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INCENTIVE AND ACCURACY ISSUES IN MOVIE PREDICTION MARKETS

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We compare the forecasts of nineteen movie box office results from real money (Iowa Electronic Market) and play money (Hollywood Stock Exchange) prediction markets. The forecasts were not significantly different, contrary to recent research on incentives and prediction market accuracy. Proponents of play money incentives suggest that (play) wealth concentrates in the hands of knowledgeable traders over time. This should lead to improved accuracy over time. A longitudinal analysis of results (1999–2002) from the play money Hollywood Stock Exchange fails to find significant improvement over time. This may be due to an increased number of less knowledgeable traders who, nevertheless, provide liquidity in the market.

1. INTRODUCTION

Prediction markets are exchanges in which traders buy and sell securities whose value will be determined by an uncertain future event. Organizers of prediction markets use a market mechanism to aggregate the information available to individual traders. Individuals with superior information about the likelihood of future events benefit from trading with others who have less accurate information (Plott and Sunder 1982). Through these interactions and the resulting prices in the market, participants and observers gain access to a distillation of a wide variety of public and private sources of information (Plott 2000). The resulting market prices have provided accurate forecasts of future events in a number of applications including political elections (Forsythe, et al. 1992), sporting events (Servan-Schreiber, et al. 2004) and movie awards (Pennock, et al. 2000). The ability of prediction markets to provide accurate forecasts of future events has sparked a great deal of interest from organizations hoping to harness the "wisdom of the crowd" (Surowiecki, 2004).

In their review of election prediction markets, Forsythe, et al. (1999) conclude that accurate forecasts would come from markets comprised of

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"a large panel of motivated, interested experts," rather than a representative sample of voters. The interactive technology of the Internet allows one to convene such panels of interested experts anytime and anywhere. The key question is: How do we motivate traders to share potentially valuable information? It would seem straightforward that monetary incentives would be necessary to motivate the participation of traders with valuable information. This assertion is supported by a stream of experimental studies beginning with Siegel (1961). This laboratory-based research shows the benefits of providing monetary incentives in experiments where participants are expected to maximize utility. In prediction markets, tying a trader's financial outcome to his or her accuracy should provide an incentive to truthfully reveal one's valuable information.

However, organizing prediction markets using real money payoffs raises a number of regulatory and organizational challenges. Depending on the subject of the prediction market, a prediction market may run afoul of laws governing gambling, securities trading, or futures contracts. Furthermore, while Internet technology allows a prediction market organizer to recruit participants globally, the laws and regulations pertaining to gambling and/or financial markets often conflict across jurisdictions. A clear illustration may be found in the prosecution of BETonSports.com, a UK-based betting business which has pleaded guilty to violating U.S. anti-gambling laws (Wall Street Journal, 2007).

The alternative of using play money avoids many of these complications. Furthermore, research on prediction markets to forecast movie box office results suggests that play money markets can provide more accurate results than individual forecasters (Pennock, et al. 2000; 2001; Spann and Skiera 2003). A study by Servan-Schreiber, et al. (2004) compared the ability of a real money prediction market (Tradesports) with a play money prediction market (Newsfutures) to predict the outcome of NFL games in 2003. Using various measures of forecasting accuracy (e.g. mean absolute error), the authors found no statistical differences between the results for the real money and play money prediction markets. A subsequent study by Rosenbloom and Notz (2005) found that real money markets were significantly more accurate than play money markets in predicting the daily direction (up or down) of the Dow Jones Industrial Average (DJIA). They found no statistically significant differences in accuracy when the subject was team sports in North America (baseball, basketball and hockey). However, for a small set of other events (tennis matches, golf, political events, etc.), the forecasts of the real money markets were significantly more accurate than those of the play money counterpart.

