\underline{\lambda}_{kk} - \lambda_T)\kappa_2}]^2} + \frac{(\kappa_2 - 1)(\frac{1}{\kappa_2 - 1} - \frac{1}{\kappa_1 - 1}) e^{(\underline{\lambda}_{kk} - \lambda_T)(\kappa_2 - 1)}}{[\frac{1}{\kappa_2 - 1} - (\frac{1}{\kappa_2 - 1} - \frac{1}{\kappa_1 - 1}) e^{(\underline{\lambda}_{kk} - \lambda_T)(\kappa_2 - 1)}]^2},$$

which equals - C when $\underline{\lambda}_{uk} = \underline{\lambda}_{kk} = \lambda_T$.

(P7) Plugging (P1)-(P6) into equation (X9) and we get equation (24).

Table A1: Predictions for Average Sales Ratio without Specifying the Distribution of λ

	Global Fixed Export Costs	Bilateral Fixed Export Costs
Pure Sunk Costs (before λ draw)	$\ln(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}) = -\delta_{uk} - t_{uk} + \ln C_{x1}$ $C_{x1} = \frac{\int_{\underline{\lambda}_u}^{\infty} e^{\lambda_{uj}} dG(\lambda_{uj})}{[\int_{\underline{\lambda}_u}^{\infty} dG(\lambda_{uj})][\int_{\ln d}^{\infty} e^{\lambda_{uj}} dG(\lambda_{uj})]}$ $\partial f_{uk} = 0,\ \partial\delta_{uk} < 0,\ \partial t_{uk} < 0,\ \partial A_k = 0,\ \partial w_k \approx 0.$	$\ln(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}) = -\delta_{uk} - \frac{t_{uk} w_k}{1+w_k} + \ln\left(\frac{\int_{\underline{\lambda}_{uk}}^{\infty} e^{\lambda_{uj}} dG(\lambda_{uj})}{\int_{\underline{\lambda}_{uk}}^{\infty} dG(\lambda_{uj})}\right)$ $+ \ln C_{x3},\ C_{x3} = \frac{1}{\int_{\ln d}^{\infty} e^{\lambda_{uj}} dG(\lambda_{uj})}$ $\partial f_{uk} > 0,\ \partial\delta_{uk}$??, ∂t_{uk} ??, $\partial A_k < 0,\ \partial w_k > 0.$
Partial Sunk Costs (after λ draw)	$\ln(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}) = -\delta_{uk} - \ln\left(\frac{\int_{\underline{\lambda}_{kk}}^{\infty} e^{\lambda_{uj}} dG(\lambda_{kj})}{\int_{\underline{\lambda}_{kk}}^{\infty} dG(\lambda_{kj})}\right)$ $-t_{uk} + \ln C_{x2},\ C_{x2} = \frac{\int_{\underline{\lambda}_u}^{\infty} e^{\lambda_{uj}} dG(\lambda_{uj})}{\int_{\underline{\lambda}_u}^{\infty} dG(\lambda_{uj})}$ $\partial f_{uk} = 0,\ \partial\delta_{uk} < 0,\ \partial t_{uk} < 0,\ \partial A_k > 0,\ \partial w_k < 0.$	$\ln(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}) = -\delta_{uk} + \ln\left(\frac{\int_{\underline{\lambda}_{uk}}^{\infty} e^{\lambda_{uj}} dG(\lambda_{uj})}{\int_{\underline{\lambda}_{uk}}^{\infty} dG(\lambda_{uj})}\right)$ $-\frac{t_{uk} w_k}{1+w_k} - \ln\left(\frac{\int_{\underline{\lambda}_{kk}}^{\infty} e^{\lambda_{kj}} dG(\lambda_{kj})}{\int_{\underline{\lambda}_{kk}}^{\infty} dG(\lambda_{kj})}\right)$ $\partial f_{uk} > 0,\ \partial\delta_{uk}$??, ∂t_{uk} ??, ∂A_k ??, ∂w_k ??.

Table A1 summarizes the expressions for the average sales ratio and the signs of its partial derivatives. We have used the approximation that $\ln(1+t_{uk}/(1+w_k)) = \frac{t_{uk}}{1+w_k}$ (see also notes 19 and 32). The models are arranged in the same order as in Table 1. The results hold for any distribution of λ. "∂x" is the partial derivative of the average sales ratio for x_{uk}. The ∂w_k terms are signed under the assumption that $\partial \frac{w_k}{1+w_k} / \partial w_k$ is close to 0. "??" means the partial derivative cannot be signed.

Table A2

Country	No. of domestic films	No. of US films	Revenue per domestic film	Revenue per US film
Lithuania	4	134	0.04	0.05
Latvia	2	92	0.04	0.05
Estonia	8	85	0.08	0.06
Romania	9	114	0.05	0.06
Slovak Republic	4	99	0.02	0.06
Iceland	5	128	0.18	0.09
Malaysia	12	159	0.45	0.10
Slovenia	7	114	0.04	0.10
Czech Republic	19	101	0.38	0.26
Philippines	103	186	0.39	0.26
Singapore	6	162	0.51	0.33
Hungary	22	106	0.19	0.38
Finland	14	106	0.79	0.39
Argentina	53	152	0.17	0.41
Thailand	26	137	1.06	0.41
Belgium	44	232	0.10	0.42
Turkey	15	125	1.21	0.43
New Zealand	5	152	0.84	0.49
Portugal	15	125	0.18	0.50
Indonesia	11	114	1.80	0.52
Poland	22	122	0.78	0.64
Ireland	4	102	0.33	0.65
Norway	15	118	1.20	0.67
Denmark	24	112	1.34	0.73
Austria	22	124	0.14	0.75
Sweden	27	115	1.22	0.97
Netherlands	31	132	0.67	1.00
Switzerland	47	122	0.20	1.03
Brazil	42	143	0.80	1.39
Russia	59	143	0.84	1.50
Spain	120	223	1.02	2.35
Italy	106	168	1.39	2.37
South Korea	77	124	5.17	2.49
Mexico	22	163	1.70	2.65
Australia	24	179	0.99	2.88
Canada	77	193	0.36	3.38
China	90	20	1.73	3.50
France	223	162	2.25	3.88
Germany	127	153	1.52	5.22
UK	89	169	3.65	6.30
USA	327	327	27.83	27.83

Revenue is in millions of 2007 US dollars.

