The World is Not Enough: Globalization's Impact on the Movie Industry *

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This draft: January 2019

Abstract

Globalization has two effects on the Hollywood movie industry. On the one hand, the increase in market size leads to higher total investment in the industry. On the other hand, its impact on investment varies across genres because of different preferences of movie-goers in the U.S. and in foreign countries. To quantify the impact of globalization on the rise of action movies in Hollywood, we develop a static equilibrium model of the movie industry with three main features. First, investments in production budget enhance a movie's perceived quality, and subsequently its demand. Second, a movie's budget elasticity of demand can vary both across genres and countries. Third, movie producers make investment and export decisions taking into account the varying demand elasticities. We estimate the model using box-office revenue data of all movies of U.S. origin released between 2007 and 2016 in 44 countries. Our estimates suggest that the budget elasticities for action movies are higher than other genres in all countries, with the relative popularity of action movies highest in Asian and South American countries. In our counterfactual experiments, we simulate equilibrium outcomes with higher trade barriers and find two results: first, action movies' budget could decrease by $64 million on average, while non-action movies' budget could increase $41 million; second, globalization does not benefit U.S. consumers significantly (less than $0.5 per consumer), but generates more significant benefits to foreign consumers.

*We would like to thank seminar participants at the CEIBS, CMES, SCAM'd, and SEA Meetings for useful comments. The usual disclaimer applies.

1 Introduction

The advent of new electronic distribution technologies are associated with two paradigm shifts in Hollywood. First, the digitization of movie distribution has greatly increased the amount of cinematic material available to consumers, exposing foreign audiences to and broadening the market of U.S.-origin movies. Second, a few blockbuster movies are becoming more dominant in the box-offices, in both the domestic and international markets. These movies are mostly of the action/adventure (action hereafter) genre. For instance, the box-office revenue share of top ten movies in the U.S. market has increased from approximately 25% in 2000 to 35% in 2016, with almost all of them in the action genre in recent years.

This paper attempts to link these two paradigm shifts by investigating the relationship between globalization of the movie industry and the rise of action movies. As globalization expands the international market of the movie industry, an average Hollywood movie faces increasingly more heterogeneous consumer preferences. For example, in 2013, "12 Years a Slave" garnered an Academy Award for Best Picture. But according to BoxOfficeMojo.com, it has hardly any presence in East Asian countries, and was not even released in China which is the second largest movie market in the world. In the same year, "Iron Man 3," a movie more popular in foreign market than in the U.S., received 66.3% of its box-office revenue from foreign market, of which 15% were from China, and was the top-grossing movie of the year. To the extent that a movie's box-office success depends largely on its production investment, the increase in the movie preference heterogeneity due to globalization would lead to different return-to-investment across movies of different genres, and would correspondingly mold the movie producers' incentives in production and export.

In this paper, we develop a structural model of movie industry demand and supply, particularly taking into account the difference in return-to-investment by genres. Our structural framework, similar to Ferreira, Petrin, and Waldfogel (2012), consists a nested logit demand model and a supply model specifying a relationship between movie investments and movie popularities. The main difference between our model and the model in Ferreira, Petrin, and Waldfogel (2012) is that we also model individual movies' export decisions into every foreign market. In our model, a movie's popularity is country specific, which depends on its perceived quality in that country. The country specific perceived quality, in turn, is a function of the movie's genre and its investment in

production budget. In other words, the model allows production budget elasticities of demand to vary across genres in different countries. Taking into account of these differences, movie producers make both production investment and export decisions, based on their expectations of budget elasticities in different export destinations. A Nash Equilibrium in supply decisions is used to characterize the industry equilibrium.

We estimate the model using box-office revenue data of all movies of U.S. origin released between 2007 and 2016 in 44 countries.[1] Our demand estimates suggest that the production budget elasticities of demand of action movies are higher than those of non-action movies across all regions in the world, ranging from 3.5 and 4.5 times in Central and Western Europe to 7.5 and 14 times in Asia and South America. In other words, the marginal return to investment of an action movie is much higher than that of a non-action movie in all regions, but especially in developing regions where the market is geographically or culturally more distant from the U.S. market. Our supply model implies that movie producers would invest disproportionate amount of their production budgets in movies of the action genre when these developing regions become more accessible under globalization.

To quantify the impact of globalization on the movie industry, we conduct several counterfactual policy experiments on trade. In these policy experiments, we increase trade barriers in specific regions of the world, then re-simulate movies' production budgets and export probabilities into every country. Imposing trade barriers have significant impact on the direction of the movie industry. For example, if China imposes a 20% tariff on all U.S. movies, the average budget of blockbuster action movies would decrease by 12.64 million dollars, or 7.21% of their average production investments. Meanwhile, the non-action movies would largely benefit from such an increase in trade barriers, with their production investments increasing between 6.34% and 13.49%. Our results suggest that globalization (i.e. lowering trade barriers) is a determining factor of the industry decisively shifting to invest heavily in blockbuster action movies.

In addition, we find that globalization has disparate welfare effects on different countries. While lowering trade barriers can significantly benefit movie-goers in East Asia and South America, the welfare gain in the home country is only marginal. In the U.S., the welfare gain due to

[1] We focus our analysis on U.S. origin movies because of two reasons. First, U.S. is the biggest movie production country. Second, the information on foreign origin movies' production budget is not as comprehensive and accurate. In focusing the U.S. origin movies, we take foreign movies' production budget and export decisions as exogenous.

better quality action movies is largely offset by reduction of investment in movies of other genres. However, in foreign markets, especially those culturally distant export destinations, the reduction in quality of U.S. movies in other genres does not cause significant welfare loss, because these movies are less likely to be exported to those countries.

Abundant empirical evidence shows that lowering trade barriers can lead to an increase in productivity and growth. The idea, crystallized by Melitz (2003) and have since garnered wide consensus, is that liberalization of trade can lead to resource reallocation across firms, from non-exporting firms to exporting firms. Because exporting firms tend to be more productive, a relatively higher investment by the exporting firms boost productivity and the overall economic efficiency. While the trade literature has largely focused on the productivity difference on the supply side, this paper shows that disparity in firms' investments and export decisions can also be demand driven, determined by consumer tastes and cultural barriers. As a result, globalization can have disparate impacts on the home country and the foreign countries.

This paper contributes to the growing literature on the economics impact of digitization in media/entertainment industries. Aguiar and Waldfogel (2018) show that in the music industry in which quality is highly unpredictable, the expansion of consumption opportunities due to digitization can yield huge welfare benefits. Reimers and Waldfogel (2015) show that digitization has reduced the costs of producing books, and has led to the introduction of some highly appealing products because of quality unpredictability. Peukert and Reimers (2018) provide evidence that digitization has improved author's bargaining position in the publishing market and therefore enabled them to get more favorable licence deals. Shiller (2013) argues that digitization enables video games sellers to prevent resale of their products, and shows that it would yeild significant profit increases.

This paper also fits into the international trade literature on the exports of motion pictures. Marvasti and Canterbery (2005) applies a gravity-iceberg model to US movie exports to determines cultural distance. Hanson and Xiang (2008) also uses a gravity model and find that market size, language, and trade costs are all important determinants of US movie exports. Hanson and Xiang (2011) uses versions of the model in Melitz (2003) and find that the data reject he bilateral fixed export cost model in favor of the model with a global fixed export cost in the trade in movies. Lastly, Dalton and Leung (2017), Danaher and Waldfogel (2014) and McCalman (2005) study the movie piracy in the international market.