To explain these results, Rosenbloom and Notz (2005) offer two interesting explanations. The first is that traders in both real and play money markets have ready access to betting odds for sporting events from sports book makers and Las Vegas casinos. This publicly available information can help traders in both types of prediction markets make accurate forecasts of the outcome of a sports contest. This leads to there being no difference in accuracy between the real and play money markets. In contrast, this type of public information is less likely to be available for non-sports events. Consequently, better informed traders seek out real money prediction markets for non-sports events in order to profit from their superior knowledge. This results in real money markets providing better forecasts for non-sports events. Given the barriers to organizing real money markets, it is important to determine whether the results obtained by Rosenbloom and Notz (2005) generalize to other, non-sports events.

Their second explanation suggests the accuracy of a play money market suffers due to the retention of losers in the trading population. In real money markets, they argue, losing traders eventually run out of money and cease to participate. The resulting trading is a contest between the best informed traders. This is an interesting conjecture since Servan-Schreiber, et al. (2004) advance essentially the same line of reasoning in arguing for the potential superiority of play money prediction markets. In real money markets, the influence of a given trader's opinion on market prices is based, in part, by the amount of money the trader is willing to risk. This is one reason that the real money Iowa Electronic Market limits trader accounts to $500. In play money markets, in contrast, the only way to increase one's (play) wealth is to have a history of successful trades, presumably the result of having accurate information about the subject of the prediction market. If this latter view of play money prediction markets were true, we would expect that the accuracy of its forecasts would improve over time as the (play) wealth of the market becomes concentrated in the hands of the better informed traders.

In this study, we consider these two issues by examining the forecasting abilities of both real money and play money prediction markets for movie box office revenues. The play money market is the Hollywood Stock Exchange (HSX), which has been the subject of prior research on forecasting accuracy (Pennock, et al. 2000; 2001; Spann and Skiera 2003). The real money market is the Iowa Electronic Market (IEM), which is best known for its election prediction markets (Berg, et al. 2007). The IEM has been organizing prediction markets to forecast movie box office results since the fall of 1995 (Gruca 2000).

To determine whether monetary incentives improve the accuracy of forecasts of movie box office revenues, we compared the outcomes from 19 matched prediction markets associated with movies released between 1998 and 2007. We find that the point estimates provided by the two markets have comparable levels of accuracy. Contrary to prior research, we found no statistically significant difference between the accuracies of the real and play money markets for these non-sports events.

To determine whether play money markets retain losers which would reduce forecasting accuracy over time (Rosenbloom and Notz 2005) or play money markets concentrate wealth in the hands of highly informed traders (Servan-Schreiber, et al. 2004), we analyzed the forecasting performance of the Hollywood Stock Exchange over a 4 year period (1999–2002). This sample of 500+ movies incorporates all of the observations in the prior research by Pennock, et al. (2000; 2001) and Spann and Skiera (2003). We find no significant improvement in the average predictive accuracy over time. We offer an explanation for these findings that has potentially important implications for play money market operators.

In the next section, we briefly describe the Hollywood Stock Exchange followed by a description of the IEM Movie Box Office Markets. We follow by presenting a comparison of the forecasts from these two prediction markets. We then report on our multi-year analysis of the forecasting accuracy of the play money Hollywood Stock Exchange. The paper closes with a discussion of our results and directions for future research.

2. PREDICTION MARKET DESCRIPTIONS

2.1 Hollywood stock exchange

Operating since April 1996, "The Hollywood Stock Exchange," or HSX.com is an Internet-based game. Every new player is provided a fund of $2 million fictitious HSX dollars (or H$). The goal of the game is to acquire more HSX dollars through the trading of entertainment related securities. The value of these securities is tied to entertainment events including movie box office performance, awards shows, etc. There are more than one and a half million registered participants in the HSX.com game. In March of 2001, a new venture called hsxresearch.com was launched to provide data from HSX.com to movie and other entertainment companies. Its predictions are discussed in major publications such as Advertising Age and syndicated to other entertainment-related outlets in traditional (off-line) media.