Table 1:
Predictions for Sales per Foreign Movie Relative to Sales per Domestic Movie

	Global Fixed Export Costs	**Bilateral Fixed Export Costs**
Pure Sunk Costs (before λ draw)	$\ln(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}) = -t_{uk} - \delta_{uk} + \ln C_u,$ (equation 10)	$\ln(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}) = \ln(f_{uk}) + \ln\frac{w_k}{A_k} + w_k + \frac{t_{uk}}{w_k+1} + C_3$ (equation 15)
Partial Sunk Costs (after λ draw)	$\ln(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}) = -t_{uk} - \delta_{uk} - w_k + \ln(\frac{A_k}{w_k}) + C_{u1}$ (equation 17)	$\ln(\frac{S_{uk}/n_{uk}}{S_{kk}/n_{kk}}) = \ln(\frac{f_{uk}}{b}) + \frac{t_{uk}}{w_k+1}$ (equation 18)

Table 2: Summary Statistics

Variable	N	Mean	St. Dev.
Number of US films	284	141.366	41.483
Number of domestic films	284	46.345	52.865
Revenue per US film	284	1.293	1.506
Revenue per domestic film	284	0.859	0.965
Log average sales ratio	284	0.386	0.958
Linguistic dissimilarity index	284	0.751	0.143
Log linguistic dissimilarity index	284	-0.304	0.185
English official language	284	0.095	0.294
Island	284	0.074	0.262
Latitude difference with US	284	16.609	16.714
Longitude difference with US	284	104.237	47.48
Distance to US (ratio to mean)	284	1.008	0.407
Log distance to US	284	-0.068	0.414
Log GDP	284	26.146	1.328
Log population	284	16.767	1.215
Income, 20th percentile (ratio to mean)	281	1.002	0.671
Ginarte-Park index	271	0.723	0.156
Intellectual property protection index	284	0.695	0.161
Super 301 action	284	0.141	0.348
Ever sign WCT	284	0.345	0.476
Tariff on exposed film	219	0.028	0.081
Levies tariff on movies	284	0.378	0.371
Has quantitative restrictions on movies	284	0.455	0.374
Has other restrictions on movies	284	0.388	0.320
Individualism index	273	0.592	0.208
Masculinity index	273	0.498	0.234
Power distance index	273	0.516	0.217

Sample is 284 observations on 46 countries over period 1995-2006.

Table 3: Average Sales Ratio and Trade Barriers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
log linguistic dissimilarity	-2.448			-2.725		-1.922		-1.831		-1.879	
	(0.540)			(0.666)		(0.545)		(0.518)		(0.555)	
linguistic dissimilarity		-3.198			-3.383		-2.480		-2.110		-2.559
		(0.685)			(0.839)		(0.701)		(0.710)		(0.753)
English official language			0.543	-0.341	-0.202						
			(0.279)	(0.409)	(0.375)						
Island						1.524	1.528	0.654	0.951	1.468	1.449
						(0.306)	(0.314)	(0.269)	(0.278)	(0.300)	(0.344)
latitude diff. with US						-0.015	-0.014			-0.014	-0.018
						(0.004)	(0.004)			(0.005)	(0.007)
longitude diff. with US						-0.008	-0.008			-0.007	-0.009
						(0.002)	(0.002)			(0.002)	(0.004)
log distance to US								-0.788		-0.179	
								(0.150)		(0.229)	
distance to US									-1.762		-0.638
									(0.782)		(0.981)
distance to US squared									0.317		0.338
									(0.280)		(0.293)
R^2	0.269	0.273	0.073	0.276	0.276	0.381	0.377	0.340	0.344	0.383	0.382
N	284	284	284	284	284	284	284	284	284	284	284

The specification is that in equation (19). The dependent variable is sales per US movie relative to sales per domestic movie. Coefficient estimates for year dummies are not shown. Standard errors (clustered by importing country) are in parentheses.

Table 4: Average Sales Ratio, Market Size, and Labor Costs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
log linguistic dissimilarity	-1.813	-1.911	-1.909	-2.143				
	(0.576)	(0.562)	(0.588)	(1.690)				
linguistic dissimilarity					-2.323	-2.473	-2.437	-2.463
					(0.745)	(0.721)	(0.743)	(2.088)
Island	1.488	1.525	1.516	2.689	1.484	1.528	1.509	2.741
	-0.299	-0.304	-0.321	-1.077	-0.302	-0.311	-0.323	-1.092
latitude diff. with US	-0.014	-0.015	-0.017	-0.038	-0.014	-0.014	-0.016	-0.035
	(0.005)	(0.004)	(0.005)	(0.027)	(0.005)	(0.004)	(0.005)	(0.027)
longitude diff. with US	-0.008	-0.008	-0.007	-0.008	-0.008	-0.008	-0.007	-0.009
	(0.002)	(0.002)	(0.002)	(0.013)	(0.002)	(0.002)	(0.002)	(0.013)
log GDP	0.041		0.079	0.099	0.049		0.089	0.101
	(0.061)		(0.186)	(0.431)	(0.061)		(0.190)	(0.436)
log population		0.034	-0.045	-0.165		0.040	-0.047	-0.141
		(0.072)	(0.178)	(0.431)		(0.072)	(0.181)	(0.429)
income, 20th percentile			-0.066	0.092			-0.066	0.066
			(0.309)	(0.445)			(0.316)	(0.467)
log urbanization rate				-0.090				-0.057
				(1.024)				(1.007)
log number of cinemas				0.102				0.089
				(0.264)				(0.263)
R^2	0.384	0.383	0.387	0.400	0.381	0.379	0.384	0.395
N	284	284	281	262	284	284	281	262

Standard errors (clustered by importing country) are in parentheses. See notes to Table 3 for other details.

