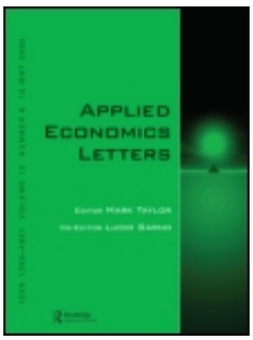

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Increasing returns to information: evidence from the Hong Kong movie market

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We examine a sample of 300 movies that appeared on the top-10 charts in Hong Kong. We apply an empirical test proposed by Ijiri and Simon (1974) and find that movie revenues in the territory of Hong Kong are consistent with the hypothesis of increasing returns to information. This empirical result confirms the results of De Vany and Walls (1996) who found evidence of increasing returns to information in their analysis of movie data from the US Top-50 charts.

I. INTRODUCTION

The motion picture industry is a source of interesting economic problems. For example, elements of ticket pricing (Cheung, 1977), multi-level principal agent problems (De Vany and McMillan, 1993), complex auction institutions (Kenney and Klein, 1983; Blumenthal, 1988) antitrust analysis (De Vany and Eckert, 1991), transactions cost economics (Chisholm, 1993; Acheson and Maule, 1995), and optimal product durability (Srivastava and Mittal, 1987) are all found in the context of the motion picture industry. Smith and Smith (1986), who examine the empirical determinants of successful movies. have argued that the motion picture industry is an especially attractive area for applied microeconomic research due to the interesting characteristics of movies as heterogeneous products and the unique features of production and distribution.

Perhaps the most interesting issue involved in the motion picture industry is the extent to which the transmission of information affects demand (Burzynski and Bayer, 1977; Mizerski, 1982; Mahajan *et al.*, 1984). In a recent paper, De Vany and Walls (1996) examined the dynamics of motion picture demand using data on box office revenues in the United States. This paper extends their work by examining data on motion picture box office revenues in Hong Kong. The empirical results of this paper confirm tire results of De Vany and Walls that motion picture revenues show strong evidence of increasing returns to information that lead to phenomena Such as information cascades (Bikhchandani *et al.*, 1992) and superstars (Rosen, 1981).

In the following section we describe a method developed by Ijiri and Simon (1974) that will be used to quantify and to test the returns to information in the motion picture exhibition market. The data are described and the empirical results are discussed in Section III. Conclusions are made in Section IV.

II. INCREASING RETURNS TO INFORMATION

Steindl (1965) discovered the empirical regularity that the size of a firm S is systematically related to its rank R in an industry according to the Pareto law $SR^{\beta} = A$, where β and A are constants. In the context of the motion picture industry, movies are naturally ranked by their box office revenues so the Pareto law implies the following relationship between revenue and rank:

$$\log Revenue = \log A - \beta \log Rank \qquad (1)$$

Simon (1955) has shown that this Pareto law can be derived given two assumptions: l) Gibrat's law, which states that the growth rate of revenues is size independent, and 2) a constant rate of entry for new films. Thus. the Pareto law has a natural interpretation for motion pictures: an increase in revenues affects future growth through the information sharing between those individuals who have seen the film and potential viewers, but the effect of the increase will diminish as time goes on due to saturation of the potential audience and the entry of new competitors.

Table 1. Summary statistics of Hong Kong movie data

Variable	Obs	Min	Max	Median	Mean	Std dev.
Rank at birth	300	1	10	5	5.57	2.98
Rank at weeks = 2	176	1	10	5	5.18	2.71
Rank at weeks =3	95	1	10	5	5.20	2.77
Rank at weeks = 4	50	1	10	6	5.82	2.58
Rank at weeks = 5	30	1	10	7	6.27	2.53
Rank at death	290	1	10	7	7.04	2.36
Weeks at rank = 1	49	1	5	1	1.45	0.87
Weeks at rank = 2	59	1	3	1	1.20	0.49
Weeks at rank = 3	58	1	4	1	1.22	0.56
Weeks at rank = 4	58	1	3	1	1.22	0.53
Weeks at rank = 5	69	1	2	1	1.03	0.17
Weeks in Top-10	290	1	13	2	2.40	1.94
Weekly revenue (US$ 1000s)	710	23.93	2624.24	203.88	311.09	325.64

Ijiri and Simon (1974) have noted that empirical size distributions frequently deviate from the Pareto law of Equation 1 by exhibiting strong concavity. Ijiri and Simon derive analytically the size distribution when growth rates can be autocorrelated, and they find that positively correlated growth rates lead to a downward concave relationship. They suggest that the curvature of the distribution may be quantified by using the following equation:

$$\log Revenue = \log A - \beta \log Rank + \gamma(\log Rank)^2 \qquad (2)$$

The curvature of the distribution is concave downward if the coefficient fly is negative and convex downward if γ is positive.

Strong downward concavity of the Revenue-Rank distribution would indicate autocorrelated growth in revenues and this is the predicted effect of increasing returns to information. De Vany and Walls (1996) show that the increasing returns to information causes some movies to become 'hits' and others to become 'bombs' through the feedback of the information dynamic. The hypothesis of increasing returns to information is consistent with Rosen's (1981) superstar phenomenon, where small differences in products can become magnified into enormous differences in final outcomes, and it is also consistent with Bikhchandani *et al.*'s (1992) informational cascades in which individuals place relatively greater weight on the information provided by a film's previous viewers.

In the following section we apply the test for autocorrelated growth in film revenues to data generated at movie theatres in Hong Kong.

