## GLUCKSMAN FELLOWSHIP PROGRAM STUDENT RESEARCH REPORTS: 2009-2010

**Benedetta Arese Lucini**, “Analyzing the ROI of Independently Financed Films: Are there many more ‘Slumdogs’ than ‘Millionaires’?”

**Orit Vaknin**, “The Family Business Risk Profile”

**Michael Reczek**, “An Examination of the Value of Covenant-Lite Debt to Issuing Companies”

**Denis Cranstoun**, “Effects of Equity Financing on Valuation of Junior Gold Mining Companies in Recessionary and Post-Recessionary Economic Realities of 2008-2010”

**Kiran Manda**, “Stock Market Volatility during the 2008 Financial Crisis”

## WILLIAM L. SILBER, EDITOR

# PREFACE

The Glucksman Institute for Research in Securities Markets awards fellowships each year to outstanding second year Stern MBA students to work on independent research projects under a faculty member's supervision. Five research projects completed by the Glucksman Fellows of 2009-2010 are included in this special issue of the Finance Department Working Paper Series. These papers focus on important topics in empirical financial economics.

Benedetta Arese Lucini, under the supervision of William Greene, analyzes the life cycle of movies by estimating revenues and costs beyond theatrical box office receipts and shows the benefits of portfolio diversification. Orit Vaknin, under the direction of Marti Subrahmanyam, examines whether the financial structure of family companies is more conservative than that of non-family companies. Michael Reczek, under the supervision of David Yermack, examines four potential sources of future value that first-lien-covenant-lite debt provides to the borrower. Denis Cranstoun, under the direction of Aswath Damodaran, analyzes the impact of access to equity financing on the valuation of publicly traded junior gold mining companies. Kiran Manda, under the direction of Menachem Brenner, examines stock market volatility before, during, and after the 2008 Financial Crisis. These papers, reflecting the research effort of five outstanding Stern MBA students, are summarized in more detail in the Table of Contents on the next two pages.

William L. Silber, Director
Glucksman Institute

Table of Contents

# Analyzing the ROI of Independently Financed Films: are there many more "Slumdogs" than "Millionaires"?

Benedetta Arese Lucini

The Leonard N. Stern School of Business
Glucksman Institute for Research in Securities Markets
Faculty Advisor: William Greene
April 1, 2010

## I. INTRODUCTION: THE CURRENT LANDSCAPE

A few main players dominate the movie industry by controlling most of the revenues and market share, with as little as 6% of movies making up 80% of revenues. The major studios focus on releasing a few blockbuster movies with budgets over $60MM dollars and huge marketing spends, with the intention of attracting a wide audience. Most of these movies are produced in-house, but some are also acquired from smaller companies in different phases of the development process. The last decade has seen a new trend in the film industry, whereby new players have emerged under the assumption that making smaller budget movies with a limited release will necessitate significantly lower prints and advertising (P&A) expenses, and result in the potential for a significantly higher return on investment. The financial industry also accepted this assumption, and began increasingly investing in these so-called “indies”, while the major studios concurrently created specialty arms to play in this space. A small number of hits kept the industry expanding every year, but with the major collapse of financial markets, the money invested in film decreased dramatically over the past 2 years. Many specialty houses, both independent and studio owned, closed as the numbers did not add up, and many investors were burned by the significant losses incurred.

## II. STATEMENT OF PURPOSE

The purpose of this paper is to analyze in depth the financing of films released in the last decade (Jan 2000 – Oct 2009). The movies will be categorized into two major groups, those that have been financed independently and those that have been financed by a studio. The budgets of these movies will then be compared to the revenue streams from distribution windows and ancillary rights on a cash-on-cash basis to evaluate the return for the initial financier. With the

collected data that should represent the full sample significantly, this paper will use statistical analysis to predict US DVD revenues from domestic box office and other variables. The results will be used to produce a model to predict the ultimate cash flow over the life of a movie both in the domestic and international markets. The return on cash invested for the financier will then be calculated by taking into account all the costs incurred in the production and distribution of the movie and the average retention rates of each cash flow stream. This paper will hopefully prove that on average, the returns for financers are significantly lower than that of an average market portfolio and will look at the reasons why movies have not historically performed as expected.

## III. PRIOR RESEARCH IN THE FIELD

There have not been a lot of studies that look at film revenues beyond the box office numbers. Much of the research in this field is specifically focused on the impact of intrinsic factors to each film in driving its success at the box office. The main reason why box office is the only data point that is referenced to, when identifying a film's success is that this number drives most of the other revenues and cost streams for movies. What this means is that both DVD sales and the ultimate revenues for movies are dependent numbers on box office results, given that it is the best indicator of demand. Furthermore, the cost of movies, participations to talent, and TV output deals are all calculated as a percentage of box office results. Even a portion of the marketing budget is dependent on box office because if a movie is performing, the advertising spend will increase to help the movie grow in revenues. This is particularly the case with small independent films that open on a limited release.

There has been a lot of research in the field of predictability given the risky nature of the movie business as many movies ultimately lose money. De Vany, A in his book *Hollywood*

*Economics: How Extreme Uncertainty Shapes the Film Industry* focuses on the topic of distribution of profits and how these are shown to follow a stable non–Gaussian distribution with heavy tails and infinite variance. In his 2005 paper De Vany also finds that stars are not significant in producing profits and thus mitigating risks, and that bigger budgets do not lead to higher profits. Joshi, A and Hanssens, D among others, stated that even though big budgets are not the drivers of revenue, advertising can help increase movie returns. They also analyze how this spending will also signal to the market about public companies' valuation of the movies they are releasing.

## IV. THE REVENUE WATERFALL FOR INDEPENDENT FILM

### *IV.I The Distributor Film Rentals from Box Office*

There are multiple ways in which films can be financed both by studios and independently. Fee, E outlines these very precisely in his paper *The Cost of Outside Equity Control* and the table below summarizes his definitions:

**Table 1: Financing Categorization**

| ***Classification*** | ***Type of Financing*** | ***Description*** |
|---|---|---|
| Studio | Studio development deal | Early involvement, at script stage |
| Studio | Studio based independent production | Exclusive relationship between the studio and an independent producers |
| Studio | Studio Financing/ distribution deal | Financing of a already packaged movie |
| Studio | Negative Pick-up | Studio will finance the cost of the movie only when it is completed (guarantee) |
| Independent | Co-financing | Financed by multiple players |
| Independent | Foreign presles | Sell theatrical and video rights to distributors internationally based on script |
| Independent | Long-term financing | Financing for a slate of movies |
| Independent | Single film financing | Limited partnership on one project |
| Independent | Self-Financing | Producer finances movie himself |

Studios can also get involved at a later stage by agreeing to distribute the independent film; they will generally buy the movie at a festival and market it with their own slate of films. An independent house can also decide to rent a distributor for a fee but maintain more of the upside from the revenue streams. Fee, E. looks at the decisions of a producer of an independent film by weighing how different financing agreements constitute a trade-off between retaining controls over the films property and creative vision or relying on outside equity and loosing the power. He concludes that by allowing for an involvement by an outside investor the film will incur costs that are mainly creative but will also have benefits, especially in distribution. The decision will mostly be influenced by how high the artistic stake is in a movie, and this is a reason to justify the continuous growth in independent films.

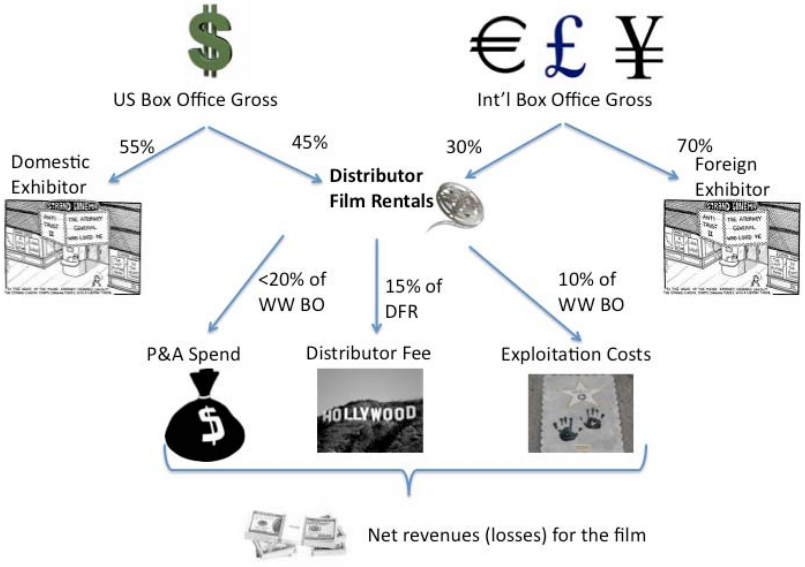
Given the decision made by filmmakers to be financed independently, it is interesting to investigate the actual profits that this asset generates for its investors. In order to better understand what the actual returns for financiers are it is necessary to outline how the revenues generated by movies, in each of the distribution windows, will be split between all significant players. Also, a better understanding of the real costs of a movie, above the actual budget, or "negative cost", and their accounting, will clarify why the investor gets paid back at a significantly later stage of the cash flow stream.

Firstly, when a movie is released theatrically, for every dollar of US domestic box office, the exhibitor, who owns the movie theatres, retains about 55% and thus only 45% of total box office revenues comes back to the film producers. Given that foreign distributors keep most of international revenue and the foreign sales agencies receive a percentage for selling the international rights as pre-sales (in the production phase of the movie), only 30% of international box office will be retained by the production company. The Distributor Film Rental (DFR) is

thus calculated as $DFR = 0.45 * BO_{US} + 0.30 * BO_{Int}$. There is an additional distribution fee that will be subtracted from the DFR to cover studio overhead (about 10% of DFR) and charges an additional fee (about 15% of DFR) to independent companies. The remaining cash flow is considered the net revenues for the movie.

Before the financier is able to recoup any money the distributor will recoup its P&A expenses. This includes all the money spent to market the movie and to physically produce copies for the theatres. On average this will be a calculated as a minimum of $2MM for movies with budgets below $10MM, and will be driven by worldwide box office success. If the box office gross for a movie is less than the "negative cost" then marketing will be limited to 10% of box office. For successful films it will rise up to on average 15% of worldwide box office for independents and 20% for studio movies. Another major cash outflow for the movie are exploitation costs, which include residuals and talent participations, usually accounting for, on average, 10% of worldwide gross. After all expenses have been recouped, the financier will start to receive his initial investment back, if the movie generated any positive cash flows. After that the financier will participate in a split with the production company and the talent in any upside.

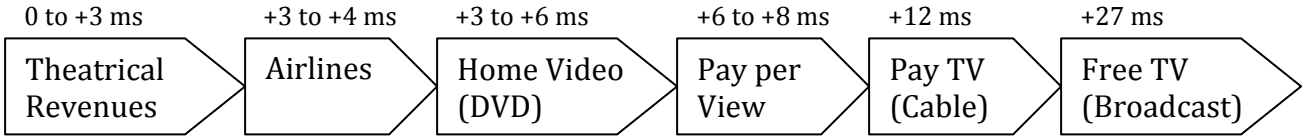
**Diagram 1: Revenue waterfall for theatrical**



### *IV.II What Happens Next?*

After a movie has been exhibited in theatres it will be cleverly sold through different channels in a system called windowing. This means that for the next 10 years it will receive revenue streams from other forms of distribution deals. This sophisticated model is what has allowed studio movies to be successful on average and for companies to be valued on their movie library. A typical movie window timeline is shown below:

**Diagram 2: The movie windows**




In order to compute the total return for an investor it is important to predict these cash flow streams that together make what is called the "ultimate" for a film. The main revenue source after box office is the Home Video market that with the release of DVDs has seen a major growth in the last 10 years, both nationally and internationally. It is important to note that this is slowly changing given the increasingly common new options available to consumers such as video downloading and streaming. The costs incurred for the film have been modeled as manufacturing costs of 7% of sales and marketing costs of about 5% of net revenues, floored at a minimum spend of $2MM.

Other than DVD sales other sources of revenue for the film are TV output deals with cable channels, pay per view options, free TV and airlines. In the chapter *Profits out of the Picture: Research Issues and Revenue Sources beyond North America Box Office* Weinberg, C argues that "industry trade publications estimate that the (TV) networks pay approximately 15% of domestic box office for the first three to four showings of feature films. Pay per view and

video on demand were smaller deals at the time the chapter was written but have gained significant sales revenues for the industry in the past few years and have substituted those of free TV. Therefore this assumption will be maintained when calculating ultimate ancillary revenues for films but will be capped at a $15 million rate for all movies. Studio movies will then have the extra revenue from merchandising and licensing, which are beyond the scope of this analysis, as it is hard to generalize across different film properties.

### *IV.III Definition of Return on Investment*

Return on Investment will be defined as the cash remaining after all expenses have been deducted from the "ultimate" (DFR and other movie revenue streams) over the negative cost of the movie. This does not take into account the time value of money given that the cash flows of the movie will be obtained starting at about a minimum of 2 years after the initial investment. It is a necessary assumption to evaluate multiple movies on a consistent basis. It is important to note that the accounting treatment allows film companies to amortize the negative costs of the movie over its life cycle. This will allow film companies to reduce the initial large losses that they incur when investing to make a movie.

## V. THE DATA

### *V. Sample Selection*

For the period analyzed, release dates from January 2000 to October 2009, there were 5,276 movies released in the US of which 38% were also distributed internationally. Furthermore, from the American Film Market (AFM) film catalogue, it is evident that another 2,858 movies were trying to get sold for release during this period and more than 90% of them

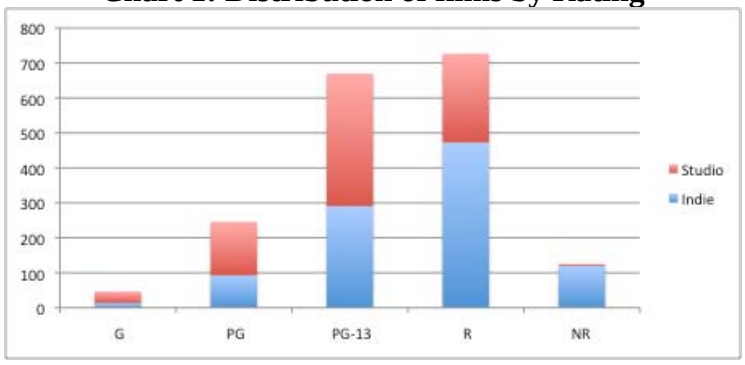
never did, ending up in straight-to-DVD distribution. The latter are all categorized as independently financed.

The database for ROI analysis has been carefully constructed to include all movie titles from the sample, which have available budget information. Each title was then categorized as independent or studio financed by distinguishing whether the main producer was an independent company or a studio/ studio subsidiary, even if a studio ultimately distributed the movie. All the movies with budgets under $2MM were also categorized as independently financed. Theatrical box office, domestically and worldwide and other information such as genre, rating and Oscar nomination, were also collected to classify the title.

The set of movies that will be analyzed compromises 1,815 films, 900 of which were categorized as independently financed and 825 as studio financed. The range of budgets for the movies in the database ranges from $258MM to less than $10,000. The database is populated with movies with multiple ratings and genres, all of which have had domestic distribution. Some of the statistics on the database are summarized below:

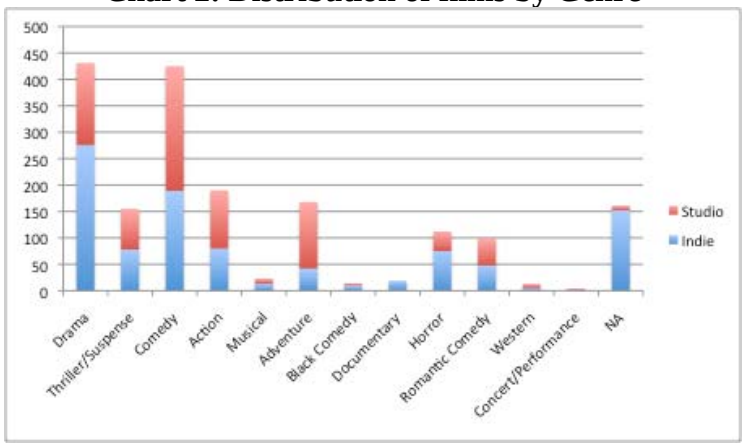
- **Ratings:** The database reflects the general knowledge that independently financed movies are mostly rated R and that studio movies will try to appeal to a wider audience and thus be significant in the G to PG-13 ratings. There are more that 10% of indie movies that have not been rated and this implies that they have never had a large release.

**Chart 1: Distribution of films by Rating**



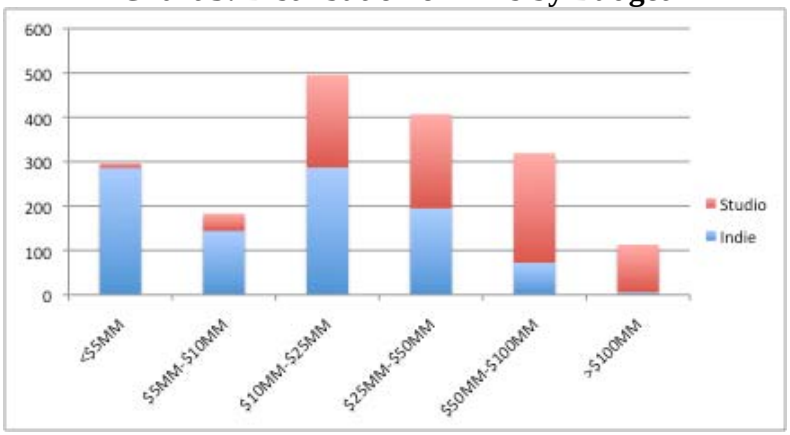
- **Genre:** Of the 12 genres by which movies have been categorized, again it is clear that independently financed films focus mainly on dramas and secondly on comedy. This is probably correlated to the fact that these are cheaper films to shoot, since indies are usually constrained by smaller budgets. The distribution for studio films is similar even though the Action and Adventure categories play a much larger role in the studio portfolio.

**Chart 2: Distribution of films by Genre**




- **Budget:** It is industry standard to accept indies as the lowest budget films. By the data collected it is clear that this is the case most of the time. But as studios have moved into the lower budget, auteur films, the dividing line becomes fuzzier. As the data suggests, studios like to play big, while indies will typically stay below a $25MM budget range.

**Chart 3: Distribution of films by Budget**



- **Oscar Nomination:** Without including the 2010 Oscars, the data analyzed shows that Studios win the Oscar competition most of the time, with 62% of Oscar nominated movies. This is changing rapidly as the academy recognizes the audiences' appreciation for more auteur movies.

***V.II Predicting domestic DVD sales***

Theatrical box office is easily accessible information, but when it comes to DVD sales it is a much harder number to identify. The website *the-numbers.com* has information on domestic DVD sales for a selected number of titles over the Jan 2006 - Oct 2009 period. The paper will make use of this data and statistical analysis to determine a statistically significant regression equation that can predict DVD sales based on a number of predictive variables, including domestic box office, budget, rating, genre and Oscar nomination. This will in turn be used to determine the DVD sales for the full dataset of movies.

Two separate regressions were performed on studio movies and on independent movies data, because studio backed films on average can achieve much higher DVD sales than independents and are affected differently by the predictor variables. The results of my statistical analysis are summarized below.

- **Studio Movies -** The regression equation is:

***log Sales Revenue*** *= 4.61 + 0.613 log Domestic BO + 0.128 log Budget + 0.103 G - 0.309 PG - 0.561 PG-13 - 0.362 R - 0.189 Drama - 0.213 Thriller/Suspense - 0.158 Comedy - 0.157 Action + 0.627 Musical - 0.040 Adventure - 0.565 Black Comedy - 0.416 Horror - 0.005 Romantic Comedy + 0.104 Oscar Nomination*

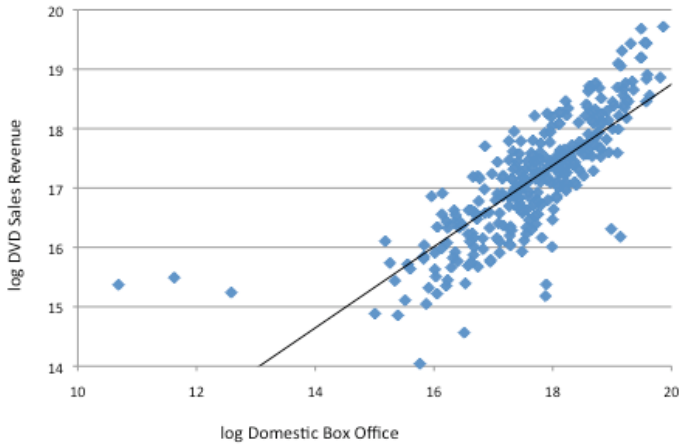
Natural logarithms were used because of the large numbers in both the predictors and the dependent variable so that the relationship would be better explained and $R^2$ will be higher. The details of this regression are as follows:

| Predictor | Coef | SE Coef | T | P |
|---|---|---|---|---|
| Constant | 4.612 | 1.107 | 4.17 | 0.000 |
| log Domestic BO | 0.61346 | 0.03986 | 15.39 | 0.000 |
| log Budget | 0.12768 | 0.05961 | 2.14 | 0.033 |
| G | 0.1032 | 0.7152 | 0.14 | 0.885 |
| PG | -0.3092 | 0.6873 | -0.45 | 0.653 |
| PG-13 | -0.5606 | 0.6846 | -0.82 | 0.413 |
| R | -0.3624 | 0.6821 | -0.53 | 0.596 |
| Drama | -0.1888 | 0.3476 | -0.54 | 0.588 |
| Thriller/Suspense | -0.2127 | 0.3569 | -0.60 | 0.552 |
| Comedy | -0.1583 | 0.3526 | -0.45 | 0.654 |
| Action | -0.1570 | 0.3560 | -0.44 | 0.659 |
| Musical | 0.6269 | 0.4319 | 1.45 | 0.148 |
| Adventure | -0.0403 | 0.3596 | -0.11 | 0.911 |
| Black Comedy | -0.5652 | 0.6754 | -0.84 | 0.403 |
| Horror | -0.4164 | 0.3755 | -1.11 | 0.268 |
| Romantic Comedy | -0.0047 | 0.3721 | -0.01 | 0.990 |
| Oscar Nomination | 0.10407 | 0.09146 | 1.14 | 0.256 |

*S = 0.583986  R-Sq = 68.2%  R-Sq(adj) = 66.4%*

It is interesting to note that the dependent variable can mainly be explained by the domestic box office. This result proves why most of academic and industry research has concentrated on these numbers as the main performance indicators. By using a scatter-plot of the two variables against each other and fitting the regression line, the relationship can be clearly visualized.

**Chart 4: Regression of US DVD Sales to Domestic Box Office**




For studio movies, the budget plays another important role. This could be because the studio invests this negative cost and thus is more motivated to recoup it through post-theatrical sales. They will invest more in marketing and retail shelf space deals in order to get the DVDs of their largest budget movies sold.

- **Indie Movies -** The regression equation is:

***log Sales Revenue*** *= 9.63 + 0.442 log Domestic BO - 0.0743 log Budget + 1.08 G + 0.678 PG + 0.605 PG-13 + 0.553 R - 0.028 Drama - 0.015 Thriller/Suspense + 0.004 Comedy + 0.211 Action + 0.185 Musical + 0.001 Adventure - 0.370 Black Comedy - 0.326 Documentary + 0.320 Horror - 0.355 Oscar* Nomination

Natural logarithms were used in this equation for the same reasons outlined above. The $R^2$ for this equation is lower because of the nature of independent movies, given the hit or miss business model, which is even less predictable than that of studio movies. Furthermore independents have less money to spend on DVD release and will therefore rely more on consumer viral marketing. The details of the regression are below:

| Predictor | Coef | SE Coef | T | P |
|---|---|---|---|---|
| Constant | 9.6323 | 0.9551 | 10.09 | 0.000 |
| log Domestic BO | 0.44196 | 0.03425 | 12.90 | 0.000 |
| log Budget | -0.07432 | 0.05044 | -1.47 | 0.142 |
| G | 1.0833 | 0.5980 | 1.81 | 0.071 |
| PG | 0.6784 | 0.5501 | 1.23 | 0.219 |
| PG-13 | 0.6053 | 0.5320 | 1.14 | 0.257 |
| R | 0.5527 | 0.5377 | 1.03 | 0.305 |
| Drama | -0.0276 | 0.2499 | -0.11 | 0.912 |
| Thriller/Suspense | -0.0150 | 0.2656 | -0.06 | 0.955 |
| Comedy | 0.0038 | 0.2487 | 0.02 | 0.988 |
| Action | 0.2106 | 0.2645 | 0.80 | 0.427 |
| Musical | 0.1849 | 0.4150 | 0.45 | 0.656 |
| Adventure | 0.0013 | 0.3153 | 0.00 | 0.997 |
| Black Comedy | -0.3698 | 0.4607 | -0.80 | 0.423 |
| Documentary | -0.3257 | 0.4162 | -0.78 | 0.435 |
| Horror | 0.3203 | 0.2676 | 1.20 | 0.233 |
| Oscar Nomination | -0.3548 | 0.1520 | -2.33 | 0.021 |

*S = 0.677110  R-Sq = 50.4%  R-Sq(adj) = 46.7%*

Again domestic box office is the main predictor of DVD sales and is statistically significant. It is interesting to note the negative sign on the budget coefficient. This could be driven by higher budget movies competing with the studio ones on DVD customers but with a smaller marketing spend and no infrastructure. Also, the nature of independents is to be low budget films so there should be a smaller correlation between the negative cost and the movie's success. Another observation from the data is that dramas and documentaries are the genres that negatively affect DVD sales, but these are the protagonist-driven genres of many significant

independent film festivals such as Sundance. Furthermore, Oscar nomination also seems to have a negative coefficient. This could be explained by the fact that independent movies do not time their release around the Academy Awards as much as studio ones and might already be out of theatres and have released their DVD, thus having potentially no added income from the press around the Oscars.

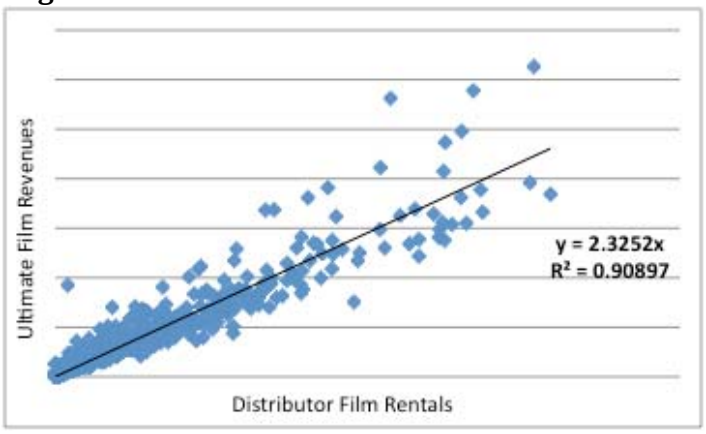
Once the two regressions were used to estimate domestic DVD sales revenues, they were used as an indicator of potential international sales. The demand for the title internationally was calculated as a ratio of foreign box office versus that in the US. This was then multiplied by the US estimate to get an international revenue stream. The main assumption here is that all foreign markets behave like the US in terms of DVD consumption, which is not necessarily true, but for the purpose of the analysis it is assumed that on average it should converge.

***V.III The Ultimate Multiple***

Once the DVD and other ancillary revenues were calculated and added to the DFR for each movie, these were used to compute the *ultimate* multiple. This can be used as a good predictor to calculate the total revenues of a film once the distributor film rentals (DFR) are known. This is a way for studios to predict the life value of each of their films after they have observed the box office performance. The two variables were regressed against each other and the regression multiple is 2.33x. This means that the other revenues count for 133% of the theatrical. This is important to note as it shows that when looking at movie profitability the other revenue streams should be taken into closer consideration. Below is the regression showing this relationship, with an $R^2$ of over 90%. Not that as the DFR gets larger the outliers increase in both directions. The highest ultimate multiple movies are the G rated animated films for children, such as the Pixar and Disney ones that have a very long revenue life after their initial theatrical release.

Merchandising and licensing also play a large part and are not included in the calculation, thus making the multiple even larger than currently computed.