Table 5: Average Sales Ratio and Protection of Intellectual Property

	(1)	(2)	(3)	(4)	(5)
linguistic dissimilarity index	-2.316	-2.570	-2.376	-2.387	-2.534
	(0.719)	(0.739)	(0.747)	(0.772)	(0.749)
Island	1.462	1.739	1.514	1.290	1.461
	(0.358)	(0.388)	(0.324)	(0.393)	(0.468)
latitude diff. with US	-0.014	-0.023	-0.016	-0.012	-0.017
	(0.006)	(0.007)	(0.005)	(0.007)	(0.009)
longitude diff. with US	-0.008	-0.007	-0.007	-0.007	-0.008
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
log GDP	-0.160	-0.096	0.078	0.166	-0.257
	(0.268)	(0.208)	(0.191)	(0.210)	(0.294)
log population	0.224	0.135	-0.025	-0.095	0.347
	(0.264)	(0.205)	(0.186)	(0.192)	(0.271)
income, 20th percentile	0.042	-0.211	-0.062	-0.041	-0.112
	(0.322)	(0.288)	(0.314)	(0.317)	(0.304)
patent protection index	1.378				1.264
	(1.048)				(1.100)
IPR protection index		1.790			2.246
		(1.215)			(1.258)
on US priority watch list			-0.125		0.164
			(0.176)		(0.178)
World Copyright Treaty				0.304	0.405
				(0.338)	(0.350)
R^2	0.400	0.398	0.385	0.398	0.433
N	268	281	281	281	268

Standard errors (clustered by importing country) are in parentheses. See notes to Table 3 for other details.

Table 6: Average Sales Ratio and Policy Trade Barriers

	(1)	(2)	(3)	(4)	(5)
linguistic dissimilarity index	-3.875	-2.648	-2.448	-2.378	-3.141
	(1.010)	(0.808)	(0.720)	(0.754)	(0.931)
Island	1.432	1.658	1.519	1.488	1.243
	(0.452)	(0.394)	(0.337)	(0.390)	(0.618)
latitude diff. with US	-0.021	-0.019	-0.017	-0.016	-0.019
	(0.007)	(0.007)	(0.005)	(0.006)	(0.009)
longitude diff. with US	-0.005	-0.007	-0.007	-0.007	-0.007
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
log GDP	-0.058	0.095	0.061	0.094	-0.075
	(0.274)	(0.218)	(0.219)	(0.189)	(0.317)
log population	0.099	-0.089	-0.030	-0.044	0.189
	(0.261)	(0.220)	(0.182)	(0.189)	(0.288)
income, 20th percentile	-0.097	-0.155	-0.025	-0.068	-0.035
	(0.348)	(0.390)	(0.368)	(0.313)	(0.424)
tariff on exposed film	-0.066				0.083
	(1.030)				(1.387)
levies tariff on foreign movies		0.328			0.246
		(0.460)			(0.585)
has quantitative restrictions			0.066		0.235
			(0.286)		(0.383)
has other restrictions				-0.050	-0.843
				(0.471)	(0.857)
R^2	0.482	0.396	0.384	0.384	0.497
N	216	281	281	281	216

Standard errors (clustered by importing country) are in parentheses. See notes to Table 3 for other details.

Table 7: Average Sales Ratio and Other Cultural Barriers

	(1)	(2)	(3)	(4)
linguistic dissimilarity index	-2.258	-1.861	-2.571	-1.964
	(0.916)	(0.671)	(0.854)	(0.694)
Island	1.492	0.864	1.399	0.741
	(0.309)	(0.313)	(0.406)	(0.419)
latitude diff. with US	-0.017	-0.007	-0.015	-0.005
	(0.006)	(0.005)	(0.006)	(0.006)
longitude diff. with US	-0.006	-0.006	-0.006	-0.006
	(0.001)	(0.002)	(0.002)	(0.002)
log GDP	0.073	0.044	0.129	0.087
	(0.189)	(0.171)	(0.208)	(0.180)
log population	-0.020	-0.031	-0.106	-0.096
	(0.175)	(0.166)	(0.212)	(0.188)
income, 20th percentile	-0.080	0.209	0.016	0.291
	(0.324)	(0.254)	(0.358)	(0.290)
individualism index	0.367			0.054
	(0.672)			(0.635)
masculinity index		1.505		1.506
		(0.392)		(0.410)
power distance index			0.656	0.713
			(0.999)	(0.820)
R^2	0.396	0.487	0.402	0.498
N	270	270	270	270

Standard errors (clustered by importing country) are in parentheses. See notes to Table 3 for other details.

Table 8: Testing for Alternative Distributions

	(1)	(2)	(3)
linguistic dissimilarity index	-2.437	-2.328	-2.332
	(0.743)	(0.871)	(0.872)
island	1.509	1.438	1.437
	(0.323)	(0.385)	(0.385)
latitude diff. with US	-0.016	-0.013	-0.013
	(0.005)	(0.008)	(0.008)
longitude diff. with US	-0.007	-0.007	-0.007
	(0.002)	(0.002)	(0.002)
log GDP	0.089	15.010	15.055
	(0.190)	(8.804)	(8.798)
log population	-0.047	-14.145	-14.230
	(0.181)	(7.141)	(7.088)
Income, 20th percentile	-0.066	-10.538	-10.543
	(0.316)	(18.537)	(18.536)
$\ln(s_{uk}/ s_T)$		-0.228	-0.237
		(0.165)	(0.154)
$\ln(s_{uk}/ s_T)^2$		0.008	0.004
		(0.041)	(0.038)
Log GDP^2		-0.667	-0.670
		(0.383)	(0.380)
Log population^2		-0.359	-0.361
		(0.331)	(0.329)
Income^2		-1.009	-1.018
		(1.104)	(1.097)
Log GDP*income		0.886	0.893
		(1.887)	(1.883)
log population*income		-0.551	-0.559
		(1.866)	(1.862)
log GDP*log population		1.065	1.073
		(0.692)	(0.686)
F statistic interaction terms		1.610	1.430
(p value)		(0.132)	(0.196)
R^2	0.384	0.453	0.453
N	281	281	281

Notes to Table 8: The specification is that in equation (25). Coefficient estimates for year dummies are not shown. Standard errors (clustered by importing country) are in parentheses. In column 2 $\ln(\underline{s}_{uk}/ s_T)$ is calculated based on estimation results of a spline function for the log rank-size relationship using the full sample of US movies in AC Nielsen in each year; in column 3 the variable is calculated based on estimation results using a restricted sample of US movies. The F statistic is for the null that the variables $\ln(\underline{s}_{uk}/ s_T)$ to log GDP*log population are jointly zero.

