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A re-examination of firm, industry and market volatilities

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ABSTRACT

In updating Campbell et al. (2001) we find evidence that the level of idiosyncratic volatility, industry-specific volatility, and market volatility have increased to their highest levels in 50 years during the 21st century. Our findings show that while the 2007–2008 Financial Crisis led to large spikes in all three measures of volatility, the Tech Bubble of early 2000's led to an even greater increase in firm and industry volatilities than the Financial Crisis. By 2010, volatilities mostly returned to their pre-crisis levels. We also find evidence that the average correlation among stocks, which decreased during 1960–2000 period, has been increasing steadily since early 2000's.

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1. Introduction

In this paper, we investigate volatility patterns in U.S. stock market by decomposing aggregate volatility into idiosyncratic, market and industry volatilities. The paper closely follows Campbell et al. (2001) updating their work with more recent data. We focus on the effects of the two major market events of the 21st century—the Dot-com Bubble and the 2007–2008 Financial Crisis—and how they affected return volatility. Campbell et al. (2001) provided a useful framework for disaggregating volatility into these three components and measuring their relative contribution to the overall volatility. By applying this framework to the recent U.S. stock market data we can gain a better understanding of which of these three components contributed the most to the overall increases in stock market volatility. Using additional decade and half of data since the original study allows us to uncover substantial changes in the patterns of volatility that occurred since 1997, the end of the sample in Campbell et al. (2001).

We find that the Financial Crisis, not surprisingly, led to large increases in all three types of volatility. However, when we compare the Financial Crisis with the Dot-com Bubble, we find that the Dot-com Bubble had an even greater and more prolonged effect on firm and industry volatilities than the Financial Crisis. We also find that during the period of "Great Moderation" and following the 2008 recession, firm volatility and industry volatility reached some of the lowest values over the last 50 years.

The reasons for exploring the cause of changes in volatility are not merely academic: As Campbell et al. (2001) point out, shifts in the firm-level vs. industry-level volatility have direct implication on those investors whose compensation is tied to a particular firm or industry through stock options or other forms of equity compensation. The impact of these types of volatility was probably most sorely felt following the Dot-com Bubble. The change in the composition of volatility may also impact the number of stocks that should be included in a portfolio aimed to achieve a reasonable level of diversification: Increases in firm-level volatility may require a larger number of stocks to attain the same level of diversification.

Having a clear understanding of the underlying causes that lead to an increase in overall volatility is also important from the policy-makers' perspective. Both major episodes in the recent history of financial markets—the Dot-com Bubble and the Financial Crisis—caused large increases in the overall volatility. Yet, during the Dot-com Bubble, most of the increase in volatility was due to firm-level and industry-level volatilities. These volatilities were likely a direct results of reallocation of capital from unsuccessful to profitable ventures, akin to Schumpeterian creative destruction, and thus, such volatility should not be countered by a policy. On the other hand, during the Financial Crisis, although the crisis ostensibly originated in the U.S. construction and financial industries,

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the entire global economy was affected. The recession also lead to increases in all three types of volatility. This elevated level of uncertainty can thus serve as a justification for policy action aimed to stem and/or prevent such crises. Moreover, the increase in volatility is not contained to one particular country. As was documented by Cheung et al. (2009), there is ample evidence that the Financial Crisis had a direct impact on financial markets in many developed economies. Emerging markets were not immune from the crisis either: Boamah et al. (2016) showed that the Financial Crisis affected African stock markets as well, with greatest impact on the most liquid and most capitalized markets. Unfortunately, while there are many reasons for policy-makers to react to such crises, Kenourgios et al. (2011) argue that policy responses are unlikely to prevent contagion because collective retrenching of investors increases cross-country correlations, thus amplifying global effects of downturns.

Another notable result presented in this paper is reversal of the trend in the correlations among stocks traded on U.S. exchanges. Campbell et al. (2001) conclude based on pre-1997 data that there is a "clear tendency for correlations among individual stock returns to decline over time". We find that in post-1997 data, there is a sharp and sustained increase in correlations among stocks that started with the Dot-com Bubble and continued thereafter. The correlation reached unprecedented levels, dwarfing 1987 stock market crash, which saw the highest level of average correlation in pre-1997 data. It is a well-documented fact that correlation among stocks increases during financial crises. A number of studies documented asymmetric correlations during bull and bear markets (e.g. Ang and Chen (2002), Cho and Engle (1999), Hong et al. (2007)) but they mostly find that correlations among stock increase during the bear markets and decrease during bull markets. Our results show that correlation remained very high even during the bull markets. Therefore, the evidence presented here suggests that there was something fundamentally different about the period of Great Moderation and the recovery following the Financial Crisis.