**Chart 5: Regression of Ultimate Revenues to Distributor Film Rentals**

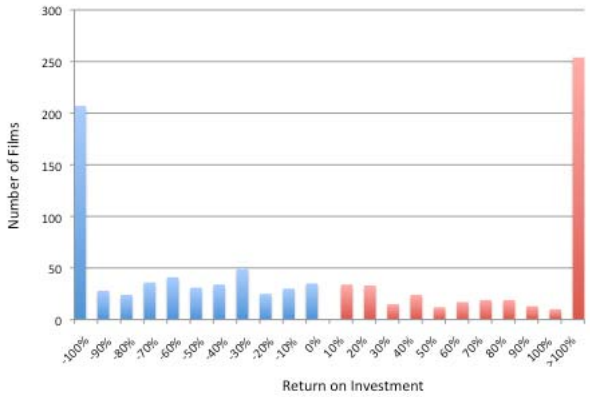



## VI. THE ANALYSIS

### *VI. Let's analyze returns*

The cash-on-cash return on investment was calculated for the 990 independently financed movies analyzed. All the revenues of the film, as described above, were added together and all the costs associated to making those revenues subtracted from these. This final cash flow was compared to the initial "negative", the movie budget. If the cash flows were smaller than the initial budget then the financiers achieved a negative return on their investment. If the return was less than -100% this implies that the financiers never received anything back from the film and that even the production company and distributors were exposed to a loss. If the ROI on the movie is more than 100% then this means that the financier was able to double its initial investment in the film. The distribution of independently financed returns is shown below:

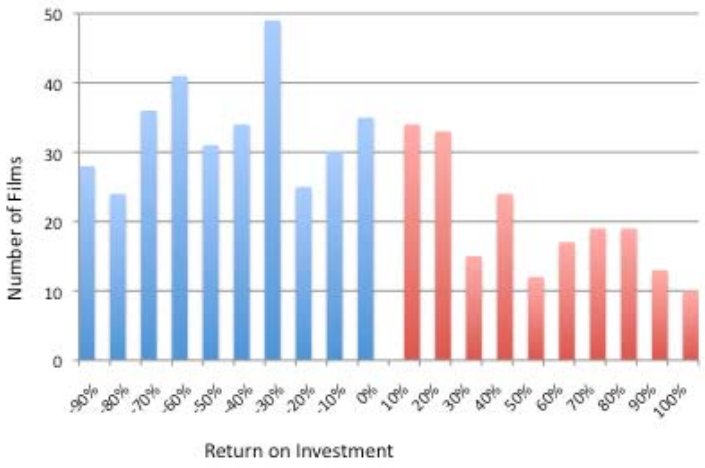
**Chart 6: Distribution of independent Film Returns**




As already documented by De Vany, A. the returns of films do not follow a normal distribution. The anomaly of movie returns explained by the large tails, shows that independently financed films behave like extreme events. This makes the predictability of a success nearly impossible, given the infinite variance of returns.

The distribution of returns can be analyzed in more detail by disregarding the tails. This assumes that over a large enough number of films the two tails will cancel out.

**Chart 6: Distribution of independent Film Returns**




The kurtosis of the distribution is low, given the flat peak around the mean and a more uniform distribution. It is interesting to note that increasing returns diminish quicker than decreasing ones.  The investors of independently financed films will have a positive return 45%

of the time but will double its money (ROI > 100%) only 25% of the time. Given that the cash flows of a film are generally achieved over a period of at least 10 years after the initial investment, this equates to a yearly return of 7.18%.

When looking at the entire distribution the mean is large and positive. This is because there is a positive skew in the distribution, the tail on the right is larger, as negative returns are floored by how much money is invested, both the negative and the film costs. This is not a significant number in explaining the potential return from a film. The median is a better indicator as it reduces the importance of outliers. The median ROI is -13.12% for an independently financed movie. This is a clear signal of the historic underperformance of these types of films. In contrast, the median of the studio-financed movies is 27%. On an annual basis over a ten-year period, this is not an impressive result either but it has sustained the studio model through the years.

The absolute return of a film, as calculated for the purposes of the analysis is heavily influenced by the size of the denominator. Very small budget movies will have significantly larger returns, both in positive and negative terms. To eliminate this effect, the analysis looks at both the absolute returns of movies in the sample and the budget-weighted % return over the whole portfolio. The statistics for studio and independently finance films are summarized below:

**Table 2: The cash-on-cash Returns**

| ***Variable*** | ***Studio Financed*** | ***Independently Financed*** |
|---|---|---|
| ***Returns in %*** | | |
| *Average % Return* | 153% | 1055% |
| *Median % Return* | 27% | (13%) |
| ***Budget-Weighted Returns*** | | |
| *Average of Absolute Returns* | $26,921,922 | $2,213,197 |
| *Median of Absolute Returns* | $8,846,379 | ($1,389,147) |
| *Total of Budgets* | $45,732,091,638 | $19,639,637,318 |
| *Total of Absolute Returns* | $22,210,585,390 | $2,191,065,514 |
| *% Budget-weighted Return* | 48.57% | 11.16% |
| *Yearly return (over 10 years)* | 4.04% | 1.06% |

It is pretty clear from the data that studio movies outperform the independent ones when looking at budget-weighted returns. For every $1 invested in a studio film, the return is $1.49 dollars, whilst for an independent it is only $1.11. Over a 10-year horizon for the investment this equates to 1.06% return a year. This shows that leaving the "negative" money in a bank account or in marketable securities is a better investment than independent movies, on the full portfolio. Independents though, do benefit from the lower costs involved in making the movie and marketing it, thus driving returns significantly higher for the successes than that of movie studios where the initial investment, that has to be recovered, is larger.

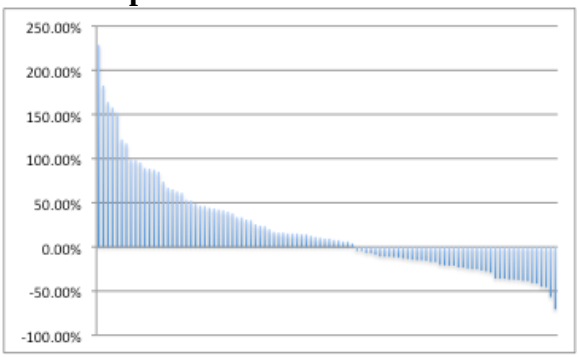
It is important to note that when using the median, and thus eliminating the effect of outliers, the return for an independent is actually negative. This is no surprise, given the failure of many of the independent film companies in the last few years. The asset class has proven to be a difficult investment to make even if in theory the lower sunk costs would facilitate the speed at which the movie would be profitable for every dollar of profit achieved.

***VI.II A little bit on portfolio theory***

The paper is now going to look at all the independent movies in the sample and is going to apply portfolio theory to discuss the returns for specific portfolios of movies. Assume that there is an investor who has no insider knowledge on any of the movies that he can choose to invest in. It will also be understood that by randomly selecting a small portfolio of 8-10 films, the investor is fully diversified, as there is no covariance between films, if they are not sequels. The covariance measures how returns of assets move together; thus no covariance describes the unpredictability of any title, whose performance cannot be predicted by that of any other film. The 100 portfolios were selected randomly and then the return of each portfolio was calculated as follows: $E(R_p) = \sum_i w_i E(R_i)$. The return from the asset was already calculated and the

weights for each film were found as the budget over the total portfolio investment. This assumes that when an investor selects a movie, he will fully invest in it. *Table 1* in the Appendix shows the details for weighted returns for a selection of 100 portfolios with randomly assigned movies. The returns are also shown in the chart below.

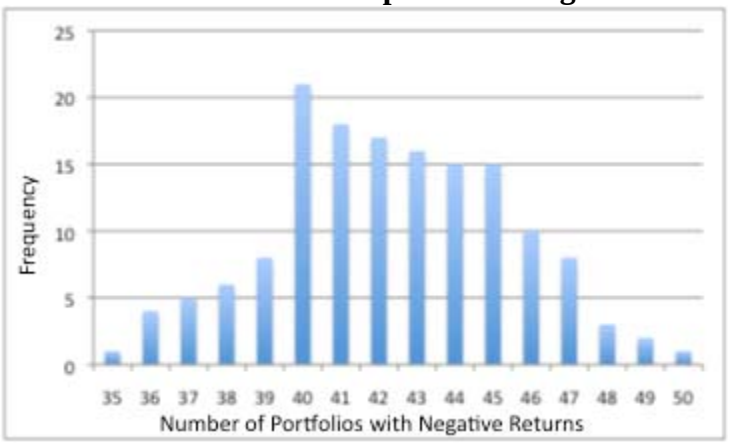
**Chart 7: Expected Returns from each Portfolio**




In this particular randomization, the number of portfolios with positive returns outweighs that with negative, both in number and size. There are 44 portfolios with negative returns and 38 portfolios yielding more than 20% return. Therefore by allowing diversification there is a larger probability of actually achieving a positive return, rather than on single investments, because of successes covering for the effects of losses.

When repeating the random selection of portfolios for 150 iterations, it is interesting to note that the number of negative portfolios will rarely be 50% and never above, as shown below:

**Chart 8: Distribution of Expected Failing Portfolios**



It can be argued that investors will have some information on the movies they want to invest in and will then decide to invest in those they believe will be more profitable. The analysis looks at portfolios of films based on certain characteristics to compare their performance. The data for expected portfolio returns is shown below:

**Table 3: The Returns from Portfolios by type**

| PORTFOLIO TYPE | EXPECTED RETURN |
|---|---|
| **Ratings** | |
| G | 119% |
| PG | 7% |
| PG-13 | 4% |
| R | 14% |
| NR | -4% |
| **Genre** | |
| Drama | 15% |
| Thriller/Suspense | 1% |
| Comedy | 9% |
| Action | -15% |
| Musical | 88% |
| Adventure | 5% |
| Documentary | 176% |
| Horror | 94% |
| Romantic Comedy | 21% |
| **Budget** | |
| <$5M | 227% |
| $5M-$10M | 158% |
| $10M-$25M | 70% |
| $25M-$50M | 36% |
| $50M-$100M | 14% |
| >$100MM | -40% |

The findings show that the best type of portfolio to invest in is of G rated films because as mentioned before, they have a high multiple for non-theatrical returns. NR movies are the worst performers, probably because of limited release and low investment in promoting ancillary revenues. These films might have to use a rent-a-distributor system and only release to get critics reviews for the movie. Surprisingly documentaries are very high performers. This could be explained by the fact that the negative cost is usually very low and that the sample is skewed to include only the ones that get theatrical release. For documentaries this is usually a very limited number as most will only be bought for TV release. horror and romantic comedies are other safer genres to look into when selecting a film investment. It is also absolutely clear that higher budget movies will not translate in better returns in the independents category, contrary to the strategy of studios. This could be because the production can devote a much lower marketing spend towards

the film and thus making it harder to support its post-theatrical success. Many studio independent film arms and production companies, given the easy capital markets from 2004 to 2008, dangerously moved into higher budget territory when looking at what films to produce and causing them to go out of business.

## VII. CONCLUSION: WHY DO INVESTMENTS IN FILM PERFORM POORLY?

This paper's results have further analyzed in depth movie returns by considering their life after the theatrical release. Even if in general the returns should be higher than those addressed by research on box office proceeds, they show that investing in movies is still a very risky decision. The reason why the returns are so variable is because learning from the past is an impossible task to do. Each new film is unique and comparing it to past releases will not predict its returns with any degree of certainty.

The investment could be compared to that of venture capital (VC) companies looking to give money to start-ups. Each film could be analyzed as a new venture that has no reliable information and a relatively low track record of performance, given only by the prior experience of the creative talent involved. The way a VC firm looks to limit the risk is to finance the new venture in stages and will only release more funds if the venture achieves some pre-defined set of milestones. This technique cannot be used with films because they are very capital intensive to make and the full cost is sunk before demand can be assessed. All film contracts with talent are also conditional on achievement of full financing and thus staging will not be possible during production.

An extra challenge faced by independent production companies is the uncertainty of distribution. When looking at the performance of the analyzed films, it is clear that the returns

can be, for successful films, quite rewarding. The main problem here is that the data only takes into account the distributed movies, thus having a positive bias on the returns. The information from the American Film Market shows that there were at least 2,570 completed and never distributed English language films in the same period. This means that investors in these films earned -100% returns driving the expected return for a film to a significantly lower % than that calculated at 11.16%. On top of these completed movies thousands of scripts are written every year for financing consideration that never get made. The rigorous process that production companies set up, through screening and then development of the best ideas, helps investors select from a smaller pool of projects and thus lower the risk of bad investments.

Another observation worth mentioning is on the nature of the consumption of the product. Movies are experience goods, meaning that the customer has to buy them before they can try them. The trailers provide some amount of information about the film itself, but none about the experience. This phenomenon makes demand for a movie very uncertain; it will be price elastic and shifting through time.

A better understanding of the variance in the returns is through an attribute of the asset, its uniqueness. This can be used to investors' advantage in formulating better financing strategies. Instead of looking at each movie separately, a structure should be put in place for investors to select to participate in a portfolio of films, thus valuing films on an aggregation basis. As shown by the data above, when all films are looked at separately, the median budget-weighted return was negative. On the other hand, looking at the portfolio analysis using random selection shows that pooling the assets will get the successes to compensate for the losses, thus giving portfolio successes a probability of on average about 60. This is because the covariance of the films in the portfolio is close to 0, thus eliminating all idiosyncratic risk through diversification.

No matter how bad the returns look, financing of films will continue and the industry will never disappear because movies can be considered a "status investment" and the benefits associated to being part of this industry as an employee or a financier are larger than the actual value of financial returns. Just by walking by a newspaper stand it is clear that this industry is vastly talked about and that fame is aspired by many. This is why investors of independent films will continue to *"Get Rich or Die Tryin'*.

## APPENDIX

**Table 1: Portfolio Returns for one random selection**

| Portfolio | Return | Portfolio | Return |
|---|---|---|---|
| 1 | -17.11% | 51 | -27.60% |
| 2 | 73.87% | 52 | -11.05% |
| 3 | 33.62% | 53 | 157.77% |
| 4 | -25.23% | 54 | 9.41% |
| 5 | 52.44% | 55 | 23.44% |
| 6 | -20.90% | 56 | 152.11% |
| 7 | 30.22% | 57 | 46.20% |
| 8 | -7.15% | 58 | 41.39% |
| 9 | -4.27% | 59 | -35.98% |
| 10 | -29.02% | 60 | -35.90% |
| 11 | 61.11% | 61 | -21.26% |
| 12 | 16.26% | 62 | -41.41% |
| 13 | 39.82% | 63 | 16.99% |
| 14 | 9.47% | 64 | -36.89% |
| 15 | 88.30% | 65 | 15.17% |
| 16 | 6.18% | 66 | -37.41% |
| 17 | 66.80% | 67 | -4.35% |
| 18 | 98.50% | 68 | 6.20% |
| 19 | 25.57% | 69 | 182.59% |
| 20 | -14.45% | 70 | 44.24% |
| 21 | 43.38% | 71 | 48.76% |
| 22 | -26.65% | 72 | -13.53% |
| 23 | 4.16% | 73 | 117.03% |
| 24 | -16.90% | 74 | 98.94% |
| 25 | 15.24% | 75 | -56.68% |
| 26 | 163.93% | 76 | 7.70% |
| 27 | 23.89% | 77 | -21.19% |
| 28 | -36.98% | 78 | -11.08% |
| 29 | -15.11% | 79 | -13.00% |
| 30 | -38.39% | 80 | 62.59% |
| 31 | -45.78% | 81 | -11.53% |
| 32 | 228.68% | 82 | 95.63% |
| 33 | -24.56% | 83 | 20.07% |
| 34 | 12.69% | 84 | -23.40% |
| 35 | -44.98% | 85 | 46.57% |
| 36 | 87.31% | 86 | -10.80% |
| 37 | -20.28% | 87 | 65.26% |
| 38 | -25.19% | 88 | 89.21% |
| 39 | 15.18% | 89 | -6.73% |
| 40 | 30.86% | 90 | -8.93% |
| 41 | -35.62% | 91 | 11.31% |
| 42 | 53.33% | 92 | -23.11% |
| 43 | 14.24% | 93 | -11.84% |
| 44 | 84.91% | 94 | 33.39% |
| 45 | -70.51% | 95 | 10.60% |
| 46 | 14.36% | 96 | -15.01% |
| 47 | 38.04% | 97 | -15.63% |
| 48 | -38.74% | 98 | -40.86% |
| 49 | 8.01% | 99 | 42.23% |
| 50 | 121.53% | 100 | 16.27% |

## REFERENCES


De Vany, A. 2004. Hollywood Economics: How Extreme Uncertainty Shapes the Film Industry, London: Routledge.

De Vany, A. 2005. "*The Movies*". In V. Ginsburgh and D. Throsby (eds.), Handbook on the Economics of Art and Culture, Noth Holland: Amsterdam.

Amit, J. and Hanssens, D. 2009. Movie Advertising and the Stock Market Valuation of Studios: A case of "Great Expectations?"*, Marketing Science*, Vol. 28, No. 2, INFORMS

Fee, Edward. 2002. The Cost of Outside Equity Control: Evidence from Picture Financing Decisions, *Journal of Business* vol. 75, no. 4, The University of Chicago.

Weinberg, C. 2005. Profits out of the Picture: Research Issues and Revenue Sources beyond North America Box Office*,* Chapter 6, *A concise handbook of movie industry economics* By Charles C. Moul

Squire, Jason E. 2004. The Movie Business Book, 3rd Edition, New York: Fireside

Vogel, Harold L. 2007. Entertainment Industry Economics, A Guide to Financial Analysis, 7th Edition, New York: Cambridge University Press

AFM film Catalogue website: http://www.thefilmcatalogue.com/catalog/

www.the-numbers.com

www.imdbpro.com

www.boxofficemojo.com

www.wikipedia.com

# The Family Business Risk Profile

Orit Vaknin

The Leonard N. Stern School of Business

Glucksman Institute for Research in Securities Markets

Faculty Advisor: Marti Subrahmanyam

April 1, 2010

## I. INTRODUCTION

The family owned business is the backbone of the world economy. By some estimates, over 90% of all business enterprises in the United States are family-owned and 60% of all employees are in family owned businesses (Ibrahim and Elis, 1994; Colli, 2003). In the UK, approximately 76% of the largest 8,000 companies are either family owned or controlled (Gallo, 1994). Among the largest corporations in the US, approximately 30-40% are estimated to be family owned (Anderson and Reeb, 2003; Anderson, Duru and Reeb, 2009) Researchers have found similar statistics for family firms around the world (Dreux, 1990; Martinez, 1994; Owens, 1994). Therefore, a better grasp of the unique characteristics of family firms is a basis for understanding a significant part of the world's economy.

Several papers have been written about the unique characteristics of family businesses and their performance compared to that of non-family businesses. Most research done in the field focused on corporate governance measures, family relationships, succession, and performance indicators of family owned businesses. Generally speaking, there are two schools of thought with regard to the analysis of family business performance. The first claims that due to the family-centered nature of the family firm, it tends to be led by nepotism, irrational decision making processes, and conflicts of interests between those of the family and those of shareholders. The second school of thought takes the opposite view: Due to the family's commitment to the business, the firm is managed with a much longer time horizon than non-family companies, employees are generally more loyal to the firm, and family members manage the firm with prudence and care, since it is inexorably linked to the family's heritage and pride.

Research papers focused on family business performance reveal mixed results. Again, some indicate that family firms outperform non-family peers, while other papers show the opposite. An analysis conducted by Thomson Financial, for example, showed evidence for the outperformance of family companies in six European countries. Similarly, Anderson and Reeb (2003) find that family firms have higher Tobin's *q* than non-family firms. Villalonga and Amit (2006) found that family ownership creates value in first generation family firms (i.e. the founder serves as CEO or chairman). On the other hand, Holderness and Sheehan (1988) found that in large US corporations, family firms have lower Tobin's *q*, indicating that, due to impaired governance and incentives mechanisms, family firms are managed less effectively and underperform their competitors.

In this research I will focus on evaluating the financial and capital structure choices made by family businesses in an attempt to characterize the risk profile of the family business. Shleifer and Vishny (1986) and DeAngelo and DeAngelo (2000) found that large and undiversified shareholders, such as those found in family firms, may induce the company's risk aversion by avoiding high risk projects even when they are positive NPV, consequently imposing costs on other, well-diversified shareholders. Anderson and Reeb (2003) indicate otherwise – the structure of the family business reduces the principal-agent issues and the asymmetric information between shareholders and managers, therefore suggesting that monitoring erodes the risk aversion nature of the controlling families.

The hypothesis leading this paper is that factors that are unique to family owned firms – such as longer-term time horizon, family legacy and succession considerations – could potentially impact capital structure choices and make family businesses more risk averse and conservative from a financial stand point. This would suggest that family owned companies

have lower leverage and lower risk, which could be a disadvantage if it creates a sub-optimal capital structure. At the same time, however, this may result in a lower inherent risk which could actually benefit companies, especially in times of economic downturn.

The paper is divided in two parts. It is structured as follows: the first part will focus on the characteristics of the family firm in terms of capital structure and leverage, and evaluate whether there are any significant differences between the leverage and risk choices of family and non-family firms. The second part will examine a series of bankruptcy filings in the US during the years 2004, 2006, and 2008, and evaluate the proportion of family businesses in this sample.

## II. PART I – CAPITAL STRUCTURE AND RISK PROFILE

### *II.1* Methodology

This section will examine the characteristics of the family firm in terms of capital structure and leverage. I use a database created by David M. Reeb and Ronald C. Anderson for their research on family businesses. The dataset is comprised of 403 S&P 500 firms in the years 1992-1999, excluding banks and public utilities firms. For each firm they identify founding family presence, using manually collected data from corporate proxy statements on board structure and characteristics, CEO attributes, equity ownership structure, and founding-family attributes.

I focus on the most recent year in Reeb and Anderson's database (1999), which includes 282 of the firms that were part of the initial sample in 1992. I identify the firms that are still publicly traded under the same ticker symbol in 2010. This screen results in a sample of 193 public firms, out of which 52 (27%) are family businesses. A variety of accounting and financial

variables are then drawn from Capital IQ, including: size (number of employees, market capitalization, total revenues, enterprise value), industry, age of firm, profitability metrics (ROE, ROA, EBITDA margin, net income margin), leverage measures (debt to capital ratio, debt to EBITDA ratio, interest coverage ratio), and the different variables needed to calculate Altman's Z-score and Z''-score. I evaluate the capital structure using multi-variable regression analysis, controlling for characteristics such as company's industry, size, and age. In all the regressions, the intercept coefficient is set to equal zero to account for the notion that when all characteristics of a firm are zero, the leverage and risk metrics are meaningless.

### *II.2* Descriptive Statistics

To estimate the significance of the difference between family and non-family firms on each of the independent variables used in this study, I used a simple T-test. The outcomes of the different T-test are summarized in Table 1, which indicates that most the controlling variables used in the paper are essentially the same for both types of companies. The exception is profitability measures, in which non-family firms appear to be more profitable than their peers.

As for the dependent variables, from a simple T-test presented in Table 2, it seems that they are the same for both family and non-family firms. However, a closer examination of the relationship between the variables in the form of a regression is required to estimate this relationship, while controlling for other possible explanations for the outcome we see using the T-test.

### *II.3* Regression Analysis

I use a regression analysis to evaluate whether a family owned company has a different level of leverage than a similar non-family company. As an indicator of leverage, I use two

variables: Debt/ EBITDA ratio and Interest Coverage Ratio. I did not examine the more obvious ratio of Debt/Capital because it is influenced not only by the choice of debt level the company makes, but also by the level of equity the company has. This would have introduced market perception of the firm into the equation, and would not be a "clean" estimate of the leverage choices made by the firm. I then analyze the family company risk characteristics by evaluating not only the debt structure, but also the risk exposure the company is willing to take on, hypothesizing that a family firm would have a tendency to be more risk averse, all other things being equal.

### *II.3.1* Leverage

The summary of regression outcomes for the leverage variables is displayed in Table 3 and Table 4. Five regressions were run for each of the two dependent variables (Debt/EBITDA and Interest Coverage Ratio). Each of the five regressions is a derivative of the following extended regression equation:

$$Debt/\ EBITDA = \beta_1 * Family\ Dummy + \beta_2 * Age + \beta_3 * Size\ measure + \beta_4 * Industry\ Dummy + \beta_5 * Profitability\ measure + \beta_6 * Interaction\ Variables$$

The first regression of the Debt/ EBITDA analysis is a simple regression of family dummy variable against the leverage measure, controlling for other possible impactful variables, including age of firm, industry, number of employees, revenues, market capitalizations, and profitability metrics. This regression shows no significance at the debt level. Regression 2 adds interaction of two of the controlling variables with the family dummy, in order to examine the cross-influence of an "older" family business on debt and a larger family firm on debt. Neither of these variables are significant.

The three last regressions (regressions 4, 5, 6) exclude some of the controlling variables and include some combination of interaction variables between size and family, profitability and family, and age and family. These regression outcomes indicate that family firms actually have a higher level of debt, all else equal. This is surprising, considering the characteristics of a family controlled business indicated in several research papers. As discussed earlier, it is believed that the family ownership and control would result in a more risk averse structure and a tendency to avoid high risk activities. This study shows that the level of debt a family company takes on is, if anything, higher than that of a non-family firm. However, the statistical significance of the family dummy coefficient in most regressions is limited. The results of the regressions using different combination of variables are mixed, but they certainly do not indicate a lower debt ratio for family firms.

The same is true for the interest coverage ratio regressions. Although the regressions as a whole are sufficiently robust, the family dummy is not significant in the vast majority of the regressions. The interaction variables are mostly highly insignificant, suggesting there is no measurable difference in any direction between family and non-family firms with regards to their choice of leverage.

One reservation regarding this conclusion is that this research only looks at a sample of the largest companies in the American economy. It could be the case that in this size company, the market's control mechanisms are effective, even though the company is majority-controlled or operated by family members. Therefore, it is possible that examining a sample of smaller firms would yield the outcome that researchers are advocating – family businesses without a wide shareholder base make non-optimal capital structure choices. This is not the case in this sample.

### *II.3.2* Risk Exposure

To get a complete picture of the risk profile of the family business, it is important to look beyond leverage, at factors that reflect overall risk. To evaluate these factors I use the Altman's Z-Score, a predictive model developed by Dr. Edward Altman to measure the overall financial health of a company and can be used to determine the company's probability of filing for bankruptcy in the next two years. The Z-score discriminant analysis is comprised of five different business ratios which include the following variables: Working Capital, Sales, Total Assets, Retained Earnings, Earnings Before Interest and Taxes (EBIT), Market Value of Equity and Book Value of Total Liabilities.

Table 5 summarizes the results of the Z-score regressions. The same five regressions as the leverage analysis were analyzed. Nevertheless, the story revealed by this analysis is entirely different. The first two simple regressions show no indication for the significance of family business as an explanatory variable of the Z-score. However, when introducing several interactions variables into the regressions (regressions 3-5), the family dummy is not only significant, but is also a high positive number. The interaction variables do not contribute a meaningful explanation to the outcome, as they are mostly close to zero and insignificant. This suggests that a family business is actually less risky than a non-family business, at any stage of the life cycle, at any size, and at any level of profitability.

In addition to the Z-score I also analyze the Z''-score, a development of the original Z-score, which better fits non-manufacturing firms. The results (Table 6) are similar to those of the Z-score analysis. The family dummy is a robust and positive variable in the explanation of the Z''-score.

Taking these outcomes into consideration, an interesting picture is revealed. Although family firms do not have lower levels of leverage than non-family firms, they have lower overall financial risk and lower probability of failure. Since the Z-score and Z''-score introduce variables that indicate operational outcomes of the company (e.g., Working Capital, EBIT and retained earnings), it is plausible that the source of the higher financial health stems from the operational management of these firms. This is a highly positive observation regarding the family business as an investment. These companies do not have a sub-optimal structure compared to their peers as conventionally assumed, yet they manage to conduct their operations in a manner that exposes them to less risk. An earlier observation made in this paper regarding the difference in profitability of family vs. non-family firms indicated that non-family firms are doing better than family firms on metrics of profitability (EBITDA Margin, ROE, and ROA). Taking these points together could indicate that the more conservative operation takes its toll on the companies' profitability, but such conclusion requires a more thorough analysis of the difference in performance in the two types of companies, which is beyond the scope of this research.

## III. PART II – BANKRUPTCIES

After evaluating the difference in risk related characteristics of family and non family firms, the second part of the paper attempts to answer the question: are family businesses more resilient than non family businesses in times of economic downturn and credit constraint? Given the outcome of the first part of the paper, which indicates that family firms have similar capital structure but manage their operations in a less risky manner which results in a less risky company, the answer to the question is highly valuable. I look at a series of bankruptcy filings of

public companies in the US in the years 2004, 2006, and 2008 to evaluate the ratio of family to non-family companies in the sample. These years were selected since they represent bear capital market environment (2008), as well as bull (2006) and stable (2004) markets in the US economy. According to my hypothesis, bear economic periods will have a milder effect on family firms' bankruptcies as they compare to other firms' bankruptcies, due to lower inherent risk.

### *III.1* Methodology

I gather the data on bankruptcy filings of public firms in the US during the years 2004, 2006, and 2008, using Capital IQ. The sample includes 222 companies for which I collect data on bankruptcy date, industry, year founded, number of employees, market cap at bankruptcy, a list of large shareholders at bankruptcy, and a list of managers and board members at bankruptcy. I then manually identify each company as either family or non-family company.

In determining the definition of a family company I follow the lead of many distinguished researchers in the field (Reeb and Anderson, 2004; Villalonga and Amit, 2004) and define a family business as follows: A company in which the founder or a member of his/her family are insiders (directors or managers); or a company in which the founder or a member of his/her family are blockholders in the company (hold 5% or more of shares outstanding).

In order to categorize each firm as family or non-family, I use multiple information sources, including: company SEC filings (annual reports, bankruptcy filings, and insider holdings reports), company website, information provided with Capital IQ, public sources of business data such as Hoovers.com, and public sources of company history such as Wikipedia, Answers.com and newspapers articles. For each company I find the names of the founder/s and

search whether at the time of bankruptcy the founder or a member of his/her family is an insider or a blockholder.

After building a database of firms in which each company is categorized as either family or non-family company, I look at the proportion of family firms in each of the years. I then use a T-test to evaluate whether there are significant differences between family and non-family companies with regards to two variables: the age of the firm, and the average number of employees. I look at the age of the firm to attempt to distinguish between "young" and "old" firms, and as a proxy of generational succession; I use number of employees as a proxy for the company's size, since the companies evaluated in the sample are bankrupt, and therefore traditional size estimates such as market cap, sales, or revenues are flawed representations of their actual size.

### *III.2* Results

Table 7 presents a summary of the sample, including the ratio of family firms in the sample under four different definition (family insiders/ blockholders, insiders only, blockholders only, and both insiders and blockholders).

