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The Effects of Inter-Industry Mergers and Acquisitions on the Long-Term Volatility of Equity Returns

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Honors Thesis

THE EFFECTS OF INTER-INDUSTRY MERGERS AND ACQUISITIONS ON THE LONG-TERM VOLATILTY OF EQUITY RETURNS

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ABSTRACT

THE EFFECTS OF INTER-INDUSTRY MERGERS AND ACQUISITIONS ON THE LONG-TERM VOLATILITY OF EQUITY RETURNS

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The objective of this research was to discover whether a significant relationship exists between the theoretically diversifying effects of inter-industry mergers and acquisitions ("M&A") and changes in the volatilities of acquisitive firms' publicly-traded equity security returns (measured as the standard deviation of percentage changes in price) from pre-transaction announcement to post-transaction completion. My hypothesis is that a negative relationship should exist between changes in a firm's equity return volatility over time and whether the firm completes a diversifying acquisition, which I define as one in which the target firm primarily operates in a different industry than the acquirer. 980 diversifying and 9256 non-diversifying M&A transactions announced and completed between January 1980 and June 2017 were included in this research. When various systematic and idiosyncratic factors which affect the volatility of equity returns were controlled in a multiple regression, a statistically significant, negative relationship was discovered between whether a firm completes a diversifying acquisition and the change in the firm's equity return volatility from a pre-transaction announcement period to a post-transaction completion period. All factors considered in the multiple regression

were found to be statistically significant. The multiple regression results also suggest that the most significant factors influencing changes in acquirers' equity return volatilities during the time periods surrounding M&A transactions are idiosyncratic.

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I. Introduction

Mergers and acquisitions ("M&A") transactions typically have significant impacts on the characteristics of the firms involved. With over $25.7tn in global, announced transaction value between 2014 and 2018, mergers and acquisitions affect a large percentage of firms across the globe each year (Bloomberg 2019). The announcement and evolution of an M&A transaction provides securities and derivatives markets with a substantial amount of novel information regarding the companies involved and the industries in which they compete (Waldman & Jensen 2001). In relatively efficient capital markets this new information is impounded quickly into the prices of related securities by market participants, increasing the securities' short-term return volatility (measured as the standard deviation of percentage changes in price, σ) surrounding the transactions' announcements (Brown et al. 1988; Lee et al. 1994; Smith et al. 1997; Rodrigues et al. 2012). While the various effects of M&A transactions on the return volatilities of affected equity securities during the periods between transaction announcements and completions have been thoroughly researched, relatively little attention has been given to the effects of M&A transactions on the return volatilities of these same securities during post-transaction completion periods. Research which is focused on discovering and understanding the primary factors affecting changes in relevant equity return volatilities across the time periods surrounding M&A transactions is even more scarce.

A thorough understanding among capital and derivatives markets participants of the trends in and drivers of the volatility of various security returns is a critical factor influencing the overall efficiency of these markets. This understanding is an important market efficiency factor because observed and expected security volatility levels influence many of the decisions made by market participants. For instance, the standard deviation

of the historical returns of a security or portfolio is a figure regularly used both in academic research and the financial services industry as a measure of the total risk of the security or portfolio. This measure of total risk is also a critical input in portfolio optimization models, as well as models which are used to value securities, portfolios, and related derivative instruments (Markowitz 1952; Sharpe 1964; Black & Scholes 1973). Therefore, an improved understanding of the effects of factors which influence changes in the overall return volatilities of the equity securities of firms involved in mergers and acquisitions is valuable to both the firms and financial market participants involved.

This paper attempts to expand the body of literature focused on understanding the factors which influence the volatility of equity security returns across time by discovering whether or not a significant relationship exists between long-term changes in the volatility of acquisitive firms' publicly-traded equity returns and the diversifying nature of certain M&A transactions. I define a diversifying transaction as one in which the target firm primarily operates in a different industry than the industry in which the acquiring firm primarily operates. If an M&A transaction diversifies the acquirer's underlying cash flows in this manner, a dampening effect on the daily standard deviation of the acquirer's equity returns may be observed over time, similar to the volatility-dampening effects of adding securities whose returns negatively covary to a single portfolio. That the addition of negatively-covarying securities to a single portfolio decreases the idiosyncratic and overall risk of the portfolio has been thoroughly demonstrated in the literature, beginning with Markowitz (Markowitz 1952). However, the effects of combining previously separate firms which primarily operate in different industries (and therefore generate somewhat independent, uncorrelated cash flows) on the resulting daily equity return volatility of the securities representing ownership in the

surviving firm have not been thoroughly studied. When beginning this research, I predicted that a statistically significant decrease in the mean daily standard deviation of the equity security returns of firms which have acquired diversifying target firms would be observed across time from each pre-transaction announcement period to each post-transaction completion period. My hypothesis is that a portion of this decrease in mean equity return volatility would be significantly related to the diversifying nature of the transactions completed by these firms.

II. Literature Review

The effects of M&A transactions on the return volatilities of the equity securities of both acquisitive and target firms during the various time periods surrounding M&A transactions have generally been well researched. The extant literature tends to focus on changes in the equity return volatilities of firms which have been targeted by takeover bids and the conditional, expected equity return volatilities implied by changes in related options prices after M&A transactions have been announced (Hutson & Kearney 2001; Geppert & Kamerschen 2008). It has been demonstrated that in both pre- and post-transaction announcement periods the daily standard deviations of the returns of equity securities affected by these significant releases of new information increase dramatically as market participants attempt to incorporate and price said information (Brown et al. 1988; Lee et al. 1994; Smith et al. 1997; Rodrigues et al. 2012). Bid-ask spreads on the prices of relevant equity securities tend to widen as the level of uncertainty regarding the future cash flows to be generated by the assets underlying these securities increases during post-transaction announcement periods (Jennings 1994). This increase in

uncertainty among market participants drives increases in the volatility of relevant equity securities' returns during post-transaction announcement periods. It has also been shown that capital market participants expect the cash flows to be generated by entities resulting from successful M&A transactions to have increased risk due to various integration frictions which may exist post-transaction completion. Expectations of new integration frictions also typically drive an increase in the daily standard deviation of the surviving entity's equity security returns for a time (Brown et al. 1988; Lee et al. 1994; Geppert & Kamerschen 2008).

Extensive research has been completed which examines the effects of mergers and acquisitions on the daily equity return standard deviations of securities representing ownership in firms operating in specific industries and over certain periods of time (Shim 2011; Pessahna et al. 2016; Chang & Cho 2017). Still other research has been conducted which examines the effects of M&A transactions on changes in the equity return volatility of firms whose operations are exposed to differing geographical and political factors (Zhu et al. 2014).

Research which analyzes the effects of diversification on the total volatility of a portfolio of securities is also extensive. Markowitz was one of the earliest researchers to show that increased diversification, or the addition of securities to a portfolio whose covariance of returns relative to that same portfolio are negative, decreases the total and idiosyncratic risk of the portfolio (Markowitz 1952). This understanding is so fundamental that most models used for pricing capital assets assume that investors are well-diversified and demand no additional return for bearing idiosyncratic (firm-specific) risk because it may be mitigated at little to no marginal cost through diversification (Goetzmann & Kumar 2001). Conversely, when well-diversified portfolios are broken into

their component parts, the average risk observed across all previously-constituent positions tends to be higher than the total risk of the original, well-diversified portfolio. This increase in mean volatility occurs as the effects of diversification are removed. The effects of lowering the level of diversification within a portfolio on the total volatility of the portfolio's returns may also be observed when analyzing the risk of equity securities representing ownership in entities which were previously combined within a single firm and represented by a single, publicly traded equity security. For instance, it has been shown that in the event of a conglomerate break-up, observed increases in the mean return standard deviations of the equity securities representing ownership in the newly-separated firms are caused, at least in part, by the lessening of the effects of diversification on the economic sensitivities of cash flows previously generated by a single firm and represented by a single security (Desai & Savickas 2010).

However, very little research has been completed which investigates the primary drivers of changes in the daily return standard deviations of equity securities affected by the opposite phenomena; that is, the effects of diversifying mergers and acquisitions on the post-transaction completion return volatilities of equity securities representing ownership in newly combined entities. There is one, currently unpublished, exception (Bharath & Wu 2006). However, this paper only compares the scaled changes in equity return volatilities from the pre-transaction announcement to post-transaction completion periods between acquirers involved in intra- and inter-industry M&A transactions and does not control for several important systematic and industry-specific factors which influence the volatility of equity returns. There are also several significant statistical control issues inherent in their approach which I attempt to overcome in this analysis, and which are treated further in the Data and Methodology section.

III. Hypothesis Development

The fundamental aspects of Modern Portfolio Theory ("MPT") are set forth in Harry Markowitz's seminal paper *Portfolio Selection* (Markowitz 1952). Importantly, Markowitz established that investors will seek not only to hold portfolios which maximize their expected return but will also simultaneously attempt to minimize the standard deviation of percentage changes in the value of their portfolios over time. This quantification of investment risk as the volatility of a portfolio's or security's returns is a relatively robust figure still widely cited today. Therefore, Markowitz's research demonstrated that sophisticated investors will attempt to maximize the amount of return they expect from a portfolio given a certain level of risk (the expected volatility of the portfolio's returns).