Figure 1: Share of US films in national movie expenditure, 2001-2006

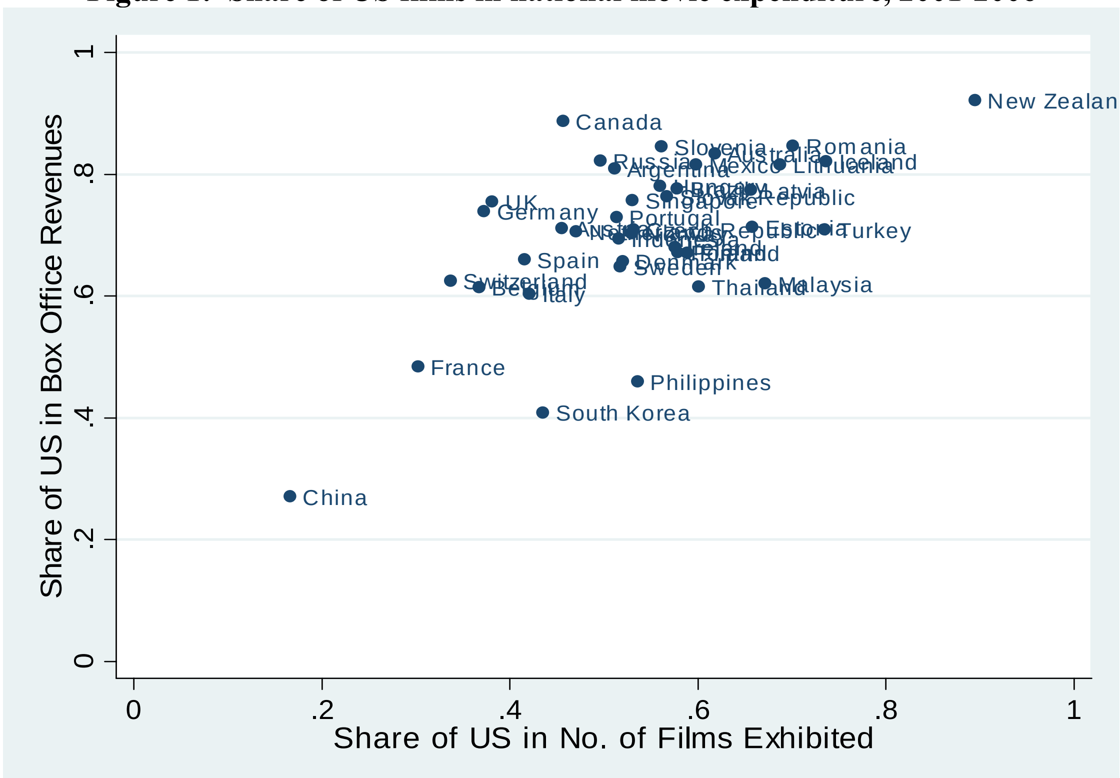


Figure 2: Intensive