The ratios of family/ non family firms in the sample in each year are 32.7% in 2004, 43.2% in 2006, and 45.5% in 2008. This initial observation rejects the hypothesis of family firms being less likely to file for bankruptcy in years of difficult financial and economic conditions, as compared to years of growth or stagnation. On the contrary, the ratio of family firms filing for bankruptcy is higher in 2008, which was a recession year. However, when examining only the companies in which family ownership is in both involvement in management or board and significant holdings in the firm, the percentage of family firms is both materially

smaller and statistically significant in 2008 than in 2006. Moreover, when considering the representation of family businesses in US economy, the findings of this study are very meaningful. As mentioned in several research papers, approximately 90% of all businesses in the US are family businesses (Ibrahim and Elis, 1994, colli, 2003). In this sample only 41.9% (average over all three years examined) of the companies which filed for bankruptcy are family companies. Furthermore, using a narrower definition of a family firm which requires both insider and blockholder representation from the founding family, only 17.6% of the companies that have filed for bankruptcy in those three years are family firms.

In Table 8 I take a closer look at some of the differences between family and non family firms in the sample. Using a T-test I examine whether there is a statistically significant difference between family and non family companies with regards to age (are family firms on average younger than non-family?), and number of employees (are family firms on average smaller than non-family?).

The results presented in table 8 show no significant difference between family and non family firms with regards to number of employees (although the difference is large). When evaluating the age of the firms in the sample, it is apparent that family firms are younger on average. A potential explanation for this significant difference is that many of the firms categorized as family firms following the definition I use in the study are start-ups or firms in an early stage in their life cycle. Such young firms are at greater risk to fail as compared to more established firms; as a result, their inclusion in the sample creates a bias.

Younger companies tend to have founder's presence due to their phase in the life cycle and therefore are categorized as family companies in this sample. Yet these firms do not

necessarily share the characteristics associated with family firms, such as long term time horizon, succession planning considerations, and risk aversion. For that reason, I test the results when keeping only firms that existed over 10 years at time of bankruptcy in the sample. In Table 9, I essentially duplicate Table 7, but only include firms that were founded more than 10 years before the company filed for bankruptcy.

In this narrower sample the representation of family firms decreases in each of the years, except for 2006. In fact, using this sample the initial hypothesis of this paper is accepted. In a year of financial crisis (2008) the ratio of family firms filing for bankruptcy is lower than in a year of economic prosperity (2006). When using a narrower definition of family owned companies (both founding family insiders and blockholders), only 13.3% of the companies that filed for bankruptcy in 2008 are family owned. When compared to 2004 (13.5%) and 2006 (26.5%), the results appear to further support the theory that family companies are better prepared to overcome periods of difficult financial environment. That being said, none of the differences has proven to be statistically significant, so the conclusions are not robust.

## IV. CONCLUSION

The unique characteristics of the family business are a popular research topic and a source for significant debate by scholars. The family company's risk profile is considered to be one of the characteristics significantly impacting the management of the company. It is generally believed that families possess a more conservative attitude toward the management of the business, specifically the company's financial structure and tendency to choose high risk projects. Following that logic, the goal of this research paper was to answer two questions: Is the

financial structure of the family company more conservative than that of a non-family company? And is the family company less risky than a non family company, and therefore more resilient to financial crises?

The analysis conducted in this paper yields some interesting results regarding the risk profile of the family firm. First, family companies do not have different capital structure than that of non-family firms. This is somewhat counter intuitive, as the prevailing perception and the starting point of this paper assumed that due to the unique set of consideration families have, the capital structure of the family firm would be more conservative. This was proven not to be the case. One reservation is that this study was conducted on a database of large firms, making this statement not necessarily true within the broad realm of family firms.

Second, family firms exhibit lower risk as captured by the Z-score and Z''-score, two metrics which measure the overall level of financial risk inherent in a firm. Z models include not only capital structure measures but also measures of operational efficiency (such as Working Capital, EBIT and Retained Earnings). The significant difference between family firms and non-family firms on the Z-score scale indicates that the lower inherent risk of family firms stems from the operational aspect of the business. That is, although the capital structure is not materially different, family firms are managed with lower risk and higher overall financial health. This conclusion is also apparent in the final part of the paper, in which bankruptcy data is analyzed to estimate the failure ratio of family firms as it compares to non-family firms. Although the majority of the analysis is not statistically significant, it still shows a considerably lower ratio of family firms that file for bankruptcy, compared to their representation in the economy. Therefore, the lower risk that was apparent in the Z-score of family firms also translates to lower than expected bankruptcies of family firms.

The findings of this study suggest that family firms, although they potentially suffer from various information and agency issues, are more financially healthy. Surprisingly, this is true even without "paying the price" of a sub-optimal capital structure.

# V. EXHIBITS

**Table 1 - Descriptive Statistics - Independent Variables**

| | All Companies | | Non-Family Companies | | Family Companies | | Difference in means | | |
|---|---|---|---|---|---|---|---|---|---|
| | Average | SD | Average | SD | Average | SD | Non family-Family | T-test | |
| Age | 94.2 | 42.6 | 94.1 | 44.3 | 94.4 | 37.7 | (0.27) | 0.7 | |
| Industry dummy | | | | | | | | | |
| Consumer Discretionary | 0.21 | 0.41 | 0.18 | 0.39 | 0.29 | 0.46 | (0.10) | 1.79 | * |
| Consumer Staples | 0.09 | 0.28 | 0.09 | 0.28 | 0.10 | 0.30 | (0.01) | 0.83 | |
| Energy | 0.09 | 0.29 | 0.09 | 0.29 | 0.10 | 0.30 | (0.00) | 0.73 | |
| Healthcare | 0.06 | 0.24 | 0.07 | 0.26 | 0.04 | 0.19 | 0.03 | 1.36 | |
| Industrials | 0.28 | 0.45 | 0.31 | 0.46 | 0.19 | 0.40 | 0.12 | 2.07 | ** |
| Information Technology | 0.04 | 0.20 | 0.04 | 0.19 | 0.06 | 0.24 | (0.02) | 1.11 | |
| Materials | 0.18 | 0.39 | 0.18 | 0.38 | 0.19 | 0.40 | (0.02) | 0.83 | |
| Specialized Consumer Services | 0.01 | 0.07 | - | - | 0.0 | 0.1 | (0.02) | 1.4 | |
| Number of Employees | 63,828 | 156,623 | 60,486 | 76,451 | 72,889 | 276,029 | (12,403) | 0.9 | |
| Total Assets | 31,716 | 90,308 | 31,054 | 75,500 | 33,511 | 122,682 | (2,457) | 0.8 | |
| Market Capitalization | 20,524 | 44,013 | 23,725 | 47,586 | 11,844 | 31,167 | 11,881 | 2.3 | ** |
| Total Revenue | 23,279 | 47,696 | 24,077 | 42,892 | 21,116 | 59,227 | 2,962 | 0.9 | |
| Net Income Margin % | 4.5 | 15.4 | 4.8 | 14.6 | 3.5 | 17.5 | 1.3 | 1.0 | |
| EBITDA Margin % | 15.9 | 10.9 | 16.9 | 11.2 | 13.4 | 9.9 | 3.5 | 2.3 | ** |
| Return on Equity % | 13.0 | 41.8 | 16.1 | 42.2 | 4.5 | 39.5 | 11.7 | 2.0 | ** |
| Return on Assets % | 6.8 | 5.1 | 7.3 | 5.0 | 5.7 | 5.2 | 1.5 | 2.1 | ** |
| Number of companies | 193 | | 141 | | 52 | | | | |

Note: significance levels are denoted with asterisks: *=10%, **=5%, ***=1%

**Table 2 - Descriptive Statistics - Dependent Variables**

| | All Companies | | Non-Family Companies | | Family Companies | | Difference in means | |
|---|---|---|---|---|---|---|---|---|
| | Average | SD | Average | SD | Average | SD | Non family-Family | T-test |
| Total Debt/Capital % | 55.5 | 119.9 | 58.3 | 139.7 | 48.0 | 25.7 | 10.28 | 1.3 |
| EBIT / Interest Exp. | 14.48 | 20.06 | 14.65 | 20.53 | 13.96 | 18.80 | 0.69 | 0.81 |
| Total Debt/EBITDA | 2.94 | 4.73 | 2.84 | 4.84 | 3.22 | 4.46 | (0.38) | 1.01 |
| 5 Year Beta | 1.32 | 0.76 | 1.31 | 0.76 | 1.32 | 0.75 | (0.01) | 0.73 |
| Z Score | 3.14 | 1.74 | 3.22 | 1.80 | 2.92 | 1.56 | 0.30 | 1.51 |
| Z'' Score | 3.56 | 2.37 | 3.62 | 2.39 | 3.39 | 2.33 | 0.24 | 1.11 |
| Number of companies | 193 | | 141 | | 52 | | | |

Note: significance levels are denoted with asterisks: *=10%, **=5%, ***=1%

**Table 3 - Debt/EBITDA Regression Summary**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Family Dummy | -0.01 | 1.28 | 2.14 | 1.50 | 3.42 |
| | (-0.01) | (0.63) | (2.96) | (0.68) | (1.71) |
| Age of Firm | 0.01 | 0.01 | | 0.03 | 0.03 |
| | (1.27) | (1.50) | | (4.57) | (4.49) |
| Number of Employees | 0.00 | 0.00 | | 0.00 | 0.00 |
| | (-0.76) | (0.74) | | (1.22) | (0.31) |
| Market Capitalization | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | (-0.81) | (0.31) | (-4.68) | (-0.22) | (-3.21) |
| Total Revenue | 0.00 | | 0.00 | 0.00 | 0.00 |
| | (1.36) | | (4.29) | (0.26) | (1.94) |
| Total Enterprise Value | | | 0.00 | | 0.00 |
| | | | (3.25) | | (3.25) |
| Return on Equity % | -0.02 | -0.03 | 0.00 | -0.01 | 0.00 |
| | (-1.94) | (-3.01) | (-0.02) | (-1.26) | (-0.25) |
| Net Income Margin % | -0.05 | | -0.09 | -0.06 | -0.08 |
| | (-1.66) | | (-3.23) | (-1.86) | (-2.81) |
| EBITDA Margin % | -0.03 | -0.09 | 0.19 | 0.00 | 0.10 |
| | (-0.83) | (-2.46) | (4.62) | (-0.03) | (2.46) |
| Return on Assets % | | | -0.20 | | -0.23 |
| | | | (-2.15) | | (-2.40) |
| Age*family | | -0.01 | | -0.02 | -0.02 |
| | | (-0.59) | | (-1.09) | (-0.83) |
| Employees*Family | | 0.00 | | 0.00 | 0.00 |
| | | (-0.78) | | (-1.12) | (0.08) |
| Market Cap* Family | | | 0.00 | 0.00 | 0.00 |
| | | | (-2.91) | (-2.27) | (-0.55) |
| Revenue* Family | | | | 0.00 | |
| | | | | (3.26) | |
| EV* Family | | | | | 0.00 |
| | | | | | (-0.44) |
| ROE* Family | | | -0.01 | -0.03 | 0.01 |
| | | | (-0.52) | (-1.15) | (0.37) |
| NI Margin* Family | | | | 0.00 | |
| | | | | (-0.07) | |
| EBITDA Margin* Family | | | | 0.11 | |
| | | | | (1.14) | |
| ROA* Family | | | | | -0.17 |
| | | | | | (-0.85) |
| Industry Dummy Included | Yes | Yes | No | No | No |
| R-Square | 0.40 | 0.38 | 0.39 | 0.42 | 0.47 |

Note: T-statistics appear in parentheses below coefficients

**Table 4 - Interest Coverage Ratio Regression Summary**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Family Dummy | 2.08 | 0.80 | 5.39 | 10.38 | 4.10 |
| | (0.70) | (0.10) | (2.01) | (1.15) | (0.53) |
| Age of Firm | -0.01 | 0.00 | | 0.02 | 0.02 |
| | (-0.18) | (0.08) | | (0.97) | (0.72) |
| Number of Employees | 0.00 | 0.00 | | 0.00 | 0.00 |
| | (-2.28) | (-1.50) | | (-1.25) | (-1.99) |
| Market Capitalization | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | (0.61) | (3.75) | (0.63) | (0.16) | (0.53) |
| Total Revenue | 0.00 | | 0.00 | 0.00 | 0.00 |
| | (1.62) | | (2.25) | (3.17) | (2.23) |
| Total Enterprise Value | | | 0.00 | 0.00 | 0.00 |
| | | | (-1.06) | (-1.89) | (-0.64) |
| Return on Equity % | 0.03 | 0.05 | -0.06 | 0.03 | -0.06 |
| | (0.86) | (1.58) | (-1.51) | (0.66) | (-1.48) |
| Net Income Margin % | 0.07 | | 0.13 | 0.04 | 0.12 |
| | (0.63) | | (1.22) | (0.26) | (1.14) |
| EBITDA Margin % | 0.14 | 0.05 | -0.21 | 0.48 | -0.23 |
| | (0.84) | (0.35) | (-1.40) | (3.34) | (-1.38) |
| Return on Assets % | | | 2.08 | | 2.12 |
| | | | (5.94) | | (5.56) |
| Age*family | | 0.01 | | -0.03 | -0.01 |
| | | (0.11) | | (-0.38) | (-0.20) |
| Employees*Family | | 0.00 | | 0.00 | 0.00 |
| | | (0.89) | | (-0.22) | (0.48) |
| Market Cap* Family | | | 0.00 | 0.00 | 0.00 |
| | | | (-2.45) | (0.48) | (-0.40) |
| Revenue* Family | | | | 0.00 | |
| | | | | (-0.56) | |
| EV* Family | | | | | 0.00 |
| | | | | | (0.24) |
| ROE* Family | | | -0.11 | -0.10 | -0.12 |
| | | | (-1.62) | (-0.95) | (-1.14) |
| NI Margin* Family | | | | 0.16 | |
| | | | | (0.61) | |
| EBITDA Margin* Family | | | | -0.29 | |
| | | | | (-0.71) | |
| ROA* Family | | | | | 0.07 |
| | | | | | (0.09) |
| Industry Dummy Included | Yes | Yes | No | No | No |
| R-Square | 0.50 | 0.50 | 0.55 | 0.47 | 0.56 |

Note: T-statistics appear in parentheses below coefficients

**Table 5 - Z-Score Regression Summary**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Family Dummy | -0.14 | -0.07 | 0.85 | 3.17 | 2.32 |
| | (-0.50) | (-0.10) | (3.50) | (3.48) | (3.67) |
| Age of Firm | 0.00 | 0.00 | | 0.01 | 0.01 |
| | (0.01) | (0.21) | | (4.47) | (5.38) |
| Number of Employees | 0.00 | 0.00 | | 0.00 | 0.00 |
| | (-0.33) | (0.60) | | (2.25) | (1.60) |
| Market Capitalization | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | (-0.49) | (0.72) | (-1.25) | (-0.39) | (0.43) |
| Total Revenue | 0.00 | | 0.00 | 0.00 | 0.00 |
| | (1.10) | | (2.97) | (2.32) | (-0.11) |
| Total Enterprise Value | | | 0.00 | 0.00 | 0.00 |
| | | | (-0.74) | (-2.86) | (-0.76) |
| Return on Equity % | 0.01 | 0.01 | -0.01 | 0.00 | -0.01 |
| | (1.95) | (3.45) | (-2.62) | (0.71) | (-3.27) |
| Net Income Margin % | 0.02 | | 0.01 | 0.01 | 0.01 |
| | (1.74) | | (0.82) | (0.64) | (1.51) |
| EBITDA Margin % | 0.03 | 0.03 | -0.01 | 0.08 | -0.04 |
| | (1.81) | (2.15) | (-0.49) | (5.86) | (-3.13) |
| Return on Assets % | | | 0.39 | | 0.38 |
| | | | (12.35) | | (12.36) |
| Age*family | | 0.00 | | -0.02 | -0.01 |
| | | (0.09) | | (-1.87) | (-2.24) |
| Employees*Family | | 0.00 | | 0.00 | 0.00 |
| | | (-0.41) | | (-1.27) | (-0.40) |
| Market Cap* Family | | | 0.00 | 0.00 | 0.00 |
| | | | (-2.09) | (1.11) | (-0.22) |
| Revenue* Family | | | | 0.00 | |
| | | | | (-1.20) | |
| EV* Family | | | | | 0.00 |
| | | | | | (-0.33) |
| ROE* Family | | | -0.01 | 0.01 | 0.01 |
| | | | (-1.14) | (1.26) | (1.03) |
| NI Margin* Family | | | | 0.00 | |
| | | | | (0.03) | |
| EBITDA Margin* Family | | | | -0.09 | |
| | | | | (-2.13) | |
| ROA* Family | | | | | -0.12 |
| | | | | | (-1.91) |
| Industry Dummy Included | Yes | Yes | No | No | No |
| R-Square | 0.81 | 0.81 | 0.84 | 0.77 | 0.87 |

Note: T-statistics appear in parentheses below coefficients

**Table 6 - Z''-Score Regression Summary**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Family Dummy | 0.05 | 0.66 | 1.11 | 4.81 | 3.75 |
| | (0.13) | (0.63) | (2.97) | (3.88) | (3.64) |
| Age of Firm | 0.00 | 0.00 | | 0.01 | 0.01 |
| | (-0.62) | (-0.29) | | (3.66) | (3.82) |
| Number of Employees | 0.00 | 0.00 | | 0.00 | 0.00 |
| | (-0.88) | (-0.84) | | (0.78) | (-0.00) |
| Market Capitalization | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | (0.49) | (0.97) | (-0.62) | (-0.01) | (0.56) |
| Total Revenue | 0.00 | | 0.00 | 0.00 | 0.00 |
| | (-0.04) | | (1.23) | (1.00) | (-0.87) |
| Total Enterprise Value | | | 0.00 | 0.00 | 0.00 |
| | | | (0.07) | (-1.32) | (0.35) |
| Return on Equity % | 0.00 | 0.01 | -0.01 | 0.00 | -0.02 |
| | (0.72) | (2.09) | (-2.32) | (-0.26) | (-2.85) |
| Net Income Margin % | 0.03 | | 0.01 | 0.01 | 0.02 |
| | (2.00) | | (0.85) | (0.71) | (1.30) |
| EBITDA Margin % | 0.05 | 0.06 | 0.02 | 0.11 | -0.02 |
| | (2.12) | (3.37) | (1.11) | (5.64) | (-0.83) |
| Return on Assets % | | | 0.37 | | 0.38 |
| | | | (7.61) | | (7.59) |
| Age*family | | -0.01 | | -0.03 | -0.02 |
| | | (-0.61) | | (-2.40) | (-2.45) |
| Employees*Family | | 0.00 | | 0.00 | 0.00 |
| | | (0.33) | | (-0.79) | (0.22) |
| Market Cap* Family | | | 0.00 | 0.00 | 0.00 |
| | | | (-1.97) | (0.78) | (-0.24) |
| Revenue* Family | | | | 0.00 | |
| | | | | (-0.69) | |
| EV* Family | | | | | 0.00 |
| | | | | | (-0.30) |
| ROE* Family | | | 0.00 | 0.03 | 0.03 |
| | | | (0.30) | (1.88) | (2.06) |
| NI Margin* Family | | | | 0.02 | |
| | | | | (0.42) | |
| EBITDA Margin* Family | | | | -0.13 | |
| | | | | (-2.37) | |
| ROA* Family | | | | | -0.20 |
| | | | | | (-1.88) |
| Industry Dummy Included | Yes | Yes | No | No | No |
| R-Square | 0.74 | 0.74 | 0.73 | 0.70 | 0.77 |

Note: T-statistics appear in parentheses below coefficients

**Table 7 - Sample Summary**

| | 2004 | 2006 | 2008 | Total |
|---|---|---|---|---|
| **Number of Companies** | 55 | 44 | 123 | 222 |
| **Family Ownership** | | | | |
| **Family Companies (%)** | **32.7% **** | **43.2%** | **45.5%** | **41.9%** |
| Family Insider (%) | 32.7% | 43.2% | 42.3% | 40.1% |
| Family Blockholder (%) | 12.7% | 29.5% * | 18.7% | 19.4% |
| Both Insider and Blockholder (%) | 12.7% | 29.5% ** | 15.4% | 17.6% |

Note: significance levels of the difference from the 2008 family/non-family ratio are denoted with asterisks: *=10%, **=5%, ***=1%

**Table 8 - Descriptive Statistics**

| | 2004 | 2006 | 2008 | Total |
|---|---|---|---|---|
| **Age** | | | | |
| Average Age (All Companies) | 24.5 | 23.6 | 24.6 | 24.4 |
| Average Age (Non-Family Companies) | 27.8 | 23.3 | 30.4 | 28.3 |
| Average Age (Family Companies) | 17.8 | 24.0 | 17.6 | 19.0 |
| Difference (non family-family) | 10.0 | -0.7 | 12.8 | 9.3 |
| T-Test | 1.9 | 0.7 | 2.7 | 2.9 |
| *P-Value* | *0.06* | *0.46* | *0.01* | *0.00* |
| | | | | |
| **Employees** | | | | |
| Average Number of Employees (All Companies) | 1,060 | 955 | 2,032 | 1,349 |
| Average Number of Employees (Non-Family Compan | 1242 | 1191 | 2530 | 1901 |
| Average Number of Employees (Family Companies) | 626 | 493 | 1145 | 911 |
| Difference (non family-family) | 616 | 698 | 1385 | 990 |
| T-Test | 1.2 | 1.3 | 1.4 | 1.6 |
| *P-Value* | *0.24* | *0.22* | *0.16* | *0.11* |
| | | | | |
| **Number of Companies** | **55** | **44** | **123** | **222** |

**Table 9 - Companies older than 10 years**

| | 2004 | 2006 | 2008 | Total |
|---|---|---|---|---|
| **Number of Companies** | 37 | 34 | 75 | 146 |
| **Family Ownership** | | | | |
| **Family Companies (%)** | **27.0%** | **44.1%** | **36.0%** | **35.6%** |
| Family Insider (%) | 27.0% | 44.1% | 34.7% | 34.9% |
| Family Blockholder (%) | 13.5% | 26.5% | 14.7% | 17.1% |
| Both Insider and Blockholder (%) | 13.5% | 26.5% | 13.3% | 16.4% |

Note: significance levels of the difference from the 2008 family/non-family ratio are denoted with asterisks: *=10%, **=5%, ***=1%

## REFERENCES


Anderson, R. and Reeb, D., 2003, Founding family ownership and firm performance: Evidence from the S&P 500, *Journal of Finance* 58, 1301–1329.

Anderson, R. and Reeb, D., 2004. Board composition: Balancing family influence in S & P 500 firms, *Administrative Science Quarterly*, 49: 209-229.

Anderson, R. and Reeb, D., 2009, R&D Spending and Capital Expenditure Decisions: The Influence of Ownership Structure, Working Paper.

Colli, A., 2003, The History of Family Business: 1850 to 2000. *Cambridge: Cambridge University Press*.

Deangelo, H., Deangelo, L., 2000, Controlling shareholders and the disciplinary role of corporate payout policy. *Journal of Financial Economics* 56, 153-207.

Dreux, D., 1990, Financing family business: Alternatives to selling out or going public, *Family Business Review*, 3, 225-243.

Gallo, M. A., 1994, Global perspectives on family businesses, Chicago: Loyola University, Family Business Centre.

Holderness, Clifford G., and Dennis P. Sheehan, 1988, The role of majority shareholders in publicly held corporations, *Journal of Financial Economics* 20, 317–346.

Ibrahim, A. B., & Ellis, W. H., 1994, Family business management: Concepts and practice, *Dubuque, IA: Kendall/Hunt*.

Martinez, J., 1994, Family business in Chile, *Family Business Network Newsletter*, No.9, p. 5.

Miller, K., 2005, Best of The Best, Newsweek Article

Owens, R., 1994, Australian family business, ethics, energy and long term commitment: The hallmarks of success, *Family Business Network Newsletter*, No. 9.

Shleifer, A. and Vishny, R., 1986, Large shareholders and corporate control, *Journal of Political Economy* 94, 461–488.

Suranjita Mukherjee, & Dr. Carol Padgett, 2005, Investment Reputation Index: family firms vs. non-family firms in the UK, *ICMA Centre Discussion Papers in Finance* DP2005-15.

Villalonga, B., Amit, R., 2006. How do Family Ownership, Control, and Management Affect Firm Value? *Journal of Financial Economics* 80, 385-417.

Villalonga, B., Amit, R., 2009, How Are U.S. Family Firms Controlled? *Review of Financial Studies* 22, no. 8: 3047–3091.

# An Examination of the Value of Covenant Lite Debt to Issuing Companies

Michael N. Reczek

The Leonard N. Stern School of Business
Glucksman Institute for Research in Securities Markets
Faculty Advisor: David Yermack
April 1, 2010

## I. INTRODUCTION

The economic boom that peaked in the first half of 2007 was marked by seemingly limitless optimism. Academic reflections and criticisms frequently point to such representative examples as Tishman Speyer Properties' $5.4 billion purchase of Stuyvesant Town and Peter Cooper Village or the perplexing ratings of collateralized debt obligations. Another fascinating, albeit less frequently discussed, illustration of financial exuberance was the rapid escalation of first-lien covenant lite loan issuances and the corresponding valuation by secondary-market purchasers. For example, in May 2007 the average bid price for covenant lite leveraged loans was within 0.01 cents of the average bid price for all other first-lien leveraged loans, indicating that secondary-market investors attached essentially zero value to the existence of maintenance covenants.[1]

Of the literature that does exist with respect to covenant lite loan issuances, much of it contemplates the topic from the perspective of the lenders (banks). This paper will attempt to present the opposite point of view and identify four potential sources of future value that first-lien covenant lite debt provides to the borrower: (1) the value of eliminating interest ratcheting and forbearance fees to waive maintenance covenant violations; (2) the opportunity for the borrower to repurchase covenant lite debt at lower prices than if it had issued traditional first-lien debt; (3) the ability to delay bankruptcy and the associated restructuring costs; and (4) the opportunity to extend the above advantages by means of debt reinstatement. In order to mitigate the abstractness of the topic, this paper will examine two hypothetical companies that received debt financing in early 2007: one which procured covenant lite first-lien bank debt and the other whose bank debt featured traditional maintenance covenants. We will assume that each

[1] "Average Bid of Leveraged Loans." Chart. *Standard and Poor's LCD and S&P/LSTA Leveraged Loan Index.* Standard & Poor's Financial Services LLC (S&P), 2009.

company's financial performance fell outside levels specified by the latter's covenants at the end of 2008.

## II. BACKGROUND

### *II.1 What is First-Lien Covenant Lite Bank Debt?*

Broadly speaking, a loan of this nature can be broken down into three points of characterization: (1) bank debt, (2) first-lien, and (3) covenant lite.

***Bank Debt***: As its name suggests, bank debt is a form of debt financing in which a banking institution is the lender. Bank debt facilities are comprised of a term loan, a revolving credit facility, or some combination of the two.[2] The entirety of a term loan is funded upfront, with payments of principal permanently reducing the balance.[3] Term loans typically amortize over the life of the loan, requiring the borrower to pay off principal (in addition to interest) at an agreed upon schedule. Frequently, term loans only partially amortize so that there remains a significant principal balance (a balloon payment) due at the end. At this point, the borrower can choose to pay off the remaining principal with its own funds or refinance the loan with new debt. A revolving credit facility, on the other hand, lacks a defined repayment schedule. Revolving credit facilities are "generally structured to finance the borrower's working capital needs."[4] Draw down, or the maximum borrowing potential, at any given point is typically defined by a borrowing base formula which takes into account the liquidation value of the collateral and is capped at the maximum borrowing capacity stipulated by the loan agreement.[5]

***First-Lien***: First-lien debt is the most senior security in a company's capital structure. While there are specific exceptions, the absolute priority rule generally dictates that in the event

[2] Moyer, Stephen G. *Distressed Debt Analysis: Strategies for Speculative Investors*. Boca Raton, Fla.: J. Ross, 2005. 306. Print.
[3] *Id.*
[4] *Id.*
[5] *Id.*

of a bankruptcy, creditors receive payment for their claims in accordance with the seniority of the securities they hold. That is, first-lien bank creditors receive payment in full prior to second-lien creditors, unsecured creditors, and equity shareholders receiving any payment. By definition, first-lien debt is secured by all or some of a borrower's assets. The credit agreement specifies which assets serve as collateral for the debt.

***Covenant Lite***: Covenants refer to the contractual obligations in the credit agreement that set forth specific standards of future conduct and performance for the borrower.[6] Affirmative covenants require that the borrower take certain actions or meet minimum performance levels while negative covenants prohibit the borrower from taking certain actions or exceeding maximum threshold levels.[7] Although covenants may cover everything from compliance with laws to maintaining insurance,[8] this paper focuses on financial covenants – those covenants which dictate minimum and maximum financial performance levels.