Diversification plays a key role in this portfolio optimization effort. Diversification involves an investor simultaneously holding multiple assets whose returns negatively covary within a single portfolio. As the number of risky assets with negatively-covarying returns that are added to a portfolio approaches infinity, the overall portfolio return volatility decreases towards a positive limit representing risk that cannot be mitigated through diversification (Bollerslev et al. 1988). This risk which cannot be mitigated through diversification is systematic in nature. Thus, diversification helps to mitigate the portion of a portfolio's return volatility which is driven by the idiosyncratic developments affecting the return volatility of the individual securities of which the portfolio is comprised. However, as a portfolio becomes more diversified and the total risk of the portfolio decreases the portfolio's level of expected return does not necessarily decrease proportionately. When tilting a portfolio towards a security causes the total risk of the portfolio to decrease in larger proportion than the potential decrease in the expected

return of the portfolio, the Sharpe ratio of the portfolio increases. This ratio is expressed as:

$$\frac{E[r_p] - r_f}{\sigma_p}$$

where $E[r_p]$ is the expected return of the portfolio, r_f is the risk-free interest rate, and σ_p is the standard deviation of the natural log of historical percentage changes in the value of the portfolio. When the Sharpe ratio of a portfolio increases it is a positive development for investors who hold the portfolio, as it is assumed that all investors attempt to maximize their level of risk-adjusted returns within the context of varying idiosyncratic constraints. To understand how diversification can help investors increase the Sharpe ratios of their portfolios through the reduction of idiosyncratic risk, it is important to understand how securities are priced.

A security's intrinsic value is a function of two major factors: the future cash flows the assets underlying the security are expected to generate as well as various risks associated with these expected cash flows. The major risks associated with these expected cash flows are that that the times at which investors receive them and their values may differ from investors' initial expectations. Both the times at which cash flows generated by the assets underlying a security are to be received, as well as the future values of the cash flows, influence investor's estimations of the present, intrinsic value of a security. This is represented by the function:

$$P_{t=0} = \sum_t \left(\frac{CF_t}{(1+r)^t} \right)$$

where $P_{t=0}$ denotes the current intrinsic value of the security, CF_t denotes the expected cash flow(s) to be received in period t, 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 return and risk levels, and fully reflect all publicly available information, Φ_t (Fama 1970).

Investors' expectations regarding the size and timing of these cash flows are 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 to be generated by different companies during the same time period. For example, a firm may have issues with members of their board of directors which negatively impact investors' expectations of the firm's future earnings, but this event has little to no correlation with changes in these same investors' expectations regarding the size and timing of the cash flows to be generated by other firms; thus, this is an idiosyncratic development. A defining feature of a firm's idiosyncratic developments is that they are relatively independent, meaning that their level of correlation with other firm's idiosyncratic developments are very low. Therefore, combining securities representing claims on the cash flows generated by different firms within a single portfolio serves to mitigate the risk of any one firm's idiosyncratic developments having a large positive or negative influence on the overall portfolio returns and thus reduces the level of idiosyncratic risk present within the portfolio. If one substitutes the total cash flows expected to be generated by the assets underlying a portfolio of securities for the

expected cash flows to be received from holding a single security in the intrinsic value formula given previously, one can immediately see that the intrinsic value of a portfolio is driven by the interaction of the expected return and risk of the individual securities which comprise the portfolio. Thus, mitigating the level of idiosyncratic risk present within a portfolio through increased diversification tends to increase the intrinsic value of the portfolio and can increase its Sharpe ratio as well, as risk is represented in the denominator of both the present value function and the Sharpe ratio. Diversification is therefore a critical element of most investors' portfolio optimization efforts.

However, while this simplistic view of security and portfolio valuation is informative, many firms do not generate earnings from a single business unit operating within a single industry, and therefore these firms generate diverse cash flows which cannot easily be assigned a single, accurate discount factor. While the weighted average cost of capital ("WACC") allows investors to quantify the risks associated with these diverse cash flows and thus approximate a firm-wide discount factor, the underlying distributions representing the volatilities of a firm's debt and equity securities may be non-stationary, especially as their proportions within the capital structure change in the time periods surrounding M&A transactions (Choi & Richardson 2016). This figure also provides investors with no predictive information regarding a diversified firm's future debt and equity return volatilities that may result from new combinations of negatively-covarying, cash-flow generating assets. When diverse, cash flow generating assets are combined within a single firm through M&A transactions, the unique risk/return profile of the combination of these assets will significantly affect the degree to which investors react to changes in idiosyncratic and systematic factor values in determining the intrinsic

valuation of the firm, and therefore will have significant effects on the firm's future standard deviation of equity returns over time.

Many firms are either the combination of previously separate firms brought together through M&A transactions or have organically developed diverse business segments. In either case, these firms simultaneously operate in different industries and therefore generate cash flows which have differing sensitivities to economic risk factors. In recent decades several global M&A waves have occurred, beginning in the 1990s (Xu 2017). M&A transactions involve 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. M&A transactions are especially attractive to companies seeking to diversify their operations, as this method of diversification typically requires less effort from the acquiring firm than attempting to organically develop a diverse portfolio of operations. Whether for this reason or others, firms often purchase and/or merge with other firms whose cash flow risk is driven by fundamentally different economic factors; that is, previously separate assets generating cash flows with differing sensitivities to changes in economic risk factors are combined within a single entity. As previously discussed, combining these diverse cash flows within a firm represented by a single publicly-traded equity security may have effects on the volatility of the returns of said security which are similar to the volatility dampening effects of combining securities with negatively-covarying returns within a single portfolio.

These points together indicate that statistically significant differences between changes in the standard deviations of returns over time should exist between the equity securities of firms which have successfully completed diversifying mergers and

acquisitions and those that have not but are otherwise comparable. The hypothesis put forward in this paper, then, is that a statistically significant difference should exist between the changes in the daily equity return standard deviations of acquisitive, diversifying firms, and a group of non-acquisitive control firms across the time periods surrounding the announcement and completion of diversifying M&A transactions, and that this difference will be significantly related to the diversifying nature of these acquisitions. I also hypothesize that the relationship between the diversifying nature of the acquisitions and the differences in the changes in equity return volatilities will be found to be negative, as increasing the level of diversification within the underlying cash flows generated by the newly combined firms should lower the average equity return volatility of the diversifying acquirers over time. Said differently, I hypothesize that the mean equity return volatility of diversifying acquirers over time will become proportionately smaller than the mean equity return volatility of non-acquisitive control firms over the same periods of time surrounding the acquisitive firms' transactions. To test these hypotheses I use both two-sided t-tests and a multiple regression, the development of which is described in the Data and Methodology section.

The importance of this research is fundamentally connected to the potential predictive value of its results. As previously discussed, being able to more accurately forecast the effects of M&A transactions on changes in the standard deviation of equity returns is important because the return volatility of equity securities constitutes a key input in several critical financial functions, such as valuing securities, pricing derivative instruments and appropriately implementing hedging strategies (Black & Scholes 1973). Being able to better predict the resulting return volatility of an acquirer's equity securities during the post-transaction completion period would allow investors to more efficiently

organize optimal portfolios. It would also allow market participants to more accurately price options and would allow companies and investors to better develop and implement various hedging strategies (Engle 2002). Furthermore, understanding what systematic factors and idiosyncratic developments influence the present value of securities allows markets to react more quickly and accurately to novel information, increasing their overall efficiency. Thus, quantifying and establishing the potentially significant relationship between the diversifying nature of an M&A transaction and the resulting change in the acquiring firm's post-transaction completion equity return volatility could help improve the efficiency of certain financial markets.

This research will attempt to uncover and quantify any existing, statistically significant differences in the changes over time of the return volatility of equity securities representing newly combined, imperfectly correlated cash flows and the return volatility of equity securities which do not. Extensive research has been completed which focuses on the drivers of M&A activity and M&A waves, and broad fluctuations in aggregate M&A activity have become easier to foresee (Harford 2005; Szucs 2016). Expanding the body of literature that is focused on better understanding the effects of M&A transactions on the risk and value of diverse portfolios through their effects on the idiosyncratic portion of equity return volatilities is important for investors wishing to organize optimal portfolios, price options, and appropriately hedge risk around these transactions, as understanding the expected level of the return volatilities of the relevant equity securities is critical to doing so successfully (Engle 2002).

IV. Data and Methodology

The major steps involved in this research and analysis involved identifying three distinct groups of firms whose historical equity return data could be used to test my hypotheses and then calculating the equity return volatility figures necessary to do so. The first group consisted of acquisitive firms which had completed diversifying acquisitions. The second group consisted of acquisitive firms which had completed non-diversifying acquisitions, which I define as an acquisition in which the target and acquirer primarily operate in the same industry. The third group consisted of firms which were comparable to the acquisitive, diversifying firms in size and primary industry but which had not completed an acquisition within 360 days prior to the announcement of and 540 days after the completion of the acquisitions of their acquisitive, diversifying counterparts. This final control group consisted of firms which were paired, one-on-one, with firms from the acquisitive, diversifying group. They were grouped first by primary industry, then removed from each diversifying acquirer's list of potential pairings if they had completed an acquisition during the acquisitive, diversifying firm's pre-transaction announcement or post-transaction completion periods, and finally a firm was selected from the list of remaining potential comparable firms for each acquisitive, diversifying firm by closest market capitalization prior to the transaction announcement. Once the firms in these three groups were identified their historical equity price data was retrieved and the relevant equity return standard deviations for each firm in each group were calculated over the time periods before and after the relevant M&A transactions. These standard deviation figures were then used to test my hypotheses.