versus Extensive Margin of Movie Imports, 2001-2006

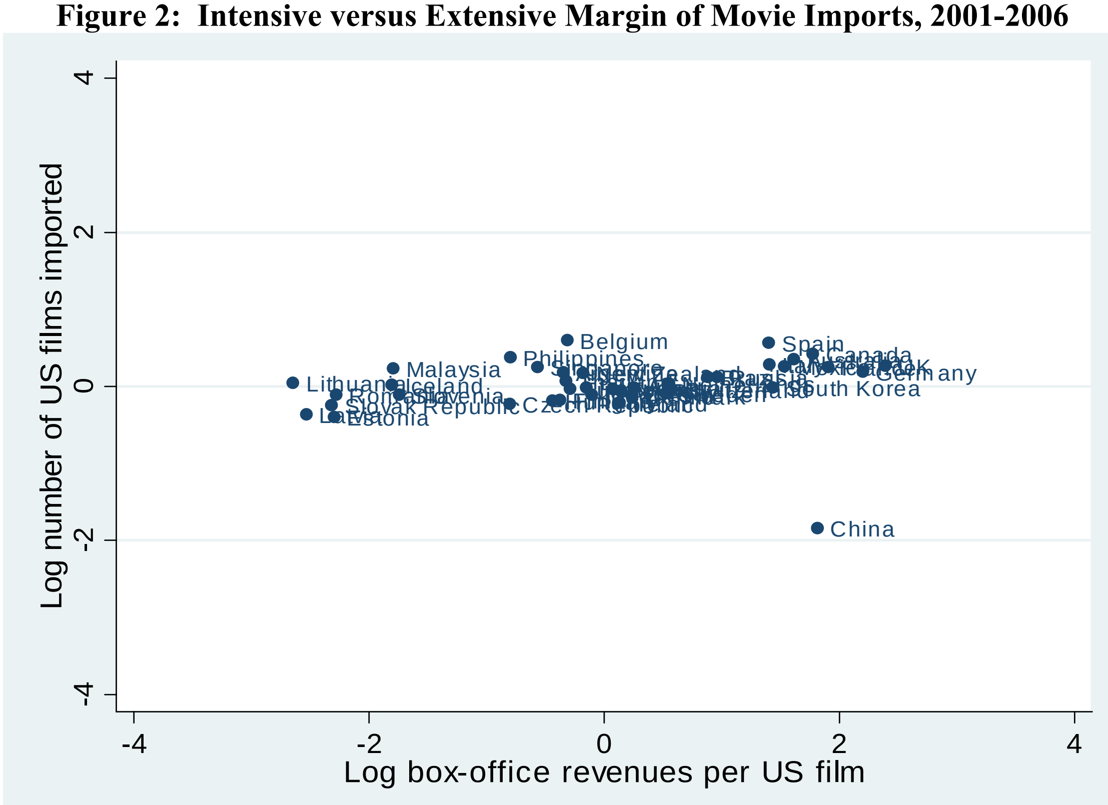
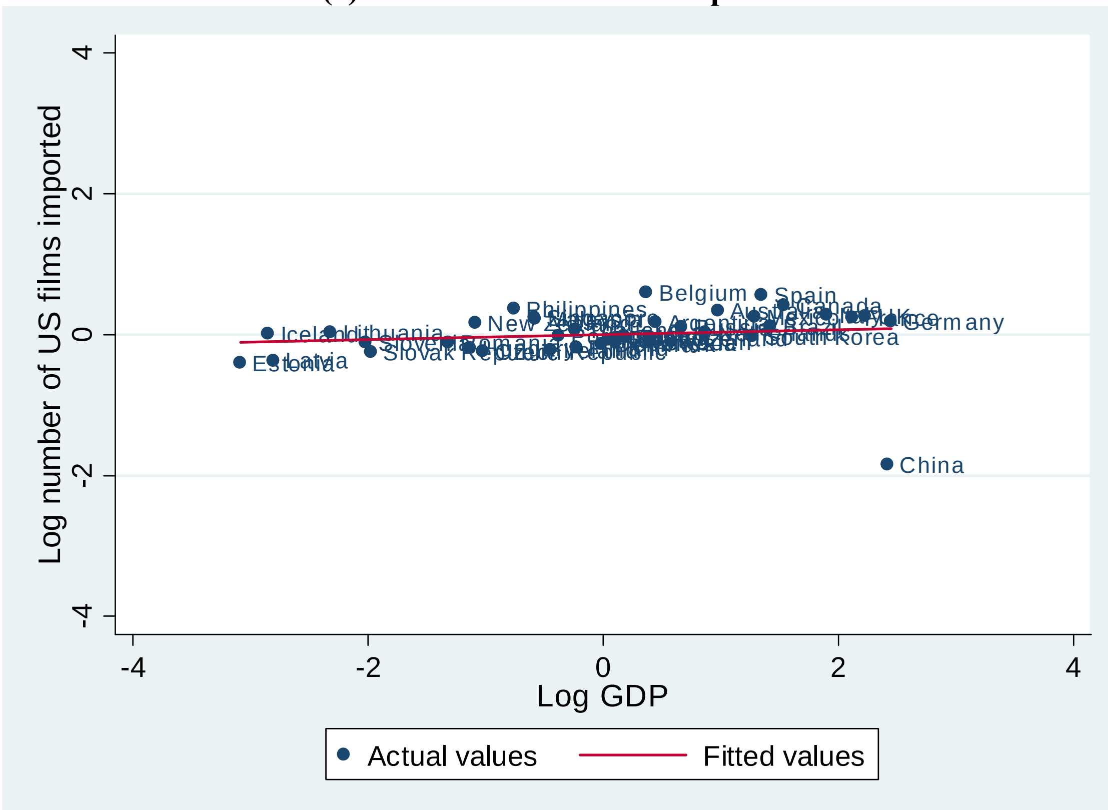