Financial covenants can be further broken down into maintenance covenants and incurrence covenants.[9] Maintenance covenants are financial covenants that must be met on an ongoing basis throughout the term of a loan (e.g., quarterly) while incurrence covenants are only effective if and when the borrower performs a specified action (such as increases debt or acquires another company).[10] Standard & Poor's defines covenant lite loans as those which feature incurrence covenants but have no maintenance covenants ("pure" covenant lite) and extends consideration to loans which have maintenance covenants that are "effectively meaningless" because the "headroom exceeds the normal market standard," thus making a

[6] Paglia, John K. "An Overview of Covenants in Large Bank Loans." *RMA Journal* (Mar. 2002). *BNET*. Web. 7 Mar. 2010.
[7] Wise, J. Eric. "Banking and Finance Market Snapshot: A Beginner's Guide to Thinking about Covenants." Kramer Levin Naftalis & Frankel LLP, Dec. 2006. Web. 8 Mar. 2010.
[8] *Id.*
[9] Wise, "Banking and Finance Market Snapshot: A Beginner's Guide to Thinking about Covenants."
[10] Lai, Ana, and Steven M. Bavaria. *The Leveraging Of America: Covenant-Lite Loan Structures Diminish Recovery Prospects.* Rep. Standard & Poor's, 18 July 2007. Web. 8 Mar. 2010.

technical default highly unlikely even if the borrower's operating performance deteriorates.[11] This is the definition that shall be used for this paper, though it should be noted that others may prefer to adopt a broader definition of covenant lite so as to allow a maximum of one or two financial maintenance covenants.[12]

### *II.2 The Rise of First-Lien Covenant Lite Bank Debt*

As investors' appetites for loans grew in 2006 and early 2007, the market became flooded with available cash. Aptly stated in a December 2006 Bloomberg news article, "[s]o much money is available that investors are lowering their standards."[13] This idea of lowered standards ultimately manifested itself in the form of increased covenant lite debt issuances. With the default rate of *speculative-grade* debt at a mere 2% at the end of 2006,[14] creditors remained optimistic that they would continue to collect on their covenant lite debt.

Although covenant lite debt had been available to borrowers for many years, the number of issuances in 2007 dwarfed that of the preceding decade. From 1997 through 2006, a total of $32 billion in covenant lite loans were issued,[15] with approximately three-quarters of that coming from 2006.[16] In the first 6 months of 2007, covenant lite volume exploded to $97 billion.[17] This represented 32% of all loan issuances for the period (as compared to 8% for the comparable period in the year prior).[18] An even more staggering statistic is that covenant lite

---

[11] *Id.*
[12] Deutsche Bank AG, London Branch. "Memorandum Submitted by Deutsche Bank." *www.parliament.uk*. United Kingdom Parliament, 22 Aug. 2007. Web. 08 Mar. 2010. <http://www.publications.parliament.uk/pa/cm200607/cmselect/cmtreasy/567/567we40.htm>.
[13] Rubinroit, Harris. "Bank Loans Lure KKR, Carlyle with Junk-Bond Returns (Update2)."*Bloomberg.com*. Bloomberg L.P., 27 Dec. 2006. Web. 25 Mar. 2010.
[14] *Id.*
[15] Rubinroit, Harris, and Darrell Hassler. "Goldman, Lee Stymied as Investors Jettison Covenants (Update1)." *Bloomberg.com*. Bloomberg L.P., 9 May 2007. Web. 8 Mar. 2010.
[16] Lai, Ana, and Steven M. Bavaria. *The Leveraging Of America: Covenant-Lite Loan Structures Diminish Recovery Prospects.*
[17] *Id.*
[18] *Id.*

loans represented almost one-fifth of all bank debt outstanding at their peak, up from a mere 1% at the beginning of 2006.[19] Unfortunately for borrowers, the abundant availability of covenant lite loans abruptly came to an end as market conditions weakened in the latter half of 2007.

## III. ANALYSIS

As previously noted, this paper will explore the value of covenant lite first-lien debt to borrowers in the context of two hypothetical companies: CovCo and CovLite. Each featured an enterprise value of $1 billion[20] and borrowed $500 million in first-lien bank debt[21] on January 1, 2007 (so as to approximate a typical LBO deal in 2006 or early 2007). CovCo's credit agreement included standard affirmative maintenance covenants defining the minimum current ratio, minimum net working capital, minimum interest coverage ratio, and minimum net worth, as well as negative maintenance covenants denoting a maximum debt/worth ratio, maximum total debt, maximum capital expenditures, and maximum dividends.[22] Antithetically, maintenance covenants were completely absent from CovLite's credit agreement.

### *III.1 The Value of Eliminating Maintenance Covenant Violations*

By the end of 2008, CovCo and CovLite experienced a significant decline in revenue as market conditions worsened. The two companies' EBITDA to interest expense ratio slipped below levels deemed acceptable by CovCo's affirmative maintenance covenant. The result was

[19] Lattman, Peter. "'Covenant-Lite' Loans Face Heavy Hits." *WSJ.com*. The Wall Street Journal, 18 Mar. 2009. Web. 8 Mar. 2010.
[20] Grocer, Stephen. "August: Month of the Shrinking Deal." *WSJ.com*. The Wall Street Journal, 11 Sept. 2007. Web. 8 Mar. 2010.
[21] Blaydon, Colin, and Fred Wainwright. "The Balance Between Debt and Added Value." *FT.com*. The Financial Times Ltd., 28 Sept. 2006. Web. 8 Mar. 2010.
[22] Strischek, Dev. "Coming to Terms with Financial Covenants." *RMA Journal* (June 2007). *BNET*. Web. 7 Mar. 2010.

that CovCo was in technical default of its credit agreement while CovLite could continue to conduct business as usual without interference from its lenders.

Credit agreements typically state that the borrower's violation of any covenant allows the bank to accelerate the maturity of the loan.[23] In practice, however, the bank and the borrower frequently reach a compromise in the form of an amended agreement. Given the powerful negotiating leverage that covenants afford the lender, the absence of maintenance covenant violation penalties encompasses the most direct and tangible value to covenant lite borrowers. In order to produce a *baseline* quantification of this value, data was collected on 31 instances of interest ratcheting on senior credit facilities in 2008 and 2009. For the purposes of selecting the data, only instances in which there was an explicitly stated change of interest (such as from prime + 300 bps to prime + 500 bps) were used. Credit agreement amendments which made less transparent modifications to the interest rate (such as changing the definition of "Base Rate" or swapping LIBOR for prime) were not used. Revolvers and term loans of the same borrower were considered separately. Public filings (predominantly 10-Qs and 10-Ks), news articles, and company press releases were utilized to obtain all information relating to this analysis.

The results indicate that interest ratcheting arises from one of three circumstances: (1) a borrower is in technical default for violating one or more covenants and a default rate of interest becomes effective in accordance with the credit agreement, (2) a borrower is in technical default for violating one or more covenants and receives a waiver from the lender in exchange for an increased interest rate and perhaps other forms of consideration, or (3) a borrower anticipates that it will be in technical default for violating one or more covenants and negotiates with the lender to prospectively avoid the violation. On average, the above events result in an increase in the interest rate of 194.44 bps, with increases ranging from 50 bps to 450 bps (see Exhibit 1).

[23] *Id.*

However, as noted, this represents only a *baseline* cost to violating borrowers. In addition, they are frequently required to consent to additional covenants (though, some requirements and restrictions are reduced so as to preclude the borrower's immediate violation upon signing the amendment or forbearance agreement), pay forbearance fees, or pay down a portion of the loan's principal. In some cases, these additional costs are quite substantial. For instance, forbearance fees generally range from 0.25% to 2.00% of the loan balance.[24]

### *III.2 The Opportunity for the Borrower to Repurchase Covenant Lite Debt at Lower Prices than if it had Issued Traditional First-Lien Debt*

At the time the hypothetical loans were signed, the average bid price for covenant lite loans on the secondary market was actually about 0.2 cents on the dollar *higher* than the average bid price for all other first-lien leveraged loans.[25] This was an entirely counterintuitive and irrational (but also short-lived) phenomenon. It meant that investors were willing to pay more for covenant lite first-lien debt (100.29 cents on the dollar as of 12/29/2006) than otherwise comparable first-lien debt featuring traditional maintenance covenants (100.10 cents on the dollar).[26] From the beginning of 2006 through June 2007, the average bids for covenant lite debt and all other first-lien debt stayed within 0.4 cents of each other.[27] However, in the months and years that followed, as realization set in that covenant lite could mean drastically reduced recoveries for the ultimate holder of the debt, the spread between average bids continued to fluctuate in accordance with market conditions but consistently in favor of the traditional first-lien variety (see Exhibit 2).

---

[24] Solomon, Jordan S. "Negotiating Forbearance Agreements." *www.gibbonslaw.com*. Gibbons P.C., 7 Apr. 2009. Web. 09 Mar. 2010.
[25] "Average Bid of Leveraged Loans." Chart. *Standard and Poor's LCD and S&P/LSTA Leveraged Loan Index.* Standard & Poor's Financial Services LLC (S&P), 2009.
[26] *Id.*
[27] *Id.*

Let's imagine that CovCo and CovLite desired to buy back $250 million of their bank debt (face value) on the secondary market at the beginning of 2009 in order to reduce ongoing interest payments and avoid bankruptcy. CovLite would spend about $21 million less than CovCo on account of the difference in trading values. This would have represented a cost savings equivalent to 2.11% of CovLite's original enterprise value.

Table 1: Hypothetical January 2009 Debt Repurchase ($250 Million Face Value)

| | **CovCo** | **CovLite** |
|---|---|---|
| **Average Bid (1/2/2009)**[28] | **65.7902¢** | **57.3310¢** |
| **Cost to Company** | **$164,475,500.00** | **$143,327,500.00** |

While this would appear to be a simple choice for a wide range of companies with bank debt trading at cheap prices, there are actually a host of legal and tax considerations involved that may preclude the company, or even the private equity sponsor,[29] from repurchasing loans on a secondary market. In general, the ability for a borrower to repurchase its own debt in this fashion should not be considered an automatic right.[30] The borrower may be required to amend the credit agreement (which may entail amendment fees), as was the case with Citadel Broadcasting and Harrah's Entertainment, or seek lender consent.[31]

### *III.3 The Present Value of Delaying Restructuring Costs*

A primary argument for the inclusion of maintenance covenants is their ability to safeguard the interests of the lender. The requirements and restrictions set forth an expectation of performance that a borrower must meet. A covenant violation, which leaves the borrower in technical default, allows the lender to accelerate the loan and potentially force the borrower into

[28] *Id.*
[29] "Private Equity Investments in Portfolio Company Debt: An Overview of Legal Issues." *Simpson Thacher's Client Memorandum* (13 Feb. 2009). *www.simpsonthacher.com*. Simpson Thacher & Bartlett LLP. Web. 9 Mar. 2010.
[30] Razin, Ely. "Credit Terms: Loan Buyback? Bring Out The Vote." Web. *WestlawBusiness.com*. Thomson Reuters, 27 May 2009. Web. 9 Mar. 2010.
[31] *Id.*

bankruptcy. This is an immensely powerful bargaining chip for the lender. Recall earlier that CovCo violated its interest coverage ratio covenant at the end of 2008. Instead of amending the credit agreement, let's now imagine that CovCo's lender decided to accelerate the loan. Given its poor financial condition and the illiquidity of the credit market at the time, CovCo was unable to come up with the capital to pay off the loan in its entirety and was forced into bankruptcy.

A comprehensive study on chapter 11 bankruptcy fees found that large debtors (averaging about $1.2 billion in assets plus debts) pay fees equivalent to 4.53% of their assets and debts for a corporate reorganization.[32] Assuming that this number for CovCo was $1 billion at the time of bankruptcy, it would have paid out $45.3 million in total fees and expenses. CovLite, though in a similarly precarious financial position, was able to continue in the ordinary course of business as long as it could make the required debt service payments. Even if it could only manage this for one additional year and assuming a discount rate of 7%, the present value of that delay in restructuring costs would have been worth more than $3 million. This savings would have been further augmented by the present value of delaying or mitigating intangible costs (damage to reputation, damage to relationships with suppliers and customers, etc.).

### *III.4 The Opportunity to Extend the Aforementioned Advantages Via Debt Reinstatement*

The ability to avoid technical default and delay bankruptcy confers additional benefits to CovLite beyond what the previous present value calculation suggests. In cases where the act of filing for bankruptcy constitutes the sole reason for default (that is, the debtor is up to date on all interest and principal payments and is not in breach of a loan's covenants), a debtor may seek to

[32] *Lubben, Stephen J.* "Corporate Reorganization & Professional Fees." 82 Am. Bankr. L.J. 77 (2008).

"reinstate" its senior loans[33] under §1124 of the Bankruptcy Code[34] against the wishes of those lenders. This means that a borrower with covenant lite debt is more likely to have this option than one subject to traditional maintenance covenants. Debt reinstatement allows a debtor to preserve the entirety of the secured debt (its interest rate, term, covenants, etc.) rather than seek then-current market terms, but only if "the lenders' legal and equitable rights would be unaffected after the bankruptcy case and that all defaults would be cured by the plan's effective date, i.e., the lenders would have the full benefit of their prepetition bargain notwithstanding the intervening bankruptcy."[35]

Given the time cushion that the absence of maintenance covenants provided for CovLite, it had much greater flexibility in choosing to file for bankruptcy prior to being in technical default. This option can yield substantial cost savings for the debtor. For example, in late 2009 Charter Communications Inc. was allowed to reinstate its secured debt against the wishes of those lenders, thus preserving the below-market interest rate and saving the company approximately $500m annually in interest expenses.[36]

[33] Analysis Group. "Reinstatement and Bankruptcy Litigation: A Q&A with Affiliate Robert Grien and Managing Principal Maureen Chakraborty." *www.ag-inc.com*. Analysis Group. Web. 10 Mar. 2010.
[34] *Hedberg, Steven M.* "Reinstatement: How Valuable is Below-Market Secured Debt? A Closer Look at 'In Re: Charter Communications.'" *Law.com*. ALM Media Properties, LLC, 5 Nov. 2009. Web. 10 Mar. 2010.
[35] *Id.*
[36] *Id.*

## IV. CONCLUSION

As this paper has shown, the value of covenant lite debt extends well beyond the avoidance of increased interest rates and one time fees resulting from covenant violations.

*Table 2: Traditional Debt versus Covenant Lite Debt - Summary*

| | **Traditional First-Lien Debt** | **Covenant Lite First-Lien Debt** |
|---|---|---|
| **Interest Ratcheting** | Companies face an average interest rate increase of 194.44 bps for financial maintenance covenant violations (or in anticipation of such violations). This is often accompanied by one-time forbearance fees, mandatory principal repayments, and/or other amendments to the loan agreement. | Maintenance covenants are absent from the loan agreement. Therefore, these costs are not applicable to covenant lite borrowers. |
| **Debt Repurchase** | As of 01/15/2010, the average bid price for traditional first-lien leveraged loans on the secondary market was 93.24 cents on the dollar. [37] | As of 01/15/2010, the average bid price for covenant lite first-lien leveraged loans on the secondary market was 91.19 cents on the dollar. Average bids for covenant lite debt have remained lower than traditional debt bids since mid-2007. [38] |
| **Bankruptcy Timing** | Maintenance covenants increase the likelihood that a borrower will find itself in technical default, allowing the lender to accelerate the maturity of the loan and potentially force the borrower into bankruptcy. On average, corporate reorganizations will cost large debtors 4.53% of assets plus debts in total fees and expenses.[39] | The absence of maintenance covenants increases a borrower's ability to delay (or potentially avoid) bankruptcy. The present value of delaying reorganization costs can be quite substantial. |
| **Debt Reinstatement** | Debt reinstatement is not an option where the debtor is in breach of the loan's covenants. | The absence of maintenance covenants provides a borrower additional flexibility in entering bankruptcy prior to being in technical default. This leaves open the possibility of debt reinstatement to preserve a loan's favorable interest rate and covenant lite status. |

CovLite, much like many of the companies that were fortunate enough to borrow covenant lite first-lien bank debt in 2006 and 2007, was additionally presented with a variety of very powerful

[37] "Average Bid of Leveraged Loans." Chart. *Standard and Poor's LCD and S&P/LSTA Leveraged Loan Index.* Standard & Poor's Financial Services LLC (S&P), 2009.
[38] *Id.*
[39] *Lubben, Stephen J.* "Corporate Reorganization & Professional Fees." 82 Am. Bankr. L.J. 77 (2008).

options. Depending on the state of the market (and subject to the various other considerations previously discussed), it could have chosen to repurchase its own debt at a price significantly lower than if it had traditional bank debt. In the event that bankruptcy was imminent, CovLite had improved flexibility in delaying the costs associated with the reorganization and pursuing debt reinstatement as an option. Overall, these benefits not only provide real, quantifiable cost savings to a covenant lite borrower, but also allow management to focus on an effective long-term corporate strategy without disruption from short-term covenant requirements and restrictions.

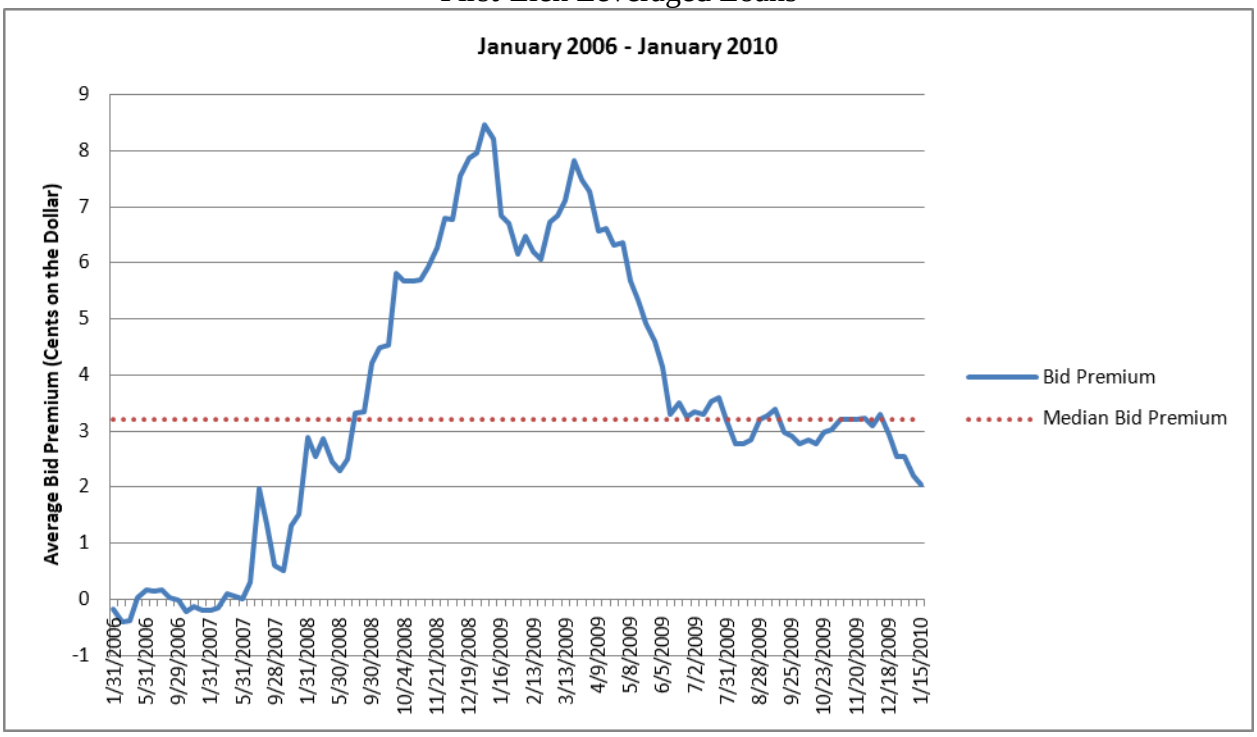
Despite the adverse implications of covenant lite lending, banks in 2010 appear to be warming up to the idea once again. In January 2010, Hexion Specialty Chemicals was allowed to refinance its existing covenant-lite debt without adding restrictions.[40] As of March 2010, Lyondell Chemical Co.'s chapter 11 exit financing package includes a $500 million covenant lite term loan.[41] Prospective borrowers should remain cognizant of the potential sources of value attributable to covenant lite bank debt and negotiate against maintenance covenants accordingly.

[40] Greene, Katherine. "Cov-Lite Loans Make a Return: High Demand as Lyondell Pares Yield; Skittish No More?" *WSJ.com.* The Wall Street Journal, 26 Mar. 2010. Web. 26 Mar. 2010.
[41] *Id.*

Exhibit 1: Interest Rate Increases in Response to (or in Anticipation of) Covenant Violations

| | |
|---|---|
| **Sample Size** | **31** |
| **Average Increase** | **194.44 bps** |
| **Median** | **200 bps** |
| **High** | **450 bps** |
| **Low** | **50 bps** |
| **Standard Deviation** | **106.36 bps** |
| **Standard Error** | **19.10 bps** |

Exhibit 2: Average Bid Premium of Traditional First-Lien Leveraged Loans over Covenant Lite First-Lien Leveraged Loans*




*Derived from data provided by Miyer A. Levy of Standard & Poor's LCD (Source: Standard & Poor's LCD and S&P/LSTA Leveraged Loan Index). Data excludes all facilities in default.

**ACKNOWLEDGMENTS**

I would like to thank my Glucksman faculty advisor, Professor David Yermack, for his time and helpful advice. I would also like to thank Steven Miller and Miyer Levy at Standard & Poor's Leveraged Commentary & Data for providing data necessary to complete my research.

**REFERENCES**

Analysis Group. "Reinstatement and Bankruptcy Litigation: A Q&A with Affiliate Robert Grien and Managing Principal Maureen Chakraborty." *www.ag-inc.com*. Analysis Group. Web. 10 Mar. 2010.

"Average Bid of Leveraged Loans." Chart. *Standard and Poor's LCD and S&P/LSTA Leveraged Loan Index*. Standard & Poor's Financial Services LLC (S&P), 2009.

Blaydon, Colin, and Fred Wainwright. "The Balance Between Debt and Added Value." *FT.com*. The Financial Times Ltd., 28 Sept. 2006. Web. 8 Mar. 2010.

Deutsche Bank AG, London Branch. "Memorandum Submitted by Deutsche Bank." *www.parliament.uk*. United Kingdom Parliament, 22 Aug. 2007. Web. 08 Mar. 2010. <http://www.publications.parliament.uk/pa/cm200607/cmselect/cmtreasy/567/567we40.htm>.

Greene, Katherine. "Cov-Lite Loans Make a Return: High Demand as Lyondell Pares Yield; Skittish No More?" *WSJ.com*. The Wall Street Journal, 26 Mar. 2010. Web. 26 Mar. 2010.

Grocer, Stephen. "August: Month of the Shrinking Deal." *WSJ.com*. The Wall Street Journal, 11 Sept. 2007. Web. 8 Mar. 2010.

*Hedberg, Steven M.* "Reinstatement: How Valuable is Below-Market Secured Debt? A Closer Look at 'In Re: Charter Communications.'" *Law.com*. ALM Media Properties, LLC, 5 Nov. 2009. Web. 10 Mar. 2010.

Lai, Ana, and Steven M. Bavaria. *The Leveraging Of America: Covenant-Lite Loan Structures Diminish Recovery Prospects*. Rep. Standard & Poor's, 18 July 2007. Web. 8 Mar. 2010.

Lattman, Peter. "'Covenant-Lite' Loans Face Heavy Hits." *WSJ.com*. The Wall Street Journal, 18 Mar. 2009. Web. 8 Mar. 2010.

*Lubben, Stephen J.* "Corporate Reorganization & Professional Fees." 82 Am. Bankr. L.J. 77 (2008).

Moyer, Stephen G. *Distressed Debt Analysis: Strategies for Speculative Investors*. Boca Raton, Fla.: J. Ross, 2005. 306. Print.

Paglia, John K. "An Overview of Covenants in Large Bank Loans." *RMA Journal* (Mar. 2002). *BNET*. Web. 7 Mar. 2010.

"Private Equity Investments in Portfolio Company Debt: An Overview of Legal Issues." *Simpson Thacher's Client Memorandum* (13 Feb. 2009). *www.simpsonthacher.com*. Simpson Thacher & Bartlett LLP. Web. 9 Mar. 2010.

Razin, Ely. "Credit Terms: Loan Buyback? Bring Out The Vote." Web. *WestlawBusiness.com*. Thomson Reuters, 27 May 2009. Web. 9 Mar. 2010.

Rubinroit, Harris, and Darrell Hassler. "Goldman, Lee Stymied as Investors Jettison Covenants (Update1)." *Bloomberg.com*. Bloomberg L.P., 9 May 2007. Web. 8 Mar. 2010.

Rubinroit, Harris. "Bank Loans Lure KKR, Carlyle with Junk-Bond Returns (Update2)."*Bloomberg.com*. Bloomberg L.P., 27 Dec. 2006. Web. 25 Mar. 2010.

Solomon, Jordan S. "Negotiating Forbearance Agreements." *www.gibbonslaw.com*. Gibbons P.C., 7 Apr. 2009. Web. 09 Mar. 2010.

Strischek, Dev. "Coming to Terms with Financial Covenants." *RMA Journal* (June 2007). *BNET*. Web. 7 Mar. 2010.

Wise, J. Eric. "Banking and Finance Market Snapshot: A Beginner's Guide to Thinking about Covenants." Kramer Levin Naftalis & Frankel LLP, Dec. 2006. Web. 8 Mar. 2010.

# Effects of Equity Financing on Valuation of Junior Gold Mining Companies in Recessionary and Post-Recessionary Economic Realities of 2008-2010

Denis Cranstoun

The Leonard N. Stern School of Business

Glucksman Institute for Research in Securities Markets

Faculty Advisor: Aswath Damodaran

April 1, 2010

## I. INTRODUCTION

While classification of gold mining companies can be somewhat ambiguous, PDAC [Prospectors and Developers Association of Canada] (2009), one of the preeminent authorities in mining, provides the following description: "Mining companies are defined largely by the way in which they derive their revenues. A senior producer or operator generates its revenues from the production and sale of the commodity it is mining. A junior mining company has no mining operations and is essentially a venture capital company. It must rely almost entirely on the capital markets to finance its exploration activities. There is another category: mid-tier producers. These are generally junior companies that have decided to go into production on properties that they have discovered" (¶ 2).

From the financial markets viewpoint, there are certain drawbacks and advantages to being a junior gold miner as opposed to a well-diversified mining company. On one hand, junior miners exploring purely/predominantly for gold enjoy a lower discount rate (i.e., lower cost of capital) due to lower asset beta, stand to capture the upside of the increase in gold price (if unhedged), can exercise downside protection with ease (by having to hedge exposure to one liquidly traded metal) and have a revenue stream which is somewhat inflation-protected. On the other hand, juniors have to rely solely on external sources of financing (which, as the last two years have demonstrated, can tighten rapidly), face the threat of drops in gold prices if unhedged and do not enjoy the diversification of exposure to a variety of metals which are not always perfectly correlated.

Industry insiders have suggested that the recent credit crunch has disproportionately affected junior gold miners' ability to draw on capital markets financing, an activity which is essential to their ongoing operations as per PDAC. "Few have been harder hit by the global

recession than the small miners and explorers that depend so much on external financing to survive until they can discover the mineral troves that can be sold on to bigger players" (Jordan, 2009, ¶ 2). Since the rock bottom of the crisis [defined *for purposes of this research* as the period commencing in August of 2008 with events leading up to Chapter 11 bankruptcy filing by Lehman Brothers on September 15, 2008 and lasting through present day] the number of public and private placements has shrunk considerably (aggregate Capital IQ data). According to Haywood Securities Mining Team (2008), "companies [were] faced with near-term financing requirements complicated by uncertain access to affordable equity given current capital market conditions" (p. 8) at that time.

Policies of fiscal easing put in place by major Western economies in an effort to overcome the recent credit crunch resulted in a gradually swelling monetary base chasing a steady supply of physical goods. This made inflation – if not immediately then in the near future – likely. Coupled with the weakening U.S. dollar, this boosted the outlook for the price of gold, the traditional physical haven for investors in time of inflation (Gold Stock Strategist, 2009, ¶ 8).

Thus it appeared that junior gold miners, as part of the broader gold market, found themselves in a favorable position to raise the financing. Furthermore, they stood to capture the premium – compared to the same peer group of companies in the past – that investors would now be willing to pay based on the expected increase in the value of the physical gold underground. An opinion by Money Morning Staff supported this viewpoint: "[I]nformed investors know that hard assets, and tangible natural resources, have always provided the best protection against the ravages of the U.S. Treasury's printing press" (2009, ¶ 30).

Increased inflationary pressures and positive gold price outlook also increased demand on the investor side, and with limited supply of established gold producers, explorers and pre-

producers that did not have access to capital markets in the past were increasingly able to raise financing. “Investors are courageously committing capital, especially in return for unsecured common shares, clearly expecting healthy returns in the coming years” (Money Morning Staff, 2009, ¶ 27).

Analysis of professional literature suggests the following levers via which capital raising may affect value of junior gold mining firms:

1) Certainty of Production–“[junior miners] with promise of near-term gold production..have the best shot at accessing capital” (Money Morning Staff, 2009, ¶ 20)
2) Time Management–miners believe time is of the essence given uncertainty of future commodity prices and time value of money
3) Gold Prices–current fiscal policy of major industrial nations makes inflation likely. In such environment, gold prices historically grow, and there is a sense of urgency to produce in order to take advantage of the trend
4) Asset Preservation–the ability to raise cash ensures that the company will not have to resort to the sale of some of its valuable assets to develop others
5) ‘Chicken-or-Egg’ phenomenon–while raising cash enables companies to move closer to production, the closer you are to production already, the easier it is to raise cash – thus, equity issuance is in effect the market’s endorsement of pre-transaction viability

One more factor that is generally considered crucial to the value of a mining operation is the quality of management. If managers have a proven track record with other projects, the probability of their current undertaking being successful increases. While it is an industry standard to value gold explorers using NAV (Net Asset Value) of their reserves, recognized industry expert Dr. Victor Rudenno (2009) further suggests that “any increase in share price is not

so much a reflection of the additional reserves, but of management's ability to convert them into future earnings" (p. 284).