To accomplish this, I first used the Thomson SDC Platinum Mergers & Acquisitions database to identify all M&A transactions which were announced after

01/01/1980 and successfully completed before 06/30/2017. I then identified all transactions announced and completed during this period in which a company had acquired a target firm primarily operating in a different industry than the primary industry of the acquiring firm and filtered the dataset such that only these transactions remained. To achieve this, I used the companies' Standard Industrial Classification codes ("SIC codes") to filter each acquirer and target firm into one of 49 industry groups, which are defined by Kenneth French and Eugene Fama (Fama and French 1997). Each of these industry groups consists of a collection of closely related SIC codes, indicating that the cash flows generated by firms whose SIC codes place them in the same Fama-French industry group have similar sensitivities to economic factors. Therefore, if a firm purchased another firm in the same Fama-French industry group I did not consider the transaction to be diversifying and removed it from the initial dataset. I identified 980 transactions during the specified historical time period in which an acquiring firm purchased a target firm operating in a different industry group, where the relevant acquirer's equity price data was available for 360 days before its acquisition announcement and 540 days after the date its acquisition was completed, and finally where the target firm became a wholly-owned subsidiary of the acquiring firm, or that 100% of the outstanding equity of the target firm was purchased by the acquirer. To filter the transactions based on the availability of each acquirer's equity price data I utilized the Wharton Research Data Service's Center for Research in Security Prices ("CRSP") and Compustat's merged database.

I then needed to identify a group of comparable, non-acquisitive firms that could be paired with each of the acquisitive, diversifying firms noted above. To create a set of comparable firms to be used in significance testing I first used CRSP/Compustat's

merged database to identify all companies which had publicly-traded equity outstanding at any point between 1/1/1980 and 6/30/2017. I then isolated all companies in this list whose SIC codes placed them in the same Fama-French industry group as at least one of the acquisitive, diversifying firms in the previously isolated transactions. I then cross-checked every company in this master set of potential comparable firms to determine whether or not each potential comparable firm had participated in an M&A transaction within 360 days prior to each previously identified diversifying transaction announcement where the acquirer also primarily operated in the same Fama-French industry group as the potential comparable firm. I also checked each potential comparable firm for participation in an M&A transaction during the 540-day period post-transaction completion for every previously identified diversifying transaction where the acquirer primarily operated in the same industry group as the potential comparable firm.

I then checked every potential comparable firm against each diversifying transaction where the acquirer primarily operated in the same industry group as the potential comparable firm and filtered out the potential comparable firms for each acquirer if they had participated in an M&A transaction during one of the time periods surrounding each relevant transaction. Thus, depending on when a potential comparable firm had participated in M&A transactions the same firm may have been considered a potential, comparable pairing for several acquisitive, diversifying firms, a single acquisitive, diversifying firm, or none. These filters created a unique list of potential comparable firms for each acquisitive, diversifying firm where all potential comparable firms for a particular acquirer had not participated in an M&A transaction within the time periods described above surrounding the relevant transaction dates and all of which operated in the same industry as the diversifying acquirer.

If equity price data was not available for a potential comparable firm for at least 360 days prior to a relevant transaction announcement and 540 days after the same transaction became effective it was removed from the set of potential comparable firms for that particular acquirer. I then paired each of the acquisitive, diversifying firms with one, non-acquisitive control firm from the previously filtered lists to better control in my significance tests and multiple regression analysis for inherent differences in the sensitivities of the equity return volatilities of firms with certain market capitalizations, operating in certain industries, and during the specific time periods under observation to various economic factors. I matched each acquisitive, diversifying firm with a comparable firm from the previously constructed lists of potential comparable firms by closest market capitalization, calculated as of one month before the time of the relevant transaction announcement. This timing decision for the data to be used in the market capitalization calculations was intended to minimize the effects of each transaction announcement on the market prices of the equity securities of the acquirers and potential comparable firms. The final dataset consisted of 980 pairs of acquisitive, diversifying firms and non-acquisitive control firms, matched by primary industry of operation and market capitalization, and where the comparable, paired control firms had not participated in an M&A transaction within the windows described previously surrounding their paired counterparts' transaction announcements and completions. The daily equity return standard deviations of these firms were used in various t-tests and the multiple regression developed in this research, the results of which may be found in Appendix tables 1-6, 8, and 9.

I also used the Thomson Reuters SDC Platinum database and the CRSP/Compustat merged database to identify all transactions in which a firm

successfully completed a non-diversifying acquisition (one in which the acquirer and target primarily operated in the same Fama-French industry group) and which were announced after 01/01/1980 and successfully completed before 06/30/2017. This is the same time period during which the initial set of transactions involving acquisitive, diversifying firms were identified. I then filtered this list of acquisitive, non-diversifying firms based on whether each acquirer's equity price data was available for the 360-day period prior to each relevant acquisition announcement and the 540-day period after the dates of the same transactions' completions, and whether or not the target firm became a wholly owned subsidiary of the acquirer. If any transaction or acquirer did not meet these requirements the transaction was removed from the initial set of non-diversifying transactions. 9256 transactions which met these requirements during this historical period and each acquirer were identified. This group of acquisitive, non-diversifying acquirers was used in several two-sample t-tests and a final paired t-test to discover if significant differences exist in the changes in equity return volatilities between companies which have merged based on whether the transaction was diversifying in nature. The results of these significance tests are discussed in the Results section of this paper and can be found in Appendix tables 5-7.

Next, I acquired all available daily equity security price data for each of the companies in the acquisitive, diversifying group, the acquisitive, non-diversifying group, and the non-acquisitive control group for the historical period between 01/01/1979 and 12/31/2018 and calculated each equity security's percentage change in price between each trading day for 360 days prior to each relevant transaction's announcement and 540 days after the same transaction's completion date. This equity price information was pulled from the CRSP/Compustat merged database. I then calculated the daily, monthly,

and yearly standard deviations of the percentage changes in price (the returns) of the equity securities of each acquisitive, diversifying firm, each acquisitive, non-diversifying firm, and each non-acquisitive control firm during the 360-day period preceding each relevant transaction announcement and for the 540 days following the date each relevant transaction became effective. This yielded a daily standard deviation of returns for every equity security in each of the aforementioned groups during both the relevant pre-transaction announcement period and the same transaction's post completion period. These 'before and after' standard deviations of the equity returns of each acquisitive, diversifying firm and non-acquisitive control firm were the volatility figures utilized in my significance tests.

Following this I calculated the daily equity return standard deviations of each firm in each of the groups for every monthly period during the 540-day period following each relevant transaction completion date. I also calculated the percentage of each firm's pre-transaction announcement equity return volatility that the daily standard deviations of the same firm's equity returns observed during each monthly, post-transaction completion period represented. The results of these calculations can be found in Appendix tables 10-12 and are represented visually across time in Appendix figure 1. Patterns in the development of the mean daily equity return standard deviation of each of the aforementioned groups over the monthly post-transaction completion periods are discussed further in the Results section of this paper.

Finally, I calculated the changes in the mean daily equity return standard deviations of both the group of acquisitive, diversifying firms and the non-acquisitive control firms from the pre-transaction announcement to post-transaction completion periods, as well as the differences of the differences between the two groups across the

same periods and during each monthly period following the dates the transactions became effective. All calculations involving historical equity price data required that I first clean the data received from the CRSP/Compustat database. Some prices pulled from this database were listed as negative values and had to be changed to their absolute values. Where daily equity price data was missing on days where financial markets were open, I assumed that the data moved in a linear fashion from the last available price to the next available price and linearly interpolated the values in the missing spaces. Therefore, some of the calculated equity return volatility figures in this research may represent slightly different figures than were actually observed in the market. Few gaps were identified which spanned more than 1-2 trading days, indicating that the CRSP/Compustat merged database's equity price data was relatively clean and complete and that my assumption to linearly interpolate where it was found to be missing should not significantly affect the results of this research. These data cleaning measures and the calculations of the relevant equity return standard deviations described above were primarily executed programmatically using proprietary algorithms I developed through Microsoft's Visual Basic Application package in Microsoft Excel.

After calculating the daily return standard deviations of the equity securities of each firm in each of the three aforementioned groups during the periods described above, I then regressed the daily return standard deviations of both the acquisitive, diversifying firms' equities and non-acquisitive control group's equities observed during both pre-transaction announcement and post-transaction completion periods. I regressed these volatility figures against several significant factors which are known to affect the volatility of equity returns. I utilized Microsoft Excel's Data Analysis programs package to run this regression. The selected factors and their sources are discussed here:

Multiple Regression Factor Selection and Data Sources

a) It has been shown that the market value of a firm affects the volatility of the returns of its equity securities (Cheung & Ng 1992). It has been shown that, while controlling for other factors affecting a firm's equity return volatility, as a firm's market value of equity increases the overall return volatility of that same equity decreases. To control for this factor, the market capitalization of each firm, both from the acquisitive, diversifying group and non-acquisitive control group, was calculated as of one month prior to the date of the paired firms' applicable transaction announcements. For each pairing, this was the date of the acquisitive, diversifying firm's transaction announcement. I then calculated the natural log of each firm's market capitalization on this date and utilized these figures in my regression. The data for these calculations, including the share price and number of common shares of stock outstanding for each firm, were accessed from CRSP/Compustat's merged database. This factor is labeled "ln(Firm Market Capitalization)" in the regression results included in Appendix table 9.

b) It has been shown that different levels of current and expected inflation significantly affect the volatility of equity security returns (Valcarcel 2012). To control for changes in the level of realized inflation over time I utilized information on the Consumer Price Index ("CPI"), which I accessed from Kenneth French's website, to approximate the value of the inflation factor within the United States associated with the time periods during which the standard deviations of equity returns were observed. Approximate percent changes in the CPI for the calendar year prior to the date of each transaction announcement and the calendar year prior to the date each transaction became effective were used.