The focus of this study is the "Movie Stock" security whose value is based on a movie's total domestic U.S. box office after the first 4 weekends of wide release (650+ screens). For example, if traders (as a group) expect a movie to take in $75 million during that time period, the price for the Movie Stock will be H$75 (Pennock, et al., 2000, 6). A Movie Stock is first offered for sale when a movie may be nothing more than a concept, e.g. Spiderman IV. Over time, the value of the Movie Stock fluctuates depending on many factors including the signing of a well-known star to the project, the successful completion of filming and the scheduling of the movie's release in theaters. (see, e.g. Elberse 2007).

2.2 HSX market operations

Most movies open on Friday. At 10 am (Pacific time) on the first Friday after a movie opens in theaters, trading in a Movie Stock is halted to ensure that no traders are able to take advantage of early box office returns. The price at this time is known as the HALT price. This figure may be used to forecast the four weekend box office total. The HALT price can also forecast the opening weekend's box office total (Pennock, et al. 2000; Spann and Skiera

2003). [This is accomplished by dividing the HALT price by the appropriate multiplier which is discussed next.]

On the Monday following a movie's opening, trading is resumed (around 3 pm Pacific time). At that time, the price for a Movie Stock is adjusted using a standard formula. The new price for the Movie Stock is set at 2.9 times the opening weekend box office receipts. (Movies opening on days other than Friday have a different multiplier.) Trading resumes until the Monday after the 4^{th} weekend of release. At this point, trading ceases as the security is removed from the exchange. At a future date, traders receive the comparable number of H$ for the 4 weekend total box office divided by one million for each Movie Stock they hold in their portfolios. This price, which is equal to the actual box office outcome, is known as the DELIST price.

Next we discuss the real money IEM Movie Box Office Market.

2.3 IEM overview

Beginning in 1988 (as the Iowa Political Stock Market), the Iowa Electronic Market (or IEM) has been used to accurately predict a number of national, local and international elections (Forsythe, et al., 1992; Berg, et al., 2007). In many instances, the market's prediction of the popular vote was more accurate than that available from pre-election "trial heat" polls (Berg, Forsythe and Reitz, 1997). While the best-known markets focus on the outcomes of political elections, there are also markets to predict stock price levels, corporate earnings, stock returns and changes in Federal Reserve policy (see www.biz.uiowa.edu/iem for more details).

The IEM is a small-scale, real money prediction market. Traders buy and sell futures contracts whose value is tied to a future political, economic or business event. Trader investments in the IEM are limited to $500 and there is no short selling allowed. Since the IEM charges no transaction fees, this is a zero-sum market in which all investments by traders are returned to the traders collectively.

In the IEM, trading is accomplished through a computerized anonymous double auction mechanism. To buy a contract, a trader can execute a market order and buy at the current best price available (lowest ask from another trader) in the market. Alternatively, the trader can submit a limit order. This would include an offer to buy (bid) at a higher price and a time limit on the offer. [The analogous process can be followed to sell or offer to sell contracts.] The limit orders (bids/asks) are queued by price and submission times. The best prices in each queue are displayed to traders. All trading of individual contracts and the resulting prices in the market are determined by activity between individual traders who remain anonymous to each other.

Traders can also acquire contracts from the market in a bundle consisting of one of each of the contracts in the market. These can be purchased from or sold to the IEM exchange at any time for $1, the guaranteed liquidation value (payoff at the end of the market) of the bundle. This feature of the market allows contract supply to expand and shrink as traders desire without contaminating the individual contract prices as set by the traders.

2.4 IEM movie box office markets

The outcome predicted by these markets is the U.S. domestic box office performance of a particular movie over a four-week period. For each movie, four to six contracts were offered in the market. Each contract is associated with a mutually exclusive and collectively exhaustive range of box office receipts within the specified four-week period. At the end of the market, only one of the contracts pays off while the others expire worthless (i.e., a set of outcome-spanning Arrow-Debreu securities).