Research has also studied the determinants of movies' box office revenues. Hennig-Thurau, Houston, and Walsh (2006) and Walls (2009) show that sequel movies perform better than other movies with similar characteristics. Einav (2007) uses a discrete choice model to structurally show that underlying seasonality for movies plays a big role in the box office performance of movies. Moul (2007) builds on Einav (2007) and show that approximately 10% of the variation in consumer expectations of movies can be directly or indirectly attributed to word-of-mouth. Several studies have documented the unpredictability of the movie and the music industry. De Vany and Walls (1999, 2004) show that, while a star can increase the expected profit of a movie, the returns are heavily skilled. The box office revenues are asymptotically Pareto-distributed. In 80% of the time, the movie will lose money. De Vany and Walls (1996) show that the movie industry was able to adapt to the unpredictable nature of the industry by using adaptive, exhibition contracts.

This paper also contributes to the marketing literature on brand extension in which an existing brand name is attached to a new product can help companies increase consumers' interest in the new product. Keller (2013) and Völckner and Sattler (2006) discusses various brand extension strategy in detail. Various studies employ stock prices (Lane and Jacobson, 1995) and market share (Smith and Park, 1992). Three papers have empirically studied sequels as movie brand extensions. Sood and Drèze (2006) study consumers' psychological reactions to the nature of a sequel's title. Basuroy and Chatterjee (2008) find that sequls perform worse than the originals, and that a shorter time lag between original and sequel is positively associated with better box office performance. Hennig-Thurau, Houston, and Heitjans (2009) conceptualize and break down the brand extension effect into forward spillover effect and reciprocal spillover effect. They then quantified the two effects using 101 sequel movies realeasd between 1998 and 2006.

2 Data

In this section, we detail the data sources, and describe the procedure of constructing and combining the data used in the subsequent analysis. Then we provide industry backgrounds and evidence to motivate our empirical model.

The movie box-office revenue data are obtained from two widely used on-line movie data websites, *The Numbers* and *Box-office Mojo*. *The Numbers* provides detailed annual movie box-office data in the United States, as well as release dates, number of theaters, production budget

estimates, and genres etc. *Box-office Mojo* provides annual box-office data for all the international markets we use in the analysis. In addition to the U.S., we collected data from 43 countries in six main regions, which are Asia , Central Europe, Eastern Europe, Northern Europe, South America, and Western Europe. The list of countries and their associated regions are in Table 1. These countries are grouped into their respective regions based on both geographic boundaries and cultural closeness.

TABLE 1: Export Regions and Countries

Region	Country
Asia	China, Hong Kong, Japan, Malaysia, The Philippines, Singapore, South Korea, Thailand
Central Europe	Austria, Croatia, Czech Republic, Hungary, Romania
Eastern Europe	Bulgaria, Greece, Poland, Turkey, Russia, Serbia, Slovakia, Slovenia, Ukraine
Northern Europe	Denmark, Finland, Iceland, Norway, Sweden
Western Europe	Australia, Belgium, France, Germany, Italy, the Netherlands, Spain, the United Kingdom
South America	Argentina, Brazil, Colombia, Chile, Peru, Venezuela, Mexico, Uruguay

Note: Some countries do not fall squarely in the geographic boundary of the associated region, such as Australia. We group the countries using both the geographic and cultural closeness of the countries in each "region".

The combined data cover all movies released in these countries between January 1, 2007 to December 31, 2017, while the U.S. data goes as far back as Dec. 30th, 1994. However, not all countries have data available in the entire data range. For example, *Box-office Mojo* only provides data for the Chinese market in 2007, 2008, 2013-2017. The main sample (i.e. the one that covers the period between 2007 and 2017) comprises 24,471 movie titles, of which many of the foreign origin movies were only released in their home countries. We also have 1,411 U.S. origin movies of which we observe their production budget information. All together, we have a total of 100,496 movie-country-year observations.

We calculate a movie's annual market share in a particular country by dividing box-office revenue by the overall market size in that country. The overall market size is constructed by multiplying average box-office ticket price and the population size of the specific country. The U.S. annual average ticket price is obtained from the *Encyclopedia of Exhibition*, and the average

ticket prices of all other countries are obtained from UIS.Stat at UNESCO.[2] The UNESCO data are available from 2005 to 2015. We use linear interpolation to obtain average prices for all other years in our movie data. The population sizes and national incomes per capital of all countries are obtained from the World Bank.

Table 2 reports the summary statistics of the main variables in our demand estimation. Developed regions such as the U.S., Western Europe and Northern Europe have higher income and more expensive ticket prices than other developing regions such as Asia and South America. In terms of population, Asia has the largest market outside the U.S., followed by South America. Average population in a Northern European country is only 5.2 million. Average movies' market shares vary significantly across regions, but do not differ significantly between developed and developing regions. They range from 0.03% on average in Eastern Europe to 0.12% on average in Northern Europe.

Table 2: Summary Statistics

Region	Income ($ '000)	Ticket Price ($)	Population (million)	Movie's Market Shares
Asia	24.62	6.49	160	0.08%
	(16.77)	(2.94)	(369)	(0.19%)
Central Europe	25.79	6.93	10.2	0.05%
	(16.83)	(2.61)	(4.6)	(0.10%)
Eastern Europe	12.56	5.34	52.7	0.03%
	(6.61)	(2.09)	(51.2)	(0.08%)
Northern Europe	60.94	11.60	5.2	0.12%
	(17.46)	(2.29)	(2.90)	(0.25%)
South America	9.76	4.50	74.0	0.05%
	(2.95)	(1.42)	(67.4)	(0.25%)
Western Europe	42.27	9.31	48.8	0.06%
	(7.68)	(1.71)	(23.3)	(0.13%)
U.S.	52.33	7.93	314	0.06%
	(3.26)	(0.58)	(7.8)	(0.28%)

Standard deviations in parentheses.

[2]The UNESCO collects data and constructs indicators on cultures around the world, see http://data.uis.unesco.org.

2.1 Industry Background

In the past 20 years, Hollywood has seen a rise of action movies in the box-office. In recent years, almost all the top-ten movies in the U.S. box office are of the action/adventure genre. Blockbusters in other movie genres are becoming exceedingly rare. One has to go back more than 20 years to 1994, to find blockbuster dramas, such as "Forrest Gump," which was ranked the second top-grossing movie in that year.

Table 3 shows that the number of action movies and their shares have steadily increased in the U.S. market between 1995 and 2016. The number of action movies has steadily increased from approximately 20% before 2000 to close to 30% in recent years. Their box office revenue shares have increased from approximately 30% before 2000 to approximately 45% in recent years.The steepest increase happened in early to mid-2000, which is before the time period of our international box office revenue data.

Table 3: Share of action Movies in the U.S.