These percentage changes in the CPI were matched in the multiple regression with the daily standard deviation of equity returns observed during the time periods surrounding the relevant transaction dates. This factor is labeled "Inflation" in the regression results included in Appendix table 9.

c) It is known that the general volatility level of a securities market is a significant factor affecting the conditional, expected return volatilities of individual securities traded in the market (Smith 1989). To control for this systematic factor, I calculated the daily standard deviations of percentage changes in the level of the S&P 500 index for the same periods I calculated each firm's equity return volatility during, namely, 360 days before every transaction announcement and 540 days after every transaction completion date. I derived these figures using data from CRSP/Compustat's merged database and included these values in my regression, pairing each equity return standard deviation with the standard deviation of daily S&P 500 returns observed during the same historical time period that the paired equity return volatility was observed. This factor is labeled "Market Volatility During Period" in the regression results included in Appendix table 9.

d) It is known that a firm's equity return volatility is significantly influenced by the age of the firm (Khan et al. 2016). The standard deviations of returns of equity securities representing ownership in older, more well-established firms tend to be smaller than the average levels of equity return volatility observed among younger firms. To control for this age factor, I first found the earliest date that each firm had floated equity securities to the public, and then, for each firm, subtracted this date from the date the relevant transaction was announced. These calculations were possible because the dates were stored as serial numbers, where

each additional day across a period of time increased the serial number representing that particular date by 1. Thus, I was able to divide these time-difference figures by 365 to give an age approximation (in calendar years) for each acquisitive, diversifying firm and each non-acquisitive control firm at the time of the relevant transaction announcement for each pairing. Data for these calculations was also accessed from the CRSP/Compustst database. This factor is labeled "Age of Firm" in the regression results included in Appendix table 9.

e) Several dummy variables were also included in the multiple regression. The first dummy variable accounts for the time period during which each daily standard deviation of equity returns was observed during, relative to the relevant transaction dates. This variable assumes a value of 0 if the standard deviation was observed during a pre-transaction announcement period and a 1 if it was observed during a post-transaction completion period. This factor is labeled "Post-Completion" in the regression results included in Appendix table 9. The second dummy variable accounts for whether each observed daily equity return standard deviation was calculated from the returns of a non-acquisitive control firm or an acquisitive, diversifying firm. This variable assumes a value of 0 if the equity security under observation was associated with a non-acquisitive control firm and assumes a value of 1 if it was associated with an acquisitive, diversifying firm. This factor is labeled "Acquisition" in the regression results included in Appendix table 9.

Finally, I included a dummy variable which accounted for any potential interaction between these two factors. This value of this variable for each observed equity return standard deviation was calculated as the product of the previous two

dummy variables' values for the same equity return volatility figure. Therefore, all values of this factor in the multiple regression assume a value of 0 except for those where the calculated daily return standard deviations are of equity securities associated with acquisitive, diversifying firms and are observed during the 540-day periods after these firms had completed their diversifying acquisitions. For equity return standard deviations with these characteristics, this final dummy variable assumes a value of 1. The regression coefficient and corresponding confidence interval of this final dummy variable were intended to show whether the null hypothesis could or could not be rejected with an α of .05, as this factor quantifies the isolated effects of the interaction between the passage of time and the diversifying nature of certain M&A transactions on changes in the equity return volatilities of diversifying acquirers. This factor is labeled "Acquisition * Post-Completion" in the regression results included in Appendix table 9.

Again, the coefficient value and 95% confidence interval associated with this interaction variable are intended to provide statistical evidence supporting the rejection of or failure to reject the null hypothesis, which is that no significant difference in the changes of acquisitive firms' observed equity return volatilities from the pre-transaction announcement to post-transaction completion periods will be observed, while controlling for the factors described above, based on whether or not the transactions are diversifying in nature. If the coefficient of this interaction variable is found to be negative and statistically significant, however, then the interaction between the diversifying nature of certain M&A transactions and the passage of time from the pre-transaction announcement to post-transaction completion periods surrounding the same transactions will be shown

to lower the mean daily standard deviation of the diversifying acquirers' equity returns, and this finding would support my hypothesis.

It is crucial to note that these are not the only systematic and idiosyncratic factors which have significant effects on the volatilities of equity returns. Other important factors were considered for use in the multiple regression but were purposefully not included, primarily due to a lack of accurate, readily-available data. Discussion treating the choice to omit several of these significant factors, as well as what could potentially be done to control for them in future research, is included in the Conclusions and Discussion section of this paper.

V. Significance Testing

While distributions of the standard deviations of returns for groups of equity securities are typically highly skewed, the differences between the daily standard deviations of the observed equity security returns from all three isolated groups of firms across time periods and between the paired groups of acquisitive, diversifying firms and non-acquisitive control firms were found to be approximately normally distributed (Andersen et al. 2001). Therefore, to test the significance of the observed changes in the mean daily equity return standard deviations of the three groups of firms included in this research across time periods and between each group during similar time periods I utilized several paired and two-sample t-tests, the results of which may be found in the first section of the attached Appendix. I used paired t-tests to analyze the significance of the differences between the mean standard deviations of the equity returns of the

acquisitive, diversifying firms and the non-acquisitive control firms during each pre-transaction announcement and post-transaction completion period, as well as the differences between the same groups' mean daily standard deviations of equity returns from the pre-transaction announcement to post-transaction completion periods. I also used a paired t-test to discover whether a significant difference exists between the mean standard deviations of equity returns of the acquisitive, non-diversifying firms across the same periods relative to their transactions.

I then used two, two-sample t-tests to examine the significance of the differences between the mean daily standard deviations of the equity returns of the acquisitive, diversifying firms and the acquisitive, non-diversifying firms during both the pre-transaction announcement and post-transaction completion periods. The variances of the distributions of the acquisitive, diversifying firms' daily standard deviations of equity returns and the acquisitive, non-diversifying firms' equity return standard deviations were assumed to be unequal in these two-sample t-tests, as the ratio of the standard deviations of the two distributions of daily standard deviations of equity returns was greater than 2 (where either s_1/s_2 or $s_2/s_1 > 2$). The results of these significance tests are included in the first Appendix section and discussed further in the Results section.

To test the significance of the diversifying nature of certain mergers and acquisitions as a factor influencing changes in the daily standard deviations of the equity returns of acquisitive firms acros the periods surrounding M&A transactions while simultaneously attempting to control for other factors which are known to significantly affect equity return volatilities (discussed in the Data and Methodology section), I developed the following multiple regression:

$$\sigma_i = \alpha + \beta_1(\ln(Firm\ Market\ Capitalization)) + \beta_2(Age\ Of\ Firm) + \beta_3(Inflation) + \beta_4(Market\ Volatility\ During\ Period) + \beta_5\left(D_{(Acquisition)}\right) + \beta_6\left(D_{(Post-Completion)}\right) + \beta_7\left(D_{(Acquisition\ *\ Post-Completion)}\right) + \varepsilon_i$$

where σ_i is the observed daily standard deviation of the historical returns of a firm's publicly-traded equity securities, α is the intercept coefficient, "ln(Firm Market Capitalization)" is the natural log of the market capitalization of the firm one month prior to the relevant transaction announcement date, "Age Of Firm" is the number of calendar years where the common stock of the firm had been publicly traded prior to the relevant transaction announcement date, "Inflation" is the realized change in the CPI for the calendar year prior to the start of the period during which the equity return standard deviation was observed during, and "Market Volatility During Period" is the daily standard deviation of the S&P 500 index returns observed during the same time period over which the equity return volatility was observed. "$D_{Post\text{-}Completion}$" is a dummy variable which assumes a value of either 1 or 0 and indicates whether the standard deviation of equity returns was observed during a 360-day pre-transaction announcement period or a 540-day post-transaction completion period, "$D_{Acquisition}$" is also a dummy variable which indicates whether or not the firm under observation was involved in an acquisition or was a non-acquisitive control firm, and "$D_{Acquisition\ *\ Post\text{-}Completion}$" is a final dummy variable which accounts for the potential interaction effects between whether or not the firm was involved in a diversifying acquisition and the time period relative to the transaction during which the equity return volatility was observed. Finally, ε_i represents residuals in the observed daily standard deviations of equity returns that are not explicitly forecasted by the factors included in the multiple regression.

In total, 3920 daily equity return standard deviations were included in the regression, which was the number of standard deviation figures for each acquisitive, diversifying firm and each non-acquisitive control firm, calculated during both the relevant pre-transaction announcement and post-transaction completion periods for the pairing each firm belonged to (980 pairs of firms * 2 firms per pair * 2 equity return standard deviations per firm). Each of these daily equity return standard deviations were regressed against the factor values unique to the time periods during which the equity volatilities were observed, and the results of this multiple regression are given in Appendix tables 8 and 9.

I did not include a factor controlling for the different industries each pair of firms primarily operated in because this factor was adequately controlled for when selecting a comparable, non-acquisitive control firm to pair with each acquisitive, diversifying firm. As mentioned previously, one of the constraints involved in selecting the potential control firms to be paired with each acquisitive, diversifying firm was that the control firms must have primarily operated in the same industry as the acquisitive, diversifying firm they were to potentially be paired with. Blocking the selected pairs of acquisitive, diversifying firms and non-acquisitive control firms by the industry in which they primarily operated allowed the use of paired t-tests, and should effectively control for inherent, industry-specific differences in firms' sensitivities to economic factors affecting equity return volatilities not explicitly controlled for in my regression.