This industry review sets the stage for the investigation of what factors, if any, determine how the market puts value on equity issuance by junior gold miners. In its Junior Precious Metals Industry Comments, the Haywood Securities Mining Team (2008) succinctly describes projects that are sufficiently advanced to be in a first mover position 'when investor interest returns' as those which "are well funded, [have] seasoned management teams and attractive development stage projects" (p. 1). This study will attempt to analyze how features of an equity financing event such as dilution percentage, prior stock performance, warrant issuance, presence or absence of producing facilities and underwriters' domicile influence the magnitude of this effect.

## II. HYPOTHESIS

This study sets out to examine how factors such as dilution percentage, prior stock performance, warrant issuance, presence or absence of producing facilities and underwriters' domicile influence the market's valuation of junior gold mining companies upon announcement of equity issuance. Thus, the null hypothesis is that there is no statistically significant relationship between the change in the stock price (dependent variable) and each of the factors listed above (independent variables). This hypothesis will be tested via an empirical examination of the closing share price one day before and on the day of the announcement, and a multiple regression against the factors outlined above

## III. DATA SELECTION

### III.1 SAMPLE SELECTION

Data in this sample was gathered from Capital IQ database over the course of the research using the following **Screening Criteria**

- Primary Industry Classification: 'Gold Ores'
- Market Capitalization: $100 - $800 million *as of latest screening date*
- Listing: publicly listed on Major US Exchanges, LSE, TSX, TSXV, JSE
- Transactions: **public** (Common Stock, ADR Common Stock, Preferred Stock, Convertible Preferred Stock) *and* **private** (Convertible Equity, Rule 144A, Individual Investors Participated, Bought Deal, Registered Direct Offering, Equity Line, Pre-IPO)
- Time Frame: transactions *announced and closed* between 8/1/2008 and 3/30/10
- Benchmark Index: ARC:GDX index Market Vectors ETF Trust - Gold Miners ETF is an exchange traded fund launched and managed by Van Eck Associates Corporation. It invests in the public equity markets across the globe. The fund invests in stocks of companies operating in the gold mining sector. It invests in stocks of companies across all market capitalizations with market capitalizations greater than $100 million. The fund replicates the Amex Gold Miners Index by investing in companies of that index in approximately the same proportion. Market Vectors ETF Trust - Gold Miners ETF was founded on May 16, 2006 and is domiciled in the United States (Source: Capital IQ).

## III.2 SAMPLE

The sample for this study, compiled as per selection criteria above, includes firms which have *announced and closed* equity issuance transactions, both public and private, between August 1, 2008 and March 30, 2010. The sample has been further divided into two sub-samples:

1. Firms (33 total, market cap in the $101.2 - $759.1 mm range *as of transaction date*) which have entered into public transactions (42 total, total transaction value in the $2.1 - $135.8 range)

| Announced/Initial Filing Date (Including Bids and Letters of Intent) | Closed/Registration Effective Date | Target/Issuer | Exchange:Ticker | Closing SP D -1 | Closing SP D | SP Change | ARCA:GDX D -1 | ARCA:GDX D | GDX Change | Relative SP Change | Total Trans Value | Market Cap | Dilution (Trans Value/MarCap) | LTM Stock Return | LTM ARCA:GDX Return | Excess LTM SP Return | Warrants (Y/N) | Revenues on Issuance (Y/N) | Lead Underwriter Canadian |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02/17/2010 | 02/26/2010 | OceanaGold Corporation | ASX:OGC | 2.10 | 2.19 | 4.25% | 44.91 | 44.71 | -0.45% | 4.70% | 52.69 | 456.7 | 11.54% | 468.12% | 21.38% | 446.74% | 0 | 1 | 1 |
| 01/28/2010 | 02/11/2010 | B2gold Corporation | TSX:BTO | 1.24 | 1.19 | -4.19% | 42.77 | 42.17 | -1.40% | -2.79% | 23.7 | 419.0 | 5.66% | 141.24% | 30.68% | 110.57% | 0 | 1 | 1 |
| 01/14/2010 | 01/29/2010 | Brett Resources Inc. | TSXV:BBR | 2.14 | 2.28 | 6.76% | 48.86 | 48.60 | -0.53% | 7.29% | 24.47 | 208.9 | 11.71% | 382.59% | 73.26% | 309.33% | 0 | 0 | 1 |
| 01/13/2010 | 01/26/2010 | Premier Gold Mines Limited | TSX:PG | 4.04 | 3.89 | -3.71% | 48.35 | 48.86 | 1.05% | -4.76% | 30.17 | 362.2 | 8.33% | 200.59% | 63.79% | 136.80% | 0 | 0 | 1 |
| 01/11/2010 | 01/19/2010 | Guyana Goldfields Inc. | TSX:GUY | 7.93 | 7.85 | -0.91% | 49.84 | 50.17 | 0.66% | -1.57% | 67.34 | 419.5 | 16.05% | 378.49% | 72.16% | 306.33% | 0 | 0 | 0 |
| 12/03/2009 | 12/10/2009 | Golden Star Resources, Ltd. | AMEX:GSS | 4.23 | 4.19 | -0.95% | 54.78 | 53.53 | -2.28% | 1.34% | 75.0 | 759.1 | 9.88% | 713.46% | 127.68% | 585.78% | 0 | 1 | 1 |
| 11/20/2009 | 12/03/2009 | Avion Gold Corporation | TSXV:AVR | 0.44 | 0.39 | -12.11% | 51.10 | 50.82 | -0.55% | -11.56% | 19.01 | 176.7 | 10.76% | 1317.07% | 180.77% | 1136.30% | 0 | 0 | 1 |
| 11/17/2009 | 12/03/2009 | Keegan Resources Inc. | TSX:KGN | 5.98 | 5.91 | -1.07% | 51.34 | 51.53 | 0.37% | -1.44% | 34.2 | 226.0 | 15.13% | 952.54% | 161.14% | 791.40% | 0 | 0 | 1 |
| 11/13/2009 | 12/18/2009 | Allied Gold Ltd. | ASX:ALD | 0.39 | 0.38 | -2.77% | 48.44 | 49.78 | 2.77% | -5.54% | 135.78 | 286.6 | 47.38% | 171.79% | 123.64% | 48.15% | 0 | 1 | 1 |
| 11/11/2009 | 12/16/2009 | Regis Resources Limited | ASX:RRL | 0.48 | 0.56 | 16.79% | 49.66 | 49.90 | 0.48% | 16.31% | 23.55 | 270.2 | 8.72% | 814.41% | 129.49% | 684.92% | 0 | 0 | 0 |
| 11/11/2009 | 12/10/2009 | ST Barbara Ltd. | ASX:SBM | 0.33 | 0.33 | 0.00% | 49.66 | 49.90 | 0.48% | -0.48% | 113.87 | 477.8 | 23.83% | 122.42% | 129.49% | -7.07% | 0 | 1 | 0 |
| 11/09/2009 | 11/19/2009 | Exeter Resource Corporation | TSX:XRC | 5.75 | 5.95 | 3.35% | 47.62 | 49.28 | 3.49% | -0.14% | 46.9 | 545.0 | 8.61% | 255.32% | 105.70% | 149.62% | 0 | 0 | 1 |
| 11/03/2009 | 11/16/2009 | Andina Minerals, Inc. | TSXV:ADM | 1.68 | 1.81 | 8.06% | 42.88 | 46.18 | 7.70% | 0.36% | 23.91 | 161.0 | 14.85% | 127.70% | 104.09% | 23.61% | 1 | 0 | 1 |
| 10/29/2009 | 12/04/2009 | Troy Resources NL | ASX:TRY | 2.22 | 2.21 | -0.70% | 41.87 | 43.80 | 4.61% | -5.31% | 22.79 | 169.5 | 13.45% | 232.55% | 100.72% | 131.83% | 0 | 1 | 1 |
| 09/30/2009 | 10/15/2009 | Colossus Minerals Inc. | TSX:CSI | 4.45 | 5.49 | 23.19% | 44.46 | 45.29 | 1.87% | 21.32% | 61.36 | 311.5 | 19.70% | 320.92% | 31.58% | 289.34% | 0 | 0 | 1 |
| 09/25/2009 | 10/30/2009 | Apex Minerals NL | ASX:AXM | 0.08 | 0.05 | -35.31% | 43.74 | 43.07 | -1.53% | -33.78% | 97.98 | 102.2 | 95.87% | -75.62% | 20.16% | -95.78% | 1 | 1 | 0 |
| 09/17/2009 | 09/21/2009 | Minefinders Corp. Ltd. | TSX:MFL | 10.61 | 10.05 | -5.30% | 48.00 | 47.78 | -0.46% | -4.84% | 61.09 | 680.4 | 8.98% | 71.37% | 40.76% | 30.61% | 0 | 1 | 1 |
| 09/08/2009 | 09/15/2009 | Vista Gold Corp. | AMEX:VGZ | 2.42 | 2.41 | -0.41% | 45.02 | 45.11 | 0.20% | -0.61% | 19.8 | 101.2 | 19.57% | -11.68% | 45.51% | -57.19% | 0 | 0 | 0 |
| 08/31/2009 | 09/22/2009 | Greystar Resources Ltd. | TSX:GSL | 3.63 | 3.50 | -3.58% | 40.18 | 39.51 | -1.67% | -1.91% | 51.46 | 368.4 | 13.97% | 89.10% | 13.99% | 75.11% | 1 | 0 | 1 |
| 07/23/2009 | 08/06/2009 | Romarco Minerals Inc. | TSXV:R | 0.79 | 0.81 | 2.59% | 39.77 | 39.96 | 0.48% | 2.11% | 37.22 | 538.9 | 6.91% | 369.65% | -10.77% | 380.42% | 0 | 0 | 1 |
| 06/29/2009 | 07/15/2009 | B2gold Corporation | TSX:BTO | 0.69 | 0.66 | -4.20% | 39.20 | 39.15 | -0.13% | -4.07% | 22.35 | 340.9 | 6.56% | -38.44% | -19.32% | -19.12% | 0 | 1 | 1 |
| 06/17/2009 | 07/03/2009 | Brett Resources Inc. | TSXV:BBR | 0.67 | 0.61 | -8.58% | 38.37 | 38.23 | -0.36% | -8.22% | 10.51 | 183.7 | 5.72% | -11.06% | -12.87% | 1.81% | 1 | 0 | 1 |
| 06/16/2009 | 06/19/2009 | Banro Corporation | TSX:BAA | 2.46 | 2.30 | -6.69% | 37.97 | 38.37 | 1.05% | -7.74% | 88.14 | 191.6 | 46.00% | -65.48% | -13.01% | -52.47% | 0 | 0 | 1 |
| 05/26/2009 | 06/08/2009 | Andina Minerals, Inc. | TSXV:ADM | 1.60 | 1.44 | -9.84% | 42.05 | 41.84 | -0.50% | -9.34% | 12.01 | 161.0 | 7.46% | -59.37% | -9.45% | -49.91% | 0 | 0 | 1 |
| 05/20/2009 | 05/28/2009 | Aquiline Resources Inc. | TSX:AQI | 2.18 | 2.36 | 8.53% | 38.43 | 40.47 | 5.31% | 3.22% | 14.57 | 549.0 | 2.65% | -74.18% | -21.12% | -53.06% | 0 | 0 | 1 |
| 05/18/2009 | 06/23/2009 | Apex Minerals NL | ASX:AXM | 0.19 | 0.15 | -21.97% | 37.65 | 37.49 | -0.42% | -21.55% | 11.19 | 102.2 | 10.95% | -74.77% | -20.84% | -53.94% | 0 | 1 | 0 |
| 05/15/2009 | 06/22/2009 | Norseman Gold Plc. | AIM:NGL | 0.39 | 0.41 | 3.32% | 38.05 | 37.65 | -1.05% | 4.38% | 7.12 | 146.1 | 4.87% | -32.37% | -17.66% | -14.71% | 0 | 1 | 0 |
| 05/14/2009 | 06/17/2009 | Citigold Corporation Limited | ASX:CTO | 0.13 | 0.12 | -6.15% | 37.94 | 38.05 | 0.29% | -6.44% | 7.56 | 102.0 | 7.41% | -53.94% | -15.09% | -38.86% | 0 | 1 | 0 |
| 05/06/2009 | 06/23/2009 | Perseus Mining Ltd. | ASX:PRU | 0.65 | 0.64 | -0.84% | 34.78 | 36.86 | 5.97% | -6.82% | 13.34 | 519.6 | 2.57% | -43.90% | -23.04% | -20.87% | 0 | 0 | 0 |
| 05/04/2009 | 05/20/2009 | Keegan Resources Inc. | TSX:KGN | 2.22 | 2.15 | -3.04% | 33.04 | 35.03 | 6.02% | -9.06% | 14.71 | 226.0 | 6.51% | -48.88% | -25.08% | -23.80% | 0 | 0 | 1 |
| 04/29/2009 | 05/12/2009 | US Gold Corporation | AMEX:UXG | 2.09 | 2.02 | -3.35% | 33.11 | 33.89 | 2.36% | -5.71% | 44.0 | 286.4 | 15.36% | 3.98% | -22.15% | 26.13% | 0 | 0 | 0 |
| 04/08/2009 | 04/21/2009 | Aurizon Mines Ltd. | TSX:ARZ | 4.56 | 4.15 | -9.13% | 33.43 | 33.53 | 0.30% | -9.43% | 40.35 | 623.4 | 6.47% | -4.27% | -30.97% | 26.71% | 0 | 1 | 1 |
| 02/24/2009 | 04/28/2009 | Focus Minerals Limited | ASX:FML | 0.02 | 0.02 | -10.19% | 36.47 | 33.50 | -8.14% | -2.05% | 2.12 | 173.2 | 1.22% | -66.67% | -28.40% | -38.27% | 0 | 1 | 0 |
| 02/23/2009 | 03/10/2009 | Rusoro Mining Ltd. | TSXV:RML | 0.56 | 0.56 | 0.77% | 37.03 | 36.47 | -1.51% | 2.28% | 78.12 | 221.9 | 35.21% | -65.35% | -27.30% | -38.05% | 0 | 1 | 1 |
| 02/23/2009 | 03/05/2009 | Great Basin Gold Ltd. | AMEX:GBG | 1.77 | 1.48 | -16.38% | 37.03 | 36.47 | -1.51% | -14.87% | 100.83 | 600.8 | 16.78% | -46.04% | -27.30% | -18.73% | 1 | 1 | 1 |
| 02/11/2009 | 02/19/2009 | Exeter Resource Corporation | TSX:XRC | 2.24 | 2.31 | 3.02% | 34.00 | 36.33 | 6.85% | -3.83% | 20.05 | 545.0 | 3.68% | -47.35% | -27.49% | -19.86% | 0 | 0 | 1 |
| 12/02/2008 | 12/04/2008 | Minefinders Corp. Ltd. | TSX:MFL | 3.62 | 3.20 | -11.62% | 22.50 | 24.69 | 9.73% | -21.35% | 31.73 | 680.4 | 4.66% | -70.81% | -51.94% | -18.87% | 1 | 0 | 1 |
| 11/18/2008 | 01/02/2009 | Resolute Mining Ltd. | ASX:RSG | 0.33 | 0.33 | 0.00% | 19.66 | 19.56 | -0.51% | 0.51% | 2.12 | 345.7 | 0.61% | -79.37% | -56.74% | -22.62% | 0 | 1 | 0 |
| 11/10/2008 | 12/09/2008 | Crew Gold Corp. | TSX:CRU | 0.15 | 0.13 | -16.96% | 21.75 | 23.15 | 6.44% | -23.40% | 14.42 | 244.2 | 5.90% | -90.69% | -53.42% | -37.27% | 0 | 1 | 0 |
| 10/31/2008 | 12/08/2008 | Catalpa Resources Limited | ASX:CAH | 0.23 | 0.23 | 0.00% | 21.70 | 20.95 | -3.46% | 3.46% | 2.3 | 186.8 | 1.23% | -80.40% | -55.55% | -24.84% | 1 | 0 | 0 |
| 09/03/2008 | 02/12/2009 | Banro Corporation | TSX:BAA | 3.21 | 2.92 | -9.17% | 35.25 | 33.57 | -4.77% | -4.40% | 14.0 | 191.6 | 7.31% | -67.34% | -8.82% | -58.52% | 0 | 0 | 0 |
| 09/02/2008 | 09/11/2008 | Banro Corporation | TSX:BAA | 3.47 | 3.21 | -7.38% | 37.64 | 35.25 | -6.35% | -1.03% | 19.25 | 191.6 | 10.05% | -64.74% | -2.64% | -62.10% | 1 | 0 | 1 |
| | | | | | | | | | | | | | | | | | | | |
| Mean | | | | | | -3.23% | | | 0.74% | -3.97% | | | | | | | | | |
| Median | | | | | | -2.91% | | | 0.24% | -3.31% | | | | | | | | | |

2. Firms (28 total, market cap in the $6.8 - $831.1 mm range *as of transaction date*) which have entered into private transactions (59 total, total transaction value in the $0.5 - $80.5 range)

| Announced/Initial Filing Date (Including Bids and Letters of Intent) | Closed/Registration Effective Date | Target/Issuer | Exchange:Ticker | Closing SP D -1 | Closing SP D | SP Change | ARCA:GDX D -1 | ARCA:GDX D | GDX Change | Relative SP Change | Total Trans Value | Market Cap | Dilution (Trans Value/MarCap) | LTM Stock Return | LTM ARCA:GDX Return | Excess LTM SP Return | Warrants (Y/N) | Revenues on Issuance (Y/N) | Lead Underwriter Canadian |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 03/16/2010 | 03/18/2010 | Catalpa Resources Limited | ASX:CAH | 1.37 | 1.32 | -3.84% | 44.94 | 46.12 | 2.63% | -6.46% | 9.22 | 198.4 | 4.65% | 48.85% | 38.02% | 10.83% | 0 | 1 | 0 |
| 03/01/2010 | 03/03/2010 | Norton Gold Fields Limited | ASX:NGF | 0.16 | 0.16 | 0.00% | 43.89 | 44.64 | 1.71% | -1.71% | 18.13 | 86.7 | 20.90% | 16.67% | 41.17% | -24.50% | 0 | 1 | 0 |
| 02/18/2010 | 03/04/2010 | OceanaGold Corporation | ASX:OGC | 2.20 | 2.19 | -0.28% | 44.71 | 45.06 | 0.78% | -1.07% | 21.49 | 408.6 | 5.26% | 284.25% | 19.64% | 264.61% | 0 | 1 | 0 |
| 02/01/2010 | 02/25/2010 | Rainy River Resources Ltd. | TSXV:RR | 4.73 | 4.84 | 2.25% | 40.72 | 42.94 | 5.45% | -3.20% | 51.56 | 271.0 | 19.03% | 213.66% | 23.77% | 189.89% | 1 | 0 | 1 |
| 01/19/2010 | 02/05/2010 | CGA Mining Limited | ASX:CGX | 2.17 | 2.37 | 9.33% | 47.42 | 47.69 | 0.57% | 8.76% | 80.45 | 622.1 | 12.93% | 79.29% | 53.56% | 25.73% | 0 | 1 | 1 |
| 01/14/2010 | 01/14/2010 | Carrick Gold Ltd. | ASX:CRK | 1.07 | 1.06 | -0.47% | 48.86 | 48.60 | -0.53% | 0.06% | 16.76 | 129.6 | 12.93% | 59.72% | 73.26% | -13.54% | 0 | 0 | 0 |
| 01/13/2010 | 02/04/2010 | Kirkland Lake Gold Inc. | TSX:KGI | 7.98 | 8.46 | 5.97% | 48.35 | 48.86 | 1.05% | 4.92% | 29.87 | 505.9 | 5.90% | 123.82% | 63.79% | 60.03% | 1 | 1 | 1 |
| 12/14/2009 | 12/30/2009 | Claude Resources, Inc. | TSX:CRJ | 1.29 | 1.21 | -6.31% | 47.82 | 48.47 | 1.35% | -7.66% | 13.08 | 152.7 | 8.56% | 368.97% | 57.61% | 311.36% | 1 | 1 | 1 |
| 12/09/2009 | 12/22/2009 | Brett Resources Inc. | TSXV:BBR | 1.65 | 1.68 | 1.63% | 47.75 | 48.79 | 2.18% | -0.55% | 4.98 | 142.6 | 3.49% | 234.62% | 87.92% | 146.70% | 0 | 0 | 0 |
| 11/10/2009 | 11/10/2009 | Crocodile Gold Corp. | TSX:CRK | 1.28 | 1.13 | -11.75% | 49.28 | 49.66 | 0.78% | -12.53% | 0.51 | 175.1 | 0.29% | 0.00% | 112.87% | -112.87% | 1 | 0 | 0 |
| 11/06/2009 | 12/22/2009 | Tanzanian Royalty Exploration | TSX:TNX | 2.97 | 2.99 | 0.64% | 46.72 | 47.62 | 1.93% | -1.28% | 2.97 | 269.2 | 1.10% | 17.91% | 113.04% | -95.13% | 0 | 0 | 0 |
| 10/29/2009 | 11/24/2009 | Victoria Gold Corp. | TSXV:VIT | 0.60 | 0.64 | 6.00% | 41.87 | 43.80 | 4.61% | 1.39% | 14.15 | 117.7 | 12.02% | 276.47% | 100.72% | 175.75% | 1 | 0 | 1 |
| 10/26/2009 | 11/10/2009 | Perseus Mining Ltd. | ASX:PRU | 1.60 | 1.46 | -8.64% | 46.69 | 44.69 | -4.28% | -4.36% | 54.22 | 486.0 | 11.16% | 307.06% | 185.22% | 121.84% | 0 | 1 | 1 |
| 10/23/2009 | 11/16/2009 | Claude Resources, Inc. | TSX:CRJ | 0.69 | 0.82 | 19.05% | 46.99 | 46.69 | -0.64% | 19.69% | 5.07 | 76.8 | 6.61% | 152.63% | 169.90% | -17.27% | 1 | 1 | 0 |
| 10/21/2009 | 11/03/2009 | Dynasty Metals & Mining Inc. | TSX:DMM | 4.16 | 4.04 | -2.92% | 47.50 | 47.39 | -0.23% | -2.69% | 5.6 | 148.3 | 3.78% | 248.44% | 116.99% | 131.45% | 0 | 0 | 1 |
| 10/19/2009 | 01/07/2010 | Norton Gold Fields Limited | ASX:NGF | 0.29 | 0.34 | 19.09% | 48.38 | 48.53 | 0.31% | 18.78% | 37.17 | 121.6 | 30.57% | 162.50% | 100.00% | 62.50% | 0 | 1 | 0 |
| 10/15/2009 | 10/30/2009 | Ventana Gold Corp. | TSX:VEN | 9.41 | 10.04 | 6.70% | 49.13 | 48.16 | -1.97% | 8.68% | 37.05 | 831.1 | 4.46% | 0.00% | 101.68% | -101.68% | 0 | 0 | 1 |
| 10/12/2009 | 10/27/2009 | Tanzanian Royalty Exploration | TSX:TNX | 3.03 | 3.09 | 1.93% | 48.29 | 48.28 | -0.02% | 1.95% | 0.94 | 271.6 | 0.35% | 23.85% | 80.19% | -56.34% | 0 | 0 | 0 |
| 10/07/2009 | 11/02/2009 | Rainy River Resources Ltd. | TSXV:RR | 2.18 | 2.12 | -2.44% | 47.60 | 47.90 | 0.63% | -3.07% | 7.68 | 122.2 | 6.29% | 76.92% | 73.85% | 3.07% | 0 | 0 | 1 |
| 10/02/2009 | 10/14/2009 | Silver Lake Resources Limited | ASX:SLR | 0.80 | 0.77 | -4.15% | 43.06 | 42.76 | -0.70% | -3.45% | 16.73 | 124.3 | 13.46% | 319.05% | 48.74% | 270.31% | 0 | 1 | 0 |
| 09/21/2009 | 10/30/2009 | CGA Mining Limited | ASX:CGX | 1.79 | 1.73 | -3.44% | 45.92 | 45.15 | -1.68% | -1.76% | 23.15 | 500.5 | 4.63% | 60.94% | 20.56% | 40.38% | 0 | 1 | 1 |
| 09/01/2009 | 09/30/2009 | Queenston Mining Inc. | TSX:QMI | 4.91 | 4.79 | -2.39% | 39.51 | 38.79 | -1.82% | -0.57% | 15.83 | 282.7 | 5.60% | 138.46% | 12.09% | 126.37% | 1 | 0 | 1 |
| 08/18/2009 | 09/10/2009 | Kirkland Lake Gold Inc. | TSX:KGI | 8.02 | 7.97 | -0.57% | 37.30 | 37.87 | 1.53% | -2.09% | 34.32 | 469.5 | 7.31% | 21.43% | 6.24% | 15.19% | 1 | 1 | 1 |
| 07/21/2009 | 07/27/2009 | OceanaGold Corporation | ASX:OGC | 0.99 | 0.98 | -1.46% | 40.23 | 39.74 | -1.22% | -0.24% | 19.93 | 159.4 | 12.50% | 46.34% | -17.38% | 63.72% | 1 | 1 | 0 |
| 07/10/2009 | 08/26/2009 | International Tow er Hill Mines Ltd | TSX:ITH | 2.87 | 2.57 | -10.62% | 35.31 | 35.14 | -0.48% | -10.14% | 2.97 | 139.1 | 2.14% | 104.55% | -24.34% | 128.89% | 0 | 0 | 0 |
| 06/29/2009 | 08/06/2009 | Victoria Gold Corp. | TSXV:VIT | 0.36 | 0.34 | -5.26% | 39.20 | 39.15 | -0.13% | -5.14% | 1.77 | 51.8 | 3.42% | -40.71% | -19.32% | -21.39% | 0 | 0 | 1 |
| 06/26/2009 | 07/13/2009 | Apollo Gold Corp. | TSX:APG | 0.43 | 0.43 | -0.40% | 39.99 | 39.20 | -1.98% | 1.58% | 11.22 | 99.9 | 11.23% | -13.16% | -13.85% | 0.69% | 0 | 1 | 1 |
| 05/26/2009 | 06/12/2009 | CGA Mining Limited | ASX:CGX | 1.37 | 1.30 | -5.16% | 42.05 | 41.84 | -0.50% | -4.66% | 17.91 | 361.8 | 4.95% | -5.91% | -9.45% | 3.54% | 0 | 1 | 1 |
| 05/18/2009 | 05/22/2009 | Apex Minerals NL | ASX:AXM | 0.20 | 0.15 | -25.90% | 37.65 | 37.49 | -0.42% | -25.48% | 10.91 | 90.9 | 12.00% | -68.75% | -20.84% | -47.91% | 0 | 1 | 0 |
| 05/06/2009 | 06/17/2009 | Perseus Mining Ltd. | ASX:PRU | 0.70 | 0.64 | -7.97% | 34.78 | 36.86 | 5.97% | -13.95% | 46.05 | 143.5 | 32.09% | -27.87% | -23.04% | -4.83% | 0 | 1 | 1 |
| 05/05/2009 | 05/29/2009 | Tanzanian Royalty Exploration | TSX:TNX | 2.98 | 2.97 | -0.33% | 35.03 | 34.78 | -0.71% | 0.38% | 0.91 | 286.3 | 0.32% | -31.31% | -20.57% | -10.74% | 0 | 0 | 0 |
| 04/10/2009 | 04/15/2009 | Tanzanian Royalty Exploration | TSX:TNX | 4.06 | 3.40 | -16.21% | 33.04 | 33.77 | 2.21% | -18.42% | 1.24 | 362.2 | 0.34% | -16.24% | -32.61% | 16.37% | 0 | 0 | 0 |
| 03/31/2009 | 05/12/2009 | Catalpa Resources Limited | ASX:CAH | 0.62 | 0.62 | -0.85% | 36.40 | 36.88 | 1.32% | -2.17% | 24.05 | 32.3 | 74.50% | 37.29% | -23.69% | 60.98% | 0 | 1 | 1 |
| 03/30/2009 | 04/30/2009 | Ventana Gold Corp. | TSX:VEN | 1.26 | 1.25 | -0.76% | 37.00 | 36.40 | -1.62% | 0.86% | 5.06 | 94.9 | 5.33% | 0.00% | -22.43% | 22.43% | 1 | 0 | 0 |
| 03/24/2009 | 03/24/2009 | Ramelius Resources Ltd. | ASX:RMS | 0.41 | 0.44 | 7.21% | 37.71 | 36.86 | -2.25% | 9.47% | 9.42 | 75.6 | 12.46% | -38.95% | -19.71% | -19.24% | 0 | 1 | 0 |
| 03/03/2009 | 03/03/2009 | Norseman Gold Plc. | AIM:NGL | 0.14 | 0.12 | -15.31% | 31.09 | 31.68 | 1.90% | -17.21% | 7.02 | 11.7 | 60.15% | -75.52% | -43.08% | -32.44% | 0 | 1 | 0 |
| 02/26/2009 | 03/05/2009 | Medusa Mining Ltd. | ASX:MML | 0.87 | 0.83 | -5.05% | 32.90 | 33.50 | 1.82% | -6.88% | 15.67 | 127.0 | 12.34% | 0.74% | -38.11% | 38.85% | 0 | 1 | 0 |
| 02/24/2009 | 04/06/2009 | Focus Minerals Limited | ASX:FML | 0.02 | 0.02 | -10.19% | 36.47 | 33.50 | -8.14% | -2.05% | 17.76 | 23.9 | 74.31% | -51.79% | -28.40% | -23.39% | 0 | 1 | 0 |
| 02/24/2009 | 02/24/2009 | Allied Gold Ltd. | ASX:ALD | 0.33 | 0.32 | -3.99% | 36.47 | 33.50 | -8.14% | 4.15% | 19.89 | 136.6 | 14.56% | -25.90% | -28.40% | 2.50% | 0 | 1 | 0 |
| 02/20/2009 | 03/04/2009 | Queenston Mining Inc. | TSX:QMI | 3.08 | 3.04 | -1.27% | 35.64 | 37.03 | 3.90% | -5.17% | 14.07 | 162.1 | 8.68% | 12.57% | -29.83% | 42.40% | 1 | 0 | 1 |
| 02/19/2009 | 03/16/2009 | Victoria Gold Corp. | TSXV:VIT | 0.41 | 0.37 | -11.38% | 37.37 | 35.64 | -4.63% | -6.75% | 8.01 | 54.9 | 14.58% | -53.57% | -26.65% | -26.92% | 1 | 0 | 1 |
| 02/12/2009 | 03/11/2009 | Ventana Gold Corp. | TSX:VEN | 0.50 | 0.68 | 36.69% | 49.13 | 48.16 | -1.97% | 38.66% | 2.61 | 33.1 | 7.89% | 0.00% | 2.87% | -2.87% | 1 | 0 | 0 |
| 02/12/2009 | 03/03/2009 | Romarco Minerals Inc. | TSXV:R | 0.29 | 0.28 | -3.22% | 36.33 | 36.48 | 0.41% | -3.63% | 21.17 | 58.9 | 35.97% | 123.53% | -23.93% | 147.46% | 1 | 0 | 1 |
| 02/12/2009 | 03/04/2009 | International Tow er Hill Mines Ltd | TSX:ITH | 2.31 | 2.37 | 2.41% | 36.33 | 36.48 | 0.41% | 2.00% | 8.21 | 102.2 | 8.03% | 37.21% | -23.93% | 61.14% | 1 | 0 | 0 |
| 02/10/2009 | 02/19/2009 | Banro Corporation | TSX:BAA | 1.52 | 1.53 | 0.78% | 34.37 | 34.00 | -1.08% | 1.85% | 14.0 | 79.8 | 17.55% | -80.27% | -29.35% | -50.92% | 0 | 0 | 0 |
| 02/03/2009 | 03/05/2009 | Tanzanian Royalty Exploration | TSX:TNX | 3.75 | 3.89 | 3.73% | 32.90 | 33.36 | 1.40% | 2.33% | 0.78 | 320.5 | 0.24% | -19.83% | -31.67% | 11.84% | 0 | 0 | 0 |
| 02/02/2009 | 02/17/2009 | Kirkland Lake Gold Inc. | TSX:KGI | 4.32 | 4.14 | -4.27% | 34.23 | 32.90 | -3.89% | -0.39% | 10.84 | 240.6 | 4.51% | -46.73% | -28.91% | -17.82% | 1 | 1 | 1 |
| 01/30/2009 | 02/19/2009 | Dynasty Metals & Mining Inc. | TSX:DMM | 3.39 | 3.35 | -1.10% | 34.40 | 34.23 | -0.49% | -0.61% | 7.96 | 111.5 | 7.14% | -45.73% | -31.68% | -14.05% | 1 | 0 | 0 |
| 01/27/2009 | 02/26/2009 | Luna Gold Corp. | TSXV:LGC | 0.13 | 0.13 | -0.64% | 33.97 | 33.47 | -1.47% | 0.83% | 24.92 | 10.8 | 230.10% | -87.40% | -33.67% | -53.73% | 0 | 0 | 0 |
| 01/27/2009 | 03/11/2009 | Apex Minerals NL | ASX:AXM | 0.25 | 0.25 | 0.00% | 33.97 | 33.47 | -1.47% | 1.47% | 12.7 | 96.2 | 13.20% | -63.46% | -33.67% | -29.79% | 0 | 1 | 0 |
| 01/27/2009 | 02/10/2009 | CGA Mining Limited | ASX:CGX | 0.94 | 0.94 | 0.00% | 33.97 | 33.47 | -1.47% | 1.47% | 20.37 | 224.7 | 9.06% | 2.86% | -33.67% | 36.53% | 0 | 1 | 1 |
| 01/21/2009 | 01/28/2009 | Perseus Mining Ltd. | ASX:PRU | 0.37 | 0.34 | -6.48% | 30.88 | 31.65 | 2.49% | -8.98% | 5.7 | 64.7 | 8.81% | -36.78% | -37.62% | 0.84% | 0 | 1 | 0 |
| 12/01/2008 | 12/18/2008 | Victoria Gold Corp. | TSXV:VIT | 0.17 | 0.17 | -1.92% | 26.57 | 22.50 | -15.32% | 13.40% | 3.57 | 16.8 | 21.20% | -70.55% | -43.25% | -27.30% | 1 | 0 | 1 |
| 10/31/2008 | 11/17/2008 | Luna Gold Corp. | TSXV:LGC | 0.11 | 0.10 | -10.31% | 21.70 | 20.95 | -3.46% | -6.85% | 2.0 | 6.8 | 29.28% | -84.66% | -55.55% | -29.11% | 1 | 0 | 0 |
| 10/29/2008 | 12/09/2008 | Tanzanian Royalty Exploration | TSX:TNX | 1.93 | 2.36 | 21.99% | 18.69 | 20.86 | 11.61% | 10.38% | 1.57 | 174.8 | 0.90% | -56.97% | -61.72% | 4.75% | 0 | 0 | 0 |
| 10/01/2008 | 10/10/2008 | Tanzanian Royalty Exploration | TSX:TNX | 2.69 | 2.62 | -2.41% | 33.79 | 33.77 | -0.06% | -2.35% | 0.84 | 210.6 | 0.40% | -48.74% | -22.85% | -25.89% | 0 | 0 | 0 |
| 09/29/2008 | 09/30/2008 | Apex Minerals NL | ASX:AXM | 0.33 | 0.34 | 2.47% | 35.83 | 34.00 | -5.11% | 7.58% | 46.19 | 127.9 | 36.11% | -62.44% | -7.32% | -55.12% | 1 | 1 | 0 |
| 08/06/2008 | 08/21/2008 | Apollo Gold Corp. | TSX:APG | 0.40 | 0.39 | -2.85% | 38.59 | 39.21 | 1.61% | -4.45% | 8.12 | 81.2 | 10.00% | -7.69% | 0.03% | -7.72% | 0 | 1 | 1 |
| 08/05/2008 | 08/07/2008 | Allied Gold Ltd. | ASX:ALD | 0.28 | 0.30 | 7.83% | 40.85 | 38.59 | -5.53% | 13.36% | 9.58 | 106.2 | 9.02% | -31.61% | 5.45% | -37.06% | 0 | 1 | 0 |
| | | | | | | | | | | | | | | | | | | | |
| Mean | | | | | | -0.68% | | | -0.45% | -0.23% | | | | | | 22.62% | | | |