Figure 3: Movie imports and country size, 2001-2006

(a) Number of US movies imported



(b) Box-office revenues per US movie

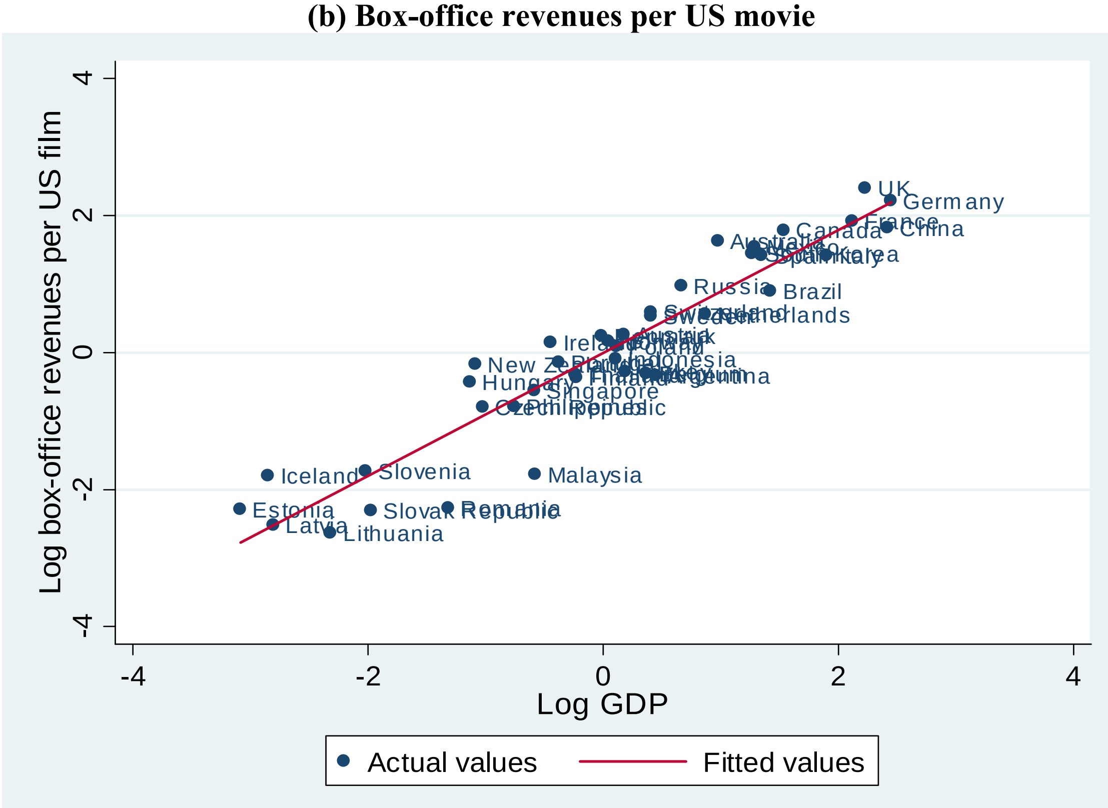
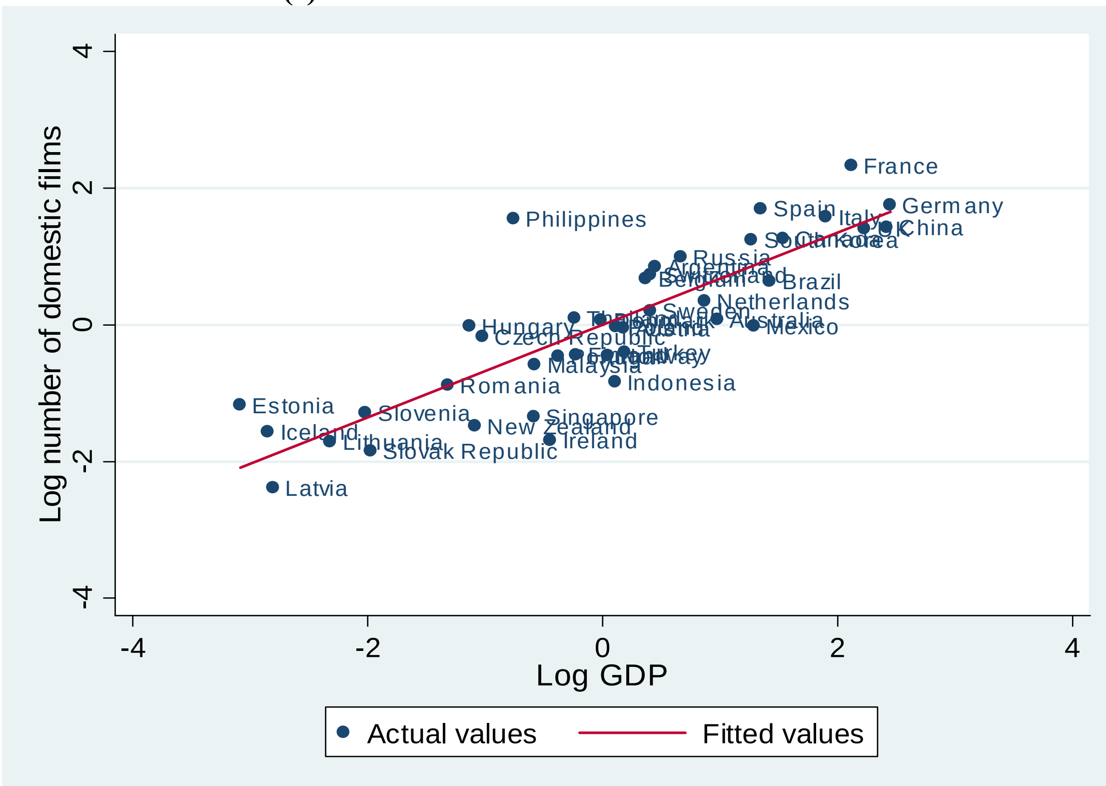