Differences in firms' sensitivities to economic factors affecting equity return volatilities across different periods of time were controlled for by blocking the pairs of firms further by selecting control firms which had not participated in an M&A transaction during the 360-day pre-transaction announcement or 540-day post-transaction

completion periods surrounding the diversifying transactions undertaken by the firms they were paired with. The control firms also must have been publicly traded during these time periods. Controlling for any inherent differences in sensitivity to factors affecting equity return volatilities between firms with differing market capitalization values required blocking the firms even further, and this was achieved in a final step by matching each acquisitive, diversifying firm with a non-acquisitive control firm operating in the same industry by closest market capitalization value as of one month prior to the acquisitive firm's acquisition announcement. Blocking the pairs of firms in this way effectively strengthened the results of the regression by mitigating the effects of differences in firm's sensitivities to these economic factors (time period, primary industry and size) on the outcome of the multiple regression.

VI. Results

The differences in the observed mean standard deviations of equity returns included in the paired t-tests were found to be significant for the acquisitive, diversifying group across time periods and between both the acquisitive, diversifying group and the non-acquisitive control group in the pre-transaction announcement and post-transaction completion periods (see Appendix tables 1, 3 and 4). Significant results from these t-tests indicate that differences between the mean equity return standard deviations of the groups involved were greater than 0 with an α of .05, or a 95% level of confidence. The differences in the mean equity return volatilities included in the paired t-tests between the non-diversifying control group across time periods and the acquisitive, non-diversifying group across time periods were both found to be insignificant with a 95%

level of confidence (see Appendix tables 2 and 7). The results of both two-sample t-tests were insignificant, indicating that no statistically significant difference was observed between the mean daily standard deviations of the equity returns of the two acquisitive groups during either the pre-transaction announcement or post-transaction completion periods (see Appendix tables 5 and 6). All of the t-tests performed, both paired and two-sample, were two-sided in nature.

The results of the multiple regression developed in the previous section indicate that there is a statistically significant, negative relationship between whether a firm completes a diversifying acquisition and the resulting change in the firm's equity return volatility from the pre-transaction announcement to post-transaction completion period (see Appendix tables 8 and 9). The multiple regression coefficient for this interaction factor was found to be negative with a 95% level of confidence, which allows a rejection of the null hypothesis that no significant relationship exists between changes in acquirers' equity return volatility and whether or not the acquisitions they engage in are diversifying in nature.

The coefficient of the interaction factor was found to be -.0025, which is smaller, in absolute value terms, than the coefficients of the factors controlling for market volatility and inflation during each period, as well as the factor controlling for whether each firm completed an acquisition. The absolute value of the interaction factor coefficient was larger than the coefficients of the factors controlling for the market capitalization of each firm, the time period relative to the relevant transaction that each equity return volatility was observed during, and the length of time during which the firm had been publicly traded at the time of the relevant acquisition announcement.

The magnitude of the interaction coefficient equates to a roughly 3.9% larger annualized decrease in the mean equity return volatility of firms which completed diversifying transactions when compared to the mean change in the equity return volatilities of those firms which had not participated in M&A transactions over the same time periods. In other words, the acquisitive, diversifying firms' mean daily standard deviation of equity returns during the post-transaction completion period was roughly equal to 96.1% of the same firm's pre-transaction announcement mean daily standard deviation if the effects of the interaction factor, accounting for the diversifying nature of the transactions and the passage of time, were isolated. This finding supports the expectations of the hypothesis put forward in this paper. All other factors selected for inclusion in the multiple regression were also found to be significant with a 95% level of confidence. The coefficients of all the multiple regression factors except for the factor controlling for the observed market volatility during each period were found to be negative, and these coefficient signs conform with expectations previously established in the literature (Schwert 1989; Valcarcel 2012; Bessembinder & Zhang 2013; Khan et al. 2016). The results of the multiple regression, including each factor coefficient and the associated 95% confidence intervals, are included in Appendix tables 8 and 9.

The monthly, mean, post-transaction completion equity return volatility of each group of firms, expressed as a percentage of the pre-transaction announcement period equity return volatility of the same group, are included in Appendix tables 10, 11, and 12. As the number of months post-transaction completion increases, the mean daily standard deviation of the equity returns of both groups of acquisitive firms decreases significantly. This is evidenced by the paired t-tests measuring the differences in the mean equity return volatility between the two acquisitive groups across the time periods surrounding the

isolated transactions. As can be seen from the results of the paired t-test for the non-acquisitive control group across time periods, there was no significant change in the mean daily standard deviation of equity returns for these firms across the time periods surrounding the transactions of the acquisitive firms they were paired with. I have included a visualization of the mean equity return standard deviation for each group, expressed as a percentage of the same group's pre-transaction announcement mean equity return standard deviation value, for each monthly period during the 540-day post-transaction completion period in Appendix figure 1.

VII. Conclusions and Discussion

The conclusions that can be drawn from these results are several. The significant, negative factor coefficient representing the effects of a firm completing a diversifying acquisition on the changes in the firm's equity return volatility over time supports my hypothesis. This finding also supports the idea that, on average, capital market participants react to new information affecting the pricing of securities representing ownership in newly combined, diversified firms in such a way that accounts for the lower level of correlation among the cash flows to be generated by the firms and the differing sensitivities of these cash flows to changes in economic factors. Thus, this research demonstrates that just as idiosyncratic developments affecting the returns of a single security have muted effects on the overall returns of a well-diversified portfolio, changes in economic factors or other developments which uniquely affect investors' estimations regarding the cash-flows to be generated by the underlying businesses of diversified firms have muted effects on the volatility of the equity returns of these same firms.

That all factors included in the multiple regression were found to have significant effects on the observed changes in equity return volatilities but the resulting R^2 value was only ~15% suggests not only that other significant factors which influence changes in the return volatilities of equity securities during periods surrounding M&A transactions could potentially be identified and controlled for in future research, but also that the majority of the factors influencing a given change in an acquirer's equity return volatility around the time of an acquisition are situationally specific and driven primarily by idiosyncratic developments. Several other potentially significant factors which could be controlled for in future research are the number of diverse, preexisting business segments that an acquirer operates prior to completing an acquisition, the amount of debt an acquirer may take on to finance a transaction, the change in the capital structure of the surviving firm during the transaction, and the historical covariance between the returns of equity securities of firms operating in the acquirer's primary industry group and the primary industry group of the target firm. The potential effects of these factors on changes in the equity return volatilities of acquisitive firms and the reasons for their omission from the multiple regression developed in this research are discussed further in this section.

The SIC codes that I used to filter the companies into their respective Fama-French industry groups are assigned only based on the primary industry in which each firm operates. If a diversifying acquirer operates multiple business units in several different industries, the firm already enjoys some measure of cash-flow diversification when it acquires yet another company that primarily operates in a different industry group than itself. The single SIC code assigned to the acquiring firm may not accurately account for this, and the effects of further diversification on the return volatility of this

acquirer's equity securities may be less significant than the effects of an initial, diversifying acquisition on the equity return volatility of a firm which only operates in a single industry prior to completing this transaction.

Readily-available anecdotal evidence accentuates the potentially significant effects that an acquirer's pre-existing level of diversification, and the degree to which an acquisition further diversifies an acquirer's underlying cash flows, may have on changes in the equity return volatility of the acquirer. For example, one of the acquisitions which was observed in this research was the acquisition of DII Industries, LLC by Halliburton Co., for $8.13b USD in an all-stock transaction. The transaction was announced on 02/26/1998 and completed on 09/30/1998. Haliburton's 1997 10-K describes two business segments extant at the time of the acquisition announcement: The Energy Group (including Haliburton Energy Services), which was primarily engaged in the sale of various specialized pieces of upstream drilling equipment and their maintenance, and the Engineering and Construction group, whose primary services included designing, engineering, and managing the constriction of physical mining and drilling assets for upstream oil and gas firms. Although the two firms involved in this transaction operated in similar industries, DII Industries allowed Haliburton to gain a significant degree of exposure to the midstream oil and gas servicing and products manufacturing markets which they had not previously enjoyed and was therefore considered a diversifying transaction. The acquisition was completed without major incident (Bloomberg 2019).

Interestingly, Haliburton's daily equity return standard deviation during the 540-day post-transaction completion period, expressed as a percentage of pre-transaction announcement daily equity return volatility, was roughly 4% higher than expected given the results of the multiple regression developed in this research and the factor levels

observed during the time periods surrounding the transaction. To be clear, this residual value indicates that Haliburton's resulting equity return standard deviation during this post-transaction completion period was 104% of the conditional, expected daily standard deviation value predicted by the multiple regression developed in this this research and the factor values present at the time. The fact that the acquisition target operated in an industry whose mean equity returns covary positively with those of the industry in which Haliburton operates and that Haliburton was already somewhat diversified (operating multiple, distinct business segments) may help explain why Haliburton's observed level of post-transaction completion equity return volatility was greater than expected given the levels of the regression factors observed at the time.

Given that the equity securities of diversified companies have been found to consistently trade at premium valuation multiples relative to their non-diversified peers, quantifying and controlling for the level of an acquirer's pre-existing diversification and the degree to which an acquisition further diversifies the cash flows generated by the combined entity's business segments could provide results with important applications for corporate valuation (Villalonga 2004). While I considered using the number of previously existing business segments as a proxy for each firm's pre-transaction announcement level of diversification, the available dataset from the CRSP/Compustat merged database was unfortunately not robust enough to provide regression values for the majority of the firms under observation. Future research could control for this factor if better information regarding historical number of business segments operated by each of the firms included in this research can be procured, or if another robust proxy measure for the level of a firm's underlying cash-flow diversification could be developed.

