A Note on the Success of Media Investments:

No Predictability, Pure Luck*

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In a seminal paper, March and Sutton (1997, p. 702) argue that "(M)ost studies of organizational performance are incapable of identifying the true causal relations among performance variables and other variables correlated with them through the data and methods they normally use." The authors criticize the interpretations of organizational performance which are built on elementary causal conceptions and are tested by multiple regression models. March and Sutton find that the simple models both mix up correlation and causation and exhibit a significant retrospective bias. As a result, the approaches claim ex post unjustifiable knowledge about the ex ante predictability of success. Coming from a different theoretical perspective we follow their line of reasoning in this note by analyzing the predictions made in the marketing literature on the success of media investments. Moreover, new empirical evidence is provided to support our argumentation.

As a general rationale, the national motion picture industry is highly influential in society by reflecting cultural identity and by shaping and spreading norms, ideas, and trends. Furthermore, this industry is economically very important. Movie project budgets mount up to double-digit size, with a huge potential for ancillary products and movie theatre revenues (Meiseberg et al. 2008). Accordingly, there is a large body of literature in marketing dealing with success factors of movies and other media investment projects. Chisholm et al. (2015) cite several marketing studies that isolate determinants which can predict the success of future movies.

In line with the actual optimism of Big Data proponents marketing research claims to have developed both forecasting models and decision-support tools that predict screen success, which is measured as revenues at the box office, and improve management decisions in the movie industry (e.g., Neelamegham and Chintagunta 1999, Eliashberg et al. 2000, Shugan and Swait 2000, Elberse 2013). Usually this strand of research tries to find determinants of economic success of movies by running models with historical data. As independent regressors, various kinds of quantitative or qualitative information have been used. Quantitative information often comes in the form of hard facts, like movie budgets, star involvement, or marketing and advertising spending. Qualitative information includes movie team members' backgrounds, alleged creative team processes, past movie popularity with critics or amateur communities and so forth (e.g., Moon et al. 2010).

When the prediction of success of media investments is at stake, then firstly the fixation of marketing research on the revenue part of movies at the box office has to be questioned. The analysis should have a revenue and a profit part. The gross part could imply that someone is able to predict the sales of a new movie. The net part would be a statement about the profitability of the investment project both actually and over time. It would imply a precise statement about which part of these sales can be appropriated by specific actors (directors, actors, writers) who are in a position to appropriate the quasi rent of their specific scarcity in the market.

Moreover, the findings of such research are challenged more fundamentally by research from a different perspective. Using both economic reasoning and statistical arguments, the latter denies the existence of formulas for generating success in the movie industry on both the level of individual projects and on the corporate level. De Vany and Walls (1999) document that the mean economic success of movies is obviously determined by only a few blockbusters. According to their research the distribution of box-office revenues belongs to a Levy probability distribution, which has a heavy upper tail. Their parameter estimates of the asymptotic upper tail index reveal that the variance of box-office revenue is infinite. This implies that movies are not only very risky projects, but also that there must not be an average to which movie revenues converge. Movie revenues can diverge over all possible values of outcomes. The average of the economic success (or failure) of movies depends to a large extent on the emergence of a few blockbusters, but these extreme successes are extremal events in the upper tail of the probability distribution with chances of occurrence being extremely small. In effect, the observable average success (or failure) of movies is largely driven by rare, extremal events. This has the consequence that mean and variance of the distribution must not converge over time to an attractor.

That is, already the statistical analysis of De Vany and Walls (1999) contradicts proposed results of studies conducted in marketing research. It implies that the information cascade which brings about the success or failure of a movie is a complex stochastic process that cannot be directed by managerial actions. Following De Vany and Walls, therefore, the decision-support tools that marketing research has developed can neither predict success nor improve management decisions in the movie industry. The same holds for film revenue forecasts which are commonly said to have zero precision.