Year	action/adventure	Total	Share of Act. (Number)	Share of Act. (Box Office)
1995	34	139	24.5%	34.8%
1996	22	131	16.8%	27.3%
1997	22	135	16.3%	21.2%
1998	36	134	26.9%	38.0%
1999	25	143	17.5%	31.0%
2000	36	145	24.8%	30.4%
2001	32	137	23.4%	42.9%
2002	39	148	26.4%	39.4%
2003	42	141	29.8%	46.5%
2004	36	151	23.8%	39.3%
2005	42	146	28.8%	39.4%
2006	31	171	18.1%	29.0%
2007	40	178	22.5%	38.1%
2008	42	162	25.9%	42.1%
2009	41	149	27.5%	42.5%
2010	36	133	27.1%	44.2%
2011	44	142	31.0%	46.3%
2012	38	140	27.1%	45.8%
2013	43	147	29.3%	49.4%
2014	42	144	29.2%	49.3%
2015	40	149	26.8%	52.9%
2016	46	160	28.8%	61.4%

Because of different market situations, the same movies can have significantly different performances across countries. While action movies tend to outperform non-action ones in the box-offices of most countries, the relative success of action movies can vary greatly. The varying successes of a movie in different exporting destinations depends on trade barriers (i.e. China imposes a quota system for foreign movies), and cultural closeness (i.e. shared cultural heritage and language between the U.S. and the U.K.).

Table 4 summarizes the export probabilities and market shares of different types of movies across regions. We categorize movies based on their production budgets (high vs low budget) and genres (action vs non-action). For example, a movie is in the "action, Low-budget" category if it is of the action genre and its production budget is below the median production budget of all action movies in the same year.

Table 4: Average Export Probabilities and Market Shares Across Regions

	Non-action		action	
Budget	Low-Budget	High-Budget	Low-Budget	High-Budget
		Export Probabilities		
Asia	44.43%	62.87%	77.82%	94.47%
C. Europe	50.54%	78.09%	80.92%	92.90%
E. Europe	46.10%	74.35%	79.71%	95.26%
N. Europe	50.76%	75.28%	76.18%	93.63%
S. America	59.43%	80.53%	84.42%	95.08%
W. Europe	70.35%	89.22%	89.44%	98.04%
U.S.	100%	100%	100%	100%
		Market Shares (conditional on entry)		
Asia	0.03%	0.09%	0.11%	0.34%
C. Europe	0.03%	0.08%	0.07%	0.17%
E. Europe	0.02%	0.06%	0.06%	0.13%
N. Europe	0.06%	0.15%	0.14%	0.40%
S. America	0.03%	0.08%	0.10%	0.25%
W. Europe	0.05%	0.12%	0.11%	0.33%
U.S.	0.13%	0.26%	0.22%	0.67%

The upper panel of Table 4 reports the export probabilities of U.S. movies in different regions. There are several things to note. First, action movies are more likely to be exported to foreign countries. For instance, the high-budget action movies have more than 90% chance in exporting to any of the six regions in our sample, while the high-budget non-action movies have approximately

75-80% chance of being exported, and the export probability is as low as 62.87% in Asia.

Second, high-budget movies have higher probabilities of being exported. Depending on the region and genre of movies, the export probabilities of high-budget movies are 10%-30% higher than those of low-budget ones. Increasing production budget has a larger impact on the export probability of non-action movies (20%-30%) than that of action movies (10%-20%). This is mostly due to decreasing marginal returns, as most of action movies are exported anyways. The differential effects of production budget on entry probabilities are the lowest in Asia and South America, where action movies tend to be more popular relatively.

Third, the export probabilities corroborate with our expectation of the trade/cultural barriers in different regions. Based on the geographical and cultural distances from the United States, movies of all types are the least likely to be exported to Asia, and are the most likely to be the exported to Western Europe.

The lower panel of Table 4 reports the market shares (conditional on entry) of Hollywood movies across regions. Action movies are more popular than non-action movies in all regions. The action movies' market shares are, on average, two to four times higher than non-action ones with a similar budget. Also expectedly, movies with higher production budgets tend to obtain higher market shares. Across regions, high-budget movies' market shares tend to be two to three times higher than low-budget ones.

The most interesting finding is that the relative market shares of action movies to Non-action movies also varies across regions. For example, the high-budget action movies has a market share that is 2.58 times of their non-action counterparts in the United States. Similar to the U.S., it is 2.75 times in Western Europe. The corresponding share is much higher in Asia, which is 3.78 times. To regions with higher cultural barriers, action movies not only have a high export probability, but also enjoy higher relative market shares conditional on entry. Overall, movies of the action genre are better at penetrating the cultural barriers.

3 Model

This section introduces a model of the global movie industry. The model consists of both the demand and supply sides of the industry. The demand model is a nested logit model that is standard in the movie demand literature. On the supply side, we model a movie's budget decision,

and its entry decision into each country in the global market.

3.1 Demand

Consumers first decide on whether to watch a movie in theaters, then decide on which movie to watch. A movie is released in a country for only one period. For notational convenience, the period subscript t is suppressed below.

The indirect utility of consumer i in country c watching movie j is

$$u_{ijc} = \theta_{jc} - \alpha p_c + \phi y_c + \xi_{cj} + \zeta_{ic} + (1-\sigma)\varepsilon_{ijc}. \tag{1}$$

In this setup, θ_{jc} is movie j's perceived quality in country c, p_c is movie ticket price of country c, and y_c is the per capita income of country c. The demand shock, ξ_{cj}, captures consumers' unobserved propensity to like a movie in country c.

Consumer i in country c can choose an outside option, which determines consumer propensity to stay away from movie theaters. Consumer utility of staying away is

$$u_{i0} = -\beta_0 + \zeta'_{ic} + (1-\sigma)\varepsilon_{i0c}, \tag{2}$$

where $-\beta_0$ is the average utility of the outside option, which is assumed to be common across all countries.

The nested nature of the logit demand depends on the idiosyncratic taste shock, $\zeta_{ic}+(1-\sigma)\varepsilon_{ijc}$. The taste shock component, ζ_{ic}, is the same across all movies, but can be different from the unobserved propensity to choose the outside option, ζ'_{ic}. We assume that ε_{ijc} is an independent and identically distributed extreme value random variable. The sum $\zeta_{ic}+(1-\sigma)\varepsilon_{ijc}$ is also extreme value distributed. Parameter $\sigma \in [0,1]$ captures the relative importance between these two taste shock components and measures the substitutability between movies and the outside option.

Following Berry (1994), the nested logit predicted market share of movie j in country c is:

$$s_{jc} = \frac{\exp\left(\frac{\theta_{jc}+\beta_0+\xi_{jc}}{1-\sigma}\right)}{D_c^{\sigma} + D_c}, \tag{3}$$

where

$$D_c = \sum_{k \in J_c} \exp\left(\frac{\theta_{jc} + \beta_0 + \xi_{kc}}{1-\sigma}\right).$$

Here, J_c is the set of all available movies in theaters in country c. Rearranging Equation 3, we have

$$\ln(s_{jc}) - \ln(s_{0c}) = \beta_0 + \alpha p_c + \phi y_c + \sigma \ln\left(\frac{s_{jc}}{1 - s_{0ct}}\right) + \xi_{jc}. \tag{4}$$

The parameter σ determines the "market-expansion" effect. A high quality movie can attract consumers who would otherwise stay away from theaters. In doing so, the movie expands the movie-going consumer base. If $\sigma = 1$, then the outside good and all the movies have no substitutability. This means that a movie can only expand its market share at the expense of other movies. If $\sigma = 0$, the model is a simple logit model, where the cross-elasticity of demand is the same across all alternative movies and the outside option. Therefore, the magnitude of σ pins down the relative size of the market-expansion effect. This approach is similar to the one in Einav (2007).

The unobserved propensity to like movie j in week t is $\xi_{jc} = \omega_{jc} + \epsilon_{jc}$, where ϵ_{jc} is an independent and identically distributed measurement error, and ω_{jc} captures an unobserved demand shock which varies across all movies in country c. Ignoring ω_{jc} can cause endogeneity bias in our demand estimates. We follow Hausman, Leonard, and Zona (1994) to use prices in other countries as instruments for p_c. The cost of exhibiting movies are common worldwide, so movie prices are highly correlated across different countries. However, country specific demand shocks in country c are not correlated with movie prices in other countries.