Similarly, the covariance between the historical equity returns of firms which operate in different industries may affect the degree to which an M&A transaction between firms operating in these industries affects the resulting return standard deviation of the equity securities representing ownership of the surviving firm. If the mean equity returns of firms operating in one industry covary positively with the mean equity returns of firms operating in another industry, the diversifying effects of an M&A transaction between firms operating in these industries may have a less significant effect on changes in the equity return volatility of the surviving entity than if the transaction involved firms operating in industries whose mean equity return covariance, relative to each other, were negative.

In the example given earlier, Halliburton purchased a company which primarily operated in an industry whose mean equity returns covary positively with the mean equity returns of the industry in which Haliburton primarily operates (upstream oil and gas servicing and construction). This positive covariance may have lessened the effects of this diversifying transaction on the change in Haliburton's equity return volatility from the pre-transaction announcement to post-transaction completion periods. If an accurate measure of the covariances between the mean, historical equity returns of each of the 49 Fama-French industry groups could be derived, these values could serve as a factor which could help control for the degree to which a transaction increases the level of diversification among the newly combined business segments of an acquisitive firm. The inclusion of such a factor would likely make the multiple regression developed in this research more robust.

It has also been shown that management's choice of capital structure (the mixture of debt and equity used to finance the firm's assets and operations) influences the volatility

of the firm's equity returns. Typically, the higher the level of a firm's debt/equity ratio, the higher the firm's equity return volatility (Black 1976; Cheung & Ng 1992; Choi & Richardson 2016; Aharon & Yagil 2019). This phenomenon is known as the "leverage effect". Further, it has been shown that previous levels of equity return volatility significantly influence future conditional return volatilities (Cheung & Ng 1992). Therefore, future research could attempt to control for the changes in the capital structure and leverage levels of acquisitive firms which occur during many M&A transactions and may serve to increase sustained levels of observed equity return volatility across time. Controlling for this factor would also improve the multiple regression model developed in this research.

Anecdotal evidence underlining the potential significance of a firm's capital structure and leverage ratios as factors influencing the firm's equity return volatility is also abundant. The acquisition of Space Systems/Loral Inc. ("SS/L") by Maxar Technologies illustrates the significant force the leverage effect exerts on the return volatilities of equity securities. Maxar Technologies is a diversified space technology company which is primarily engaged in the manufacturing, marketing, sale, and servicing of communication, observation, GPS, and equipment servicing satellites (Bloomberg 2019). The purchase of SS/L represented the firm's first major foray into the telecommunications industry and was therefore considered a diversifying transaction. The transaction was announced on 06/26/2012 and was completed without major incident on 11/02/2012. Maxar Technologies financed the roughly ~$1b USD transaction through a term loan ($250m), an asset-backed notes issuance ($600m), and cash from its reserves, significantly increasing the debt load of the company and its leverage levels (Bloomberg 2019).

Because Maxar Technologies chose to finance this relatively large transaction primarily through the use of debt, the value of the firm's total debt to total equity ratio increased by no less than 413% over the course of this transaction, while the firm's total debt to total asset ratio increased by 166% during the same period (Bloomberg 2019). The firm's daily equity return standard deviation also increased significantly from the pre-transaction announcement to post-transaction completion periods, with the daily standard deviation of equity returns becoming almost 114% larger during the post-transaction completion period than pre-transaction announcement levels. This is a significantly larger increase (ε_i = ~19%) in equity return volatility than would have been expected given the multiple regression developed in this research and the factor values extant during the respective time periods surrounding the transaction. It is not unreasonable to assume that this inflated change in equity return volatility was largely driven by the assumption of relatively large amounts of debt by the Maxar Technologies and the resulting significant increases in the firm's leverage ratios. The leverage effect and changes in acquirers' leverage ratios were not controlled for in this research primarily due to a lack of available data regarding the values of firms' assets and debt, especially in the decades included in this research before financial reporting requirements became generally more rigorous. Future research could be performed which controls for the effects of debt firms take on to finance acquisitions on their resulting equity return volatility if adequate data regarding the market values of the debt securities and assets of the firms included in this research can be procured.

Another important factor that was not controlled for by the multiple regression developed in this research is connected to the leverage factor discussed above. It is important to note the two main factors which influence the idiosyncratic portion of the

variance of the equity returns of a given firm: management's choice of capital structure and the volatility of the cash flows generated by the underlying assets (Choi & Richardson 2016). These two factors work in tandem to influence the idiosyncratic volatility of a given firm's equity returns, while systematic factors (such as several of those controlled for in the multiple regression discussed previously) determine of the remainder the volatility of the firm's equity returns. It is also important to note that mergers and acquisitions transactions are not undertaken by firms solely for the purpose of diversification. Diversification can be achieved independently by investors at little to no marginal cost, and, all else being equal, the merging of any two publicly-traded companies marginally decreases the total value available to investors because it takes away the choice these investors previously had of investing in either one of the now-merged firms or the combination of such. For this reason, among others, an acquisition must be synergistic, not simply diversifying, if shareholders are to support it. Thus, the newly combined firms must also be expected to generate synergies for the acquiring firm's management to justify the premiums typically paid for control of a target firm.

In completing any transaction, management will attempt to select a financing mix that will maximize the value of the synergies expected to be realized in the resulting levered free cash flows of the combined entity. These are the cash flows which primarily drive the value of a firm's equity securities. In many instances, this financing optimization effort involves the use of debt. Debt is attractive as a financing instrument because the cost of debt to an acquirer is typically lower than the cost of equity due to their relative positions in the capital structure and debt's corresponding priority in terms of claims on cash flows generated by the liquidation of a firm's assets in the event of a bankruptcy. Firm management may also decide to finance an acquisition by issuing stock if they feel

that this would maximize firm value. If a transaction is financed solely by equity and a premium is paid, the leverage ratios of the acquirer will decrease, potentially lowering the volatility of the combined firm's equity returns. However, regardless of management's choices regarding the composition of the transaction financing mix, the resulting, combined entity's capital structure will likely be different that the original capital structure of the acquirer, and the combined volatility of the cash flows generated by the underlying assets of the newly merged entity will differ from the volatilities of the cash flows generated by the separate assets prior to the transaction.

This change in the capital structure of the surviving entity has substantial effects on the resulting equity return standard deviation of the acquirer post-transaction completion. For instance, if a firm pays a premium to acquire another firm in a stock-for-stock transaction, then the resulting lower debt-equity ratio may decrease the equity return volatility of the acquiring firm, but the opposite may be true if the transaction is financed primarily by debt. In the long-run, management teams will attempt to steer firms' capital structures towards optimal mixtures of debt and equity, but as acquirers' capital structures and leverage ratios change over the course of mergers and acquisitions the resulting post-transaction completion equity return volatilities of these acquirers are significantly influenced by these changes (Baker & Wurgler 2002; Leary & Roberts 2005; Bessembinder & Zhang 2013; Choi & Richardson 2016).

Hence there exists a potentially significant confounding issue between the leverage effect and the results of my multiple regression. There are essentially only two possible changes which may occur to a firm's capital structure between the pre-transaction announcement and post-transaction completion periods; Leverage ratios will either increase or decrease depending on management's choice of financing for the

transaction. The chance that the transaction financing mix is such that the acquirer's leverage ratios remain completely unchanged post-transaction completion is so small that it may be reasonably dismissed as a possibility. Even if this were somehow achieved, the volatility of the new, underlying combination of cash-flow generating assets would still interact differently with the capital structure to uniquely affect the volatility of the surviving firm's equity returns.

Therefore, because the level of a firm's leverage is positively correlated with the daily standard deviation of the firm's equity returns, if the majority of the acquisitive firms included in this research financed their transactions in such a way as to increase their leverage ratios, this should serve to increase the mean daily equity return standard deviations of these groups from the pre-transaction announcement to post-transaction completion periods, all else being equal. If this were the case, the fact that a significant, negative relationship between the diversifying nature of certain M&A transactions and the resulting equity return volatilities of the acquirers was still discovered while not controlling for changes in the acquisitive firm's capital structures would serve to unambiguously strengthen the conclusions of this research. However, if the opposite were true and a majority of the acquisitive firms in this research financed their acquisitions primarily with equity, leverage ratios would decrease on average, which would work to decrease the mean daily standard deviation of the acquisitive firms' equity returns post-transaction completion. If this were the case, because the changes in the acquirers' capital structures from the pre-transaction announcement to post-transaction completion periods are not controlled for in my multiple regression the effects of this factor would be confounded with the hypothesized volatility-decreasing effects of the diversifying nature of the M&A transactions undertaken by these firms.

Therefore, in order to truly make the equity return volatility of an acquirer comparable between the pre-transaction announcement and post-transaction completion periods, one would need to control for how changes in the acquirer's capital structure interact with the new combination of underlying assets to influence the idiosyncratic portion of the return volatility of the equities representing ownership in the newly combined entity. Said differently, one would need to control for changes in acquirers' capital structures and leverage ratios that occur throughout each transaction, not simply the amount of debt potentially taken on to finance the acquisitions. To make the differences in the acquisitive firms' equity return volatilities comparable across time periods and further isolate the diversifying effects of certain transactions on equity return volatility levels, a factor would need to be introduced which would control for the change in capital structure attributable to management's choice of financing for each transaction and the resulting variance of the new portfolio of cash-flow-generating assets (the newly combined firm). However, the development of such a flexible, robust factor is complicated by the fact that the relationship between a firm's level of equity return volatility, leverage ratios, and underlying asset volatility is concave, non-linear, and asymmetric. At relatively low levels of leverage, the assumption of additional leverage by a firm generally serves to decrease the equity return volatility of the firm, but at relatively high levels of leverage the assumption of additional debt increases a firm's equity return volatility exponentially (Nelson 1991; Choi & Richardson 2016).

