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The Effects of the Intensity of Firm's Intangible Assets on the Volatility of Their Stock Prices

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Abstract

The volatility of share prices is an important variable in most asset pricing models and option pricing formulas. Valuations of volatility of share prices have become a major challenge with the development of the knowledge-driven economy as evidence suggest that not all elements of company wealth are physical in nature. The purpose of this paper is to check if the intensity of intangible assets in a firm's balance sheet affects the volatility of their stock price. A brief overview of intangible assets is also included in this study. An OLS regression was run and the results of the entire data set gives a negative correlation between intensity of intangible assets and volatility of stock prices probably due to the fact that the volatility of the firm share prices are driven by uncertainty and expectation of future growth. An industry-grouping regression was carried out, the results shows that for basic pharmaceuticals there is a positive correlation between the intensity of intangible assets and their price volatility while the other three industry groups produce a negative correlation. The study relies on secondary data of randomly selected forty (40) publicly traded companies in Ghana from four different industry groupings namely: manufacture of basic pharmaceuticals, manufacture of food products and beverages, information technology and manufacture of basic metals.

Keywords: Ghana, intangible assets, volatility, stock prices

1. Introduction

The rise of intangible assets size and the contribution to corporate growth over the last two decades posed an interesting topic for analysis. The increasing importance of intangible assets and the absence of explicit information about the contribution of intangible to earnings imply strong market incentives for analyst to provide value-added information for high-intangible firms. Goldfinger (1974) suggest that the source of economic value and wealth is no longer the production of material goods but the creation and manipulation of intangible assets. The increase in information complexity of intangible assets increases the difficulty of forecasting earnings of intangibles-intensive firms. Chan, Louis K.C., Lakonishok, Josef and Sougiannis, Theodore (1999) suggested that companies engaged in high R&D intensity have a distinctive effect on returns using two groups of stocks. Within the set of growth stocks, R&D-intensive stocks tend to out-perform stocks with little or no R&D. Their tentative investigation of the effects of advertising on returns yields similar results. They provided evidence that R&D intensity is positively associated with return volatility. The pharmaceutical industry expends millions of dollars yearly on intangibles, all in the pursuit of greater profits. Thus, investors are naturally interested in whether intangible assets and expenditures truly create shareholder value. In a paper by Heiens, Richard A; McGrath, Leanne C; Leach, Robert T (2008), four intangibles, namely advertising, research and development (R&D), goodwill and other intangibles, are investigated to establish their effects on market-adjusted holding period returns (HPR). Their results seem to indicate that of these variables, advertising does in fact seem to have a significant and positive impact on HPR. There are observations that the stock market behaviour of the so called 'knowledge companies' frequently deviates from that of basic industries. There also exists some evidence supporting a positive correlation between a firm's intangibles and its share market value (Amir and Lev 1996, Lev 1997, Lev and Zarowin 1998). The increasing importance of intangible assets to investors, analyst and

shareholders has increased investment community's needs to understand how companies create and manage their intangible assets, and to know how companies share prices are affected by intangible assets.

2. Literature Review

2.1 Definition of Intangible Asset

Intangible assets have been extensively analyzed in the economic literature within the frame work of innovation. There is generally no agreement on the economic nature, definition and classification of intangible assets. For simplicity, we define an intangible asset as an asset (something of value) that is non-physical in nature. Corporate intellectual property (items such as patents, trademarks, copyrights, business methodologies), goodwill and brand recognition are all common intangible assets. In brief, intangible assets are assets that are used in the operation of the business but that have no physical substance and are noncurrent. It should be noted that the basic for valuation of intangible assets is cost; these assets will appear on the balance sheet at their cost and will only be listed if significant costs are incurred in their acquisition or development.