Since the contracts are designed to pay off $1, the corresponding market prices of the contracts can be interpreted as an estimate of the probability of the corresponding event occurring. If the box office receipts fall within a given contract's range, then the contract pays $1; all other contracts pay $0. Thus, our structure is a winner-take-all market.

For example, in the fall 2002 market, there were 5 contracts associated with the movie "Die Another Day." They were defined as follows:

DIE90L	$1.00 if Die Another Day's official box office receipts for the 11/22-12/19 period are lower than or equal to $90 million; zero otherwise.
DIE100L	$1.00 if Die Another Day's official box office receipts for the 11/22-12/19 period are greater than $90 million and lower than or equal to $100 million; zero otherwise.
DIE110L	$1.00 if Die Another Day's official box office receipts for the 11/22-12/19 period are greater than $100 million and lower than or equal to $110 million; zero otherwise.
DIE120L	$1.00 if Die Another Day's official box office receipts for the 11/22-12/19 period are greater than $110 million and lower than $120 million; zero otherwise.
DIE120H	$1.00 if Die Another Day's official box office receipts for the 11/22-12/19 periodare greater than $120 million; zero otherwise.

Trading in the IEM movie box office markets began from 4–19 days before the opening of the movie in theaters (all but three of the movies opened on a Friday). Traders could access the market 24-hours a day through the Internet. Trading continued for four weeks after the opening of the movie. The contracts were liquidated soon after when the official box office data became available.

There were a total of nineteen IEM Movie Box Office Markets organized between 1998 and 2007. The earliest markets, offered in December 1995 to January 1996 were omitted from this analysis due to there being no comparable forecast since these markers predated the debut of HSX.com. We provide an overview of these markets in Table 1.

TABLE 1
MOVIE BOX OFFICE MARKETS USED IN THIS STUDY

Movie	Market Opening Date	Date Movie Opened	Four Week Box Office (millions)	HSX UAPE	IEM UAPE
Lost in Space	27 March 1998	3 April 1998	$59.1	0.22	0.24
Mercury Rising	27 March 1998	3 April 1998	$28.5	0.15	0.12
Enemy of the State*	9 November 1998	20 November 1998	$74.3	0.18	0.28
I Still Know What You Did Last Summer*	9 November 1998	13 November 1998	$36.3	0.40	0.27
The Matrix	24 March 1999	31 March 1999	$117.1	0.84	0.84
Ten Things I Hate about You	24 March 1999	31 March 1999	$28.8	0.55	0.31
Sleepy Hollow	5 November 1999	19 November 1999	$82.9	0.46	0.69
The World is not Enough	5 November 1999	19 November 1999	$101.3	0.53	0.60
The 6th Day*	3 November 2000	17 November 2000	$33.4	0.17	0.10
How the Grinch Stole Christmas*	3 November 2000	17 November 2000	$199.8	0.25	0.40
Monsters, Inc.	19 October 2001	2 November 2001	$194.9	0.25	0.27
Harry Potter and the Sorcerer's Stone	2 November 2001	16 November 2001	$243.4	0.03	0.02
Die Another Day	8 November 2002	22 November 2002	$134.4	0.04	0.11
Tears of the Sun	20 February 2003	7 March 2003	$41.4	0.26	0.89
The Cat in the Hat*	7 November 2003	21 November 2003	$91.6	0.30	0.57
The Sponge Bob Square Pants Movie*	5 November 2004	19 November 2004	$74.3	0.07	0.07
The Fountain*	3 November 2006	22 November 2006	$9.8	0.58	1.18
Happy Feet*	3 November 2006	17 November 2006	$137.9	0.16	0.12
300	23 February 2007	9 March 2007	$179.9	0.41	0.62

*indicates markets in which all traders were supplied with funds.