If a variable could be developed which is highly correlated with how a change in a acquirer's capital structure interacts with the volatility of the underlying assets to affect the volatility of the firm's levered free cash flows (and thus the volatility of the equity returns) between the pre-transaction announcement to post-transaction completion

periods, then this factor could be effectively controlled for. This factor was not controlled for in this research primarily due to a lack of available data which could be used to identify the changes in the capital structure of the acquiring firms included in my significance tests. A variable which was tenable and robust and which could effectively control for this factor was also difficult to identify and develop with such little data. The identification and testing of different proxy variables that could be used to control for this factor could be undertaken by future researchers and could provide a valuable improvement to the quality and accuracy of the multiple regression developed in this research.

A final uncontrolled yet recognized factor which significantly affects an acquisitive firm's post-transaction completion equity return volatility is the relative market capitalization of the target firm to that of the acquirer. In the case of this research, it is not unreasonable to assume that the size of the target firm's market capitalization relative to the market capitalization of the acquirer pre-transaction announcement may be positively correlated to the degree to which the acquisition further diversifies the economic sensitivities of the cash flows to be generated by the surviving entity, although this has not been treated directly in the literature. However, it has been demonstrated that, in the case of portfolios of securities, progressively larger tilts towards a particular security cause the portfolio to be increasingly affected by the characteristics of the security (Markowitz 1952; Engle 2002). This would imply that larger, diverse target firms should, on average, have a greater diversifying effect on their acquirers' cash flows.

For instance, assume one firm acquires another firm whose market capitalization is equivalent to 1% of the acquiring firm's pre-transaction announcement market capitalization, and another firm acquires a firm whose market capitalization is the same as the second acquirer's market capitalization pre-transaction announcement. If one

assumes that both transactions are diversifying in nature and all other significant factors are held constant, the second transaction should have a more significant effect on the extent to which the acquirer is diversified post-transaction completion because the relative size of the target to the acquirer is much larger than in the first hypothetical transaction. Although this relative size factor was not controlled for in the regression developed in this research, the fact that significant results supporting my hypothesis were still discovered in spite of the fact that many of the target companies were relatively small when compared with their acquirers serves to strengthen the case for the results of my significance testing. Future research could control for this relative size factor to strengthen the results of this research.

A note should also be made that no distinction was made between different share classes that some of the firms under observation may have issued prior to the transactions isolated for use in this research. Firms may issue different classes of shares with unique rights and voting privileges, and the prices of each of these share classes may react differently to new information. Because of this, the return volatility of one share class may be different than that of another over the same time period, even if both share classes evidence ownership of the same firm. The 6-digit Committee on Uniform Securities Identification Procedures ("CUSIP") codes given for each firm in the initial M&A data from the Thomson Reuters SDC Platinum database were matched with the 8-digit CUSIP code for each unique equity security included in the CRSP/Compustat merged database. My algorithms identified the unique equity security corresponding to each firm included in this research in such a way that the class A (or first class issued) shares were included in this research. Thus, the conclusions of this research may not easily extend to other classes of shares which may be issued by firms.

The development of the resulting daily equity return standard deviations of the acquisitive firms during the post-transaction completion period is also interesting. While the equity return volatilities of the non-acquisitive control group changed slightly on average between the pre-transaction announcement to post-transaction completion periods, the change was subtle and did not appear to occur within any particular month or set of months during the post-transaction completion periods. This finding of an insignificant change in the mean equity return volatilities of the non-acquisitive control group across various time is consistent with extant research on aggregate equity return volatilities over the historical period observed in this research (Morton 1996).

Significant patterns of change in the mean equity return volatilities of both groups of acquisitive firms post-transaction completion are observed, however. The mean daily equity return standard deviations of securities representing ownership in both the acquisitive, diversifying firms and the acquisitive, non-diversifying firms are initially heightened post-transaction completion relative the same firms' pre-transaction announcement mean equity return standard deviations. One can assume that this observed increase in average equity return volatility is primarily driven by investors working to incorporate new information resulting from the successful transaction completion into the price of each relevant equity security. Interaction frictions between the newly combined firms also provide capital market participants with novel information that moves acquirers' equity prices more aggressively, on average, than in the acquirers' pre-transaction announcement periods, inflating the mean volatility of returns for a time. These findings are consistent with previously completed research on post-transaction completion equity return volatilities (Geppert & Kamerschen 2008). However, a significant decrease in the mean equity return volatilities of both groups of acquisitive

firms is observed between 4-10 months post-transaction completion, suggesting that during this period a lowered level of novel information regarding the companies' recently completed transactions serves to lessen mean equity return volatilities. Mean equity return volatility levels during months where firms typically report earnings appear to be slightly higher during the period from 10-18 months post-transaction for both groups of acquisitive firms and the non-acquisitive control group. These periodic increases in average equity return volatility are most likely driven primarily by investors working to price new information from earnings reports and financial filings as they are released to the public.

The effects of dividend issuances on the returns of equity securities were not accounted for when calculating the daily standard deviations included in the multiple regression developed in this research. Although the issuance of dividends would have influenced the observed percentage changes in the equity prices of the issuing firms, the majority of the firms included in this research were relatively young and had yet to issue a dividend by the date of each relevant acquisition announcement. This implies that any dividends issuances which may have occured had a negligible effect on the mean daily equity return standard deviations utilized in the multiple regression, and therefore should not have significantly affected the results of my significance testing. The effects of dividends were omitted primarily due to a lack of readily available dividend-related data for the majority of the firms included in this research. If accurate and robust historical dividend issuance records could be obtained for the companies included in this research, this information could be used to adjust the calculated daily standard deviations of the firms' equity returns. These more accurate standard deviation values would increase the accuracy of the results of the multiple regression developed in this research.

VIII. Further Research

The body of research addressing the effects of mergers and acquisitions on the volatility of equity security returns is far from complete. This paper has highlighted a plethora of subjects which future researchers could attempt to treat. Further research could focus on answering the same basic question this research attempted to answer (namely, does the theoretically diversifying nature of certain M&A transactions have significant effects on changes in the long-term equity return volatility of acquisitive firms?) over different historical time periods, within specific industries over differing periods of time, or while controlling for several of the the additional, omitted factors discussed in the Conclusions and Discussion section of this paper. Whether or not the degree to which an acquisitive firm is previously diversified affects the resulting change in the acquirer's equity return volatility post-transaction completion could be researched. The effects on changes in an acquirer's equity return volatility driven by the relative market capitalization values of the acquirer and target firm could also be studied.

Future research could also attempt to uncover any significant differences in the effects of diversifying mergers and acquisitions on the return volatility of different classes of equity shares that acquirers may have previously issued. The development of a variable which effectively and accurately controls for the effects of management's choice of transaction financing on an acquirer's post-transaction completion equity return volatility could also be pursued. Finally, additional research could be conducted to establish which factors most significantly influence changes in the equity return volatility of firms which have recently completed a diversifying acquisition to further improve the results of the multiple regression developed in this research.

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Appendix

Section 1

t-test results

Table 1

Significant results for tested differences between the mean daily standard deviations of equity returns of the group of acquisitive, diversifying firms during their pre-transaction announcement periods and the group of acquisitive, diversifying firms during their post-transaction completion periods. This significant, positive t-statistic indicates that there was a significant decrease in the mean daily equity return standard deviation of the acquisitive, diversifying firms from the pre-transaction announcement to post-transaction completion periods with a 95% level of confidence.

Paired t-test on the Distributions of Daily Equity Return Standard Deviations of the Acquisitive, Diversifying Firms		
	360-Day Pre-Transaction Announcement Period	*540-Day Post-Transaction Completion Period*
Mean Daily σ	0.025	0.024
Variance In Daily σ	1.22E-04	1.87E-04
Observations	980	980
Pearson Correlation	0.574	
Hypothesized Mean Difference	0	
df	979	
t Stat	3.351	
P(T<=t) two-tail	0.000	
t Critical two-tail	1.962	

Table 2

Insignificant results for tested differences between the mean daily standard deviations of equity returns of the group of non-acquisitive control firms during their paired, pre-transaction announcement periods and the group of non-acquisitive control firms during their paired, post-transaction completion periods. This insignificant t-statistic indicates that there was not a significant change in the mean equity return standard deviation of the non-acquisitive control firms from their paired, pre-transaction announcement to post-transaction completion periods with a 95% level of confidence.

Paired t-test on the Distributions of Daily Equity Return Standard Deviations of the Non-Acquisitive Control Firms		
	360-Day Pre-Transaction Announcement Period	*540-Day Post-Transaction Completion Period*
Mean Daily σ	0.029	0.029
Variance In Daily σ	3.46E-04	1.17E-03
Observations	980	980
Pearson Correlation	0.434	
Hypothesized Mean Difference	0	
df	979	
t Stat	1.936	
P(T<=t) two-tail	0.053	
t Critical two-tail	1.962	

Table 3

Significant results for tested differences between the mean daily standard deviations of equity returns of the group of acquisitive, diversifying firms during their pre-transaction announcement periods and the group of non-acquisitive control firms during their paired, pre-transaction announcement periods. This significant, negative t-statistic indicates that there was a significant difference between the mean daily equity return standard deviations of the acquisitive, diversifying firms and the non-acquisitive control firms during their pre-transaction announcement periods with a 95% level of confidence.