2.2 Classification of intangible assets

There is no generally accepted classification of intangible assets. However, the six most common categories of intangible assets are suggested accordingly:

- *General*, which means goodwill and others, e.g. advantageous relationships with the government.
- *Brand Equity*, meaning the capacity of brands to sustain and encourage economic demand and other market capabilities, such as advertising.
- *Intellectual Capital*, including trade secrets, internally developed computer software, drawings and other proprietary technology as well as intellectual property (patents, trade names, trademarks, copyrights) which exist because of a complex body of law.
- *Structural Capital,* including assembled workforce (the relationship between the business and its employees, training and employee contracts), leadership, organisational capacity for sellable innovation, organisational learning capacity, leaseholds, franchises, licenses and mineral rights.
- *Customer Equity*, which means customer lists and other customer-based intangibles, customer loyalty and satisfaction as well as distribution relationships and agreement.
- *Supplier Relations* including equity interest in suppliers, contracts and supplier reliability

2.3 Empirical Studies

Intangible assets that are accounted for are mostly those whose costs are expensive when incurred such as R&D and advertising. Lev and Sougiannis (1996) speculated that the excess returns reflect either stock market mispricing, or represent compensation for the extra risk associated with R&D intensive firms. A follow-up study by Lev and Sougiannis (1999) after conducting a series of tests, they conclude that the excess returns are more likely a consequence of additional risk. Later studies (Lev, Sarath and Sougiannis, 2000; and Penman and Zhang, 2002), however, switch their focus from R&D intensity defined based on the estimated amount of R&D assets to change in R&D assets because observations suggest that it's not the absolute levels of R&D assets that affect the persistence of earnings. These papers document evidence consistent with the hypothesis that the market is, to some extent, fixated on earnings and does not fully understand the impact of R&D accounting on earnings quality.

The conference paper by Chambers, Jennings and Thompson provides more compelling evidence supporting the risk explanation and they show that earnings volatility of R&D intensive firms is high, which is consistent with prior findings (see Chan, Lakonishok and Sougiannis, 2000). Recent finance literature highlights the role of technological change in increasing firm specific and total stock price volatility (Campbell et al. 2001, Shiller 2000, Pastor and Veronesi 2005). The productivity literature on market value and innovation has already established a positive relationship between a firm's market value, its R&D intensity and its citation weighted patents (Griliches 1981; Pakes 1985; Hall 1993, Hall, Jaffe and Trajtenberg 2005).

The analysis builds on the empirical work by Mazzucato (2002; 2003) where it is found that stock price volatility is highest during periods in the industry life-cycle when innovation (measured at the industry level) is the most 'competence-destroying'. Comments have often been made that intangible assets are an important contributor to economic well-being; academic research has still a long way to go to quantify their impact (Griliches 1998). One problem is that intangible asset such as R&D outlays, advertising, marketing and human capital, are quite difficult to measure. Academic research has generally employed either company accounts or industry data. Previous work using the former tended to concentrate on research activities alone, due to the lack of data on other forms of intangible investment.

There have been increased attentions in stock price volatility after the "New Economy" period when many high-tech stocks that were considered overvalued experienced a large drop in their share price. This persistent idea of 'knowledge economy' has resulted in even greater stock price volatility although there have been no trend increase in total stock price volatility (Schwert 1989; 2002). Shiller's (2000) has shown that 'excess volatility' is highest in periods of technological revolutions when uncertainty is greatest due to increased uncertainty regarding both technology and demand causing investors to be less confident about their own judgments. He claims that the efficient market model greatly underestimates stock price volatility due to the fact that it does not incorporate the social mechanism by which expectations are formed (i.e. animal spirits, herd behaviour, bandwagon effects). Uncertainty in finance models refers to how expectations about a firm's future growth affect its market valuation (Campbell, Lo and McKinley 19973). Knight (1921) and Keynes (1973) highlight that technological changes is an example of true uncertainty which cannot be calculated using probabilities like risk but it's a key determinant of a firm's possible future growth.