## IV. RESULTS

According to Rudenno (2009), "on a day-to-day basis such issues as commodity prices and exploration announcements will influence price movements" (p. 283). As this is a compelling argument both from the theoretical and the practical viewpoints: a) ARCA:GDX index is used for benchmarking to control for fluctuations in the price of gold companies; b) firms with exploration announcements on the date of equity issuance announcement are not included in the sample.

### Public Transactions

When examining public transactions over the specified time period, we observe an average drop of 3.23% in the share price of the issuer; when we benchmark share price movement against the ARCA:GDX movement on the same date, this drop is negative 3.97%. The considerable range of benchmarked share price movement of between negative 33.78% and positive 21.32% suggests that the fact of issuance in itself is not a predictor of how the share price will react and that other factors need to be examined for correlation with share price fluctuation.

The null hypothesis posits that there is no statistically significant relationship between the change in share price upon equity issuance announcement and such factors as dilution percentage (defined as Total Transaction Volume/Market Cap on day of Transaction), prior stock performance (defined as LTM returns over benchmark, ARCA:GDX), warrant issuance (Y/N), presence or absence of producing facilities (Y/N) and underwriters' domicile (Canada/Other). Multiple regression method was used to test this hypothesis.

## Regression Analysis: Relative SP Change versus Dilution

The regression equation is

Relative SP Change = - 0.0115 - 0.204 Dilution

| Predictor | Coef | SE Coef | T | P |
|---|---|---|---|---|
| Constant | -0.01149 | 0.01852 | -0.62 | 0.539 |
| Dilution | -0.20431 | 0.08652 | -2.36 | 0.023 |

S = 0.0917208 R-Sq = 12.2% R-Sq(adj) = 10.0%

Analysis of Variance

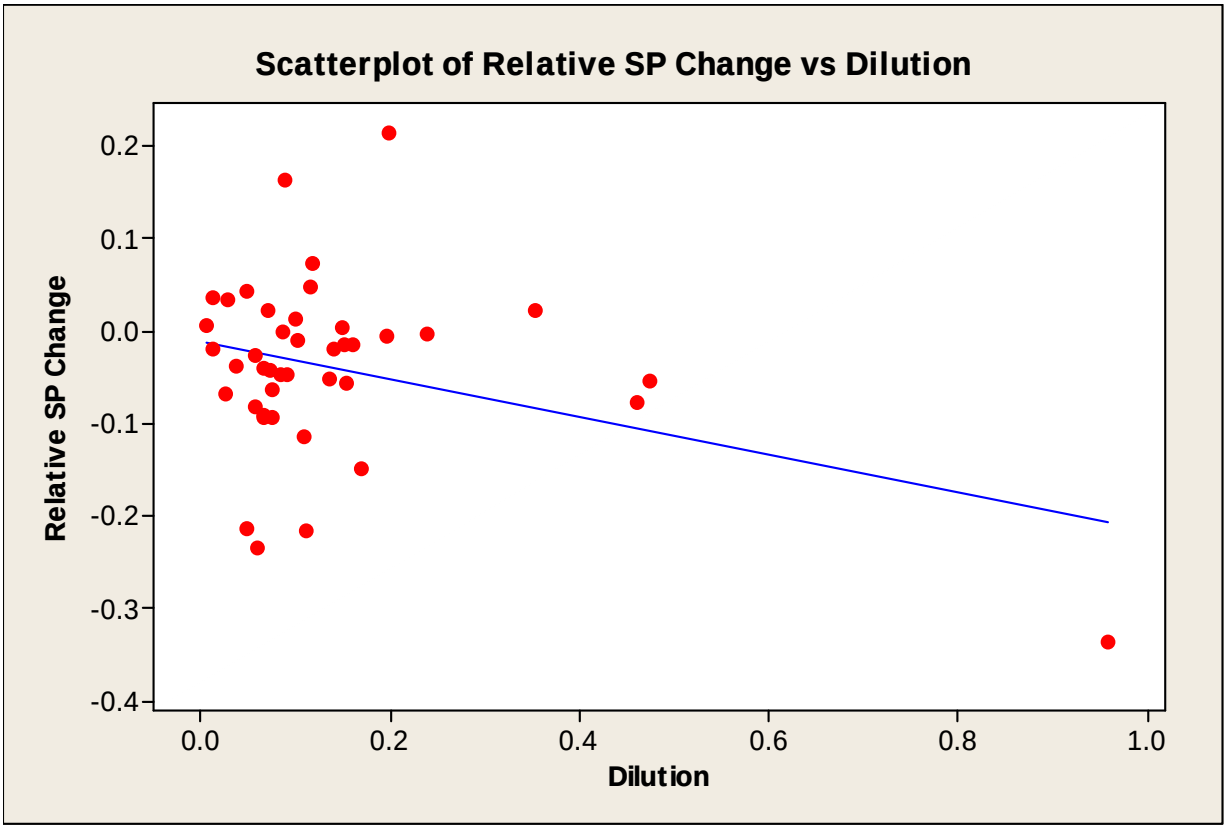
| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Regression | 1 | 0.046914 | 0.046914 | 5.58 | 0.023 |
| Residual Error | 40 | 0.336508 | 0.008413 | | |
| Total | 41 | 0.383422 | | | |

Unusual Observations

| Obs | Dilution | Relative SP Change | Fit | SE Fit | Residual | St Resid |
|---|---|---|---|---|---|---|
| 10 | 0.087 | 0.1631 | -0.0293 | 0.0148 | 0.1924 | 2.13R |
| 15 | 0.197 | 0.2132 | -0.0517 | 0.0150 | 0.2650 | 2.93R |
| 16 | 0.959 | -0.3378 | -0.2074 | 0.0724 | -0.1305 | -2.32RX |
| 26 | 0.109 | -0.2155 | -0.0339 | 0.0144 | -0.1816 | -2.00R |
| 37 | 0.047 | -0.2135 | -0.0210 | 0.0162 | -0.1925 | -2.13R |
| 39 | 0.059 | -0.2340 | -0.0236 | 0.0157 | -0.2104 | -2.33R |

R denotes an observation with a large standardized residual.

X denotes an observation whose X value gives it large leverage.




T statistic value in this regression indicates that there is a significant negative correlation between shareholder base dilution precipitated by the transaction and the post-announcement adjusted share price movement; the coefficient suggests that for each percentage point in shareholder base dilution there is a 0.2 percentage point drop in share price (adjusted for corresponding index movement). This inverse relationship is what we would reasonably expect from the point of view of a shareholder whose holdings in the company get diluted. However, the adjusted R-sq of 10.0% implies that only 10% of the share price movement is explained by the dilution, with 90% attributable to other factors.

**Regression Analysis: Relative SP Change versus Dilution, Excess LTM SP Return**

The regression equation is

Relative SP Change = - 0.0254 - 0.188 Dilution + 0.0101 Excess LTM SP Return

| Predictor | Coef | SE Coef | T | P |
|---|---|---|---|---|
| Constant | -0.02544 | 0.01931 | -1.32 | 0.195 |
| Dilution | -0.18833 | 0.08409 | -2.24 | 0.031 |
| Excess LTM SP Return | 0.010141 | 0.005229 | 1.94 | 0.060 |

S = 0.0887107 R-Sq = 20.0% R-Sq(adj) = 15.8%

Analysis of Variance

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Regression | 2 | 0.076507 | 0.038254 | 4.86 | 0.013 |
| Residual Error | 39 | 0.306914 | 0.007870 | | |
| Total | 41 | 0.383422 | | | |

| Source | DF | Seq SS |
|---|---|---|
| Dilution | 1 | 0.046914 |
| Excess LTM SP Return | 1 | 0.029594 |

Unusual Observations

| Obs | Dilution | Relative SP Change | Fit | SE Fit | Residual | St Resid |
|---|---|---|---|---|---|---|
| 7 | 0.108 | -0.1156 | 0.0695 | 0.0549 | -0.1851 | -2.66RX |
| 15 | 0.197 | 0.2132 | -0.0332 | 0.0174 | 0.2464 | 2.83R |
| 16 | 0.959 | -0.3378 | -0.2157 | 0.0702 | -0.1221 | -2.25RX |
| 37 | 0.047 | -0.2135 | -0.0361 | 0.0175 | -0.1774 | -2.04R |
| 39 | 0.059 | -0.2340 | -0.0403 | 0.0175 | -0.1936 | -2.23R |

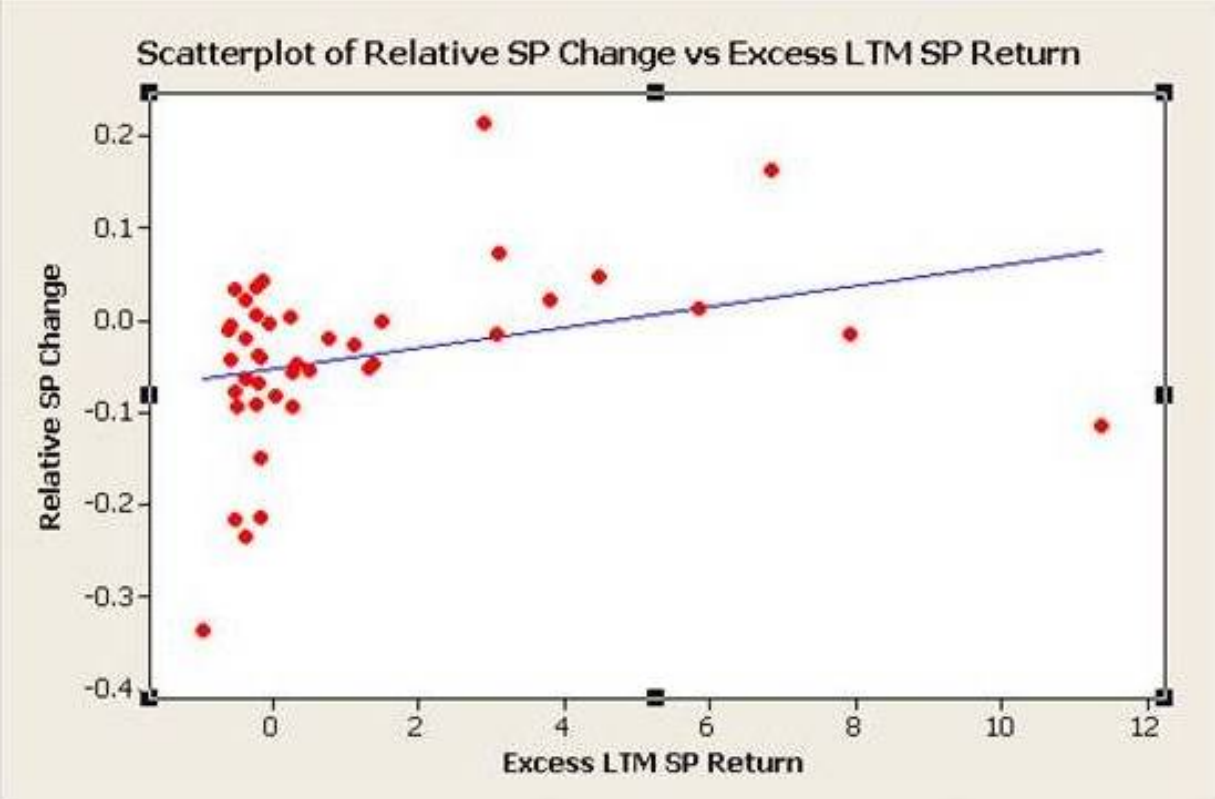
R denotes an observation with a large standardized residual.

X denotes an observation whose X value gives it large leverage.

T statistic values in this regression indicates that–while there is a significant negative correlation between shareholder base dilution precipitated by the transaction and the post-

announcement adjusted share price movement–the correlation between share price movement and historical stock performance fails to clear the standard of significance: t statistic of 1.94 (<2.0).

An examination of the relationship between Relative SP Change and Excess LTM Return suggests that it may not be linear, as illustrated by the graph below, which further corroborates the lack of statistical significance of the latter independent variable.




**Regression Analysis: Relative SP Change versus Dilution, Excess LTM SP Return, Warrants**

```
The regression equation is

Relative SP Change = - 0.0182 - 0.171 Dilution + 0.00872 Excess LTM SP Return
                     - 0.0424 Warrants
```

```
Predictor                 Coef   SE Coef      T      P
Constant              -0.01815   0.02021  -0.90  0.375
Dilution              -0.17070   0.08505  -2.01  0.052
Excess LTM SP Return  0.008721  0.005346   1.63  0.111
Warrants              -0.04241   0.03633  -1.17  0.250

S = 0.0883013   R-Sq = 22.7%   R-Sq(adj) = 16.6%
Analysis of Variance
Source          DF        SS        MS     F      P
Regression       3  0.087131  0.029044  3.72  0.019
Residual Error  38  0.296291  0.007797
Total           41  0.383422

Source                DF    Seq SS
Dilution               1  0.046914
Excess LTM SP Return   1  0.029594
Warrants               1  0.010624

Unusual Observations
                Relative
Obs  Dilution  SP Change      Fit  SE Fit  Residual  St Resid
  7     0.108    -0.1156   0.0626  0.0550   -0.1782     -2.58RX
 15     0.197     0.2132  -0.0265  0.0182    0.2398      2.78R
 16     0.959    -0.3378  -0.2326  0.0713   -0.1052     -2.02RX
 26     0.109    -0.2155  -0.0415  0.0186   -0.1739     -2.01R
 39     0.059    -0.2340  -0.0315  0.0190   -0.2025     -2.35R
R denotes an observation with a large standardized residual.
X denotes an observation whose X value gives it large leverage.
```

T statistic values in this regression indicates that while there is a significant negative correlation between shareholder base dilution precipitated by the transaction and the post-

announcement adjusted share price movement, the factor of presence of warrants fails to clear the standard of significance, with a t statistic of -1.17 (<2.0).

The three regressions above pass the multicollinearity test as we observe

1. No significant change in regression coefficients as independent variables are added or removed
2. T-statistics in line with F-scores

In summary, although adding independent variables such as prior stock performance and presence of warrants increases the R-sq of our regression, these independent variables do not have a statistically significant relationship with benchmarked share price performance on the day of announcement as indicated by the respective t statistic values. Although the t statistic value was significant for dilution as an independent variable, the R-sq of 10.0% does not allow us to reject the $H_0$ that there is no statistically significant relationship between share price performance on announcement date and any of the three predictors examined above.

It is also important to note that the following potential predictors of share price performance on announcement date were examined

- Producing v Non-Producing firms (using respective dummy variables of 1 and 0)
- Canadian v Non-Canadian underwriters (using respective dummy variables of 1 and 0)

No correlation between Excess LTM Return as Independent Variable and Relative SP Change as dependent variable was found as indicated by individual respective regressions yielding R-sq values of 0.0% and 0.0%. Thus, $H_0$ hypotheses cannot be rejected for any of these factors.

**Private Transactions**

When examining private transactions over the specified time period, we observe an average drop of 0.68% in the share price of the issuer; when we benchmark share price movement against the ARCA:GDX movement on the same date, this drop is 0.23%. The considerable range of benchmarked share price movement of negative 25.48% to positive 38.66% suggests that the fact of issuance in itself is not a predictor of how the share price will react and that other factors need to be examined for correlation with share price fluctuation.

The null hypothesis posits that there is no statistically significant relationship between the change in share price upon equity issuance announcement and such factors as dilution percentage, prior stock performance, warrant issuance, presence or absence of producing facilities and underwriters' domicile. Multiple regression method was used to test this. When each one of the proposed predictors was examined against the dependent variable (share price change) individually, R-sq of 0.0% was obtained in each case. This led to the conclusion that $H_0$ for private issuances cannot be rejected based on the data set at hand.

The examination of the relationship between share price change on private issuance and dilution is enclosed below for illustrative purposes.

**Regression Analysis: Relative SP Change versus Dilution**

```
The regression equation is
Relative SP Change = - 0.0028 - 0.0073 Dilution

Predictor      Coef  SE Coef      T      P
Constant   -0.00282  0.01423  -0.20  0.844
Dilution   -0.00728  0.03920  -0.19  0.853

S = 0.0965167   R-Sq = 0.1%   R-Sq(adj) = 0.0%
```

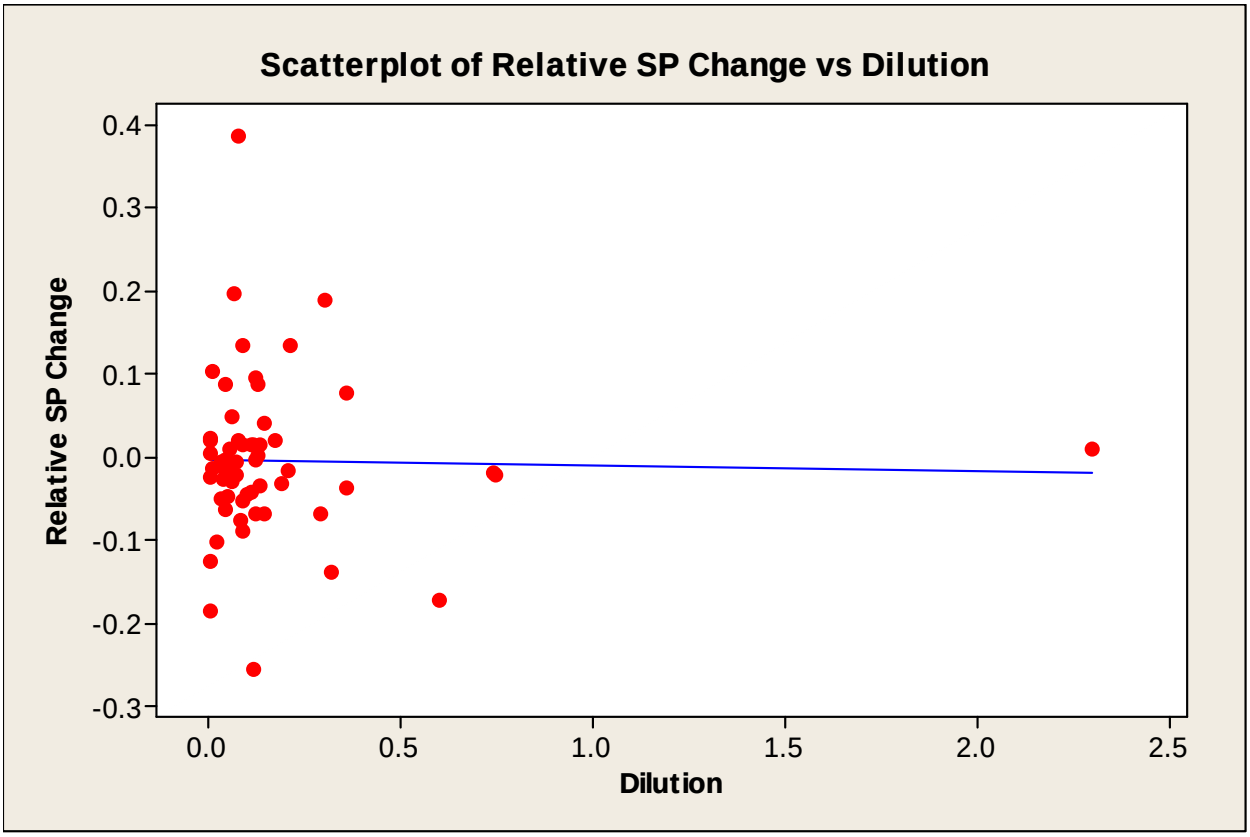
Analysis of Variance

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Regression | 1 | 0.000321 | 0.000321 | 0.03 | 0.853 |
| Residual Error | 57 | 0.530982 | 0.009315 | | |
| Total | 58 | 0.531304 | | | |

Unusual Observations

| Obs | Dilution | Relative SP Change | Fit | SE Fit | Residual | St Resid |
|---|---|---|---|---|---|---|
| 14 | 0.07 | 0.1969 | -0.0033 | 0.0132 | 0.2002 | 2.09R |
| 16 | 0.31 | 0.1878 | -0.0050 | 0.0136 | 0.1929 | 2.02R |
| 29 | 0.12 | -0.2548 | -0.0037 | 0.0127 | -0.2511 | -2.62R |
| 44 | 0.08 | 0.3866 | -0.0034 | 0.0131 | 0.3900 | 4.08R |
| 51 | 2.30 | 0.0083 | -0.0196 | 0.0844 | 0.0279 | 0.60 X |

R denotes an observation with a large standardized residual.



## V. DISCUSSION

Below are some of the main factors which may explain why the hypothesis that there is no statistically significant relationship between changes in share price of junior gold mining companies upon follow-on equity issuance in recessionary and post-recessionary economic environment of 2008-2010 and projected company- / issuance-specific features could not be rejected. When considered specifically within the context of current economic situation, some of these issues may have a negative effect, while some – positive, especially when applied to individual companies. We posit that such dichotomy is the main reason for absence of an observable, statistically significant relationship. One other factor which impeded finding a statistically significant relationship is the sheer sample size, as there were mere 42 public and 59 private transactions in the time period examined.

### Factors which may depress share price

**Dilution.** This is the most obvious, defensible and oft-quoted reason for a drop in share price upon a follow-on offering. Junior gold companies are no exception. According To Haywood Mining Team (2008), with "access to capital constrained by the global credit crisis…those companies successful in raising new equity expect this to be achieved at the expense of significant dilution" (p. 2). This 'outsized' dilution not only produces negative share price movements in line with expectations directionally, but also exacerbates their magnitude in comparison to what would be anticipated in a stable economic environment.

**Change in risk profile assessment due to financing risks.** In the recessionary and post-recessionary environment, investors are re-evaluating the risk profile of junior gold miners in their portfolios–and demanding a larger return for that risk. The resulting greater discount rate

decreases the present value of future cash flows, and precipitates a decrease in share price when the number of claims (i.e., shares outstanding) on those cash flows goes up after an offering.

**Change in risk profile assessment due to technical and political risks.** Due to the gradual decrease in effectiveness of exploration discussed below, companies are increasingly pursuing opportunities that entail higher technical and political risk options (McKeith, 2009, p. 14). As a result, while an injection of cash may facilitate development and eventual production, cash flows from such production are discounted at a higher rate, bringing down total firm value.

**Realignment of NAV.** NAV multiples have been reset to the 0.8x – 1.0x range by analysts (Haywood, 2008, p.4) as a result of the financing uncertainty and the increased risk of continuous financing across the industry at large. Consequently, new investors are getting a better value proposition than existing investors, leading to greater dilution for the latter.

**Equity Issuance Assumptions.** Exacerbating prior issue, according to Haywood Mining Team (2008), "companies [raise] project financing at prices significantly lower below project NAV" (p.4). Thus, as 'average' NAV across all security holders drops, and so does share price.