2.5 Traders

The pool of traders for the IEM movie box office markets was limited to participants with an academic affiliation including students, staff and faculty. In nine of these markets, all traders were business students who were provided a $5 or $10 trading account that they could redeem for cash after the market liquidated (They could add more funds to the $500 market limit). In exchange, as part of a course assignment, the students were required to submit a forecast of the 4-week box office performance for the movie(s) that would be traded on the IEM during the semester. The students were also required to execute at least two trades while the market was open.

In the other markets, there was either a mix of student traders and self-selected traders who provided their own funds for trading or all traders were self-selected. In the markets indicated by *, all of the traders were students who were provided funded trading accounts.

3. RESULTS OF PREDICTION MARKET COMPARISONS

The HSX forecasts were determined using the Movie Stock prices on the night before the movies opened in theaters. These data were collected from the HSX.com site directly (http://movies.hsx.com/exchange/market/). We used this price rather than the HALT price since traders may have superior access to information about a movie once it is released in theaters, i.e. traders could actually see the movie and judge its appeal to others. For example, for three of the movies in this study - The Fountain (2006), The Matrix (1999) and Ten Things I Hate About You (1999) - the HALT price was determined 2 or 3 days after the movie's release in theaters.

3.1 Determining a point forecast from contract prices

In contrast to the single market prices of Movie Stocks at HSX.com, there is a different price for each IEM futures contract. The prices we use to estimate a point forecast are the normalized last transaction prices at Midnight on the night before the movie opened in theaters.

To convert these prices into a point estimate of box office performance, we assume that contract prices reflect a set of normally distributed point forecasts by individual traders. Under this assumption, the resulting price of a contract can be computed for any mean and standard deviation using the cumulative normal distribution function. Specifically, for a given mean and standard deviation, we can compute the Z-scores associated with the top and the bottom of the range for a given contract. Using this data, we can compute the difference of the cumulative normal distribution evaluated at these Z-scores. This difference is the expected price of the particular contract for a given mean and standard deviation.

To identify the best fitting mean and standard deviation based on observed contract prices, we reversed the above process. We employ an iterative search of a positive two-dimensional space in which the first dimension corresponds to the mean of the normal distribution while the second dimension is the standard deviation. For each candidate mean and standard deviation, we computed the root mean squared error (RMSE) between the observed contract prices (normalized to sum to one) and contract prices implied by a normal distribution with the candidate mean and standard deviation. Overall, the goal of the optimization was to minimize the RMSE measure. We used multiple starting points for each of the markets to reduce the chances of obtaining a local minimum solution.

We illustrate the outcome of this process in Table 2 using the contract prices for the fall 2002 IEM box office market associated with the movie, "Die Another Day."

The average of RMSE's for these computations was less than 0.03.

3.2 Comparing forecast accuracy

Note that the basis for forecasting accuracy is different for the different markets. The HSX.com Movie Stock price is intended to predict the four-weekend (25 day) box office total while the IEM contracts are tied to the four-week (29 day) box office total. This means there is difference of four days' receipts in the actual outcomes. The deviations between the actual box office results and the prediction market forecasts are presented in Figure 1.

Across the nineteen pairs of markets, we see that the errors of the point estimates for the two markets are usually on the same side (positive or negative) and of comparable magnitude. The correlation between forecasting errors of the two markets is 0.93.

To compare the accuracy of the two markets, we first analyzed the point estimates. We computed the unbiased absolute percentage error (UAPE) for both sets of forecasts. Following Makridakis (1993), the formula for the UAPE is given by:

$$\text{UAPE} = \text{Absolute Value}\,(\text{Forecast} - \text{Actual})/\text{Average}\,(\text{Forecast, Actual}).$$

TABLE 2

FORECAST IMPLIED BY IEM CONTRACT PRICES

Contract (Range)	Pre-opening Price (Normalized to sum to 1)	Prices if forecasts were distributed ~ Normal (119.69, 13.1)[1]
DIE90L (≤$90MM)	0.04	0.01
DIE100L ($90 + MM, $100MM)	0.06	0.05
DIE110L ($100 + MM, $110MM)	0.13	0.16
DIE120L ($110 + MM, $120MM)	0.28	0.28
DIE120H (>$120MM)	0.49	0.49