Paired t-test on the Distributions of Daily Equity Return Standard Deviations During the Pre-Transaction Announcement Period		
	Acquisitive, Diversifying Firms	*Non-Acquisitive Control Firms*
Mean Daily σ	0.025	0.029
Variance In Daily σ	1.22E-04	3.46E-04
Observations	980	980
Pearson Correlation	0.363	
Hypothesized Mean Difference	0	
df	979	
t Stat	-7.050	
P(T<=t) two-tail	0.000	
t Critical two-tail	1.962	

Table 4

Significant results for tested differences between the mean daily standard deviations of equity returns of the group of acquisitive, diversifying firms during their post-transaction completion periods and the group of non-acquisitive control firms during their paired, post-transaction completion periods. This significant, negative t-statistic indicates that there was a significant difference between the mean daily equity return standard deviations of the acquisitive, diversifying firms and the non-acquisitive control firms during their post-transaction completion periods with a 95% level of confidence. Note that this t-statistic is more negative than the t-statistic in Appendix table 3. This difference indicates that mean equity return standard deviation of the group of acquisitive, diversifying firms became proportionately smaller than the mean equity standard deviation of the non-acquisitive control firms between the pre-transaction announcement and post-transaction completions periods. This negative change in t-statistics essentially constitutes a dif-dif measurement which reinforces the regression results which support my hypotheses.

Paired t-test on the Distributions of Daily Equity Return Standard Deviations During the Post-Transaction Completion Period		
	Acquisitive, Diversifying Firms	*Non-Acquisitive Control Firms*
Mean Daily σ	0.024	0.029
Variance In Daily σ	1.87E-04	1.17E-03
Observations	980	980
Pearson Correlation	0.299	
Hypothesized Mean Difference	0	
df	979	
t Stat	-7.097	
P(T<=t) two-tail	0.000	
t Critical two-tail	1.962	

Table 5

Insignificant results for tested differences between the mean daily standard deviations of equity returns of the group of acquisitive, diversifying firms during their pre-transaction announcement periods and the group of acquisitive, non-diversifying firms during their pre-transaction announcement periods. This insignificant t-statistic indicates that there was no significant difference between the mean daily equity return standard deviations of the acquisitive, diversifying firms and the acquisitive, non-diversifying firms during their pre-transaction announcement periods with a 95% level of confidence. This was a two-sample t-test that assumed unequal variances in the distributions of equity return standard deviations of the acquisitive, diversifying firms and the acquisitive, non-diversifying firms (where either s_1/s_2 or $s_2/s_1 > 2$).

Two Sample t-test on the Distributions of Daily Equity Return Standard Deviations During the Pre-Transaction Announcement Period		
	Acquisitive, Diversifying Firms	*Acquisitive, Non-Diversifying Firms*
Mean Daily σ	0.025	0.025
Variance In Daily σ	1.22E-04	2.67E-05
Observations	980	9256
Hypothesized Mean Difference	0	
df	1025	
t Stat	0.796	
P(T<=t) two-tail	0.426	
t Critical two-tail	1.962	

Table 6

Insignificant results for tested differences between the mean daily standard deviations of equity returns of the group of acquisitive, diversifying firms during their post-transaction completion periods and the group of acquisitive, non-diversifying firms during their post-transaction completion periods. This insignificant t-statistic indicates that there was no significant difference between the mean daily equity return standard deviations of the acquisitive, diversifying firms and the acquisitive, non-diversifying firms during their post-transaction completion periods with a 95% level of confidence. This was also a two-sample t-test that assumed unequal variances in the distributions of equity return standard deviations of the acquisitive, diversifying firms and the acquisitive, non-diversifying firms (where either s_1/s_2 or $s_2/s_1 > 2$). Again, although both t-statistics are insignificant, note the differences between the t-statistic in this table and the t-statistic in Appendix table 5. This difference indicates that mean equity return standard deviation of the group of acquisitive, diversifying firms became proportionately smaller than the mean equity standard deviation of the acquisitive, non-diversifying firms between the pre-transaction announcement and post-transaction completions periods, providing further support for my hypotheses.

Two Sample t-test on the Distributions of Daily Equity Return Standard Deviations During the Post-Transaction Completion Period		
	Acquisitive, Diversifying Firms	*Acquisitive, Non-Diversifying Firms*
Mean Daily σ	0.024	0.025
Variance In Daily σ	1.87E-04	1.70E-01
Observations	980	9256
Hypothesized Mean Difference	0	
df	9438	
t Stat	-1.107	
P(T<=t) two-tail	0.268	
t Critical two-tail	1.960	

Table 7

Insignificant results for tested differences between the mean daily standard deviations of equity returns of the group of acquisitive, non-diversifying firms during their pre-transaction announcement periods and the group of acquisitive, non-diversifying firms during their post-transaction completion periods. This insignificant t-stat indicates that there was not a significant change in the mean equity return standard deviation of the acquisitive, non-diversifying firms from the pre-transaction announcement to post-transaction completion periods with a 95% level of confidence. Note the extremely low correlation coefficient, which indicates that for the acquisitive, non-diversifying firms, each firm's daily equity return standard deviation during the pre-transaction announcement period gives very little information regarding that same firm's conditional, expected daily equity return standard deviation during the post-transaction completion period.

Paired t-test on the Distributions of Daily Equity Return Standard Deviations of the Acquisitive, Non-Diversifying Firms		
	360-Day Pre-Transaction Announcement Period	*540-Day Post-Transaction Completion Period*
Mean Daily σ	0.025	0.025
Variance In Daily σ	2.67E-05	1.70E-01
Observations	9256	9256
Pearson Correlation	-0.001	
Hypothesized Mean Difference	0	
df	9255	
t Stat	0.063	
P(T<=t) two-tail	0.950	
t Critical two-tail	1.960	

Section 2

Regression results

Table 8

The multiple regression statistics. Note the R^2 value, implying that much of the change in a given firm's equity return volatility during the periods surrounding an M&A transaction is driven by idiosyncratic developments.

Regression Statistics	
Multiple R	0.387
R Square	0.150
Adjusted R Square	0.148
Standard Error	0.020
Observations	3920

Table 9

The results of the multiple regression. Note the significant, negative interaction factor coefficient (Acquisition * Post-Completion).

Coefficients and Confidence Intervals						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.04780	0.00224	21.32344	0.00000	0.04341	0.05220
ln(Firm Market Capitalization)	-0.00175	0.00015	-11.40430	0.00000	-0.00205	-0.00145
Inflation	-0.07571	0.01587	-4.77105	0.00000	-0.10682	-0.04460
Market Volatility During Period	1.19365	0.07507	15.89970	0.00000	1.04646	1.34083
Age of Firm	-0.00023	0.00003	-8.82950	0.00000	-0.00028	-0.00018
Acquisition	-0.00385	0.00090	-4.26796	0.00002	-0.00561	-0.00208
Post-Completion	-0.00216	0.00090	-2.38731	0.01702	-0.00393	-0.00039
*Acquisition * Post-Completion*	-0.00259	0.00128	-2.03143	0.04228	-0.00510	-0.00009

Section 3

Post-transaction completion mean equity return standard deviations

Table 10

Mean daily equity return standard deviations of the 980 acquisitive, diversifying firms during each monthly period post-transaction completion, expressed as a percentage of the same firms' 360-day pre-transaction announcement period daily equity return standard deviation. Note the significant decrease in mean equity return volatility between 4-10 months post-transaction completion.

Changes in Daily Equity Return Volatility: Acquisitive, Diversifying Group	
Monthly Period Post-Transaction Completion	*% of Pre-Transaction Announcement Period Volatility*
0-1	102.3
1-2	101.8
2-3	102.6
3-4	102.0
4-5	101.9
5-6	100.8
6-7	100.3
7-8	99.3
8-9	99.7
9-10	98.6
10-11	99.1
11-12	98.2
12-13	98.4
13-14	98.0
14-15	98.3
15-16	98.2
16-17	98.0
17-18	98.1

Table 11

Mean daily equity return standard deviations of the 980 non-acquisitive control firms during each monthly period after their paired firms' transaction completions, expressed as a percentage of the non-acquisitive control firms' mean, 360-day paired pre-transaction announcement period daily equity return standard deviation. No pattern of change in the mean daily equity return standard deviations of this group is easily observable.

Changes in Daily Equity Return Volatility: Non-Acquisitive Control Group	
Monthly Period Post-Transaction Completion	*% of Pre-Transaction Announcement Period Volatility*
0-1	99.6
1-2	99.8
2-3	99.1
3-4	100.0
4-5	100.5
5-6	99.7
6-7	99.7
7-8	100.1
8-9	99.4
9-10	99.9
10-11	99.4
11-12	100.7
12-13	100.2
13-14	100.1
14-15	99.1
15-16	100.0
16-17	99.0
17-18	99.3

Table 12

Mean daily equity return standard deviations of the 9256 acquisitive, non-diversifying firms during each monthly period post-transaction completion, expressed as a percentage of the same firms' 360-day pre-transaction announcement period daily equity return standard deviation. Note the significant decrease in mean equity return volatility between 4-10 months post-transaction completion.

Changes in Daily Equity Return Volatility: Acquisitive, Non-Diversifying Group	
Monthly Period Post-Transaction Completion	*% of Pre-Transaction Announcement Period Volatility*
0-1	101.1
1-2	100.7
2-3	101.6
3-4	101.3
4-5	100.4
5-6	99.2
6-7	99.1
7-8	99.6
8-9	99.9
9-10	99.7
10-11	100.4
11-12	98.8
12-13	99.3
13-14	98.3
14-15	99.0
15-16	99.6
16-17	98.9
17-18	98.4

Figure 1

Mean daily equity return standard deviations of each group of firms during each monthly period post-transaction completion, expressed as a percentage of the same groups' mean 360-day pre-transaction announcement period daily equity return standard deviation. Note the significant decrease in the mean equity return standard deviations of both groups of acquisitive firms between 4-10 months post-transaction completion.