3.2 Budget and Export Decisions

From the demand model, movie j's market share in country c depends on its price-adjusted movie quality, $\delta_{jc} = \theta_{jc} - \alpha p_c$. The price-adjusted quality depends on observable movie characteristics and a movie-country specific random shock ϵ_{cj}, where

$$\delta_{jc} = G(A_j, B_j, c) + \epsilon_{jct}. \tag{5}$$

The movie observables include movie genres A_j, production budgets B_j, and the country to which the movie is released. We assume that a movie's genre is predetermined by the screen-plays. Therefore, a movie producer must make budget and export decisions.

We describe the movie producers' decisions in two stages. In the first stage, the producer of movie j makes the production budget decision before the random shocks ϵ_{jct} is realized. All movie producers make production budget decisions simultaneously. After the decisions are made, all production budgets are public information. In the second stage, the random shocks are realized and revealed to all the movie producers, who make export decision.

We describe the second stage export decisions first. At the beginning of the second stage, movie producer j knows its own movie's budget and genre, as well as budgets and genres of all the other movies released in the same period. For a particular realization of the random shocks $\tilde{\epsilon}_{cjt}$, movie j's quality is

$$\tilde{\delta}_{jct} = G(A_j, B_j, c) + \tilde{\epsilon}_{jct}.$$

Equation 3 describes how movie j's market share depends on its price adjusted quality. In this setup, movie j's market share in country c, s_{jc}, depends on not only movie j's own price-adjusted movie quality and export decision, but also price-adjusted movie qualities and export decisions of all other movies.

A movie would choose to enter a foreign market only when its revenue exceeds the fixed cost of that country F_c. Movie j's revenue in country c is

$$R_{jc} = W_j \cdot p_c M_c s_{jc},$$

where W_j is the movie specific weight factor, capturing unobservable movie producer attributes that can potentially scale a movie's revenue.[3] An entry equilibrium is such that all movies entered make non-negative profits, but no additional entry would make positive profit.

While export decisions are made given movie qualities in the second stage, qualities of movies result from budget decisions in the first stage. In the first stage, the movie-country specific random

[3]The boxoffice revenue does not represent all the revenue for movie studios because of two reasons. First, as they have to share a significant portion of the boxoffice revenue with theater owners. Second, they obtain revenue from other sources, such as home video, television, and streaming. We do not observe the revenue-sharing contracts and the revenue from these other sources. As a result, we assume there is a movie-specific scale factor W_j, so that the actual revenue generated by movie j in country c is $W_j R_{cj}$.

shocks, ϵ_{cj}, are yet to be realized. Therefore, movie producers make budget decisions based on their expectations of export decisions and profits of all the movies released in the same period. In a period, all movie producers make budget decisions simultaneously. For movie j's producer, its budget decision $\tilde{B}_j$ maximizes its expected return:

$$\tilde{B}_j = \arg\max_{B_j} \sum_c E[R_{jc}(B_j, \bar{B}_j) - F_c] - B_j.$$

Because the expected return is a function of all other movie's expected qualities, which are functions of their budgets $\bar{B}_{-j}$, the optimal production budget of movie j is a best response function to all other movies' budgets, $\tilde{B}_j(\bar{B}_{-j})$.

A *Production Budget Nash Equilibrium* is defined as the set of production budgets $B^*_{j\,j\in J_t}$, where

$$B^*_j = \tilde{B}_j(B^*_{-j}), \forall j \in J_t.$$

Essentially, the Nash Equilibrium is the fixed point of all movies' production budget best response functions.

4 Estimation

In this section, we detail the empirical specification of the model, as well as describe and discuss the estimation procedure.

4.1 Quality Production Specification

We first specified the quality production function $G(A_j, B_j, c)$. Central to our analysis is whether trade affects the popularity and budget decisions of action movies. In considering genres, $A_j = 1$ if movie j is classified as the action/adventure variety, and $A_j = 0$ if movie j is of any other genres. For simplicity, we assume that all potential movies are released in the US market.

The price-adjusted movie quality, δ_{jc}, of movie j in country c of region r released in period t is

$$\delta_{jct} = \mu_r + \mu_c + \gamma_{1r}(A_j \times \ln(B_j)) + \gamma_{2r}\ln(B_j) + \gamma_{3r}A_j + \tau_{1r}(t - t_0) + \tau_{2r}(t - t_0)^2 + \epsilon_{cjt}. \quad (6)$$

In this specification, all the countries within the same region share the same quality production function coefficients. Seven possible regions are considered: Asia, North Europe, Central Europe, West Europe, East Europe, South America, and the US. μ_r is the region fixed effect, μ_c is the country fixed effect, parameters γ_{1r}, γ_{2r}, and γ_{3r} are region specific coefficients governing how movie genres and production budgets affect movie qualities. We also consider how macro-economic environment might have affected the perceived movie qualities overtime. Here, $t-t_0$ is the number of periods elapsed from the first period of our dataset. Parameters τ_{1r} and τ_{2r} are region specific coefficients governing the time trends in the movie industry. The idiosyncratic random shock $\epsilon_{cjt} \approx N(0, \rho_c)$ is i.i.d. across different countries and different time periods, where ρ_c is the country specific random shock standard deviation.

The set of supply-side parameters are $\Theta_c = \{\mu_r, \mu_c, \gamma_{1r}, \gamma_{2r}, \gamma_{3r}, \tau_{1r}, \tau_{2r}, \rho_c\}$.

We assume that all potential movies are released in the US. The price-adjusted movie qualities in the US are estimated from the demand model. Therefore, we can recovered all the US parameters Θ_{US} by estimating Equation 6 directly. However, not all movies export to all countries in the data. Importantly, movies are not missing from the data randomly. In fact, the non-export decisions tell us some information regarding the movie and the country. A movie decides not to export to a country, either because it has a low quality or it has a bad random shock. We use the empirical procedure described below to recover Θ_c for all the non-US countries jointly.

4.2 Export Decision

We solve the model backwards. Backing out the fixed export cost is straightforward. We observe in data the ticket price, market size, and all exporting movies' realized market shares. Therefore, the boxoffice revenues of the movies can be calculated by $R_{cj} = \sum_t p_{ct} M_{ct} s_{cjt}$. We assume that the marginal movie just breaks even, then given the set of revenue weights $\{W_j\}$, the fixed costs are

$$FC_c = \min_j \{W_j R_{jc}\}.$$

Given a set of model parameters Θ_c, in particular, ρ_c, we draw a particular set of random shocks $\{\epsilon_{jct}\}$. Then, we can construct movie j's would-be quality in a country, $\tilde{\delta}_{cjt}$, based on Equation 6. In each country, we assume that movies make export decisions in a sequential fashion. Movies' $W_j \cdot \delta_{jc}$ are ranked from high to low. We assume that the movie with the highest $W_j \cdot \delta_{jc}$ makes

the export decision in country c first. In practice, we can add one movie to the market at a time. Calculate the would-be market share $\tilde{s}_{cjt}$ and revenues $W_j R_{cj}$ and check if they are greater than FC_c. Given the demand model, specified by Equation 3, and given the sequential entry assumption, if movie k with $W_k \cdot \delta_{kc} < W_j \cdot \delta_{jc}$ enters profitably into country c, then the previously entered movie j can remain in the same country with a positive profit. This process would continue until the new entrant movie can no longer make a positive profit.