Figure 3: Domestic movie production and country size, 2001-2006

(c) Number of domestic movies exhibited



(d) Box-office revenues per domestic movie

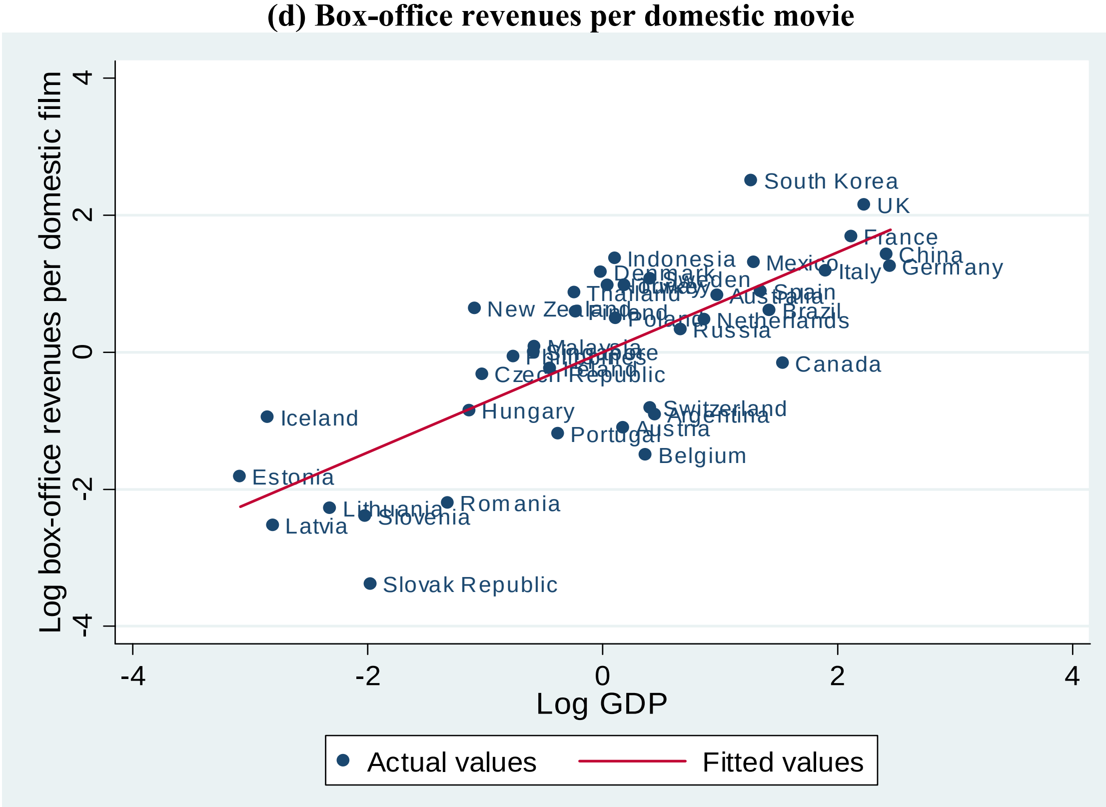
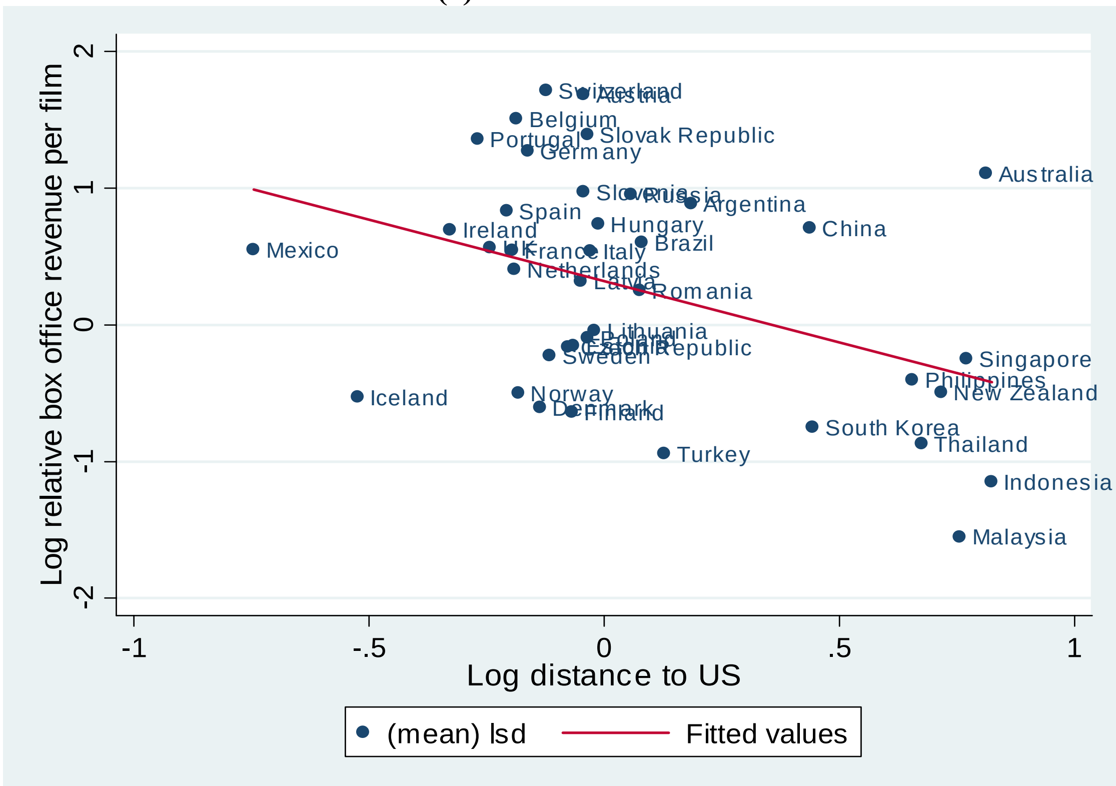