Example: Die Another Day (Fall 2002 IEM Movie Box Office Market)
[1]RMSE = 0.02

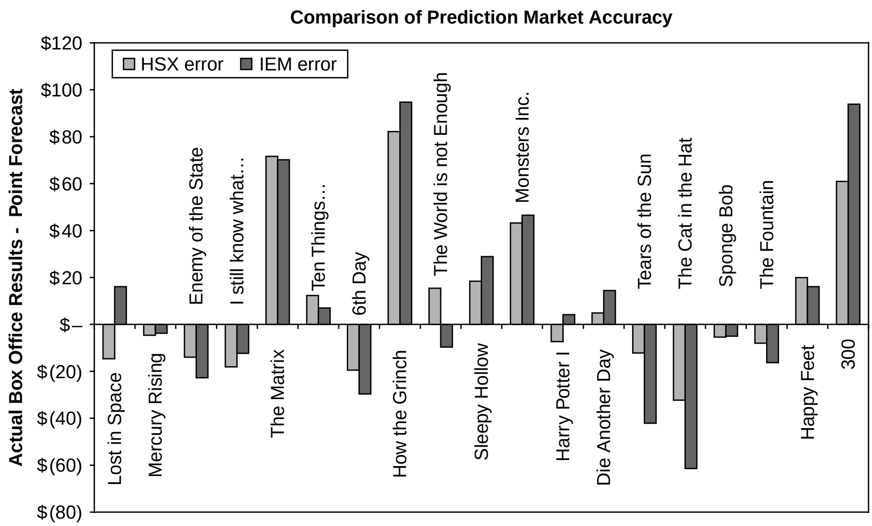

FIGURE 1. Comparison of Prediction Market Accuracy.

The UAPE measure is bounded between 0 and 200 and does not favor low forecasts as in the case of the traditional APE measure (Collopy and Armstrong 2000).

Based on the results of Rosenbloom and Notz (2005), we should expect that the forecasts generated by the real money IEM movie box office market should be significantly more accurate than those of the play money HSX since these events - movie box office revenues - are not associated with team sports contests. The mean UAPE for the IEM forecasts was 0.41 compared to a mean UAPE for the HSX.com forecasts of 0.31. Using a paired comparison t-statistic, this difference ($t = 1.948$) is not significant ($p < 0.067$) for the two-tailed test. For these markets, we find that the forecasts for the real money market (IEM) are not significantly more accurate than for the play money counterpart (HSX). The results from this pair of play money and real money prediction markets do not support the earlier findings of Rosenbloom and Notz (2005).

One potential problem with the comparison of point forecasts is the assumption necessary to convert the contract prices in the IEM market into a point estimate. Therefore, we examined the probabilistic forecasts generated by each market. The probability of interest is which real money IEM contract will pay $1 based on the movie's performance.

For the IEM markets, we chose as our forecast the contract with the highest price on the night before the movie's opening. For the HSX markets, we identified the IEM contract in which the HSX point forecast fell. For example, in the 2002 movie Die Another Day, the Thursday night HSX forecast was H$127 or $127 million. The corresponding IEM contract was DIE120H. The price of that IEM contract was $0.49 on Thursday at midnight.

Comparing the market forecasts in this way, we find that both markets identified the correct contract (paying $1) a total of 7 times. Both markets identified the wrong contract (not always the same wrong contract) a total of seven times. The IEM alone identified the correct contract three times and the HSX price alone identified the correct contract twice.

We can compare the quality of the information provided by the prices of the contracts identified by the IEM and the HSX price using a proper scoring rule. Treating these pairs of prices as probabilities, we used the following logarithmic scoring rule:

$$s_i = \ln[w_i * p_i + (1 - w_i)(1 - p_i)]$$

where $w_i = 1$ if the four week box office falls within the range of the specified contract and $p_i =$ the price of that contract on the night before the movie opens in theaters.

