Toward a Practical Measure of Firm Risk-taking:

Revisiting Bowman's Paradox

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Abstract

Literature overwhelmingly shows a negative relationship between firm-level risk and returns based on accounting data, which is counter-intuitive from the rational perspective of risk-aversion. The present paper revisits this so-called Bowman's Paradox and examines the wealth of literature on the topic with the objective of contributing to the development of an appropriate measure for firm risk-taking that would provide a counter-argument on the existence of the paradox. After formulating the criteria for such a measure, potential firm risk-taking measures were developed based on variability of some key financial ratios and empirically tested using US listed companies' data for several time periods. The results showed the same counter-intuitive negative relationship between risk-taking and returns but the present paper identified an area for future theory development that hopefully will lead to a firm risk-taking measure that would exhibit the elusive positive relationship with returns.

Introduction

Several early work have postulated a positive relationship between financial market-level risk defined as variability of returns and expected return of securities, most notably the Capital Asset Pricing Model (Sharpe 1964; Lintner 1965). This original model for determining the expected return of securities based on risk has been expanded through the large volume of work that followed including the addition of other factors like in the Four-Factor Model (Fama & French 1992). While most of the models have exhibited empirical deficiency in terms of predicting expected returns of securities (Rossi 2016), there is general support for the positive relationship between financial market-level risk and expected return of securities. This relationship is commonly referred to as risk-return trade-off, which intuitively makes sense based on the assumption that investors are generally risk-averse (i.e. they will only accept higher risk if they will get a higher return).

Bowman's Paradox

At the firm-level and based on a similar definition of risk which is variability of returns but this time using accounting data, the relationship between risk and return is a lot more inconclusive. A seminal work observed that accounting-based risk and returns are negatively correlated across firms within industries (Bowman 1980). This seeming risk-return paradox implies that both higher risks and lower returns would be acceptable to firms. However, it is acknowledged that financial market-level and accounting firm-level risk-return relationships are perhaps only obliquely linked to each other. At financial market-level, efficient market forces determine risk-return relationships while firm strategies offering diverse levels of risk and return are not something that are bought or sold in a market (Bromiley *et al.* 2001). The importance of the implications of Bowman's paradox have generated significant

research interest. Subsequent work by numerous researchers have confirmed his result and various explanations for the paradox have been presented. A review paper showed the depth of Bowman's paradox, with increasing citation in subsequent papers that explore other aspects of managerial decision-making while still being mostly supportive of the original conclusions, and highlights the need to develop an appropriate measure of accounting-based risk (Nickel & Rodriguez 2002). Later review papers discuss continued interest in the paradox (Andersen *et al.* 2007; Brick *et al.* 2015).

There are two main research streams in subsequent study of Bowman's paradox. The first stream assumes the existence of the paradox and explains it by applying established theory with empirical support. The second stream points out possible methodological weaknesses in previous studies with empirical support and therefore implies the non-existence of the paradox (Nickel & Rodriguez 2002). The theory stream can be further categorised into contingent decision making and strategic management conduct while the methodology stream can be further categorised into statistical analysis weakness and misspecification of variables (Andersen *et al.* 2007).

Theoretical explanations for Bowman's paradox

The contingent decision making framework posits that risk preference and therefore the risk-return relationship could change depending on the context of the choice. Reference-based models of choice under this framework assume that firms decide on their risk preferences after comparing their performance to certain reference points. The most prominent model, Prospect Theory states that individuals are risk averse when prospects are positive and risk seeking when prospects are negative (Kahneman & Tversky 1979) which transposes to a situational framing where good performance by the firm is associated with risk aversion and poor performance by the firm is associated with risk seeking behaviour (Andersen *et al.* 2007). An early work using US data found a negative risk-return relationship for firms with returns below target levels and a positive relationship for firms with returns above target levels (Fiegenbaum & Thomas 1988). Consistent with Prospect Theory, results using Compustat data show that firms with returns above their reference levels take less risk than firms with returns below their reference levels (Kliger & Tsur 2011). More recently, it was documented that the relationship between risk and return is positive in winner firms and negative in loser firms (Holder *et al.* 2016). However, there are questions on the application of Prospect Theory to organisational contexts as it was developed with a different set of assumptions to explain individual behaviour (Bromiley & Rau 2010).