The work of Pastor and Veronesi (2005) provides interesting insights on the relationship between innovation, uncertainty and volatility of stock prices. They claim that if one includes the effect of uncertainty about a firm's average future profitability into market valuation models, then bubbles can be understood as emerging from rational, not irrational, behaviour about future expected growth. It thus follows from the result in Pastor and Veronesi (2004) that uncertainty about average productivity increases market value. They extend the model to explain why technological revolutions cause the stock prices of innovative firms to be more volatile and experience bubble like patterns. The basic idea is that when a firm introduces a new technology, its stock price rises due to the expectations regarding the positive impact of the new technology on its productivity. Volatility also rises because risk is idiosyncratic when technology is used on a small scale. When the new technology gets adopted throughout the economy, the risk becomes systematic causing the stock price to fall and volatility to decrease. This bubble like behaviour is strongest for those technologies that are the most uncertain. The study of Mazzucato and Tancioni (2005) reveal that it is not true that more innovative industries are on average more volatile than less innovative ones, at the firm level a positive and significant relationship is found between idiosyncratic risk and R&D intensity.

3. Methodology

3.1 Research Design

Prior research finds that firms invest in intangible assets with two purposes: to develop new knowledge and to lean about and benefit from the innovation of others (Mowery, 1983; and Cohen and Levinthal, 1989). Accordingly, we predict that firms (Industry group) with higher intangible assets will have higher volatility of their stock prices. Our hypothesis (in alternate form):

Firms (industry group) with higher intangible assets have higher volatility of their stock prices.

We study intangible assets recognized on the firm's balance sheet (BI) and the volatility of stock prices of the firms (S). To examine the intensity of firm's intangible assets and volatility of stock prices, we estimate using the following regression model:

$$S_t = \alpha + \beta BI_t + \varepsilon_t$$

Where S_t is the volatility of stock prices. It should be noted that we assumed that the price volatility was constant over the ten year period so we calculated the price volatility using price changes for the year 2011.

BI_t represents the intensity of annual average of booked value of intangible assets on the firm's balance sheet. From the regression model, a more precise form of the hypothesis is thus stated as;

$$H_1 : \beta \succ 0$$

The coefficient estimate β of the intangible variable BI inform whether the volatility of the stock prices are related to firm's intangible intensity.

3.2 Sample Data

The test of this study requires sample firms (industry group) to have at least ten (10) years of consolidated balance sheet data and the firm should be listed in at least one stock exchange. The analysis covers a period from 2001 to 2011 and includes a total of 40 firms from four different industry group that have the required financial data available from two secondary sources namely; Ghana Stock Exchange and Ghana Statistical Service. Later in the analysis, data from two firms were dropped due to lack of stock prices data. Sample firms in this study are taken from the following industry groups: manufacture of basic pharmaceuticals, manufacture of food products and beverages, information technology and manufacture of basic metals. The descriptive statistics of the variables of interest are shown in Table 1 below. The mean values of BI and stock price volatility are all higher than their medians indicating substantial concentration in a subset of firms with higher intangible assets.

Table 1: Descriptive Statistics of Sample Data

	IA / TA	*Stock Price Volatility*
Mean	0.23100912	0.021679507
Standard Error	0.031700579	0.001685175
Median	0.184009613	0.020154619
Mode	#N/A	#N/A
Standard Deviation	0.195415496	0.010388118
Sample Variance	0.038187216	0.000107913
Kurtosis	0.085494659	2.86273831
Skewness	0.884435395	1.419778016
Range	0.732925517	0.049782951
Minimum	0.005838209	0.008531435
Maximum	0.738763727	0.058314386
Sum	8.778346571	0.82382125
Count	38	38

*BI = IA / TA

4 Empirical Results

The regression analysis was done using both Microsoft excel and SPSS software. Both software give identical results which is shown on Table 2 below. The coefficient of intangible assets to total asset, BI (-.011, p=0.221) seems to be unrelated to volatility of stock prices which is also indicated by the standardized beta (β= -0.203). That is, the results show that the coefficient for the Intangible intensity is not statistically significant The R-squared is 0.041; meaning that approximately 4.1% of the variability of stock price volatility (S_t) is accounted for by the variables in the model.