The average score for the HSX forecasts was -0.24 and -0.28 for the IEM forecasts (closer to zero is better). These averages are not significantly different ($t = 0.62$, $p < 0.54$ for a two-tailed, paired comparison t-test). The results suggest there is no significant difference in the information available from each market to identify which real money contract will pay off in the IEM.

4. PLAY MONEY PREDICTION MARKET PERFORMANCE OVER TIME

In this section, we turn to the issue of trying to better understand why the play money HSX markets performed as well or better than the real money IEM movie markets. As noted above, Servan-Schreiber, et al. (2004) argue that the outcomes of real money markets can be affected by differences in wealth between traders regardless of their ability to correctly forecast future events. In the long run, of course, poorly informed traders will eventually lose their investments and leave the market.

In contrast, play money markets usually endow all players with the same initial stake of trading currency. The only way to build one's wealth in a play money market is through a series of correct predictions. Over time, the best prognosticators should prosper and drive the prices in the prediction markets in the correct direction. As time passes and more uninformed traders lose money and drop out of the market, the predictions of a play money market should improve since the surviving participants have proven forecasting abilities.

We tested this conjecture by examining the ability of HSX to predict the opening weekend box office results for movies released between 1999 and 2002. Following prior research by Pennock, et al. (2000) and Spann and Skiera (2003), we transformed the HALT price (described above) which is a forecast of the four weekend box office total into a forecast of the opening weekend results by dividing the HALT price by the appropriate multiplier. For movies released on Friday, this multiplier is 2.9 (it differs for other opening days).

We collected information about HALT prices and opening box office performance for a total of 568 movies released between 1999 and 2002 from hsj.org, a website for fans of the HSX.com game. This sample includes all of the observations in the Pennock, et al. (2000) and Spann and Skiera (2003) studies.

For each movie, we computed the error using the same formula given above. We then computed the median unbiased absolute percentage error as well as the 25th and 75th percentiles for each year. The results are presented in Table 3.

The mean UAPE does not significantly vary across the four year period ($F = 2.43$, $df = 3$, $p < 0.06$). While there seemed to be some improvement in forecasting accuracy between 1999 and 2000, the mean UAPE rose to comparable levels by 2002. Therefore, contrary to our expectations, we do not find evidence that forecasting accuracy of the play money HSX market improves over time.

5. DISCUSSION AND CONCLUSIONS

In this paper, we contribute to the growing literature comparing the relative forecasting performance of play money and real money prediction markets. This is an important issue for the future development and deployment of prediction market technology due to the obstacles of organizing real money prediction markets. Comparing the point forecasts from the play money Hollywood Stock Exchange and the real money IEM movie box office markets, we find there to be no significant difference in their accuracy as measured by the mean unbiased absolute percentage error for 19 movies released between 1989 and 2007. This result is not consistent with earlier research on the relative performances of real and play money markets for non-sports events by Rosenbloom and Notz (2005). We also test the implications of a conjecture by Servan-Schreiber, et al. (2004) who claim that, over time, play money prediction markets may yield superior forecasts since the prices in the market would reflect the opinions of successful, surviving traders. Examining the ability of the play money Hollywood Stock Exchange to forecast the first weekend's box office results, we find no statistical differences across the years 1999 to 2002.

TABLE 3
HSX FORECASTS OF OPENING WEEKEND RESULTS USING HALT PRICES

Year	1999	2000	2001	2002
Mean UAPE	.374	.295	.331	.363
Std. Dev. UAPE	.287	.233	.264	.287
75%ile UAPE	.528	.419	.481	.504
Median UAPE	.339	.273	.267	.363
25%ile UAPE	.143	.113	.121	.141
Observations	137	140	134	156

Data source: www.HSJ.org

There are some important limitations that should be considered in interpreting the results of the comparison between the play money HSX and the real money IEM. The traders in the real money prediction markets for non-sports events studied by Rosenbloom and Notz (2005) were clients of Tradesports.com. Presumably, these traders were self-selected and were risking their own money in the prediction markets. The participants in IEM movie markets were generally a mixture of the self-selected traders and students who were provided the money to trade. The students trading with "house money" may have been more risk seeking in their trading (Ackert, et al. 2006). The presence of these risk-seeking traders may have made the resulting market prices less efficient, leading to less accurate forecasts. In addition, the design of the IEM contracts – paying either $1 or $0 depending on the outcome – may have encouraged more risky trading in general.