Another model used to explain Bowman's paradox is the Behavioural Theory of the Firm. It posits that a firm's propensity for taking risks depends on the gap between expected and aspired performance and the firm's organizational slack resources (Cyert & March 1963). This theory was cited in the seminal paper that introduced Bowman's paradox, with the negative risk-return relationship being attributed to

losing firms assuming more risks in order to increase the chances of eventually making profits (Bowman 1982). It was found that when expected performance is exceeding aspired performance, firms do not take risks through major operational changes and therefore there is a positive risk-return relationship. When expected performance is below aspired performance, firms take risks through major operational changes and therefore there is a negative risk-return relationship (Singh 1986). Using a lagged model based on Behavioural Theory of the Firm, poor performance appear to increase risk-taking and risk-taking appear to result in poor performance, suggesting a vicious circle (Bromiley 1991). Incorporating Agency Theory and Implicit Contracts Theory into models based on the Behavioural Theory of the Firm showed further support to the contingent explanation for the risk-return relationship (Deephouse & Wiseman 2000). It could be noted that these models based on firm behaviour overcome the major criticism of the use of Prospect Theory to explain risk-return relationships for organisations.

There are other contingent theoretical explanations for Bowman's paradox. Market power can allow firms to achieve not only higher return but also lower risk, however this has not been conclusively established empirically (Nickel & Rodriguez 2002). Industries having intense rivalry among participants may constitute competitive environments where risk decision-making is associated with negative risk-return relationships (Cool *et al.* 1989). The age of the firm could be a factor in the absence of a universal relationship between risk and return because that relationship evolves as firms age and as technology progresses (Henderson & Benner 2000). Risk and return appear to be influenced directly and separately by various industry conditions and business strategies and not by each other (Oviatt & Bauerschmidt 1991). Decision makers were also found to be influenced by their perception of environmental risk and the organisation's capacity to handle them (McNamara & Bromiley 1999). Differences in empirical results on the risk-return relationship depending on prevailing economic conditions imply the importance of macroeconomic factors (Deephouse & Wiseman 2000). It has been proposed earlier that the theorised relationship between expectations-aspirations gap and firm risk propensity might hold only during economic upturns and not downturns (March & Shapira 1992).

The strategic management conduct framework posits that the negative risk-return relationship is the result of good or bad strategic management conduct, but it is less grounded in theory than the contingent decision making framework. The first explanation offered for the paradox in the seminal paper was that good management, if present in an industry, can bring about both higher returns and lower returns variability simultaneously in that industry (Bowman 1980). Good management can positively influence both the mean and variance of performance while bad management can negatively influence both the mean and variance of performance (Andersen *et al.* 2007). One explanation offered is that risk increases the cost of doing business and management actions to reduce risk is therefore associated with lower cost and better firm performance (Miller & Wei-Ru Chen 2003). A dynamic model of competitive strategy

based on strategic fit and the heterogeneity of firm capabilities has been presented showing how firms can strategically achieve sustainable high returns at low risk (Fiegenbaum & Thomas 2004). Another stream of research argues that some types of firm diversification may simultaneously reduce risk and increase returns with mixed empirical support (Bromiley & Rau 2010). Using a sample of Australian firms, an empirical study found a positive relationship between firm-level risk and returns for firms with increasing institutional shareholdings (Hutchinson *et al.* 2015).

The aforementioned theoretical arguments try to explain when the risk-return relationship can be positive and when it can be negative. However, there is still no overarching theoretical explanation offered for the general negative relationship described by the paradox.

