Working Title

The working title of my Honors Thesis will be "The Effects of Mergers and Acquisitions on the Short-Term Volatility of Security Prices."

Project Purpose

The purpose of my proposed research is to determine whether statistically significant differences in short-term price volatility exist between companies which are comparable except for a recent, significant merger or acquisition (M&A) transaction. I will define a significant M&A transaction as one in which the consideration paid for the acquired firm is at least 10% of the market value of the acquiring firm. I hypothesize that the volatility of securities which represent ownership in companies which diversify their internal cash flows through M&A transactions will be significantly lower than those securities representing companies which have not recently experienced a significant M&A transaction.

Project Background and Importance

The fundamental aspects of Modern Portfolio Theory are set forth in Harry Markowitz's seminal paper *Portfolio Selection* (Markowitz 1952). Importantly, Markowitz established that investors will seek not only to hold a portfolio that maximizes expected return, but will also attempt to minimize the price volatility of the portfolio, as volatility is commonly understood to be a measure of investment risk. Said differently, sophisticated investors will attempt to maximize the amount of return they expect given a certain level of portfolio risk.

Diversification plays a key role in this optimization effort. Diversification involves an investor simultaneously holding multiple assets which have correlative relationships with values less than 1. As an increasing number of assets with less than perfect, positive correlations are added to a portfolio, the overall portfolio risk decreases towards a positive limit representing risk that cannot be mitigated through diversification (Bollerslev et al 1988). Thus, diversification helps to mitigate idiosyncratic (firm-specific) risk within a portfolio. However, the portfolio's level of expected return does not necessarily decrease proportionately. When this occurs, the Sharpe ratio of the portfolio increases This ratio is given as:

$$(E[r]_p - r_f)/\sigma_p$$

where $E[r]_p$ is the expected return on the portfolio, r_f is the risk-free rate, and σ_p is the standard deviation of the historical movements of the portfolio value. This is a positive development for investors attempting to maximize their risk-adjusted returns. In understanding how diversification achieves this, it is important to understand how securities are priced.

A security's intrinsic value is a function of the future cash flows the underlying assets are expected to generate as well as the risk that these expected cash flows will differ in size and timing from the investor's initial expectations. This is represented by the equation:

$$P_0 = \Sigma(CF_1/(1+r)^{\wedge}1, \, CF_2/(1+r)^{\wedge}2,...,CF_n/(1+r)^{\wedge}n)$$

where P_0 denotes the current price of the security, CF_n denotes the expected cash flow(s) to be received in each year n, and r is the required rate of return on the security. Prices of securities in efficient markets represent investors' estimations of the securities' intrinsic values given specific expected returns and risk levels, and fully reflect all publicly available information (Φ_t) at a given time (Fama 1970). An investor's expectations of the size and timing of these cash flows is influenced by both systematic and idiosyncratic factors. These idiosyncratic factors differ widely among firms, and will uniquely influence investors' expectations of the size and timing of cash flows generated by different companies during the same period. For example, a firm may have a issues with members of their board of directors which negatively impacts investors' expectations of the firm's future earnings, but this event has very little correlation with changes to other firms' stock prices; thus, this is an idiosyncratic event. Combining securities representing the cash flows of different firms within a single portfolio serves to mitigate the risk of any one security having a large positive or negative influence on the overall portfolio return and thus reduces the level of idiosyncratic risk present within the portfolio. Substituting a portfolio of securities for the single security priced above, we can immediately see that the intrinsic value of a portfolio is also driven by a combination of expected return and risk. Mitigating idiosyncratic risk within a portfolio tends to increase the value of the portfolio and is a critical element of the portfolio optimization effort.

While this simplistic view of pricing is informative, many publicly-traded companies do not generate earnings from a single source or have earnings sources which can easily be assigned a single discount factor. Many firms are the combination of many previously separate firms brought together through M&A transactions. Over the past several decades, several global merger waves have occurred, beginning in the 1990s (Qianying Xu 2017). M&A involves firms purchasing or selling assets, business segments, or entire companies outright. M&A exists as a strategic alternative to firms developing technology, hiring top talent, or gaining market share organically. Firms often purchase and/or merge with other firms whose cash flow risk is driven by fundamentally different economic forces; that is, cash flows with differing sensitivities to changes in economic factors are combined within a single entity. Combining these uncorrelated cash flows within a firm represented by a single publicly traded security may have effects on the volatility of said security similar to the volatility dampening effects of diversification within a portfolio of several securities.