**Reduced Effectiveness of Exploration Throughout the Industry.** In his report, McKeith (2009) points out the decreasing long-term effectiveness of gold exploration globally. This is indicated by the metric of the ratio of in-situ value of gold found per exploration dollar spent: according to GFL/MinEx Consulting, for the 2000-2009 decade, this ratio was 11x (i.e., $11 worth of gold discovered for every $1 spent on exploration), compared to 23x, 57x, 83x, 105x and 42x times respectively for 1990-1999, 1980-1989, 1970-1979, 1960-1969 and 1950-1959. (p. 12). If this trend continues, investors should now and may very well in the future expect an increasingly lower return on each dollar they invest into exploration.

**Factors which may boost share price**

While it was found that *on average* (albeit with no statistical significance) a follow-on equity offering will decrease the share price of a junior gold mining company, it is easily observable in the sample that some individual firms do, in fact, get a boost to their share price as a result. This phenomenon can have the following explanations

**Moving closer to development.** The cash received in the follow-on equity transaction could provide pivotal in getting to the next stage of the company cycle. The broad market may be aware of that in specific situations based on prior management reports, and private investors–even more so based on pre-existing relationships with companies.

**Signaling of a steady source of financing.** A one-off transaction, while precipitating an immediate dilution effect–particularly when new shares are issued at a lower NAV multiple valuation than existing shares–could also be a signal of more cash injections to come in the future.

**Acquisition arbitrage.** McKeith (2009) notes that "Major-Junior partnerships [are a factor]–perhaps some of the investment is speculation on prospective acquisition by majors" (p. 18). While the equity issuance in itself is no way an indication of such upcoming acquisition or partnership, perhaps new investors informed of such event in the future accept a short-term flogging on dilution in expectation of future outsized gains.

## VI. ISSUES OUTSTANDING / NEXT STEPS

Both industry literature and anecdotal evidence from insiders strongly point at the quality of a junior gold mining company management as one single issue pivotal to its valuation. Dr. Rudenno, in his seminal work "The Mining Valuation Handbook", mentions that the three most important issues to a gold mining company value are 1) Earnings Growth ; 2) Increasing Cash Flow [from Operations]; and 3) Exploration Success. Further, he posits that "management should have a track record of exploration success" in order to for the company to realize favorable future outcome of investment in the development of proven reserves. While it proved challenging to express "quality of management" in quantitative terms–and thus to apply this theory when evaluating a large group of junior gold miners using statistical tools – in this study, it is imperative to take a qualitative look at management quality when examining individual explorers'/mid-tiers producers' value proposition.

## REFERENCES


Capital IQ. 2009-2010. Select data retrieved 7.1.2010 – 3.31.2001 from www.capitaliq.com

Gold Stock Strategist. 2009. "Why Are So Many Junior Gold Miners Raising Capital Through Equity?" Retrieved 9.30.2009 from http://www.goldstockstrategist.com/2009/04/why-so-many-secondaries-and-private.html

Haywood Mining Team. 2008. "Industry Comment: Junior Precious Metals." Haywood Securities Inc. Retrieved 3.18.2010 from Thomson ONE Banker http://banker.thomsonib.com/

Jordan, P. 2009. "Junior Gold Miners Seeing Windows of Opportunity." Retrieved 1.21.2010 http://www.mineweb.com/mineweb/view/mineweb/en/page66?oid=85536&sn=Detail

Junior Miners. 2009. "What is a Junior Miner Anyway?" Retrieved 3.31.2010 from http://www.juniorminers.com/companies.html

McKeith, T. 2009. "Exploration – A Gold Industry Perspective." Presentation at the London World Mining Investment Congress

Money Morning Staff. 2009. "Why the Mining Sector Doesn't Need Banks." Retrieved 1.18.2010 from http://moneymorning.com/2009/03/30/mining-sector/

Rudenno, V. 2009. The Mining Valuation Handbook. Milton, Queensland: Wrightbooks, an imprint of John Wiley & Sons Australia, Ltd.

# Stock Market Volatility during the 2008 Financial Crisis

Kiran Manda*

The Leonard N. Stern School of Business
Glucksman Institute for Research in Securities Markets
Faculty Advisor: Menachem Brenner
April 1, 2010

* MBA 2010 candidate, Stern School of Business, New York University, 44 West 4th Street, New York, NY 10012, email: kkm266@stern.nyu.edu. I would like to thank Professor Menachem Brenner and Professor William Silber for their invaluable comments and suggestions.

## 1. INTRODUCTION

From 2004 to early 2007, the financial markets had been very calm. The market volatility, as measured by the S&P 500 volatility and the VIX index, have been below long-term averages. However, the financial crisis of 2008 changed this: most asset classes experienced significant pullbacks, the correlation between asset classes increased significantly and the markets have become extremely volatile. During this time, the S&P 500 lost about 56% of its value from the October 2007 peak to the March 2009 trough and the VIX Index more than tripled, highlighting the leverage effect that Black (1976) described in his paper on the study of stock market volatility.

**Figure 1: Historical values of S&P 500 Index and VIX**

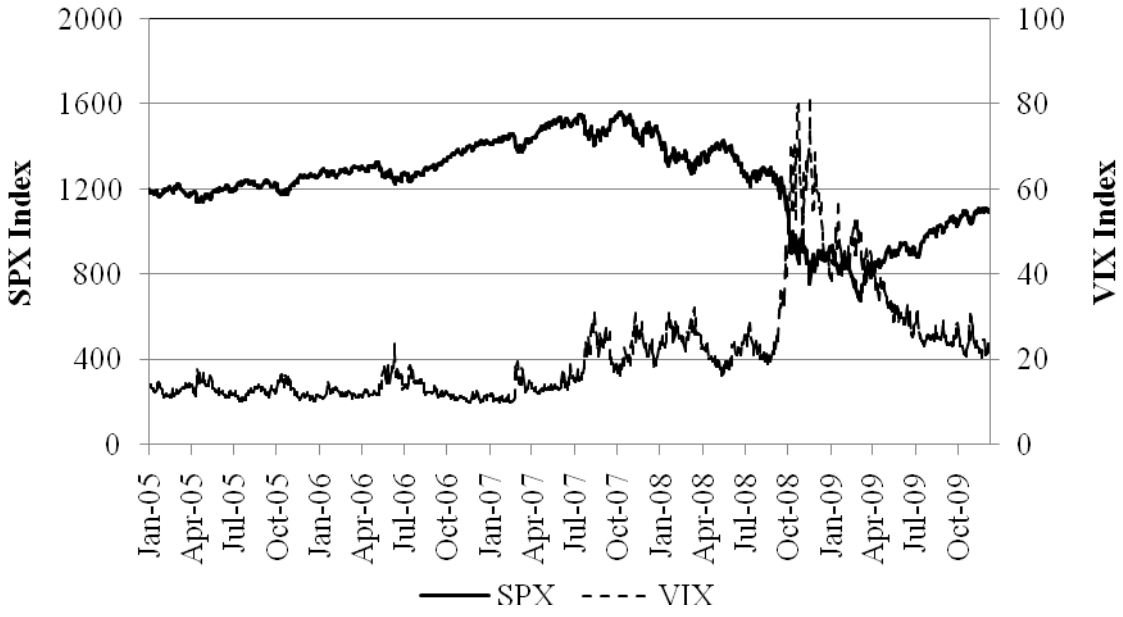



**Figure 1:** Daily closing levels of the S&P 500 Index (SPX) and the S&P 500 Volatility Index (VIX). The sample period is January 3, 2005 – December 11, 2009. Source: CBOE and Yahoo Finance

While the industry and academia have done extensive work on the stock market volatility and the negative relationship between stock returns and volatility over the years, we did not find any literature examining these subjects during the recent financial crisis. In this report, we study the stock market volatility and the behavior of various measures of volatility before, during and after the 2008 financial crisis, and whether the leverage effect was observed during this period. To explore the stock market volatility and different measures of volatility, we analyzed the volatility of S&P 500 returns, the VIX Index, VIX Futures, VXV Index, and S&P 500 Implied Volatility Skew. We also analyzed the implied volatility of Options on VIX Futures to study the behavior of "volatility of volatility" during the financial crisis. To study the leverage effect, we analyzed the relationship between S&P 500 returns, VIX Index and VIX Futures.

### 1.1 VIX Index

Since its introduction in 1993, VIX – the CBOE Volatility Index – became the benchmark for stock market volatility and is followed feverishly by both option traders and equity market participants. VIX measures the market's expectations of 30-day volatility, as conveyed by the market option prices. While the original VIX used options on the S&P 100 index, the updated VIX uses put and call options on the S&P 500 index. The new methodology estimates expected S&P 500 Index (SPX) volatility by averaging the weighted prices of SPX puts and calls over the entire range of strike prices. The components of VIX are near- and next-term put and call options, always in the first and second SPX contract months.

VIX has been dubbed as the "Fear Index" because it spikes during market turmoil or periods of extreme uncertainty. VIX reached its highest level ever during the major stock market decline in October 1987. Additionally, it has been shown that it is negatively correlated with the

S&P 500 index – it rises when the index falls and vice versa.

### 1.2 VIX Futures

While the VIX index has a strong negative relationship with the S&P 500 Index, VIX is not a tradable asset. Hence, one cannot use the VIX index to protect against market declines. However, futures contracts on the VIX Index are available and market participants can use them as a hedging instrument. Unlike S&P 500, the futures contracts on VIX have an expiration date. The value of a particular VIX Futures contract corresponds to the markets expectation of the VIX Index value as of the expiration date of the contract. Since the maturity of the VIX Futures contract decreases every day, we decided to construct a VIX Futures contract with constant 30 day maturity for the purpose of this study. The fixed maturity VIX futures prices are constructed by using the market data of available contracts with linear interpolation technique.

**Figure 2: VIX Futures - Open Interest and Contract Volume**

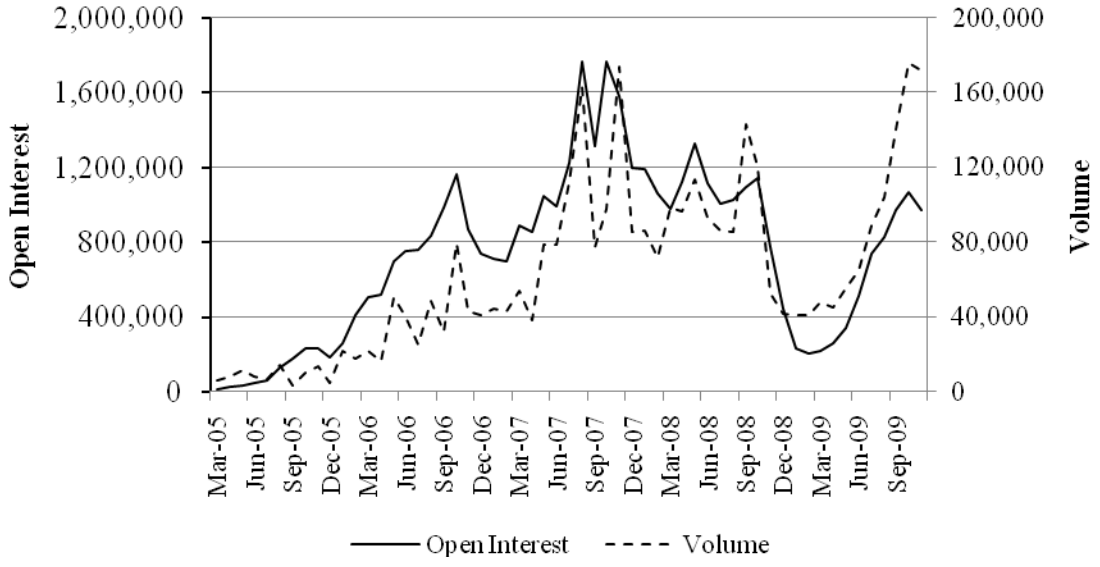


**Figure 2:** VIX Futures monthly open interest and volume. Plot shows increase in monthly volume and open interest of VIX Futures contracts since their introduction. The sample period is March 2005 – November 2009. Source: CBOE

### 1.3 VXV Index

While VIX is a measure of expected 30 days volatility of the S&P 500 Index, VXV measures the expected 3 month S&P 500 Index volatility. Conceptually, one can think of VIX as an indicator of near term event risk, because it captures the volatility that is associated with events that are expected to occur in the next 30 days. Using VIX and VXV indexes together, one can get good insight into the term structure of S&P 500 Index (SPX) options implied volatility.

**Figure 3: Historical values of VIX and VXV Indexes**

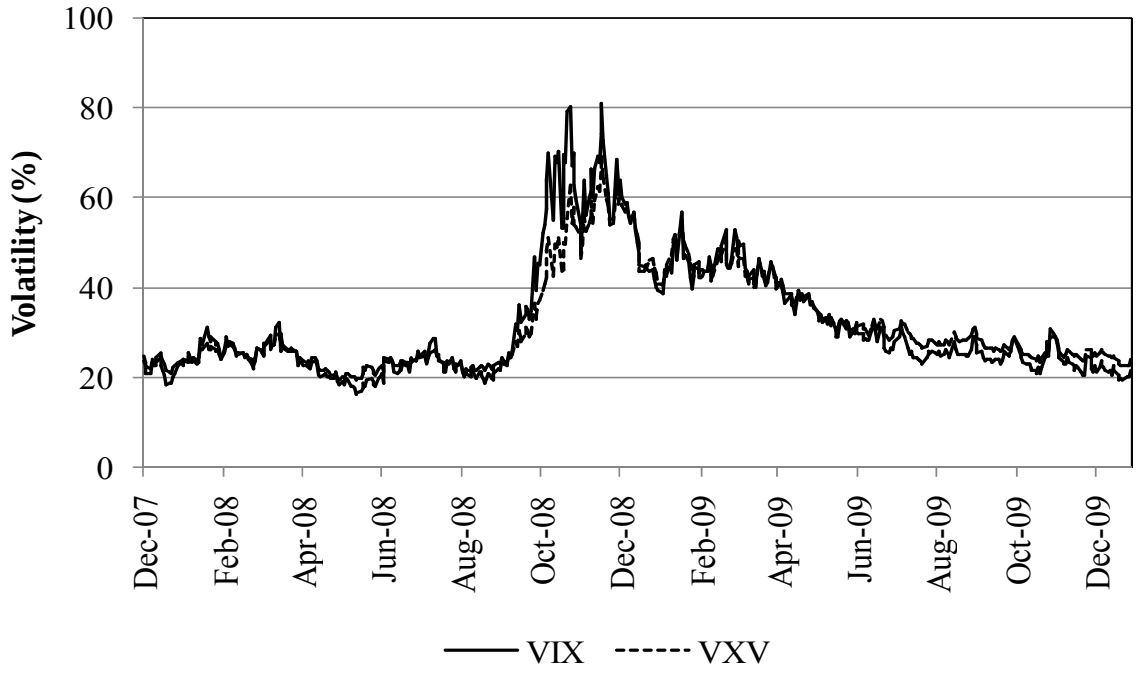



**Figure 3:** Daily closing values of VIX and VXV indexes. Plot shows strong correlation between the VIX and VXV Indexes. Additionally, the difference between VIX and VXV indexes was the highest just after the Lehman Brothers bankruptcy in September 2008. The sample period is December 4, 2007 – December 31, 2009. Source: CBOE

### 1.4 Implied Volatility Skew of S&P 500 Index Options

Several market participants use index options to either protect their investments or express their market views. Black-Scholes-Merton Model (BSM) is the industry standard for pricing equity and foreign exchange options. For a given stock or index, BSM assumes that the implied volatility is the same across option strike prices. However, several studies have shown that market prices for options do not reflect this constant volatility assumption and instead show a skew. Figures 4a and 4b show the S&P 500 Implied volatility skew and surface plots. Market participants define volatility skew in different ways; for the purpose of this report, we define it as the difference in implied volatilities of 30 days maturity S&P 500 Index options that are 90% moneyness and 110% moneyness. Moneyness is defined as:

% moneyness = Strike Price / Spot Price

**Figure 4a: SPX Index 30 Days Implied Volatility Skew**

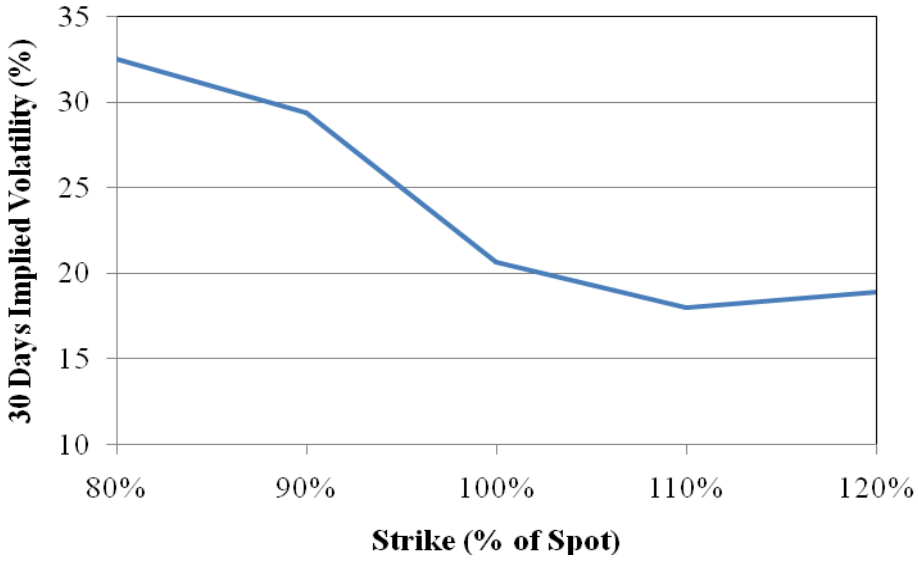



**Figure 4a:** S&P 500 Implied Volatility Skew on 11/30/2009. The skew referes to the pattern where the implied volatility of in-the-money options is higher than the implied volatility of at-the-money options. Source: Bloomberg

**Figure 4b: SPX Index Implied Volatility Surface**

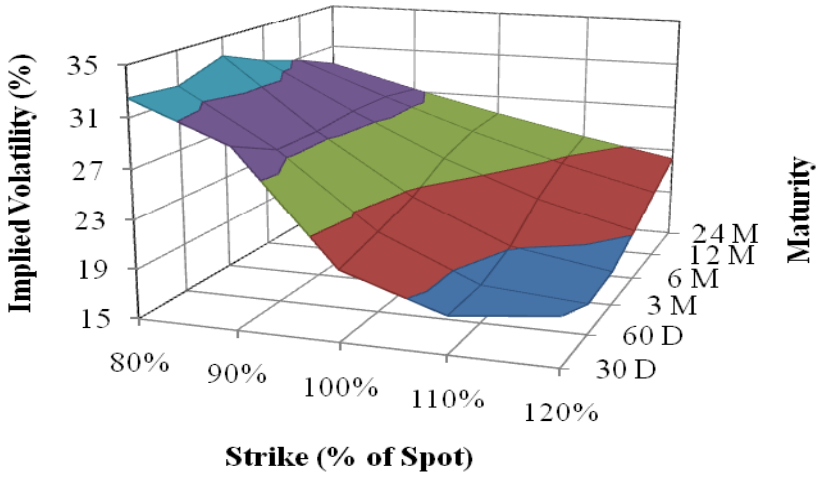



**Figure 4b:** S&P 500 Implied Volatility Surface on 11/30/2009. The implied volatility surface is a plot of implied volatility as a function of both strike price and time to maturity. It can also be described as a plot of volatility skews with different time to maturity. Source: Bloomberg

### 1.5 Implied Volatility of the Options on VIX

Since the introduction of options on VIX in 2006, VIX options have become very popular with investors trying to express their views on market volatility. VIX options are European style options and can only be exercised on the expiration date of the contract. The valuation of VIX options uses the expected, or forward, value of VIX on the expiration date and not the spot value of the VIX Index. Further, VIX options are priced differently from Stock or Index options. Stock or Index option pricing models assume that the underlying asset is lognormally distributed, whereas, VIX is not lognormal (in a lognormal world, the asset price can go to zero, but VIX cannot go to zero because it would mean that there is no volatility in S&P 500 Index). Another distinct feature of VIX options is very high implied volatility (i.e., very high volatility of volatility). Volatility of volatility, as defined here, is a measure of the volatility of the VIX forward values. Put another way, this is a measure of how volatile markets views are about expected 30 day S&P 500 volatility on the expiration date of the contract.

**Figure 5: Historical Trading Volumes of VIX Options**

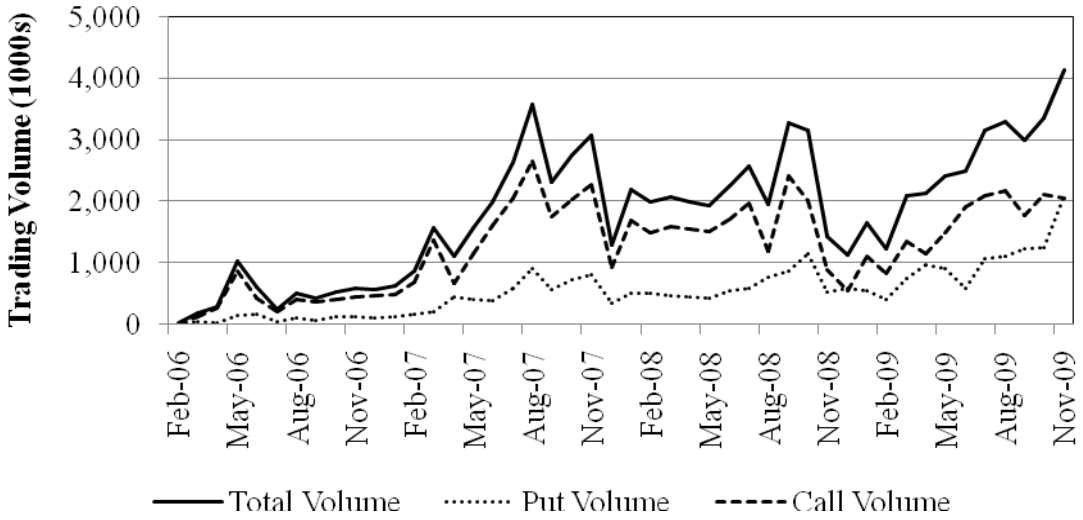



**Figure 5:** Monthly trading volumes for Put and Call Options on VIX. Total volume is the sum of put and call volumes. The increasing trading volume highlights the growing popularity of VIX Options. The sample period is February 2006 – November 2009. Source: CBOE

## II. PREVIOUS WORK

Brenner and Galai (1989) first introduced the concept of volatility derivatives and the need for a volatility index. Moran and Dash (2007) demonstrated that VIX Futures contracts have a negative correlation to the S&P 500 returns and how they could be used in a hedging portfolio to improve the efficiency of investor portfolios. Further, they tested the behavior of the VIX Futures contracts during periods of high market volatility to demonstrate that the beneficial qualities of VIX exposure can be obtained through the use of VIX-linked Futures and Options contracts. Zhang, Shu and Brenner (2010) analyzed recent data to establish a theoretical relationship between VIX Futures and VIX and suggested a model that gives good VIX Futures prices under normal market conditions which could be used in pricing VIX Options.

Despite the popularity of the Black-Scholes model for pricing options, many researchers have shown that the model's constant volatility assumption across different strikes is inconsistent with market prices. It has been shown that the implied volatilities generally increase as the strike price decreases (Poon and Granger 2003). A popular explanation for the existence of volatility skew relate to the *Leverage Effect*. The *Leverage Effect* theory posits that as the stock index value decreases, the leverage of the market increases, which makes the equity more risky. Thus, the implied volatility increases for the lower strike prices.

Extensive research has been done on the leverage effect in the stock market returns since this phenomenon was first described by Black (1976). Whaley (2000) demonstrated the negative correlation between the S&P 500 returns and changes in the VIX Index. He showed that this negative relationship between S&P 500 returns and change in VIX is asymmetric – the index falls more when the VIX increases but it doesn't rise by as much when VIX falls. According to

Whaley (2000), the S&P index falls by 0.707% for a 100 bps increase in VIX and the S&P 500 index rises by 0.469% for a 100 bps drop in VIX.

## III. DATA DESCRIPTION

For the purpose of our analysis, we reviewed daily data from January 2005 – November 2009. We divided this period into three distinct sub-periods called Pre-Crisis, Crisis and Post-Crisis. While there are different opinions about the exact date of the onset of the financial crisis, we have used March 17th 2008, the date on which US Investment Bank Bear Stearns & Co was taken over by JP Morgan, as the cutoff for our Pre-Crisis/Crisis periods. While it is difficult to exactly pinpoint when the crisis ended, we picked March 31st 2009 as the end date for the crisis because the S&P 500 index rebounded well from its lowest value by the end of March. Table 1 shows our assumptions regarding the study period dates.

**Table 1: Classification of Study Period**

| Period | Start Date | End Date |
|---|---|---|
| **Pre-Crisis** | 3-Jan-05 | 16-Mar-08 |
| **Crisis** | 17-Mar-08 | 31-Mar-09 |
| **Post-Crisis** | 1-Apr-09 | 30-Nov-09 |

While the dates for the Crisis and Post-Crisis periods are consistent throughout the report, the start date for the Pre-Crisis period is different for different measures of volatility due to data availability. We have provided this information along with the exhibits in this report. Table 2 shows the sources of data used in the analysis followed by a brief description of the data.

**Table 2: Data sources**

| Data Description | Data Source | Website Link |
|---|---|---|
| S&P 500: Adjusted Close Values | Yahoo Finance | http://finance.yahoo.com/q/hp?s=SPX |
| VIX: Daily Closing Values | Chicago Board of Options Exchange (CBOE) | http://www.cboe.com/micro/VIX/historical.aspx |
| VXV: Daily Closing Values | Chicago Board of Options Exchange (CBOE) | http://www.cboe.com/micro/vxv/ |
| VIX Futures: Daily Settle Values | CBOE Futures Exchange (CFE) | http://cfe.cboe.com/Products/historicalVIX.aspx |
| S&P 500: Implied Volatility Data | Bloomberg | |
| VIX Options: Call Options Prices | CBOE Market Data Express Service | http://www.marketdataexpress.com/ |

**S&P 500 Index Data**: We used the adjusted daily closing values of the SPX index as they incorporate the dividend yield. We assumed that the SPX daily returns are lognormal and used the percentage daily returns in estimating the negative correlation between index returns and volatility.

**VIX and VXV Indexes**: We used the daily closing values for both the indexes. VXV data is available from December 4, 2007 onwards. Thus, we used the data from the period December 2007 – December 2009 when analyzing VIX versus VXV.

**VIX Futures**: We considered using the daily "settle" values for the various VIX Futures contracts that were traded each day. However, the maturities of these contracts were not fixed and would decrease every day. So, we created a constant 30-day maturity VIX Futures contract

through linear interpolation of available VIX Futures contracts with varying maturities.

**S&P 500 Implied Volatility Skew Data**: We obtained the implied volatilities of S&P 500 Index options that are 90% money, 100% money and 110% money from Bloomberg. We then obtained the volatility skew as the difference in implied volatilities of options at 90% money and 110% money. Appendix A provides details of the methodology that Bloomberg uses to estimate the implied volatilities for 30 days maturity options at a particular level of moneyness.

**Implied Volatility of VIX Options (volatility of volatility):** To study the volatility of volatility, we estimated the volatility implied by the VIX Options prices. Since there are no standard VIX Options pricing models, we decided to use the Black model for futures as a reasonable solution. For each trading date, we first mapped the available call option contracts to VIX Futures contracts such that the VIX Futures maturity is later than the options expiry date. For all VIX Futures contracts that satisfied this condition, we picked the one with the earliest maturity as the underlying for the VIX Options contract. Next, we picked option strike prices that straddle the VIX Futures closing values. Using the VIX Futures value as the price of the underlying, 1-month T-Bill rates as the riskless rate, the difference between the option expiry date and the current trading date as time to expiry, and option strikes and option prices from the selected call option contracts, we estimated the implied volatility of the VIX options.

We also estimated the volatility of VIX Index and the computed 30-day VIX Futures by calculating the standard deviation of percentage daily changes in their respective values.

## IV. RESULTS and DISCUSSION

### IV.1. Behavior of Stock market volatility and different measures of volatility

Table 3 below provides a summary of the stock market behavior, as measured by the S&P 500, during the study period. The results clearly show that the volatility of the index returns was significantly higher during the Crisis period compared to other periods.

**Table 3: Summary Statistics for S&P 500 Index Performance**

| Period | S&P 500 Index Average Value | Annualized Volatility of S&P 500 Index Returns[2] |
|---|---|---|
| Pre-Crisis | 1,335 | 13.4% |
| Crisis | 1,098 | 43.6% |
| Post-Crisis | 984 | 20.9% |
| All Data[1] | 1,233 | 24.2% |

1. 'All Data' corresponds to the time period January 2005 - November 2009

2. Annualized volatility is estimated by multiplying the standard deviation of daily returns by sqrt(250)

It is interesting to note that the average value of the S&P 500 index was higher during the Crisis period than that during the Post-Crisis period. However, this could be due to our selection of the dates for each period. If one were to analyze the performance of the SPX index from the time of the Lehman Brothers bankruptcy in September 2008 to the market bottom in March 2009, the core of the crisis, the average value of the index is 884, which is lower than the average value during the Post-Crisis period. Similarly, the annualized volatility of the SPX returns during the September 2008 – March 2009 period, the core of the crisis, is 56.9%. This confirms that the

market volatility was significantly higher during the crisis period compared to other periods. Tables 4a and 4b provides a summary of different volatility measures that we analyzed.