Methodological explanations for Bowman's paradox

Statistical analysis weaknesses in previous research have been used to refute Bowman's paradox. The observed risk-return relationships have been explained as spurious or statistical artefact lacking substantive interpretation as management or strategy phenomena (Bromiley *et al.* 2001). One major criticism of the common method of using means and variances of accounting returns is that two moments of the same variable might have an inherent statistical relationship that is not a real economic relationship (Nickel & Rodriguez 2002). Using the same dataset in the original Bowman paper, it was shown that skewness of firms' return distributions has a considerable spurious effect on the empirically estimated negative risk-return relationship (Henkel 2009). It is also argued that firms should only consider negative return variations as risky and the use of downside risk measures have shown that positive risk-return relationships are also evident (Miller & Leiblein 1996). Most of the previous studies have been cross-sectional in nature, so the relationships observed may be short-term and does not capture the changing industry characteristics over time that longitudinal studies can (Fiegenbaum & Thomas 1985). However, a model that allows firms to adjust their position in a changing environment through either imperfect learning or mindless random walk still resulted to a negative longitudinal risk-return relationship (Andersen & Bettis 2015). Bowman's paradox has also been explained within the context of declining industries where good performers have stable returns resulting to low variance while bad performers have declining returns resulting to high variance, yielding a negative risk-return relationship for such industries (Wiseman & Bromiley 1991).

Misspecification of risk and return variables are offered as explanations for Bowman's paradox. Although widely used in literature as a measure of risk, variance of returns has no management strategy theory linked to it. Furthermore, it is measured ex-post when it should be an ex-ante measure (Ruefli *et al.* 1999) and managers therefore cannot use them prospectively when making decisions (March & Shapira 1987). A survey among 670 financial analysts concerning the definitions of risk that they use

identified size of loss, probability of loss, variance of returns and lack of information, in order of frequency of mention. The measure used most widely by researchers, variance of returns, appears to be a poor third among practitioners (Baird & Thomas 1990). This ex-post concept of accounting-based risk has evolved in academic literature as a proxy for the ex-ante concept of managerial risk-taking, to the extent that the terms firm risk and firm risk-taking are taken interchangeably.

Measures of return have been questioned to a lesser degree than risk measures. One major criticism is in the use of end of period denominators for ROE or ROA when beginning of period denominators make more intuitive sense. Some studies that use beginning of period denominators yield a positive risk-return relationship (Baucus et al. 1993; Brick et al. 2012). More recently, adjustments for beginning of period denominators, earnings management and consideration of additional control variables such as issuance and repurchase of shares, firm size and leverage showed that a positive risk-return relationship is more likely than a negative one, but still not conclusively (Brick *et al.* 2015). In terms of causality, a criticism of the findings is that risk-taking and return were measured contemporaneously and directional influence therefore cannot be established. To address this, one paper used a lagged model but still found a similar result with risk-taking being negatively correlated with next period return (Bromiley 1991).

Extension of Bowman's Paradox

The studies related to Bowman's paradox have utilised mainly US financial data. There have been studies to extend it to other contexts. One such study assessed the generalisability of Bowman's paradox across 12,235 firms from 28 countries. Cross-sectional and longitudinal relationships between risk and return provided broad support for Bowman's paradox in most countries in Asia, Europe and South Africa except for India, Japan and South Korea, where the risk-return relationship was positive (Patel *et al.* 2017). A similar study on companies from several emerging markets for the period 2003 to 2010 confirm that risk is negatively associated with return, in support of Bowman's paradox (Pirtea *et al.* 2014). Clearly, the paradox applies not just to the US situation but in other countries as well.

Even though a significant period of time have passed since Bowman's paradox was first observed, there is still no general agreement on the explanation for this phenomenon. The importance of such an explanation is obvious as management strategy is related to both returns and the risks associated with those returns (Andersen *et al.* 2007).

Research aims and contribution

Risk and uncertainty have been used interchangeably in economics and management since they were formally defined (Knight 1921). Later, academics recognised the need to refine the definition of risk and develop a categorisation of risks that relates to strategic management issues (Baird & Thomas 1985).