4.3 Nash Equilibrium for Production Budget

A movie does not observe random shocks when it makes the budget decision. We follow Ferreira, Petrin, and Waldfogel (2012) to model how movie studios compete in production budget.

From the simulated entry equilibrium, a movie knows its expected entry decision and its expected revenue $\tilde{R}_{cjs}$ for any given set s of error draws $\{\epsilon_{jc}\}$.The worldwide boxoffice revenue for movie j is the sum of its boxoffice revenue in all countries, conditional on entry:

$$\widetilde{RW}_j = W_j \sum_c \max\{\tilde{R}_{cjs} - F_c, 0\},$$

where $\tilde{R}_{cjs}$ is a function of all movies' budgets B_j and random draws $\{\epsilon_{jc}\}$. Therefore, the worldwide expected profit for movie j is

$$\int_s \sum_c \widetilde{RW}_j ds - B_j,$$

where we are integrating over all possible random draws. We assume that all random draws of i.i.d. across different movies and different countries. To numerically simulate the integral, we simulate the model S times with different random draws, so the expected profit is

$$E\pi_j = \frac{1}{S} \sum_s \sum_c \widetilde{RW}_j - B_j.$$

Over all possible random draws, a movie with low quality with high enough random shock can export to a country, and vice versa. Therefore, all movies export into all countries with strictly

positive probabilities. This enables the use of first order conditions to solve the Nash Equilibrium.

$$\begin{aligned} 0 &= W_j \frac{1}{S} \sum_s \sum_c p_c M_c \frac{d\tilde{s}_{cjs}}{dB_j} - 1 \\ 1 &= W_j \frac{1}{S} \sum_s \sum_c p_c M_c \tilde{\eta}_{cjs} \frac{\tilde{s}_{cjs}}{B_j} \\ B_j &= W_j \frac{1}{S} \sum_s \sum_c p_c M_c \tilde{s}_{cjs} \tilde{\eta}_{cjs}, \end{aligned}$$

where $\tilde{\eta}_{cjs}$ is the demand elasticity with respect to production budget. The budget elasticities are functions of market shares ($\tilde{s}_{cjs}$), production budgets and the estimates of which are obtained in the demand estimation (See the Appendix). In the first order conditions, ticket prices (p_c) and market sizes (M_c) are observables in the data. We assume that the observed production budgets in data (B_j) are movie producers' optimal choices. Therefore, we can use the first order conditions to back out movie-specific scale factor (W_j).

4.4 Simulated Method of Moments

We used simulated method of moments to jointly estimate all the supply-side parameters Θ_c for all the non-US countries. We use export-moments by genres and by production budgets. In a particular year, we categorize all the movies by whether they are action/adventure movies or not. Within each category, we further separate the movies into quartiles by their observed production budgets. Then we calculate, for each country, the probability of export of all the movies in the same quartile and genre. These probabilities can be calculated for both the actual data and any particular realization of the simulated equilibrium. The supply-side parameters Θ_c^* minimizes the difference of the data probabilities $\bar{Pr}$ and the average the simulated probabilities $\hat{Pr}_s(\Theta_c)$.

$$\Theta_c^* = \arg\min \sum_c \sum_{q=1}^{4} (\bar{Pr} - \frac{1}{S} \sum_s \hat{Pr}_s(\Theta_c))^2$$

The identification of movie qualities parameters vs random shock draws. If we see a movie with high budget, but didn't export to many countries, that means it has a low W_j; vice versa. If we see a movie with a high budget, and has a high probability entering into all other countries, but it didn't export to country c, that means it got a bad random draw; vice versa. If a country

conforms to the expectation that higher budget movies exports more often than lower budget movies, then it has a lower variance in random draws; vice versa.

5 Results

5.1 Demand Estimates

Table 5 reports estimates of the demand model. The first column reports the specification without using any instrument. The second column reports the specification in which we instrument the inside share (i.e. the substitution parameter σ) using the number of rival movies in each market. This is a simple version of the "BLP instruments", which are functions of the remaining products in the market. Note that the estimate of the substitution parameter σ drops significantly from close to one (0.958) in column (1) to 0.742 in column (2). Column (3) reports the specification in which we instrument the movie ticket price in country c using the movie ticket prices in other countries. Note that the estimates of the parameter for ticket price are similar in magnitude (-0.169 and -0.157) in columns (1) and (3).

Table 5: Demand Model Estimates

	(1) No IV	(2) IV for Inside Share	(3) IV for Price	(4) IV for Both
Income	0.482***	0.501***	0.465***	0.511***
	(0.00173)	(0.00231)	(0.00203)	(0.00246)
Ticket Price	-0.169***	-0.198***	-0.157***	-0.206***
	(0.00112)	(0.00152)	(0.00138)	(0.00165)
Sigma	0.958***	0.742***	0.958***	0.757***
	(0.000751)	(0.00251)	(0.000753)	(0.00249)
Constant	-2.392***	-3.766***	-2.430***	-3.623***
	(0.00684)	(0.0172)	(0.00725)	(0.0171)
Observations	106874	106874	106874	100256
R^2	0.94	0.90	0.94	0.90

Standard errors in parentheses
* $p < .1$, ** $p < .05$, *** $p < .01$

In column (4), we use both instruments for inside share and ticke price. The estimate of the substitution parameter σ (0.757) is similar to column (2), and is in line with the estimate reported

in Ferreira, Petrin, and Waldfogel (2012). The estimate of price coefficient (-2.06), however, is slightly higher than that in Ferreira, Petrin, and Waldfogel (2012). We use demand estimates in column (4) for our counterfactual experiments.

5.2 Supply Estimates

Table 6 reports the estimates of the quality production function across regions from Simulated Method of Moments estimation. Most of the estimates have the expected sign. The estimated coefficients of the logarithm of production budgets are all positive and range from 0.103 to 0.312, which indicate that the returns to investment on movie's quality are positive in all regions. Also, the estimates on the interaction term between the action dummy and the logarithm of production budget are positive and range from 0.088 to 0.214 across regions, which suggest that the same increase in production budget would have a higher return on action movie's quality than that on non-action movie's quality. The estimates on the action dummy are negative and range from -1.185 to -3.537 across regions. This, together with the results that action movies' return of production budget is higher than that of non-action movies, suggests that high-budget action movies would have a higher movie quality than high-budget non-action movies, while the ranking of quality would be reverse for low-budget movies.

TABLE 6: Quality Production Function Estimates

	Asia	C. Europe	E. Europe	N. Europe	S. America	W. Europe
action	-1.959***	-1.423***	-1.185***	-2.065***	-3.537***	-2.721***
	(0.378)	(0.362)	(0.246)	(0.340)	(0.472)	(0.199)
ln(Budget)	0.149***	0.270***	0.312***	0.172***	0.103***	0.275***
	(0.034)	(0.048)	(0.039)	(0.036)	(0.029)	(0.029)
action $\times$ ln(Budget)	0.133***	0.088***	0.075***	0.124***	0.214***	0.152***
	(0.021)	(0.021)	(0.015)	(0.019)	(0.027)	(0.011)
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Time Trend	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

Different countries have different market conditions, such as the numbers and qualities of the

local movies in each country, which can affect the return of production budget on market shares. Therefore, the magnitude of the estimates in Table 6 cannot be directly compared across regions. To quantify the return to investment, we construct the budget elasticity of demand for each movie. For a movie j that is released in country c, the budget elasticity η_{cj} is $\frac{\partial s_{cj}}{\partial B_j}\frac{B_j}{s_{cj}}$, where s_{cj} is the nested logit market share of movie j in country c.[4] The budget elasticity of movie j in region R is $\sum_{c\in R}\eta_{cj}$, and the market-share weighted budget elasticity of movie j in region R is $\sum_{c\in R} s_{cj}\eta_{cj}$.