**Table 4a: Performance Summary of Volatility Measures – Average Values**

| Period | VIX Average | VIX Futures Average[2] | VXV Average |
|---|---|---|---|
| Pre-Crisis | 24.76 | 25.28 | 24.87 |
| Crisis | 36.85 | 34.70 | 35.39 |
| Post-Crisis | 30.70 | 29.80 | 32.93 |
| All Data[1] | 32.16 | 31.74 | 32.03 |

1. 'All Data' corresponds to the period December 4, 2007 - November 30, 2009
2. Refers to the 30 days constant maturity VIX Futures Index that we constructed

**Table 4b: Performance Summary of Volatility Measures - Annualized Volatility of % Daily Changes[1]**

| Period | VIX | VIX Futures[2] | VXV |
|---|---|---|---|
| Pre-Crisis | 96% | 47% | 64% |
| Crisis | 128% | 71% | 86% |
| Post-Crisis | 83% | 48% | 50% |
| All Data[3] | 107% | 61% | 72% |

1. Annualized volatility is estimated by multiplying the standard deviation of % daily changes by sqrt(250)
2. Refers to the 30 days constant maturity VIX Futures Index that we constructed
3. 'All Data' corresponds to the period December 4, 2007 - November 30, 2009

For all three volatility measures, the average values for the different periods were comparable. The average values for the Crisis period were 49%, 37% and 42% higher than the Pre-Crisis period averages for the VIX, VIX Futures and VXV respectively. These results make

sense intuitively: VIX Futures are mean reverting and thus don't change as much as the VIX Index. Additionally, since VXV measures 90 day expected market volatility and incorporates the expectations of the 30 day market volatility (VIX), it is expected to be more stable than the VIX Index. Further, the average values for the Post-Crisis period were 24%, 18% and 32% higher than the Pre-Crisis period averages for the VIX, VIX Futures and VXV respectively. These results show that even as the stock market rebounded from its March 2009 bottom, the average values for three volatility measures were still significantly higher than their Pre-Crisis averages.

Results from Table 4b provide evidence that these three measures of volatility were more volatile during the Crisis period compared to other periods. The annualized volatility values for the VIX, VIX Futures and VXV for the Crisis period were 34%, 50% and 33% higher than the Pre-Crisis period volatilities. For the Post-Crisis period, the volatilities of VIX, VIX Futures and VXV were 87%, 101% and 77% respectively of their Pre-Crisis period values.

The behavior of the volatility of VIX Futures was different from that of the volatility of VIX and VXV Indexes. During the Crisis, volatility of VIX Futures increased more than that of the other measures, whereas during the Post-Crisis period, the volatility of VIX Futures reverted to its Pre-Crisis level while VIX and VXV became more stable compared to Pre-Crisis. The reason for this behavior could be related to VIX Future's Pre-Crisis value. During the Pre-Crisis period, VIX Futures had the lowest volatility of all three measures: the volatility of VIX and VXV Indexes were 2.0 and 1.36 times that of the 30 days constant maturity VIX Futures.

**Volatility of Volatility: Implied Volatility of VIX Options**

Figure 6 shows a plot of the average monthly implied volatilities that were estimated using the At-The-Money VIX Call Options. Not surprisingly, the implied volatility of VIX

Options was highest in October 2008, the month following the bankruptcy of Lehman Brothers. The spike in implied volatility in August 2007 could be related a specific action – the French bank BNP Paribas decided to freeze redemptions from its structured products funds due to liquidity concerns, which resulted in a panic in the market.

**Figure 6: Average Impied Volatility of ATM VIX Options**

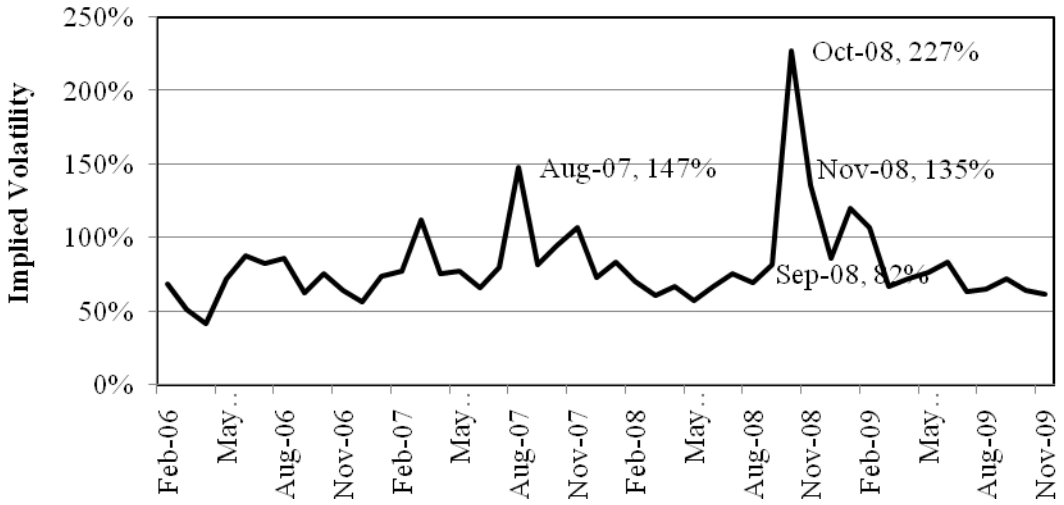



**Figure 6:** Average implied volatility of At-The-Money VIX Call Options. The August 2007 spike in implied volatility correspond to the problems with the BNP Paribas structured funds and the Oct 2008 peak corresponds to the market panic following the Lehman Brothers bankruptcy in September 2008. The sample period is February 2006 – November 2009. Source: CBOE MarketData Express Service

**Table 5: Comparison of different measures of Volatility of Volatility**

| Period | VIX Options - Average Implied Volatility[1] | Volatility of VIX % Daily Changes | Volatility of VIX Futures % Daily Changes[2] |
|---|---|---|---|
| Pre-Crisis[3] | 80% | 119% | 56% |
| Crisis | 96% | 128% | 71% |
| Post-Crisis | 69% | 83% | 48% |
| All Data[4] | 83% | 116% | 59% |

1. At-The-Money Call Options were used to estimate implied volatility using the Black model
2. Refers to the 30 days constant maturity VIX Futures Index that we constructed
3. Pre-Crisis volatility estimates for VIX and VIX Futures are different from that reported in Table 4b due to the different sample periods.
4. All-Data corresponds to the period February 24, 2006 - November 30, 2009

Data in Table 5 shows that the implied volatility of VIX options increased during the Crisis period. Further, as the market rebounded from its March 2009 lows, the implied volatility of VIX Options dropped to levels lower than were observed before the Crisis. From Figure 6, it is easy to see that, except for a few spikes, the average monthly implied volatilities were quite similar.

Results in Table 5 also show that the implied volatility of VIX Options is lower than the realized volatility of VIX for all periods. This difference is to be expected because the underlying for the VIP Options is VIX Forwards, which are less volatile than VIX due to mean reversion.

### IV.2. Term Structure of Volatility: VIX vs VXV

Tables 4a and 4b showed the average values of the VIX and VXV Indexes and their annualized volatilities. Table 6 provides the correlation between these indexes and the statistical summary of the VIX:VXV ratio.

**Table 6: Summary Statistics for the VIX:VXV Ratio**

| Period | Correlation between VIX and VXV | Average VIX:VXV Ratio | Standard Deviation of VIX:VXV Ratio | % Time VIX:VXV Ratio > 1[1] |
|---|---|---|---|---|
| Pre-Crisis | 0.961 | 0.993 | 0.053 | 44% |

| | | | | |
|---|---|---|---|---|
| Crisis | 0.967 | 1.021 | 0.111 | 46% |
| Post-Crisis | 0.984 | 0.928 | 0.043 | 2% |
| All Data[2] | 0.969 | 0.983 | 0.095 | 30% |

1. % Time is estimated as the % of days the ratio of closing values of VIX and VXV was greater than 1

2. 'All Data' refers to the time period December 4, 2007 - November 30, 2009

The above results provide some interesting observations. First, there is very strong correlation between these two indexes, as expected. Second, for 70% of the study period, the VXV Index was higher than the VIX Index, indicating that the market expected the medium term stock market volatility to be higher than the short term volatility. This effect is very pronounced for the Post-Crisis period where the VXV Index was higher than the VIX Index for almost 98% of the time and the average VIX:VXV ratio was the smallest. The behavior of the VIX:VXV ratio during the Crisis period was different from other periods – during the Crisis period, on average, the VIX Index was higher than the VXV Index, indicating more near-term uncertainty. Moreover, the VIX:VXV ratio during the Crisis period was twice as volatile as this ratio in other periods, as seen by the standard deviation of this ratio. Appendix B shows the results of T-tests which indicate that the average VIX:VXV ratio during the crisis is different from 1 and different from the ratios for the other periods at 95% significance levels.

### IV.3. Volatility Skew

Figure 7 and Table 7 provide a summary of the regression of 30 days Implied Volatility Skew of the S&P 500 Options on the 30 days Implied Volatility of the At-The-Money S&P 500 Options. The results indicate that there is a strong correlation between the Volatility Skew

and the ATM Implied Volatility during the Crisis period, whereas during other periods, the correlation is very weak. For the Post-Crisis period, the small t-statistic for the regression indicates that the linear relationship between Volatility Skew and ATM Volatility cannot be established at high significance levels. We posit that the reason for the weak correlation during the Post-Crisis period could be due to the low variance of both the Volatility Skew and the ATM Volatility during this period. The standard deviation as a percentage of the average was the lowest for both ATM Volatility (19.4%) and the Volatility Skew (15.2%) during the Post-Crisis period. As a result, the observed data may not have had sufficient variability to establish a linear relationship with a high level of significance. This suggested to us that the volatility skew might be level dependent but insensitive for small changes in ATM Volatility. So, we divided the data into groups based on bands of ATM Volatility and performed a regression between the Average ATM Volatility and Average Volatility skew. Table 8 shows the ATM Volatility and Volatility Skew data by bands and Table 9 shows the summary of the regression analysis using the bands.

**Figure 7: S&P 500 Implied Volatility Skew Vs ATM Implied Volatility**

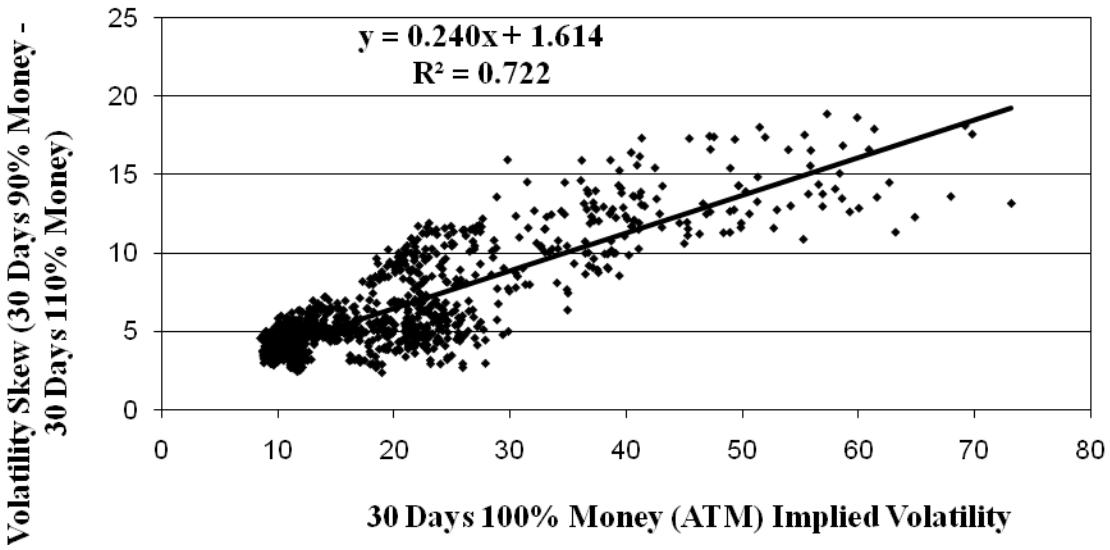



**Figure 7:** Regression of Implied Volatility Skew of 30 days S&P 500 Options on the At-The-Money Implied Volatility of 30 days S&P 500 Options. The regression results are significant and indicate that a strong correlation volatility skew and the level of volatility. The sample period for this study is January 2005 – November 2009. Data Source: Bloomberg

**Table 7: Summary of Regression of S&P 500 Implied Volatility Skew on ATM Implied Volatility**

| Period | Correlation | Average ATM IV[1] | Std Dev ATM IV[1] | Average Vol Skew[2] | Std Dev Vol Skew[2] | Coefficient of ATM Volatility | t-Statistic |
|---|---|---|---|---|---|---|---|
| Pre-Crisis | 0.406 | 13.4 | 4.7 | 4.6 | 1.05 | 0.089 | 12.58 |
| Crisis | 0.853 | 33.1 | 14.1 | 9.4 | 4.43 | 0.268 | 26.46 |
| Post-Crisis | 0.019 | 25.3 | 4.9 | 9.3 | 1.42 | 0.005 | 0.232 |
| All Data[3] | 0.849 | 19.1 | 11.4 | 6.2 | 3.23 | 0.240 | 56.05 |

1. 'ATM IV' refers to the At-The-Money Implied Volatility (100% money) of 30 days S&P 500 Options

2. 'Vol Skew' refers to the implied volatility skew of 30 days S&P 500 Options (90% money Implied Volatility - 110% money Implied Volatility)

3. 'All Data' refers to the time period January 2005 - November 2009

**Table 8: Summary of data grouped by ATM Implied Volatility Bands**

| Group | 30 Days 100% Money Implied Volatility | 30 Days Implied Volatility Skew |
|---|---|---|
| 5-10 | 9.50 | 3.93 |
| 10-15 | 11.60 | 4.52 |
| 15-20 | 17.64 | 5.43 |
| 20-25 | 22.29 | 6.70 |
| 25-30 | 26.82 | 7.70 |
| 30-35 | 32.80 | 10.36 |
| 35-40 | 37.82 | 11.70 |
| 40-45 | 41.49 | 13.01 |
| 45-50 | 47.72 | 13.56 |
| 50-55 | 52.02 | 14.35 |
| 55-60 | 57.35 | 14.83 |
| 60-65 | 62.37 | 14.32 |
| 65-70 | 68.93 | 16.40 |
| 70-75 | 73.11 | 13.12 |

**Table 9: Summary of Regression of S&P 500 Volatility Skew on 30 days ATM Volatility**

| | Coefficient | t-Statistic | Regression R-square | Regression F |
|---|---|---|---|---|
| Intercept | 3.157 | 3.35 | 0.87 | 80.3 |
| 30 Days 100% Money | 0.188 | 8.96 | | |

1. The sample period for this study is January 2005 - October 2009

2. The regression equation is: Volatility Skew = 3.157 + 0.188 * ATM Volatility

The large t-statistic for the regression indicates with a high level of significance that there is linear relationship between the Volatility Skew and the ATM Volatility. Moreover, an R-square of 0.87 indicates that the ATM Volatility explains 87% of the variability in the Volatility Skew. These results and the regression results for the Post-Crisis period shown in Table 7 (where the correlation was weak due to low variance of the independent and dependent variables) support our hypothesis that the Volatility Skew is dependent on the level of ATM Volatility but is insensitive to small changes in ATM Volatility.

### IV.4. Leverage Effect: Relationship between S&P 500 returns, VIX and VIX Futures

Table 10 below shows the results of our analysis. Appendix C shows the complete results of the regression analysis for each period that we analyzed.

**Table 10: Regression Results – Relationship between daily SPX returns (dependent variable) and daily changes in VIX (independent variable)**

| Period | VIX Increases 100 bps[3] | VIX Decreases 100 bps[3] | R-Square | Regression F | Intercept |
|---|---|---|---|---|---|
| Pre-Crisis | -0.745% | 0.539% | 0.71 | 961 | 0.115% |
| Crisis | -1.468% | 0.557% | 0.76 | 423 | 0.265% |
| Post-Crisis | -0.645% | 0.700% | 0.56 | 111 | 0.073% |
| All Data[1] | -0.861% | 0.593% | 0.72 | 1588 | 0.118% |
| Whaley[2] | -0.707% | 0.469% | 0.56 | | |

1. 'All Data' corresponds to the time period January 2005 - November 2009
2. In 2000, Robert Whaley estimated the relationship between weekly changes in VIX values and impact on S&P 500 based on data from 1986 - 1999
3. The data in these columns represents the changes in S&P 500 associated with a 100 bps increase or decrease in VIX

During the Pre-Crisis and All-Data scenarios, the relationship between the SPX Index returns and changes in VIX is comparable to the results reported by Whaley. During the Crisis period, however, the relationship between S&P 500 returns and VIX change is different from that in other periods. During the crisis, a -1.468% return of S&P 500 index value is associated with a 100 bps increase in VIX, whereas during the other periods, S&P 500 index returns of -0.65% to -0.86% were associated with a 100 bps increase in VIX. Although we regressed S&P 500 returns on VIX Change, we do not imply that the change in VIX values causes the S&P 500 to decrease or increase. The mechanics of the interaction could be described as follows: if an

exogenous negative shock impacts the system, it would cause a drop in the value of the S&P 500 index. This could cause an instantaneous increase in the volatility, which increases the value of the VIX.

The results show that the VIX index was less sensitive to drops in the value of S&P 500 during the crisis period compared to other periods. It is possible that during the crisis, the implied volatility on the S&P options was very high and thus bigger changes in S&P 500 were required during this period, compared to other periods, to cause the same change in implied volatility. The implied volatility data for the At-The-Money (ATM) SPX options that we obtained from Bloomberg confirms this hypothesis – the average ATM implied volatility during the crisis period was 33.1 compared to 19.1 for the entire study period. Additionally, during the Post-Crisis period, the impact on S&P 500 was higher when VIX dropped than when VIX increased. Again, without implying causality, what this means is that VIX dropped less for a certain increase in the S&P 500 value during this period compared to other periods. This could be because investors were very risk-averse after experiencing the turbulent markets during the crisis period and thus were slow to change their expectations about future volatility despite the improvements in S&P500.

**Table 11: Correlation of SPX Returns with VIX and 30-day maturity VIX Futures**

| Period | SPX Returns Correlation with VIX | SPX Returns Correlation with 30-day maturity VIX Futures |
|---|---|---|
| Pre-Crisis | -0.84 | -0.80 |
| Crisis | -0.87 | -0.85 |
| Post-Crisis | -0.75 | -0.82 |
| All-Data[1] | -0.85 | -0.84 |

1. All-Data corresponds to the period January 2006 - November 2009

Table 11 shows that the 30 day maturity VIX Futures contract has a strong negative correlation with SPX returns. Moreover, the results show that the correlation of the VIX Futures contract with SPX returns is quite comparable to the correlation between SPX returns and VIX changes, indicating that VIX Futures provide a good hedge against market volatility.

## V. SUMMARY

The stock market volatility, as measured by the volatility of S&P 500 Index, increased from 13.4% during the Pre-Crisis period to 43.6% during the Crisis (325% of Pre-Crisis level). Even after the S&P 500 Index rebounded from its March 2009 lows, the market volatility reverted only to 20.9%, which is 156% of the Pre-Crisis level. Similar behavior was also observed in the other measures of Volatility that we analyzed, i.e., VIX, VIX Futures and VXV. All three measures of volatility increased significantly during the Crisis period compared to the Pre-Crisis values. Moreover, as the market rebounded during the Post-Crisis period, all three measures decreased from their Crisis period highs, but did not revert back to the pre-Crisis level, indicating that market participants continued to expect higher market volatility despite the rally in the S&P 500 Index. The behavior of observed Volatility of Volatility (VIX, VIX Futures and VXV) and expected volatility of volatility (Implied Volatility of VIX Call Options) was a little different from that of Market Volatility. The Volatility of Volatility during the Crisis period increased from the Pre-Crisis levels, similar to the behavior of market volatility. However, during the Post-Crisis period, the volatility of volatility reverted to levels lower than those observed during the Pre-Crisis levels for most measures that we analyzed, unlike the market volatility values which remained above their Pre-Crisis levels.

We found the leverage effect during the study period. The relationship between market returns and volatility during the Pre-Crisis period was similar to that found by Whaley (2000). However, during the Crisis and Post-Crisis periods, this relationship seemed different. During the Crisis period, VIX seemed to be less sensitive to decreases in SPX Index, whereas during the Post-Crisis period, VIX seemed to be less sensitive to increases in SPX Index.

**References**


1. Black, F, 1976, "Studies of Stock Price Volatility Changes," *In Proceedings of the 1976 American Statistical Association, Business and Economical Statistics Section. Alexandria, VA: American Statistical Association*, pp. 177-181.
2. Brenner, M. and D. Galai, 1989, "New Financial Instruments for Hedging Changes in Volatility," *Financial Analyst Journal*, July/August, pp. 61-65.
3. Moran, M.T., and S. Dash, 2007, "VIX Futures and Options: Pricing and Using Volatility Products to Manage Downside Risk and Improve Efficiency in Equity Portfolios," *The Journal of Trading*, pp. 96-105.
4. Poon, Ser-Huang, and Clive W. J. Granger, 2003, Forecasting volatility in financial markets: A review, *Journal of Economic Literature,* 41, pp. 478–539.
5. Whaley, R.E, 1993, "Derivatives on Market Volatility: Hedging Tools Long Overdue," *The Journal of Derivatives*, pp. 71-84.
6. Whaley, R.E, 2000, "The Investor Fear Gauge," *Journal of Portfolio Management*, 26, pp. 12-17.
7. Zhang, J.E., Shu, J., and Brenner, M., 2010, "The New Market for Volatility Trading," *Journal of Futures Markets*, January.

## Appendix A – Bloomberg Implied Volatility Calculations

### I. Introduction

Bloomberg equity implied volatility datasets consist of implied volatilities for fixed maturities and moneyness levels based on out of the money option prices (4 pm closing mid prices). Their methodology is split into 2 parts: calculation of the implied forward price and calculation of implied volatility surface consistent with the implied forward price.

### II. Implied Forward Price

First, Bloomberg calculates the European Call and Put option prices from mid prices of American options, mid-underlying price (S), rates from Bloomberg S23 curve and dividends based on Bloomberg forecast model. Next, using put call parity, the implied forward price is calculated from the European call and put prices closest to the at-the-money and the interpolated risk-free rate as follows:

$$F_{impl} = Strike + e^{rt}\,(c^E - p^E)$$

*Where $c^E$ and $p^E$ are the European Call and Put option prices.*

To calculate the implied forwards for fixed maturity points (30, 60 days etc), the forward prices are transformed into returns using the following formula:

$$r_{impl}(T) = \left(\frac{1}{T}\right) \ln\left(\frac{F_{impl}(T)}{S}\right)$$

Finally,

$$F_{impl}(T) = Spot * \exp(r_{impl} * T)$$

## III. Volatility Surface

The implied volatility $\sigma_{impl}$ for each maturity and strike level is computed by equating the Black-Scholes formula to the European option price calculated using the methodology of section II and the implied forward also calculated in section II.

$$c^E = e^{-rt} F_{impl} N\left(\frac{\ln\left(\frac{F_{impl}}{K}\right) + 0.5 * \sigma_{impl}^2 * T}{\sigma_{impl}\sqrt{T}}\right) - Ke^{-rt} N\left(\frac{\ln\left(\frac{F_{impl}}{K}\right) - 0.5 * \sigma_{impl}^2 * T}{\sigma_{impl}\sqrt{T}}\right)$$

To calculate the implied volatility at a fixed level of moneyness, Bloomberg uses non-parametric interpolation in variance space across strikes and to interpolate in time, they use a Hermite cubic spline interpolation in total implied variance space.

## IV. Definition

% Moneyness = $\frac{Strike}{Spot}$

## Appendix B – VIX:VXV T-test results

### Two-Sample T-Test and CI: Crisis Period, Post-Crisis Period

Two-sample T for Crisis Period vs Post-Crisis Period

| | N | Mean | StDev | SE Mean |
|---|---|---|---|---|
| Crisis | 263 | 1.021 | 0.111 | 0.0069 |
| Post-Crisis | 191 | 0.9278 | 0.0434 | 0.0031 |

Difference = mu (Crisis) - mu (Post-Crisis)
Estimate for difference: 0.09280
95% CI for difference: (0.07796, 0.10765)
T-Test of difference = 0 (vs not =): T-Value = 12.29
P-Value = 0.000 DF = 361

### Two-Sample T-Test and CI: Crisis Period, Pre-Crisis Period

Two-sample T for Crisis Period vs Pre-Crisis Period

| | N | Mean | StDev | SE Mean |
|---|---|---|---|---|
| Crisis | 263 | 1.021 | 0.111 | 0.0069 |
| Pre-Crisis | 70 | 0.9929 | 0.0526 | 0.0063 |

Difference = mu (Crisis) - mu (Pre-Crisis)
Estimate for difference: 0.02777
95% CI for difference: (0.00944, 0.04610)
T-Test of difference = 0 (vs not =): T-Value = 2.98
P-Value = 0.003 DF = 241

### One-Sample T: Crisis Period

Test of mu = 1 vs not = 1

| Variable | N | Mean | StDev | SE Mean | 95% CI | T | P |
|---|---|---|---|---|---|---|---|
| Crisis | 263 | 1.02064 | 0.11133 | 0.00686 | (1.00713, 1.03416) | 3.01 | 0.003 |

## Appendix C – Leverage Effect: Regression Analysis Results

**Regression Results - Pre Crisis**

| | |
|---|---|
| Multiple R | 0.8428 |
| R Square | 0.7104 |
| Adj R Square | 0.7096 |
| Standard Error | 0.0046 |
| Observations | 787 |

ANOVA

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 2 | 0.0401 | 0.0200 | 961.4 | 1.11E-211 |
| Residual | 784 | 0.0163 | 0.0000 | | |
| Total | 786 | 0.0564 | | | |

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* | *Lower 95.0%* | *Upper 95.0%* |
|---|---|---|---|---|---|---|---|---|
| Intercept | 0.001 | 0.000 | 4.538 | 0.000 | 0.001 | 0.002 | 0.001 | 0.002 |
| ΔVIX | -0.005 | 0.000 | -30.125 | 0.000 | -0.006 | -0.005 | -0.006 | -0.005 |
| $\Delta VIX^+$ | -0.002 | 0.000 | -4.802 | 0.000 | -0.003 | -0.001 | -0.003 | -0.001 |

**Regression Results - Crisis**

| | |
|---|---|
| Multiple R | 0.875 |
| R Square | 0.765 |
| Adj R Square | 0.763 |
| Standard Error | 0.013 |
| Observations | 263 |

ANOVA

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 2 | 0.153 | 0.076 | 423.1 | 0.000 |
| Residual | 260 | 0.047 | 0.000 | | |
| Total | 262 | 0.200 | | | |

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* | *Lower 95.0%* | *Upper 95.0%* |
|---|---|---|---|---|---|---|---|---|
| Intercept | 0.003 | 0.001 | 2.073 | 0.039 | 0.000 | 0.005 | 0.000 | 0.005 |
| ΔVIX | -0.006 | 0.000 | -19.77 | 0.000 | -0.006 | -0.005 | -0.006 | -0.005 |
| $\Delta VIX^+$ | -0.009 | 0.002 | -4.278 | 0.000 | -0.013 | -0.005 | -0.013 | -0.005 |

Note: $\Delta VIX^+ = \Delta VIX$ if $\Delta VIX > 0$; otherwise $\Delta VIX^+ = 0$

**Regression Results - Post Crisis**

| | |
|---|---|
| Multiple R | 0.747 |
| R Square | 0.559 |
| Adj R Square | 0.554 |
| Standard Error | 0.009 |
| Observations | 178 |

ANOVA

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 2 | 0.017 | 0.009 | 110.8 | 0.000 |
| Residual | 175 | 0.014 | 0.000 | | |
| Total | 177 | 0.031 | | | |

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* | *Lower 95.0%* | *Upper 95.0%* |
|---|---|---|---|---|---|---|---|---|
| Intercept | 0.001 | 0.001 | 0.659 | 0.511 | -0.001 | 0.003 | -0.001 | 0.003 |
| ΔVIX | -0.007 | 0.001 | -9.96 | 0.000 | -0.008 | -0.006 | -0.008 | -0.006 |
| $\Delta VIX^+$ | 0.001 | 0.002 | 0.266 | 0.790 | -0.004 | 0.005 | -0.004 | 0.005 |

**Regression Results - All Data**

| | |
|---|---|
| Multiple R | 0.8495 |
| R Square | 0.7217 |
| Adj R Square | 0.7212 |
| Standard Error | 0.0081 |
| Observations | 1228 |

ANOVA

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 2 | 0.2082 | 0.1041 | 1588 | 0 |
| Residual | 1225 | 0.0803 | 0.0001 | | |
| Total | 1227 | 0.2884 | | | |

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* | *Lower 95.0%* | *Upper 95.0%* |
|---|---|---|---|---|---|---|---|---|
| Intercept | 0.0012 | 0.0003 | 3.45 | 0.0006 | 0.0005 | 0.0019 | 0.0005 | 0.002 |
| ΔVIX | -0.0059 | 0.0001 | -43.79 | 0.0000 | -0.0062 | -0.006 | -0.006 | -0.006 |
| $\Delta VIX^+$ | -0.0027 | 0.0006 | -4.79 | 0.0000 | -0.0038 | -0.002 | -0.004 | -0.002 |

Note: $\Delta VIX^{+} = \Delta VIX$ if $\Delta VIX > 0$; otherwise $\Delta VIX^{+} = 0$