In academic research, risk has a variety of definitions such as variability of accounting or stock returns, innovation, lack of information, entrepreneurship and threat of serious loss. The wide range of definition means that it is not safe to settle on one definition and exclude all others as any one of these concepts of risk may exist in a strategic decision context. The most popular definition, variability of returns, has major problems. It measures risk after the fact rather than the risk facing a manager during the decision process, it measures only one aspect of risk and it may not reflect the perceptions of managers. Clearly, there is a need to formulate a more adequate representation of risk and its relevant components which recognises the interplay among decision-makers, organisational processes and industry factors in assessing risk and strategic risk-taking. (Baird & Thomas 1990)

The four categories of explanations for Bowman's paradox discussed in the previous section is summarised schematically in table 1.

Table 1 - Explanations for Bowman's paradox

Contingent decision making	Returns → Risk-taking	Previous returns influence risk-taking behaviour
Strategic management conduct	Actions → Returns → Risk	Management actions directly influence both returns and risk
Statistical analysis weakness	Returns ← ? → Risk/Risk-taking	There is no real relationship between returns and risk/risk-taking
Misspecification of variables	Risk-taking → Returns	If variables are properly specified, intuitively, risk-taking should influence returns

Here, a distinction is made between risk-taking and risk, as a choice and as an outcome respectively. The former is commonly referred to in literature as managerial risk-taking or managers' strategic choices associated with uncertain outcomes. This recognises that managers need to take risks, in an uncertain environment, in order to improve the firm's performance and competitive standing. The latter is commonly referred to in literature as organisational risk or the subsequent uncertainty to the firm's income stream resulting from managers' actions (Hoskisson et al. 2017).

The present paper posits that if the variables for risk-taking and returns are properly specified, a positive relationship contrary to the negative risk-return relationship presented by Bowman's paradox, will be evident. Lack of willingness to take some level of risk generally precludes financial reward and growth (Stulz 2015). In the competitive business environment, the ways to increase profitability and to grow are either to establish a sustainable competitive advantage (Porter 2004) or to take greater risks (Shaw

2003). In general, economic analysis argues that firms need to be rewarded with higher returns for taking risks (Bromiley 1991).

The present paper aims to formulate a practical measure of firm risk-taking. It is important to examine the consequences of firm risk-taking as it is an essential element of business activity. It sets out the criteria for such a practical measure and carries out empirical tests on the formulated measure. This will be a significant contribution to literature as it will allow proper framing of the large body of literature studying the relationships among such concepts as corporate governance, managerial action, firm risk and returns.

Current risk measures

Risk can be defined as the probabilistic variation inherent in a firm's actions and their outcomes (Arrfelt *et al.* 2016) and literature reflects this broad definition with the wide range of constructs that have been referred to as risk. Papers on strategic management use the terms risk and risk-taking interchangeably, and lump together various constructs including risk preference, activities that increase risk and variability in performance outcomes that clearly have different underlying meanings (Bromiley *et al.* 2017). As mentioned earlier, in the case of firms, risk can be broadly categorised as either choice or outcomes into managerial risk-taking and organisational risk respectively.

The most common organisational risk construct is income stream uncertainty where risk is commonly associated with the ex-post variance of a return measure (i.e. ROA or ROE and sometimes ROS) and less commonly ex-ante variance in forecast of earnings by analysts. Recognising that only negative outcomes is associated with increasing risk, variance measures are sometimes modified to reflect only downside risk. Managerial risk-taking constructs define risk in terms of actions that may be seen as increasing firm risk or uncertainty through such measures as R&D expenditures, capital expenditures, change in capital structure, lending decisions, diversification, acquisition, change in top management, engaging in activity that results in lawsuits, etc. Some research proxy firm risk-taking with the risk propensities of individual managers. The discussion in these previous research makes evident that these different measures reflect different underlying constructs (Bromiley & Rau 2010), some being largely choices and some being largely outcomes. For instance, factor analysis yielded three factors for risk measure: income stream risk (historical returns variability, analysts' earnings forecasts), stock returns risk (systematic risk, unsystematic risk) and strategic risk (debt to equity ratio, capital intensity, R&D intensity), all having low correlations with each other. Use of income stream risk supports Bowman's paradox while use of strategic risk provides only conditional support (Miller & Bromiley 1990). An earlier paper involving one of the most comprehensive studies of perceptions of risk-taking by executives

and other common risk measures also found no significant correlation between these various measures of risk (MacCrimmon & Wehrung 1986).