We summarize the average budget elasticities of action and non-action movies across regions in Table 7. The first two columns report the average budget elasticities in each region. In all regions, the budget elasticities of action movies are higher than that for non-action movies. The ratios of the budget elasticities between action and non-action movies range from 1.58 in Central Europe to 3.46 in South America. In Asia, the budget elasticity of action movies is approximately 2.72 times higher than that of non-action movies.

The last two columns report the market-share weighted budget elasticities in each region. As in the first two columns, the market-share weighted budget elasticities of action movies are higher than that of non-action movies in all regions. The difference between action and non-action movies' budget elasticities are even bigger after weighting the elasticities by market shares. The ratios of the market-share weighted budget elasticities between action and non-action movies range from 3.5 in Central Europe to 14 in South America. In Asia, the market-share weighted budget elasticity of action movies is approximately 7.5 times higher than that of non-action movies.

TABLE 7: Mean Budget Elasticity Across Regions

	$\sum_{c\in R}\eta_{cj}$		$\sum_{c\in R} s_{cj}\eta_{cj}$	
Region	action	Non-action	action	Non-action
Asia	6.861	2.524	0.015	0.002
Central Europe	5.864	3.707	0.007	0.002
Eastern Europe	12.003	7.275	0.010	0.003
Northern Europe	5.043	2.371	0.013	0.003
South America	8.510	2.461	0.014	0.001
Western Europe	12.929	7.106	0.027	0.006
US	1.010	0.471	0.004	0.001

NOTES: R is a region.

[4] If movie j is not released in country c, then $\eta_{cj} = 0$. Therefore, this is an imperfect proxy of the "true" budget elasticity which would incorporate the impact of budget on export decision.

6 Counterfactual Experiments

To quantify the impact of globalization on the rise of action movies, we conduct several counterfactual experiments. Specifically, we compare equilibrium outcomes in five scenarios, described in Table 8. We consider an increase in trade costs in different countries and regions of the world. In the first three scenarios, a 20% tariff is imposed on China, Asian countries, non-OECD countries, respectively.[5] In the fourth scenario, we consider an extreme case in which the Chinese market became completely unavailable. The equilibrium outcomes in the four scenarios are compared with fifth one, which is the benchmark.

TABLE 8: Five Scenarios in the Counterfactuals

Scenario	Description
1. China Tariff	20% tariff on all U.S. movies in China
2. Asia Tariff	20% tariff on all U.S. movies in Asian countries
3. Non-OECD Tariff	20% tariff on all U.S. movies in non-OECD countries
4. No China	Completely shut down the Chinese market
5. Benchmark	Current situation

In each of the first four scenarios, we take as given the estimates of movie demand, quality production function, qualities of non-Hollywood movies, and entry costs, as well as the same random shocks in the quality production function as in the benchmark. Then, we re-optimize each movie's budget and export decision by solving the two-stage game described in the previous section.[6] Because there are several years in which the Chinese box-office revenue data are unavailable, we only consider the counterfactual results for years between 2013 and 2017.

6.1 Production Budgets

Table 9 reports the changes of production budgets (both in dollar amount and in percentage) from the benchmark to each of the four counterfactual scenarios. We summarize the production budget responses by four types of movies: low-budget non-action, high-budget non-action, low-budget ac-

[5]The Asian countries include China, Hong Kong, Japan, S. Korea, Malaysia, Singapore, and Thailand. The non-OECD countries include ...

[6]We also assume the number of Hollywood movies in each year is the same. In other words, we do not model the entry-exit decision in the US market in the counterfactual experiments.

tion, high-budget action. The budget categories are defined using the production budgets in data, and remain unchanged across different counterfactual experiments. Because the policies in the counterfactual experiments mainly target the countries in which action movies' budget elasticities are dis-proportionally higher than non-action movies', we would expect the production budget responses to be different between these two types of movies. Our results largely corroborates with our expectation.

The first two columns report changes of non-action movies' production budgets. There are several things to note. First, in almost all counterfactual scenarios, non-action movies' production budget increases when trade barriers are higher. As expected, the production budgets would change more when tariffs are imposed on more countries. For instance, when a 20% tariff is imposed on all non-OECD countries, low-budget and high-budget non-action movies would increase their budget by 37.02% ($5.44 million) and 46.31% ($21.71 million), respectively. However, production budgets would only increase 6.34% ($1.04 million) and 13.49% ($6.5 million) for the two types of movies when the tariff is imposed on China only.

Table 9: Production Budget Changes

	Non-action		action	
	Low-Budget	High-Budget	Low-Budget	High-Budget
China Tariff	+ $1.04 m	+ $6.50 m	− $1.18 m	− $12.64 m
	(6.34%)	(13.49%)	(0.64%)	(7.21%)
Asia Tariff	+ $1.81 m	+ $13.31 m	− $2.38 m	− $25.06 m
	(8.48%)	(27.04%)	(1.42%)	(13.47%)
Non-OECD Tariff	+ $5.44 m	+ $21.71 m	− $9.13 m	− $44.17 m
	(37.02%)	(46.31%)	(11.30%)	(24.10%)
No China	+1.44 m	+ $41.25 m	− $12.36 m	− $64.42 m
	(16.24%)	(84.47%)	(12.55%)	(35.17%)

Second, while non-action movies generally benefit from less globalization, the benefits are heterogeneous between low-budget and high-budget non-action movies. For instance, the percentage increase in production budgets the high-budget non-action movie *Hidden Figures* (released in 2016 with a production budget of $25 million) is approximately twice as high as that of the low-budget counterpart *Blair Witch* (also released in 2016 with a production budget of $10 million) in all counterfactual scenarios. On average, columns (1) and (2) of Table 9 show a similar pattern.

Columns (3) and (4) of Table 9 suggest that action movies, in particular the high-budget ones', production budget would decrease when there is less globalization. For instance, *Captain America: Civil War*, which was released in 2016 and had a production budget of $250 million, would have seen its production budget cut by 16.35%, 26.85%, and 33.54% if a 20% tariff is imposed on China, all Asian countries, and all non-OECD countries, respectively. In the scenario in which the Chinese market is completely shut off, the movie's production budget would even decrease by 51.76%. Column (4) show that, on average, these high-budget action movies' production budgets would decrease by $12.64 million, $25.06 million, $44.17 million, and $64.42 million in these four scenarios, representing 7.21%, 13.47%, 24.1%, and 35.17% decreases.

The impact of less globalization on low-budget action movies is less significant. For instance, *The Angry Birds Movie*, which was released in 2016 and had a production budget of $73 million, would have seen its production budget remained approximately the same in the "China Tariff" and "Asia Tariff" scenarios. Its production budget would decrease approximately 8% in the "Non-OECD" scenario, and 17.12% if the Chinese market is completely shut off. On average, column (3) show that a low-budget action movie's production budget would decrease $1.18 million, $2.38 million, $9.13 million, and $12.36 million in these four scenarios, which translate into decreases of production budget by 0.64%, 1.42%, 24.10%, and 35.17%.