More research is needed to determine whether real money prediction markets wherein the organizers provide funding work as well as those with self-selected traders. Providing traders with funds with which to participate is one possible option that prediction market organizers might employ to avoid complications inherent in real money markets with self-selected traders drawn from the public at large. In addition, markets run for the internal benefit of a given company are likely to have funded traders as in Chen and Plott (2001) than require participants to risk their own money.

A second limitation involves the trading population for the IEM movie box office markets as a whole. Due to restrictions on the types of participants allowed, these markets were not open to the general public. In contrast, the non-sports markets studied by Rosenbloom and Notz (2005) did not have such restrictions. It is entirely possible that traders with superior information about the box office success of various movies were unable to profit from their superior knowledge due to this restriction on participation in the real money IEM markets. While a better informed individual faces no barrier to participating in the HSX markets, it is not clear whether the intrinsic rewards offered by that play money market are sufficient to motivate participation by truly knowledgeable traders.

The inability of traders in the real money IEM movie box office market to improve on the forecasting performance of the play money HSX raises an interesting issue regarding the role of monetary incentives in prediction markets. Much of the research on monetary incentives and performance is focused on experiments in which a participant's success is governed in large part by his or her efforts regarding some task (see, for example, Smith and Walker 1993). It may be true that the traders in the real money IEM movie box office market expended a great deal of effort in their participation in the markets. However, superior financial performance by a trader and, by extension, superior forecasting performance by a market, may have more to do with better information than increased effort.

Interestingly, the winner-take-all design of the IEM contracts would lead to traders with valuable information to benefit handsomely especially when that information is rare. Consider the case that a consensus of trader opinion holds that the movie's four week total would lead to a given contract paying $1. For example, the consensus of opinion (based on a price of $0.87) suggested that the movie Tears of the Sun (2003) would earn more than $60 million in its first four weeks of release. A trader with superior knowledge of the true outcome of actual outcome of $41 million could have purchased the associated contract for about $0.03 the night before the movie opened in theaters. An interesting area for future research would be to measure individual trader's information before a prediction market to determine under what circumstances traders benefit from superior information.

Turning to our analysis of the predictive accuracy of the HSX forecasts over time, the results are really not surprising. Over the time period we studied, the number of registered traders increased dramatically. In 1999, the Hollywood Stock Exchange boasted of 350,000 traders (Braunstein 1999). This number grew to more than 1 million by May, 2003. The addition of new traders, especially those with worse information, is of great benefit to experienced and better informed traders. The newly arrived "noise traders" provide liquidity in the prediction market that allows the better informed participants to profit from their knowledge. However, this increased liquidity may be benefiting some traders at the cost to reduced accuracy for the market as a whole. The influx of these new, inexperienced traders may be affecting the ability of better informed survivors to move market prices in the direction of an accurate forecast. Therefore, organizers of play money markets seeking to improve forecasting accuracy over time will have to find a balance between keeping participation rewarding for better informed traders through adding new traders and taking advantage of the superior knowledge concentrated in long-run survivors.

In conclusion, this study suggests that the presence of monetary incentives on their own does not lead to better forecasts of movie box office performance than those produced by a play money counterpart. However, as impressive as are the results from the play money HSX market, the market's overall performance did not improve substantially between 1999 and 2002. This suggests the drive to add new participants may have increased market liquidity at the expense of improved forecasting accuracy.

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