While objections have been raised about its conceptual validity, variance of return is the most widely used measure of risk in research literature. Aside from validity, another criticism is that it defines ex-post risk as any positive or negative deviation from mean when only variance below the mean is comparably significant to managers from the risk standpoint (March & Shapira 1987). One paper that recognises this indicates a positive relation with downside risk of subsequent return but returns show a negative relation with subsequent downside risk (Miller & Leiblein 1996). Another criticism is that the use of mean and variance of the same variable as dependent and independent elements in a model leads to spurious correlation if a single stable distribution is assumed (Ruefli 1990). Risk is an essential element of strategic management and much of the research in this area borrows measures from other disciplines such as financial economics and statistics, and the variance of returns measure is a major example. Perhaps because of being a borrowed measure, it has yielded inconsistent and inconclusive empirical results. Being an ex-post measure, it also does not capture the concept of ex-ante risk decision making actually employed by managers. While it offers computational ease and convenience, mean-variance approaches to studying risk-return relationships are not explicitly supported by a body of theory (Ruefli et al. 1999). In the special case of banks, the most widely used measure of risk in research literature is the Z-score which is calculated based on ROA and is interpreted as the distance from insolvency (Boyd & De Nicolo 2003; Bhagat *et al.* 2015).

Even in corporate governance research, variance of returns is the most widely used measure of risk. One popular formulation involves the variance over a five year period of earnings before interest tax and depreciation allowance (EBITDA) scaled by total assets (TA) for each firm in excess of the industry average of EBITDA/TA for each year. It is worth noting that the only justification offered is "since riskier corporate operations have more volatile returns to capital, we develop three proxies for the degree of risk-taking in firms' operations based on the volatility of corporate earnings" (John *et al.* 2008 p. 1687). This measure is widely used, with the paper having 246 subsequent citers according to Scopus and 842 according to Google Scholar at the time of the present paper's writing.

Ex ante measures (e.g. variance of analysts' earnings forecasts) are preferred over the above ex-post measures because they reflect uncertainty resulting from managerial decisions prior to the actual outcomes from those decisions (Bromiley 1991). They measure risk in terms of income stream uncertainty at the time of managerial decision and therefore provide a better proxy of managerial propensity for risk than do ex-post measures (Deephouse & Wiseman 2000).

Managerial risk-taking, as opposed to organisational risk, has been investigated early on in relation to Bowman's paradox. Using content analysis of annual reports for keywords associated with risk-taking, it appears that risk-taking did not influence future performance (Bowman 1984). Subsequent research have used measures based on the levels of discretionary firm activity as reflected in firm accounting data (e.g. R&D investment, capital and advertising expenditures, debt, acquisitions, divestitures and large investments) to capture risk-related behaviour. These risk-taking measures are more associated with managerial decisions than more distant measures such as variability of returns, but the extent to which they actually reflect risk rather than other factors remains an open question (Bromiley *et al.* 2017) although considerable empirical evidence supports a positive relation between the debt-equity ratio and risk (Deephouse & Wiseman 2000). A meta-analysis of 257 unique studies yielded questions on whether firm risk-taking measures commonly used without theoretical justification and further differentiation fall under one overarching risk-taking construct. Specifically, four of the most commonly used risk-taking measures in the literature (e.g. R&D investment, capital expenditures, advertising expenditures, and the use of debt) were found to have little convergence and have very different relationships with firm risk and firm performance and may not be as homogenously risk increasing as often assumed (Arrfelt et al. 2016). This finding builds on an earlier research using the exploration-exploitation framework that divides firm resource allocation into two different types of activities based on their nature and subsequent effect on firm outcomes and which found that explorative expenditures increase risk and performance while exploitative expenditures reduce risk and increase performance (March 1991). It is argued that definitions of the risk-taking construct in the literature have been abstract and all-encompassing and it has been proposed that managerial risk-taking be unpacked into its three major elements namely the size of an outlay (R&D, capital and acquisition investment), the variance of potential outcomes and the likelihood of extreme loss (Sanders & Hambrick 2007).