The current literature tends to focus on the volatility of firms which have been targeted by bids and the implied volatility of options price after potential M&A transactions have been announced (Geppert & Kamerschen 2008; Hutson & Kearney 2001). There has also been research that has shown that conglomerate breakups tend to increase the volatility of the parent firms, and that this may be caused in part by a loss of cash flows diversification (Desai & Savickas 2010). This would further imply that a significant difference should exist between firms which have recently completed mergers and those that have not. Other research has shown significant increases in price volatility during intraday trading after the announcement of a transaction, as well as prior to the announcement itself (Smith et al. 1997; Rodriguez et al. 2012). While research into the implied volatility shows that investors expect M&A transactions to, on average, increase risk, little research has been done into the realized changes in price volatility post-merger (Geppert & Kamerschen 2008).

The importance of this research lies in its potential predictive usefulness. Being able to better predict the volatility effects of M&A volatility is a key input in several critical financial functions, such as options pricing and appropriately implementing hedging strategies (Black & Scholes 1973). Being able to better predict the volatility of a stock post-merger completion would allow investors to more efficiently organize optimal portfolios, more accurately price options and companies to better plan for and implement various hedging strategies (Engle 2002).

This project will attempt to uncover any existing, statistically significant differences between the price volatility of securities representing newly combined cash flows and those which do not. There has been much research into what drives M&A activity and M&A waves (Harford 2005; Szucs 2016) and broad fluctuations in aggregate M&A activity have become easier to foresee. Expanding the current literature regarding the effects of M&A on the risk of diverse portfolios through its effects on idiosyncratic volatility will be important for investors wishing to organize optimal portfolios, price options, and appropriately hedge risk around of these periods and transactions, as understanding the expected level of price volatility of these assets is critical to doing so successfully (Engle 2002).

Project Overview

To begin this research and analysis I will identify pairs of publicly traded companies which are comparable in size, industry, geography serviced, and other important factors. I will then identify 20-30 examples of when one of the companies in each of these pairs announced a significant transaction while the other did not. I will then observe the volatility of each firm's stock stock price for three months prior to the announcement and three months after the merger closes. I may need to enlarge this timeframe over the life of this project, and I may observe significant differences in realized price volatility over different lengths of time post-merger completion. It has been shown that the period after the announcement of most M&A transactional bids is one of lower volatility, as trader's opinions on the price of the target decreases, and so I will not examine this period between announcement and merger completion (Hutson & Kearney 2001). Measuring the difference between the volatility of two comparable firms over the period of time prior to the announcement and after merger completion should help control for potentially confounding factors that could also affect price volatility. In practice, simple rolling averages, as well as time-weighted exponential smoothing and various multivariate generalized autoregressive conditional heteroskedasticity (GARCH) or stochastic volatility models are used to measure volatility over time (Engle 2002). It is likely that I will incorporate all three of these approaches into my project. I will access data primarily from resources located on the Brigham Young University campus, such as the Bloomberg™ terminal databases, CapitalIQ, and Gregory Adams, the Director of Finance Research within the Finance Department. The statistical aggregators and analysis software I will use will include Microsoft Excel, Tableau, and Microsoft Access.

Thesis Committee Qualifications

Professor Hal Heaton

Finance Department Honors Coordinator

Professor Heaton is currently the Denny L. & Jerri Brown Professor of Finance at Brigham Young University. Professor Heaton holds a BS in Mathematics and a Master's in Business Administration degree from Brigham Young University, as well as a Master of Arts degree in Economics and a Ph.D, both from Stanford University. His published research includes:

1) "Key Issues in Determining Discount Rates for Real Property" *Journal of the Society of Petroleum Evaluation Engineers*, Edition 1, Volume VI, Issue 1, pages 39-44, Society of Petroleum Evaluation Engineers, Baltimore, MD, Richard Miller, 2012.
2) "Adjusting Discount Rates to Reflect Illiquidity" *Property Tax Alert: Practitioner Perspectives*, Edition 1, Volume 8, Issue 1, Pages 1-8, CCH Institute, Chicago, IL, 2010.
3) "On Using Data from Securities to Determine Discount Rates for Real Property", *The Journal of Property Tax Assessment and Administration*, 2009.