6.2 Entry Probabilities and Market Shares

Movies with different global exposures would be affected by de-globalization differently. For movies that had more global exposures (mostly action movies, especially the high-budget ones), the imposition of a tariff or the complete shutdown of a market has two direct impacts on these movies' marginal return to production budget: first, the net box office revenue in the countries hit by the tariffs would decrease; and second, the movie might not even be exported to these countries anymore.

For movies with less global exposures (mostly non-action movies), there would be no direct effect on their marginal returns to production budget. However, the lesser competition from movies directly hit by de-globalization would translate into positive strategic effects on their marginal returns to production budget. This in turns would increase the global exposures, both in terms of entry probabilities to and market shares in the international markets, of these lesser

known movies .

We break down the changes in entry probabilities and market shares of different types of movies in Tables 10 and 11, respectively. Table 10 reports the percentage changes in entry probabilities of different types of movies across regions.

TABLE 10: Entry Probability Changes

		Non-action		action	
		Low-Budget	High-Budget	Low-Budget	High-Budget
China Tariff	Asia	+ 1.70%	+ 1.92%	− 0.31%	− 1.10%
	C. Europe	+ 4.09%	+ 3.22%	+ 0.68%	− 0.45%
	E. Europe	+ 5.33%	+ 4.03%	+ 0.85%	− 0.49%
	N. Europe	+ 4.58%	+ 2.71%	+ 0.86%	− 0.66%
	S. America	+ 2.56%	+ 2.31%	+ 0.78%	− 0.35%
	W. Europe	+ 1.49%	+ 1.17%	+ 0.43%	− 0.27%
Asia Tariff	Asia	− 5.67%	+ 0.08%	− 2.31%	− 2.72%
	C. Europe	+ 4.79%	+ 6.03%	+ 1.37%	− 0.71%
	E. Europe	+ 6.51%	+ 7.45%	+ 1.61%	− 0.78%
	N. Europe	+ 7.37%	+ 5.14%	+ 1.63%	− 1.24%
	S. America	+ 3.93%	+ 4.44%	+ 1.60%	− 0.55%
	W. Europe	+ 1.22%	+ 2.19%	− 0.81%	− 0.45%
Non-OECD Tariff	Asia	+ 6.04%	+ 5.64%	− 2.10%	− 2.77%
	C. Europe	+ 13.60%	+ 7.25%	− 2.25%	− 2.32%
	E. Europe	+ 20.83%	+ 9.84%	− 1.94%	− 2.24%
	N. Europe	+ 39.52%	+ 8.15%	− 0.83%	− 2.55%
	S. America	+ 3.23%	+ 3.40%	− 2.32%	− 2.25%
	W. Europe	+ 6.75%	+ 3.25%	− 0.50%	− 0.97%
No China	Asia (w/o China)	− 32.53%	+ 11.11%	+ 1.80%	− 1.65%
	C. Europe	− 2.71%	+ 13.34%	+ 1.10%	− 2.75%
	E. Europe	− 15.87%	+ 13.33%	+ 1.03%	− 3.15%
	N. Europe	− 32.42%	+ 8.19%	+ 1.95%	− 3.91%
	S. America	− 28.98%	+ 8.64%	+ 2.88%	− 1.75%
	W. Europe	− 39.72%	+ 0.87%	+ 0.10%	− 1.93%

As expected, high-budget action movies' entry probabilities would decrease when there is de-globalization, even though the magnitude of the changes is small. Column (4) of the table shows that high-budget action movies' entry probabilities into all regions would decrease in all of the scenarios. The magnitude of the decreases is small, which ranges from 0.27% to less than 4%. In most cases, these movies' entry probabilites decrease the most in Asian countries, where they are, relative to other types of movies, more popular. Their entry probabilities reamin almost the same in Western Europe in most of the scenarios, mostly because the entry costs are small in this region, especially compared to their huge box office revenues.

Non-action movies (columns (1) and (2) in the table) mostly would experience an increase

in the probabilities in exporting to the international market. Interestingly, these movies' entry probabilities would increase more in European countries than in Asian countries in most of the scenarios. The magnitude of the increases in entry probabilities would also be higher than the decrease in high-budget action movies' entry probabilities. The strategic effects on the low-budget non-action movies are strong in some cases. For instance, low-budget non-action movies entry probabilities would increase, on average, significantly in Europe, ranging from 6.75% in Western Europe to almost 40% in Northern Europe when there is a 20% tariff imposed on all non-OECD countries. Note that in the case when the Chinese market is completely shutdown, only high-budget non-action movies would experience an increase in entry probabilities.

Table 11 report the changes in market shares of different types of movies across regions. The

TABLE 11: Market Shares Changes

		Non-action		action	
		Low-Budget	High-Budget	Low-Budget	High-Budget
China Tariff	Asia	+ 5.39%	+ 8.87%	+ 2.72%	− 3.10%
	C. Europe	+ 6.40%	+ 14.48%	+ 1.09%	− 6.17%
	E. Europe	+ 6.70%	+ 15.61%	+ 1.30%	− 6.29%
	N. Europe	+ 3.69%	+ 8.54%	+ 0.60%	− 5.46%
	S. America	+ 4.35%	+ 7.39%	+ 2.06%	− 4.85%
	W. Europe	+ 7.10%	+ 14.10%	+ 0.77%	− 7.27%
Asia Tariff	Asia	− 16.92%	+ 22.24%	+ 7.28%	− 5.05%
	C. Europe	+ 9.74%	+ 28.33%	+ 2.43%	− 11.11%
	E. Europe	+ 10.91%	+ 31.79%	+ 2.53%	− 11.64%
	N. Europe	+ 5.97%	+ 16.95%	+ 1.36%	− 9.92%
	S. America	+ 7.39%	+ 14.40%	+ 4.39%	− 8.64%
	W. Europe	+ 11.30%	+ 28.78%	− 1.50%	− 14.16%
Non-OECD Tariff	Asia	+ 30.05%	+ 35.78%	+ 2.55%	− 11.22%
	C. Europe	+ 38.58%	+ 54.48%	− 1.86%	− 18.27%
	E. Europe	+ 43.32%	+ 62.22%	− 3.12%	− 20.06%
	N. Europe	+ 18.89%	+ 30.33%	− 4.32%	− 17.46%
	S. America	+ 27.71%	+ 31.82%	+ 2.77%	− 14.07%
	W. Europe	+ 40.18%	+ 52.54%	− 8.67%	− 25.16%
No China	Asia (w/o China)	− 10.41%	+ 55.25%	+ 6.84%	− 18.37%
	C. Europe	+ 46.23%	+ 100.75%	− 3.52%	− 30.54%
	E. Europe	+ 49.42%	+ 113.77%	− 4.91%	− 32.85%
	N. Europe	− 9.31%	+ 55.39%	− 1.80%	− 25.33%
	S. America	− 10.56%	+ 46.70%	+ 6.88%	− 21.56%
	W. Europe	+ 5.22%	+ 91.74%	− 8.31%	− 37.81%

results follow a similar pattern as the changes in entry probabilities reported in Table 10, though the magnitude of the changes of market shares are higher. Column (4) suggests that high-budget action movies' market shares would decrease significantly in all scenarios. For instance, when the

Chinese is completely shutdown, the decrease in market shares of the high-budget action movies would range from 18.14% in Asia to 37.81% in Western Europe, while the biggest beneficiary are the high-budget non-action movies, whose market shares would increase 46.7% in South America to more than 100% in Eastern Europe.