Among resource allocation measures of risk-taking, R&D expenditure is the most commonly used. However, analysis found a lack of consistent correlation between R&D and firm risk based on other standard measures. Furthermore, many previous studies associate R&D with risk taking even without sufficient theoretical justification. It is noted that in rapidly evolving industries, lack of R&D spending may increase the chances of poor performance and therefore R&D spending might actually reduce firm risk. Also, if R&D projects are looked at as a portfolio, then higher R&D expenses means a larger portfolio and less variable performance therefore lower risk (Bromiley et al. 2017).

Understanding risk in firms have been hindered by lack of agreement over the meaning and measurement of risk. In some research, risk is measured through managerial choices associated with uncertain outcomes (i.e. managerial risk-taking). In other research, risk is characterised by volatility of income streams (i.e. organisational risk). There is no explicit distinction between managerial risk-taking and

organisational risk and oftentimes the latter is used as proxy for the former based on the assumption that managerial risk-taking causes variation in firm performance even if the casual relationship has not been sufficiently tested (Palmer & Wiseman 1999).

Criteria for a practical firm risk-taking measure

The present paper will focus on managerial risk-taking measure with the aim of formulating a practical measure for firm risk-taking. As literature has established, risk is a multi-dimensional construct, and popular measures such as variability of returns capture only one aspect (i.e. firm outcomes of firm choices). Most of the current measures are borrowed from other disciplines. In formulating a practical risk-taking measure, instead of simply citing previous literature, there should be theoretical support on their applicability to strategic management research. The risk-taking measure should also make clear the relevant context where it can be used to test a particular hypothesis. Some important considerations in specifying risk measures are: (1) ex-ante measures are better because ex-post measures may not reflect the risk at the time of decision making (2) downside measures are more reflective of risk (3) should they reflect a reference level or should they be non-contingent? (4) comparability across firms (Bromiley *et al.* 2001). To these can be added other criteria such as stability of the resulting risk-return relationship across country settings, time periods, industries, firm size and economic conditions.

Although risk may influence returns, in many cases management choices directly influence both risk and returns. In any given context, it needs to be established whether risk and returns are related because they both have the same antecedents or whether risk directly influences returns (Bromiley *et al.* 2001) and the author believes that this is where a practical measure for firm risk-taking would be very useful.

Proposed risk measure

The present paper proposes a risk-taking measure for firms based on key ratios that can be calculated from publicly available annual financial statements. It posits that firm risk-taking is associated with the variability of these financial ratios, such variability being an indication of managerial decision-making. As discussed earlier, literature has explored the use of levels of discretionary firm activity (e.g. advertising expenses, R&D expenses) based only on their magnitude. The present paper is novel in that it examines the variability of these parameters. The financial ratios that are explored as basis for potential firm risk-taking measures are as follows:

1. Total Liabilities/Total Assets (a measure of firm leverage)
2. Days Inventory
3. Days Receivable

4. Gross Margin
5. Advertising Expenses/Sales
6. R&D Expenses/Sales

It is noted that these financial ratios are the cumulative results of operational decisions of the firm and are therefore more akin to choices (i.e. managerial risk-taking) rather than results (i.e. organisational risk). This distinguishes the proposed measure with the widely used risk measure of variability of returns which is based on the results of managers' actions.

Firm risk-taking is measured using the coefficient of variation (i.e. standard deviation/mean) of these financial ratios over a five-year period. Using coefficient of variation or CV instead of just standard deviation or variance as is widely done in literature normalises to a comparable scale the magnitude of variability among firms.