Figure 4: Relative average revenue per US movie and trade barriers, 2001-2006

(a) Distance to the US



(b) Linguistic dissimilarity with the US

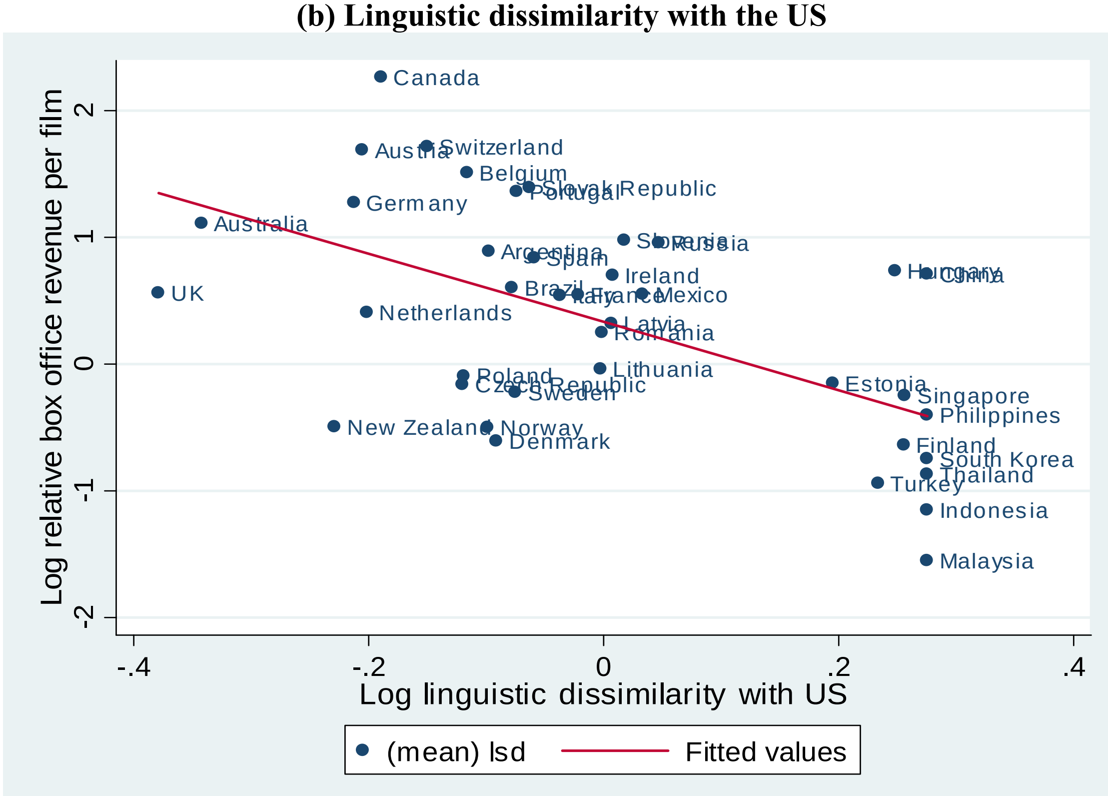
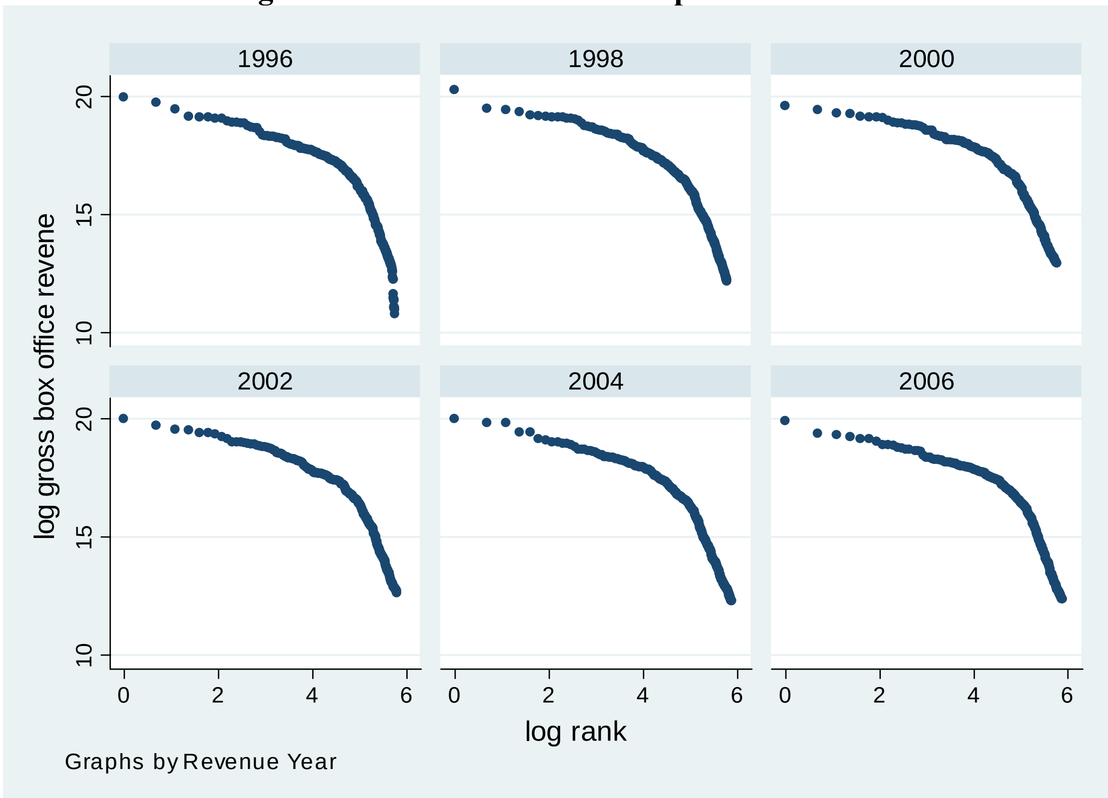


Figure 5: Rank-Size Relationship for US Movies



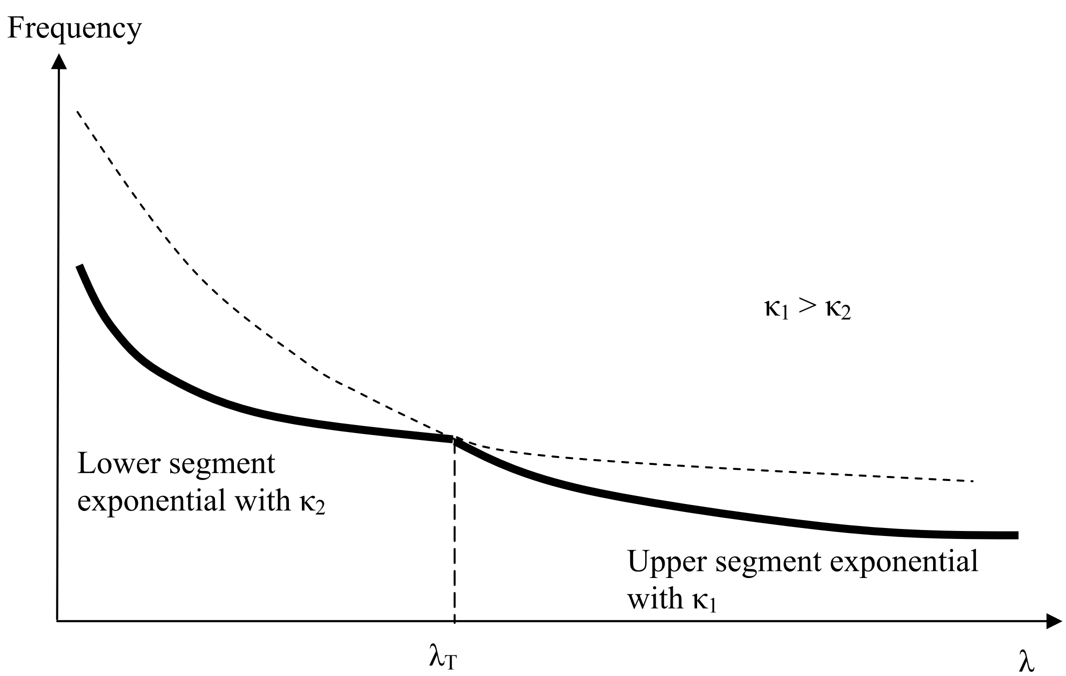


Figure 6: Two Segment Exponential Distribution