Any sound marketing research attempt to establish determinants of movie success by running regressions with historical data, which statistically sometimes is said to require a normal distribution of variables. However, the movie industry is also a small sample business. Blockbuster movies are rare events, which by definition cannot be created by focusing on success factors for the statistical artefact of the average movie. From an economic perspective, blockbusters are the consequence of some kind of innovation incorporated in movie creation. Since landing a blockbuster hit is an extremal event in a small sample, historical data and experience can logically not be used as a recipe for the success of new movie projects in the future. Likewise, often movies that were considered a sure thing turned out to be ten ton turkeys, meaning they totally flopped at the box-office. “Waterworld” is a famous example (De Vany and Walls 1999, Meiseberg et al. 2008).

While De Vany and Walls’ (1999) argument is straightforward and empirically valid, the unpredictability of media investments can also and more generally be explained by the efficient markets hypothesis applied to the case of media companies owning the movie studios. The efficient markets hypothesis (Fama 1970) states that asset prices contain all available and relevant information for anticipating future prices. As the prevailing asset prices fully reflect the available information, no investor can earn an abnormal economic profit. Based on the amount of the information set, the weak, semi-strong and strong form of efficiency have been distinguished. The information set of the weak efficiency form contains past asset prices, the semi-strong form in addition all publicly available information and the strong form adds insider information. As stocks of media companies are traded on exchanges and trading on insider information is legally prohibited, stock prices of media companies contain all publicly available information and, hence, follow a random walk:

$$p_{t+1} = p_t + \varepsilon_{t+1}, \tag{1}$$

where p_t denotes the stock price and ε_{t+1} the unpredictable component.[1] Only unpredictable events, company-specific and economy-wide, can affect the next period's stock price. Consequently, stock price changes and in turn the success of media investments are not predictable because the content of the information set is publicly available.[2] Our argument will not be undermined by marketing researchers' attempt to capture the determinants of economic successes of movies because the future stream of explanatory variables, like any future event, cannot be known with certainty. It can only be predicted on the basis of publicly available information. The only information which can alter the stock price are unpredictable events. This is just another way of saying that stock price changes are not forecastable.

To test the hypothesis of the unpredictability of media companies' stock prices, we implement the often used variance ratio test (Cochrane 1988, Lo and MacKinlay 1988, Poterba and Summers 1988, among others). The variance ratio of k-periods stock returns is defined as:

$$V(k) = \frac{Var(r_t + r_{t-1} + ... + r_{t-k+1})/k}{Var(r_t)} \tag{2a}$$

$$= \frac{Var(p_t - p_{t-k})/k}{Var(p_t - p_{t-1})} = 1 + 2\sum_{i=1}^{k-1}\left(\frac{k-i}{k}\right)\rho_i, \tag{2b}$$

where $r_t = p_t - p_{t-1}$ denotes the stock return and ρ_i the i-lag autocorrelation coefficient. $V(k)$ is a linear combination of $k-1$ autocorrelation coefficients. The main idea of the variance ratio test is based on the observation that when stock returns are not autocorrelated the variance ratio is equal to one due to $Var(r_t + r_{t-1} + ... + r_{t-k+1}) = kVar(r_t)$. The variance

[1] A martingale is another way to state formally the market efficiency hypothesis. The martingale is less restrictive with respect to the properties of shocks than the random walk. However, martingale and random walk reach the same conclusion concerning the unpredictability of next period's stock price.

[2] Despite the popularity of the market efficiency hypothesis it is not the only explanation for the behavior of stock prices. A large part of the behavioral finance literature comes to different conclusions compared with the implications of the efficient markets hypothesis (see, for example, Shleifer 2000).

ratio test investigates the null hypothesis that stock returns are serially uncorrelated, $H_0 : \rho_1 = \rho_2 = ... = \rho_{k-1} = 0$ and stock prices are not predictable.[3]

We apply the variance ratio test on stock returns of six media companies, namely Comcast, Walt Disney, Time Warner, 21st Century Fox, Sony and Viacom, which own the movie studios with the highest market shares. Daily settlement prices are obtained from Thomson Reuters DataStream. The sample periods extend from March, 1973 to September, 2016 for Comcast and Walt Disney, from March, 1992 to September, 2016 for Time Warner, from November, 2004 to September, 2016 for 21st Century Fox, from January, 1973 to September, 2016 for Sony and for Viacom from June, 1990 to September, 2016.