The potential measures of firm risk-taking will be assessed based on the direction of their relationship with the measure of firm returns. The present paper utilises a return measure consistent with literature, which is average EBIT/Total Assets over the same five-year period in excess of the sector average. EBIT was considered more appropriate than Net Income in analysing returns among firms because it does not include the effects of financing and accounting decisions. In the present paper, risk-taking and returns are measured concurrently without any lags as it can be assumed that the managerial choices and the subsequent results occur within a relatively short period of time of each other.

Empirical testing of proposed risk measure

The present paper tests the potential firm risk-taking measures by examining their correlation with the measure of return. The present paper did not use a regression model in the analysis as the use of the potential risk-taking measures is largely exploratory without significant theoretical support.

Compustat data for all listed US companies was utilised, narrowed down to firms that have complete financial information for the five-year periods studied, namely 1992-96, 2002-2006 and 2012-2016. The correlation analysis was carried out for several five-year periods to examine the stability of any relationship across time periods and financial market conditions, noting that the US sharemarket performed differently during these periods. The 1992-96 period is a high growth period with the DJIA increasing by 103%, 2002-2006 is a relatively flat period with the DJIA increasing by only 19% and 2012-16 is a moderate growth period with the DJIA increasing by 56%. The NBER recession indeces indicate that all three periods are expansionary periods. Correlation analysis is also carried out for the

different GICS sectors that the firms belong to examine the consistency of any relationship across industries.

The Pearson Correlations of the return measure (EBIT/Total Assets) with potential measures of firm risk-taking for all companies included in the study are summarised in table 2.

Table 2 – Summary of correlation results for all companies included in the study

Period	N	CV of Total Liabilities/ Total Assets	CV of Days Inventory	CV of Days Receivable	CV of Gross Margin	CV of Advertising Expenses/ Sales	CV of R&D Expenses/ Sales
1992-96	1510	-0.373**	-0.286**	-0.240**	0.163**	-0.133**	-0.348**
2002-06	3050	-0.372**	-0.278**	-0.296**	-0.047*	-0.268**	-0.366**
2012-16	4607	-0.347**	-0.262**	-0.287**	0.011	-0.250**	-0.337**

** correlation is significant at the 0.01 level *correlation is significant at the 0.05 level

Table 2 shows a significant negative relationship between return and all risk-taking measures except for CV of Gross Margin. The negative relationships are consistent across the three time periods, with the correlation coefficients interestingly almost identical for each risk-taking measure. This indicates stability across time periods and the prevailing financial market condition. The Pearson Correlation for CV of firm leverage as measured by Total Liabilities/Total Assets is consistently highest and significant for all time periods.

The negative relationships seemingly support Bowman's Paradox and seemingly indicate that the proposed measures still do not address the previously identified problem of misspecification of variables. However, from the perspective of competition in business, it can be argued that a laissez-faire strategy characterised by non-changing financial ratios or very low CV of these ratios is actually riskier compared to a more competitive strategy characterised by high CV of ratios. A possible future area of research is the development of a theoretical basis for this argument that would allow a refinement of the firm risk-taking measures explored in this paper to yield the elusive positive relationship between risk-taking and returns. Hopefully, this will also address the result in table 2 showing a uniquely different pattern in the case of CV of Gross Margin.

The present paper also examines whether the contingent decision making framework discussed earlier applies to the data. Toward this end, the same set of correlation analysis is carried out for cases where the prospect is positive (i.e. firms with EBIT/Total Assets higher than the sector average) and for cases

where the prospect is negative (i.e. firms with EBIT/Total Assets lower than the sector average). The results are shown in tables 3 and 4.