III. DATA DESCRIPTION AND EMPIRICAL RESULTS

The data set contains the name, rank, and box office revenue of the top ten movies in the territory of Hong Kong on a weekly basis.[1] The data span the period from: 13 July 1994 to 27 December 1995, inclusive, for a total 710 unique observations. Over the span of 71 weeks, 300 unique movies appeared on Hong Kong's top-10 charts. Table 1 contains summary statistics on the rank of movies at various stages of their runs, the duration of movies at various ranks, and weekly box office revenues.

The transmission of information affects movie revenues through the length of their theatrical runs and the size of the audience during the course of the runs. We will briefly describe the 'lifetimes' of the sample of movies before proceeding to test the hypothesis of increasing returns to information. The 300 movies that entered the top-10 charts ranged from rank 1 to rank 10 and the average rank at 'birth' was five. The range of ranks and average ranks for the second and third weeks that a movie remained on the top-10 charts are similar to the same quantities at birth. For the movies that remained on the charts for four weeks and five weeks the median ranks fell to rank six and rank seven, respectively. Of the 300 movies contained in the sample, 290 were observed to fall from the charts. The average rank at 'death,' when a film fell out of the top-10 charts, was rank seven. On average a film's rank and revenues fell until the film was replaced on the top-10 chart by a competing film. However, some individual films did show noticeable growth in rank and revenue early in their lifetimes on the top-10 chart before eventually losing revenue and rank and falling from the charts.

During the 71 weeks of the sample a total of 49 movies attained the top ranking, and of these observations the median movie remained at the top ranking for a single one week. Ranks 2, 3, and 4 were achieved by 59, 58, and 58 movies, respectively, and these movies remained at these ranks for an average of one week. Of the 290 movies observed to fall from the top-10 charts, the completed lifetimes ranged from one week to 13 weeks with a median lifetime of two weeks.

The weekly revenue for each movie ranged from about 24 000 (*Casper*) to 2.6 million (*From Beijing with Love*) US$. with a median of about 204 000 and a mean of about 311 000. It is clear that the revenue distribution is skewed to the right, reflecting the strong influence of the few movies that became superstars.[2] It is interesting to note that the sample of movies consists primarily of Chinese language movies produced in Hong Kong and English language movies produced in Hollywood. The Chinese movies accounted for much of the mass in the tails of the revenue distribution. producing both

[1] The data are available from the author as an ascii file at the following URL: ftp://ftp.econ.hku.hk/pub/staff/wdwalls/HK-Movie-Top-10.dct.gz.
[2] De Vany and Walls (1996) found a similarly skewed distribution of revenues using weekly data from *Variety's* Top-50 charts.

Table 2. *Estimates of the revenue-rank relationships. Dependent variable is log revenue*

	(1)	(2)	(3)	(4)
Constant	13.9014	13.5160	13.9469	13.5601
	(0.0448)	(0.0510)	(0.1298)	(0.1096)
Log Rank	−1.1061	−0.0443	−1.1073	−0.0402
	(0.0270)	(0.0887)	(0.0215)	(0.0644)
(Log Rank)	–	−0.4408	–	−0.4430
	–	(0.0354)	–	(0.0257)
Weekly dummy	No	No	Yes	Yes
Adjusted R^2	0.7039	0.7569	0.8122	0.8717

Note: Estimated standard errors are in parentheses.

superstars and bombs. This reflects the relative uncertainty of locally produced movies and the fact that some 98% of Hong Kong's population are ethnic Chinese. The Hollywood movies consistently earned above-average revenues in Hong Kong, but they were not always superstars. This would appear to reflect the relative certainty of Hollywood movies: nearly all of these movies were previously box office hits in the US. Furthermore, many of the English language movies appeal to ethnic Chinese while few expatriates are Chinese film buffs.

Equation 2 was estimated by least-squares regression and the results are reported in Table 2. Column 1 of the table reports the estimates of the Pareto relationship under the assumption of Gibrat's law (equation 1) and column 2 reports the estimates of the Pareto relationship where autocorrelated growth, the parameter on $(\log Rank)^2$ to be estimated from the, data (Equation 2). It is clear from the table that the parameter on $(\log Rank)^2$ differs from zero at the 1% marginal significance level; we can reject the null hypothesis of size-independent growth in favour of the alternative of autocorrelated growth.

Columns 3 and 4 of Table 2 report the estimates when dummy variables are included in the regression equations to control for week-specific shifts in the Revenue-Rank relationship.[3] The set of weekly dummy variables improved the fit of the regression equation considerably, and the set of variables was significant at the 1% level. The substantive results remained unchanged; moreover, the estimated standard errors fell on the parameters of interest. The positively autocorrelated growth in movie revenues is evidence of the increasing returns to information; the increasing returns are caused by the information dynamic that leverages the audiences' reaction to films causing some to become bombs while others grow to become superstars.

Another interpretation of the regression model is the nonlinear effect of a change in rank on a film's box office revenues. Movies that can move up the charts are rewarded more than proportionately by the revenues they generate. However, once a movie begins to decline in rank its revenues fall precipitously in a swift death.

IV. CONCLUSION

This research has analysed a large sample of motion pictures exhibited in the territory of Hong Kong. The substantive conclusion of the research is that motion picture revenues in Hong Kong are consistent with the hypothesis of increasing returns to information. This evidence could be interpreted as support for the superstar and information cascade theories. However, further research will be necessary in order to test these theories against one another to determine the source of the increasing returns to information.

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[3] The estimates in column 4 of Table 2 are very similar to the estimates reported in De Vany and Walls (1996) that are based on US data. This would seem to indicate that the demand dynamic generating motion picture revenues is more general than one might otherwise expect.

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