Table 1: Results of Variance Ratio Tests

		$k=2$	$k=5$	$k=10$	$k=20$	$k=40$
Comcast	$V(k)$	1.03	1.03	0.88	0.78	0.73
	$Z(k)$	0.91	0.43	- 1.18	- 1.52	- 1.40
Walt Disney	$V(k)$	1.03	0.98	0.96	0.98	1.02
	$Z(k)$	1.55	- 0.46	- 0.65	- 0.30	0.15
Time Warner	$V(k)$	1.03	1.03	1.00	0.94	1.00
	$Z(k)$	1.29	0.70	- 0.07	- 0.66	0.02
21st Century Fox	$V(k)$	0.95	0.92	0.89	0.84	0.83
	$Z(k)$	- 1.28	- 0.88	- 0.85	- 0.83	- 0.63
Sony	$V(k)$	1.04	1.00	0.97	1.00	1.07
	$Z(k)$	2.60*	- 0.04	- 0.64	- 0.03	0.81
Viacom	$V(k)$	1.04	1.00	0.92	0.90	0.86
	$Z(k)$	1.78	- 0.01	- 1.23	- 1.09	1.06

Note: The table shows variance ratios $V(k)$ and heteroscedasticity-robust test statistics $Z(k)$ of k-periods stock returns. Under the random walk hypothesis, the value of $V(k)$ should be close to one. * indicates statistical significance at least at the 5% level. All other test statistics are insignificant.

Table 1 displays the results of variance ratio tests for sampling intervals of 2, 5, 10, 20 and 40 days. For each interval k estimates of the variance ratio $V(k)$ and the heteroscedastic robust test statistics $Z(k)$ are presented. A value of $V(k)$ close to one, indicates a that the stock prices show random walk behaviour. With only one exception the null hypothesis of random walk behavior of stock prices cannot be rejected. Only for Sony the null hypothesis is rejected at least at 5% significance level at $k = 2$. All other test statistics are insignificant. Hence, we find overwhelming evidence that stock prices of media companies exhibit random walk

[3] See, Charles and Darne (2009) for more details on variance ratio tests.

behavior. Stock prices are not predictable as past stock returns do not contain any information which are exploitable for forecasting purposes.

What are the differences between De Vany and Walls' and our line of argument? Both have in common the finding that the success of media investments is not predictable. While De Vany and Walls' argument is based on a single project's probability distribution, our approach relies on the efficient markets hypothesis. In doing so, we provide a more general line of argument by considering media investments as part of exchange listed companies. From the investors' point of view, companies can be regarded as a portfolio consisting of different activities, including the risky media investment business, to reduce unsystematic risk. While investments in the portfolio makes sense in case the stock price compensates for the risk premium, investments in single projects are unpredictable and bear in addition to the systematic risk component the unsystematic, diversifiable risk. As has been shown by Litman et al. (2000) portfolio management theory provides an appropriate framework to explain a network's choice of their optimal program portfolio. The same argument also holds for the movie industry. Hence, the perspective taken by De Vany and Walls to look at individual movie projects only is overly pessimistic because it overlooks the compensating and diversifying effects these investments have in the context of a firm portfolio with other investments.

Diversification within a conglomerate firm, which is also active in the movie business, can come in different forms. Firstly, the corporate holding can assemble business activities which have negatively correlated risks with each other. Secondly, diversification can also take an intertemporal form. The movie library of a media company is a good example for it. Here continuous content delivery for movies over time helps to overcome the one time hit nature of the movie business by using diverse retail channels and formats like DVDs. It is the chosen portfolio consisting of different activities, including the risky movie investment business, that reduces unsystematic risk. By just counting revenues at the box office the diversification effects mentioned above will be systematically overlooked.

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