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Author:

e-mail:

MktgSci@notes.cba.ufl.edu

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A Bayesian Model to Forecast New Product Performance in Domestic and International Markets

Ramya Neelamegham • Pradeep Chintagunta

INSEAD, Boulevard de Constance, 77305 Fontainebleau, Cedex, France, rneelamegham@hotmail.com

Graduate School of Business, University of Chicago, 1101 E. 58th Street, Chicago, Illinois 60637,

fpchinta@gsbfac.uchicago.edu

Abstract

This paper attempts to shed light on the following research questions: When a firm introduces a new product (or service) how can it effectively use the different information sources available to generate reliable new product performance forecasts? How can the firm account for varying information availability at different stages of the new product launch and generate forecasts at each stage? We address these questions in the context of the sequential launches of motion pictures in international markets.

Players in the motion picture industry require forecasts at different stages of the movie launch process to aid decision-making, and the information sets available to generate such forecasts vary at different stages. Despite the importance of such forecasts, the industry struggles to understand and predict sales of new movies in domestic and overseas markets.

We develop a Bayesian modeling framework that predicts first-week viewership for new movies in both domestic and several international markets. We focus on the first week because industry players involved in international markets (studios, distributors, and exhibitors) are most interested in these predictions. We draw on existing literature on forecasting performance of new movies to formulate our model. Specifically, we model the number of viewers of a movie in a given week using a Poisson count data model. The number of screens, distribution strategy, movie attributes such as genre, and presence/absence of stars are among the factors modeled to influence viewership. We employ a hierarchical Bayes formulation of the Poisson model that allows the determinants of viewership to vary across countries. We adopt the Bayesian approach for two reasons: First, it provides a convenient framework to model varying assumptions of information availability; specifically, it allows us to make forecasts by combining different sources of information such as domestic and international market-specific data. Second, this methodology provides us with the entire distribution of the new movie's performance forecast. Such a predictive distribution is more informative than a point estimate and provides a measure of the uncertainty in the forecasts.

We propose a Bayesian prediction procedure that provides viewership forecasts at different stages of the new movie release process. The methodology provides forecasts under a number of information availability scenarios. Thus, forecasts can be obtained with just information from a historical database containing data on previous new product launches in several international markets. As more information becomes available, the forecasting methodology allows us to combine historical information with data on the performance of the new product in the domestic market and thereby to make forecasts with less uncertainty and greater accuracy.

Our results indicate that for all the countries in the data set the number of screens on which a movie is released is the most important influence on viewership. Furthermore, we find that local distribution improves movie sales internationally in contrast to the domestic market. We also find evidence of similar genre preferences in geographically disparate countries. We find that the proposed model provides accurate forecasts at the movie-country level. Further, the model outperforms all the extant models in the marketing literature that could potentially be used for making these forecasts. A comparison of root mean square and mean absolute errors for movies in a hold out sample shows that the model that combines information available from the different sources generates the lowest errors. A Bayesian predictive model selection criterion corroborates the superior performance of this model. We demonstrate that the Bayesian model can be combined with industry rules of thumb to generate cumulative box office forecasts.

In summary, this research demonstrates a Bayesian modeling framework that allows the use of different information sources to make new product forecasts in domestic and international markets. Our results underscore the theme that each movie is unique as is each country—and viewership results from an interaction of the product and the market. Hence, the motion picture industry should use both product-specific and market-specific information to make new movie performance forecasts.

(Hierarchical Bayes; New Products; Motion Pictures; International Markets; Forecasting)