How many non-action movies would become one of the top-grossing movies in the international markets in the counterfactuals? Table 12 reports the ratio of action movie in the top 30 movies across regions. The results are largely consistent with the results in Table 11. In Asia and South America where the decrease in action movies' market shares and increase in non-action movies' market shares are relatively small, the action movie's ratio in top 30 would remain high (above 90%) in the counterfactuals. On the other hand, in Europe (in particular Western Europe) where the changes of market shares are more drastic for both action and non-action movies, the action movie's ratio in 30 would drop significantly. For instance, almost 80% of top 30 movies in Western Europe are action movies in the benchmark, the proportion would drop to less than 60% in the "No China" scenario.

TABLE 12: action Movies Shares in Top 30 Movies Lists

Region	Benchmark	China Tariff	Asia Tariff	Non-OECD Tariff	No China
Asia	95.95%	95.83%	95.95%	95.95%	95.97%
C. Europe	87.78%	87.22%	85.93%	82.96%	76.11%
E. Europe	87.22%	85.46%	84.35%	80.19%	72.22%
N. Europe	90.67%	90%	89.67%	87.5%	84.17%
S. America	94.38%	94.38%	94.27%	93.75%	93.33%
W. Europe	79.72%	77.41%	74.72%	67.78%	59.44%

6.3 Consumer Welfare

The structural estimation allows us to evaluate consumer welfare in the counterfactual. Table 13 reports the change in consumer welfare from the benchmark to different scenarios in the counterfactuals. There are several things to note. First, while we would see an increase in the production budget, and hence quality, of some (mainly non-action) movies, the overall production budget by Hollywood movies would decrease. All regions would therefore experience a decrease in consumer welfare when Hollywood movies have less global exposures. In the extreme case when the Chi-

nese market is completely shutdown, consumer welfare would decrease $1.13 per person in Asia (equivalent to almost 20% of the average ticket price in the region).

Second, because the relative quality of action movies would decrease compared to non-action movies in the counterfactuals, the decreases in consumer welfare would be more significant in regions where action movies are more popular. In Asia and South America, where action movies' budget elasticities are significantly higher than that of non-action movies' (Table 7), consumer welfare would decrease more significantly (both in terms of absolute dollars and percentage of the region's ticket price) than other regions. On the other hand, in the US where the relative popularity of action movies is the lowest (Table 7), the decrease of the consumer welfare would also be the least significant. In the case when Chinese market is completely shutdown, consumer welfare would decrease $0.49 per person (equivalent to almost 5.88% of the average ticket price).

TABLE 13: Consumer Welfare Changes from Benchmark (per consumer)

Region	China Tariff	Asia Tariff	Non-OECD Tariff	No China
Asia	-$0.18	-$0.35	-$0.75	-$1.13
	(3.07%)	(6.17%)	(13.11%)	(19.81%)
C. Europe	-$0.16	-$0.32	-$0.58	-$0.46
	(2.91%)	(5.67%)	(10.14%)	(8.38%)
E. Europe	-$0.18	-$0.38	-$0.70	-$0.62
	(4.89%)	(9.91%)	(17.64%)	(17.73%)
N. Europe	-$0.13	-$0.26	-$0.50	-$0.64
	(1.12%)	(2.21%)	(4.20%)	(5.29%)
S. America	-$0.20	-$0.41	-$0.80	-$1.22
	(5.45%)	(10.81%)	(19.76%)	(31.87%)
W. Europe	-$0.15	-$0.31	-$0.54	-$0.44
	(1.63%)	(3.34%)	(5.88%)	(4.86%)
U.S.	-$0.06	-$0.13	-$0.26	-$0.49
	(0.73%)	(1.61%)	(3.14%)	(5.88%)

Changes in terms of percentage of ticket prices are reported in parenthesis.

7 Conclusion

As globalization widens the world movie market, international consumers' tastes and choices have correspondingly molded the movie producers' incentives of production and export. This paper

investigates the relationship between the rise of action movies and globalization of the movie industry. We develop a structural model of movie industry demand and supply, particularly taking into account the difference in return-to-investment by genres. The model allows different demand responsiveness, by genres, to production investment in different countries. Taking into account of these differences, movie producers make both production investment and export decisions. We estimate the model using box-office revenue data of all movies of U.S. origin released between 2007 and 2016 in 44 countries. Based on our model estimates, consumers demands of the action/adventure movies are much more responsive to production investment than movies in any other genre. Our counterfactual experiments have indicated that globalization and lowering trade barriers are a determining factor in the industry decisively shifting to invest heavily in blockbuster action movies. Finally, when disparity in firms' investments and export decisions are demand driven, determined by consumer tastes and cultural barriers, as in the movie industry, we show that globalization has disparate welfare effects on different countries.

Appendix

Market share of a movie in country c is defined as

$$s_{jct} = \frac{\exp\left(\frac{\delta'_{cjt}+\alpha p_{ct}}{1-\sigma}\right)}{D^{\sigma}_{Jct} + D_{Jct}}$$

where $D_{J_{ct}} = \sum_{k\in J_{ct}} \exp\left(\frac{\delta'_{jct}+\alpha p_{ct}}{1-\sigma}\right)$. The within industry market share is

$$z_{jct} = \frac{\exp\left(\frac{\delta'_{cjt}+\alpha p_{ct}}{1-\sigma}\right)}{D_{Jct}}.$$

Therefore, the demand elasticity w.r.t. budget is

$$\begin{aligned}
\eta_{cjt} &= \frac{ds_{cjt}}{dB_j}\frac{B_j}{s_{cjt}} = \frac{\partial s_{cjt}}{\partial \delta'_{jc}}\frac{\partial \delta'_{jc}}{\partial B_j}\frac{B_j}{s_{cjt}} \\
&= \left(\frac{\frac{1}{1-\sigma}\exp\left(\frac{\delta'_{cjt}+\alpha p_{ct}}{1-\sigma}\right)}{D^{\sigma}_{Jct}+D_{Jct}} - \frac{\frac{1}{1-\sigma}(\sigma D^{\sigma-1}_{Jct}+1)\exp\left(\frac{\delta'_{cjt}+\alpha p_{ct}}{1-\sigma}\right)^2}{(D^{\sigma}_{Jct}+D_{Jct})^2} \right) \cdot \frac{\partial \delta'_{jc}}{\partial B_j}\frac{B_j}{s_{cjt}} \\
&= \frac{1}{1-\sigma} s_{cjt}(1-(\sigma D^{\sigma-1}_{Jct}+1)s_{cjt}) \cdot (\gamma_{2c}+\gamma_{3c}Sequel_j)/B_j \cdot \frac{B_j}{s_{cjt}} \\
&= \frac{1}{1-\sigma}(1-(\sigma D^{\sigma-1}_{Jct}+1)s_{cjt}) \cdot (\gamma_{2c}+\gamma_{3c}Sequel_j) \\
&= \frac{1}{1-\sigma}(1-(\sigma D^{\sigma}_{Jct}+\sigma D_{Jct})s_{cjt}/D_{Jct}-(1-\sigma)s_{cjt}) \cdot (\gamma_{2c}+\gamma_{3c}Sequel_j) \\
&= \frac{1-\sigma z_{cjt}-(1-\sigma)s_{cjt}}{1-\sigma} \cdot (\gamma_{2c}+\gamma_{3c}Sequel_j)
\end{aligned}$$

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