The paper is organized as follows: In the next section, we survey some of the literature on the determinants of stock volatility. In the following section, we describe our methodology and present empirical findings, followed by a conclusion.

2. Literature review

While there are many intuitive reasons for changes in market volatility such as business cycles, political risks, geopolitical factors etc., the reasons for changes in firm-level volatility are far less obvious. Here we will focus on some of the reason that have likely contributed to changes in idiosyncratic and industry volatility documented in this paper.

One of the topics that has gained prominence in the literature is the change in the nature of publicly-traded firms. Fama and French (2004) document that new firms' fundamentals are different than older firms and that newer firms are more left-skewed in profitability, more right-skewed in their growth, and overall have lower survival rates. The effect of new firms is investigated in depth by Brown and Kapadia (2007). They find that the increase in idiosyncratic volatility is largely due to new listings by riskier firms. They also conclude that the decline in R-squared of the market model in their sample is due to new listings of companies with higher idiosyncratic risk. Increase in the number of such firms reduces the average R-squared as these firms become more prevalent in the market.

Brown and Kapadia (2007) also show that idiosyncratic volatility is inversely related to the average age of firms within an industry and directly related to the proportion of firms within an industry that are newly listed. Newer firms have declining profit margins and tangible assets, but older firms' profit margins and level of tangible assets have stayed almost the same.

As Bartram et al. (2012) point out, volatility isn't necessarily a good or bad thing. Rather, high volatility can be good or bad depending on its root causes. One of the positive characteristics they found to increase idiosyncratic volatility is the number of patents. Similarly, Comin and Philippon (2005) document that idiosyncratic volatility increases in industries that experience large increases in research and development, and that current volatility has a significant impact on future research and development. They also found that past research and development spending affects current levels of volatility, and that the sign was always positive, statistically significant, and typically larger than the contemporaneous correlations between research and development and idiosyncratic volatility.

Increased competition in product markets is what Comin and Philippon (2005) report to be another key factor of the increase in idiosyncratic volatility. They found that the profit margins of the industry leaders have not changed over time, but the average length of time that a firm is an industry leader has decreased dramatically. Brown and Kapadia (2007) also found changes in the composition of firms within an industry to be an important factor in explaining idiosyncratic volatility, more important than the changing of the weights of industries within the market over time. Irvine and Pontiff (2009) further confirmed the positive relationship of turnover within an industry and future idiosyncratic volatility. Increases in research and development mean that there will be more competition in the market and more differentiated products. In this environment it is harder to stay ahead of an entire industry, thus the average duration of a market leader declines. Since the expected duration of a firm as an industry leader has dropped drastically, there is an increased incentive to innovate and invest in new technologies in aspiration of unseating the current market leader. Thus, one creates incentives for the other, and while both increase volatility, they also spur innovation and progress.

3. Empirical analysis

As this study intends to update Campbell et al. (2001), it is substantially based upon their work. In this paper we use daily stock returns from The Center for Research in Security Prices (CRSP) database. The sample ranges from July 1, 1962 to December 31, 2013 and includes all firms traded on the NYSE, NASDAQ, NYSE Market, and the NYSE Arca exchanges during the period. We also obtained each firm's SIC code and market capitalization from the CRSP database at monthly intervals with the observation recorded on the final trading day of the month. We used the SIC codes to assign industry codes using the Fama and French (1997) scheme. This scheme classifies firms into 49 industries, including one "other" category. From the monthly data we dropped any observations that had missing values for market capitalization. Finally, we obtained 1-month Treasury bill data in monthly intervals from Kenneth French's Data Library for the sample period.

Our data differs slightly from the data Campbell et al. (2001) because we include firms that are traded on the NYSE Arca exchange. The NYSE Arca exchange did not begin actively trading securities until 1997, the final year included in Campbell et al. (2001). Because this study includes sixteen years of trading since the NYSE Arca became active, including stocks traded on this exchange is pertinent to investigating the volatility of equities in the United States as a whole. After deleting observations containing missing values, the sample used in this paper differed slightly from Campbell et al. (2001) in the number of firms. At the beginning of the period our sample contained 2044 firms compared to the 2047 in Campbell et al. (2001), and in the last month of Campbell et al.

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