Table 2: Statistics summary of OLS Regression**.**

Regression Results of S_t on BI_t								
Dependent Variable: S_t								
	Coeff.	**Std Error**	**Standardized Beta**	**t-Stat**	**Sig**	**F-value**	**R-Square**	**Adj-R^2**
α	0.024	0.003		9.261	0.000	1.551	0.041	0.015
BI_t	-0.011	0.009	-0.203	-1.246	0.221			

The negative correlation established between intensity of intangible assets and volatility of stock prices obtained in this result counter works prior research on non-booked degree of intangible assets. The negative sign of the coefficient of beta (β) at the first sight seems to be the opposite direction to what we would expect. This negative association may be due to the fact that;

- There seem to be little or no significant impact of booked intangible asset on the volatility of the firm share prices which are driven by uncertainty and expectation of future growth.
- One could also argue that it is costs on R&D and marketing (advertising) which eventually will be generating intangible asset, but they are not booked as such to have a positive impact on the volatility of share prices, not when these costs are recognized as intangible asset, sometimes with quite conservative/ precautious application of accounting principles. Thus the book value of intangible assets is always lower that the actual value of the intangible asset.

Following the results obtained above, an industry-wise regression is run on the same data and the results are shown on table 3, table 4, table 5 and table 6 below.

Table 3: Statistics summary of OLS regression for Basic Pharmaceutical

Regression Results of S_t on BI_t								
Dependent Variable: S_t								
	Coeff.	**Std Error**	**Standardized Beta**	**t-Stat**	**Sig**	**F-value**	**R-Square**	**Adj-R^2**
α	0.016	0.005		3.017	0.017	1.817	0.186	0.083
BI_t	0.019	0.014	0.430	1.348	0.215			

From table 4 above, coefficient of intangible assets to total asset, BI (0.019, p=0.215) for the manufacture of basic pharmaceuticals seems to be related to volatility of stock prices which is also indicated by the standardized beta (β= 0.430). This positive correlation supports previous research on the fact that there is a positive relation between the intensity of intangible assets and the volatility of their stock prices for pharmaceutical firm probably due to the high level of R&D in this industry. The results of the regression from the other three industry group namely manufacture of food product and beverages, information technology and manufacture of basic metals all have a negative relation between the intensity of intangible assets and the volatility of their stock prices with beta value of -0.318, -0.415 and -0.348 respectively. These negative coefficients seems to be opposite the direction we expected and this might be due to the fact that there is little or no significant impact of booked intangible asset on the volatility of the firm share prices.

Table 4: Statistics summary of OLS regression for Food product and beverage

Regression Results of S_t on BI_t for Food Products and Beverages								
Dependent Variable: S_t								
	Coeff.	Std Error	Standardized Beta	t-Stat	Sig	F-value	R-Square	Adj-R^2
α	0.014	0.002		6.217	0.000	0.787	0.101	-0.027
BI_t	-0.007	0.008	-0.318	-0.887	0.405			

Table 5: Statistics summary of OLS regression for Information Technology

Regression Results of S_t on BI_t for Information Technology								
Dependent Variable: S_t								
	Coeff.	Std Error	Standardized Beta	t-Stat	Sig	F-value	R-Square	Adj-R^2
α	0.026	0.003		8.269	3.438	1.662	0.172	0.069
BI_t	-0.011	0.009	-0.415	-1.289	0.233			

Table 6: Statistics summary of OLS regression for production of Basic Metals

Regression Results of S_t on BI_t for Basic Metals								
Dependent Variable: S_t								
	Coeff.	Std Error	Standardized Beta	t-Stat	Sig	F-value	R-Square	Adj-R^2
α	0.037	0.008		4.589	0.003	0.970	0.122	-0.004
BI_t	-0.249	0.253	-0.349	-0.985	0.357			

5 Conclusion

The study shows a negative correlation between the intensity on firm's intangible assets and the volatility of their stock prices which opposes my initial prediction and previous studies in this area. This negative association is probably due to that fact that the data for intangible assets used in this study are book values which are lower than the actual value and additionally, averaging over a period between 8 and 10 years might have contributed to the counter intuitive results.

Based on industry groups, we examine the relation between the intensity of book value of intangible assets of four industry groups and the volatility of their stock prices. Consistent with this prediction, I find a positive correlation between the pharmaceutical industry book value of intangible assets and the volatility of their stock prices which is supported by previous studies in this area. The impact of uncertainty and expectation on the behaviour of investors in this industry due to the high level of R&D going on in this industry also contribute to this result. The other three industry groups did not give any different results from the main result of this study.

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