Professor Brian Boyer

Honors Thesis Advisor

Professor Boyer is currently the H. Taylor Peery Fellow and an Associate Professor of Finance at Brigham Young University. Professor Boyer holds a BS in Economics from Brigham Young University and a Ph.D in Finance from the University of Michigan Ross School of Business. He has previously taught in several positions at Brigham Young University and the University of California at Los Angeles, and spent several years as a research assistant for the Board of Governors of the Federal Reserve. His published research includes:

1) "Investor Flows and Stock Market Returns", *Journal of Empirical Finance*, Volume 16, Pages 87-100, 2009.
2) "Evaluating Forecasts of Correlation Using Option Pricing", *Journal of Derivatives*, Volume 6, Pages 18-38, 1998.
3) "Pitfalls in Tests for Changes in Correlations", *International Finance Discussion Papers*, Volume 597, Board of Governors of the Federal Reserve System, 1997.

Professor Todd Mitton

Honors Thesis Reader

Professor Mitton is currently the Ned C. Hill Professor of Finance at Brigham Young University. He holds a BA in Economics from Brigham Young University and an MBA from the BYU Marriott School of Business, as well as a Ph.D in Financial Economics from the Massachusetts Institute of Technology Sloan School of Business. He was awarded the 2018 Marriott School Faculty of the Year award. His published research includes:

1) Analysis for Financial Management, 12th Edition. McGraw-Hill Education, 2018.
2) "Expected Idiosyncratic Skewness." *Review of Financial Studies* 23, 2010, 169–202.
3) "Why Do Firms with Diversification Discounts Have Higher Expected Returns?" *Journal of Financial and Quantitative Analysis* 45, 2010, 1367–1390.

Project Timeline

Deliverable	*Date of Completion (all dates 2019)*
Accumulate and aggregate relevant information, including: 1) Find firms with robust and firms with insignificant levels of previous M&A activity 2) Gather historical price data of relevant securities for comparison	February 1
Perform analysis	March 1
Discuss findings with committee members and begin drafting my thesis	March 7
Multiple thesis revisions and submission of thesis draft	April 1
Submit thesis draft and thesis defense information form	April 7
Thesis defense and submission of thesis defense form	May 1
Submit finalized thesis	May 14

I will follow up on the completion of each step with meetings with my committee members for an increased level of accountability. I will also meet with my advisor and reader as frequently as necessary to ensure that these deadlines are met. I plan on graduating in December, 2019, and at the time of writing the applicable BYU Honors Program deadlines have not been released. The expected deadlines are approximated as follows, using information available for December 2018 graduates:

Deliverable	Approximate Deadline (all dates 2019)
Deadline to apply for graduation	September 15
Thesis proposal submitted	May 4
Thesis defence information form	November 2
Thesis submission form	November 30
Thesis final	December 7
Thesis publication	December 7

These deadlines are fully understood, and the above project timeline indicates that the applicable deliverables should be completed well prior to their respective deadlines.

IRB and/or IACUC Approvals

Neither of these approvals will be necessary for my project, as I will not be utilizing human or animal subjects.

Funding

I do not expect the completion of my thesis to require funding.

Culminating Experiences

While several professional, asset management focused conferences and journals exist, they are limited in number my chances of being selected to be published or present at these is also limited. Because of this, I will attempt to publish in at least one undergraduate research journal, such as the *American Journal of Undergraduate Research*, the *Honors Review*, or the *Journal of Undergraduate Research and Scholarly Excellence*. I will also attempt to present at at least one undergraduate research conference, such as the National Conferences for Undergraduate Research or the Utah Conference for Undergraduate Research.

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