Table 3 – Correlation results when firm prospect is positive

Period	N	CV of Total Liabilities/ Total Assets	CV of Days Inventory	CV of Days Receivable	CV of Gross Margin	CV of Advertising Expenses/ Sales	CV of R&D Expenses/ Sales
1992-96	821	0.202**	-0.002	-0.068	0.045	0.022	-0.048
2002-06	1721	0.279**	-0.010	-0.033	-0.026	-0.021	-0.093*
2012-16	2511	0.239**	0.027	-0.020	-0.046*	-0.026	-0.014

** correlation is significant at the 0.01 level *correlation is significant at the 0.05 level

Table 4 – Correlation results when firm prospect is negative

Period	N	CV of Total Liabilities/ Total Assets	CV of Days Inventory	CV of Days Receivable	CV of Gross Margin	CV of Advertising Expenses/ Sales	CV of R&D Expenses/ Sales
1992-96	689	-0.571**	-0.276**	-0.197**	0.212**	-0.189**	-0.321**
2002-06	1329	-0.593**	-0.137**	-0.317**	0.089**	-0.310**	-0.296**
2012-16	2096	-0.592**	-0.201**	-0.277**	0.017	-0.324**	-0.263**

** correlation is significant at the 0.01 level *correlation is significant at the 0.05 level

There is strong support for Prospect Theory in the case of CV of Total Liabilities/Total Assets. For this risk-taking measure, the relationship with return is consistently and significantly positive when the prospect is positive, indicating a risk-averse attitude. The opposite is true when the prospect is negative, indicating a risk-seeking attitude. If consistency with Prospect Theory is one criterion, then CV of Total Liabilities/Total Assets would stand out among the proposed risk-taking measures.

Correlation analysis is also carried out for the different GICS sectors that the firms belong to examine the consistency of any relationship across industries. The Pearson Correlations of the return measure (EBIT/Total Assets) with potential measures of firm risk-taking for the different GICS sectors across the various time periods are summarised in tables 5 to 7.

Table 5 – Correlation results for 1992-96 period for different GICS sectors

	N	CV of Total Liabilities/ Total Assets	CV of Days Inventory	CV of Days Receivable	CV of Gross Margin	CV of Advertising Expenses/ Sales	CV of R&D Expenses/ Sales
All companies	1510	-0.373**	-0.286**	-0.240**	0.163**	-0.133**	-0.348**
Energy	104	-0.196*	-0.132	-0.138	0.181	0.028	-0.329
Materials	113	-0.582**	-0.337**	-0.341**	-0.246*	0.029	-0.495**
Industrials	259	-0.401**	-0.347**	-0.411**	-0.008	-0.065	-0.412**
Consumer Discretionary	187	-0.124	-0.246**	-0.111	-0,105	-0.195*	-0.069
Consumer Staples	83	-0.468**	-0.515**	-0.184	0.388**	-0.088	-0.252
Health Care	157	-0.628**	-0.496**	-0.505**	0.158	-0.171	-0.467**
Financials	184	-0.243**	0.024	-0.242*	0.163*	-0.314	-0.244
Information Technology	176	-0.427**	-0.424**	-0.363**	0.396**	-0.261*	-0.456**
Telecom-munications	21	-0.202	-0.351	-0.064	-0.013	0.205	0.923
Utilities	155	-0.608**	-0.131	-0.051	-0.286**		
Real Estate	71	-0.077	-0.415	-0.258	0.062	-0.163	0.022

** correlation is significant at the 0.01 level *correlation is significant at the 0.05 level

Table 6 - Correlation results for 2002-06 period for different GICS sectors

	N	CV of Total Liabilities/ Total Assets	CV of Days Inventory	CV of Days Receivable	CV of Gross Margin	CV of Advertising Expenses/ Sales	CV of R&D Expenses/ Sales
All companies	3050	-0.372**	-0.278**	-0.296**	-0.047*	-0.268**	-0.366**
Energy	188	-0.280**	-0.246**	-0.111	0.145	-0.540	-0.212
Materials	192	-0.552**	-0.401**	-0.386**	-0.051	-0.112	-0.288**
Industrials	417	-0.449**	-0.224**	-0.235**	0.055	-0.385**	-0.334**
Consumer Discretionary	351	-0.357**	-0.327**	-0.190**	-0.095	-0.297**	-0.317**
Consumer Staples	135	-0.660**	-0.540**	-0.106	0.175*	-0.272*	-0.340*
Health Care	327	-0.504**	-0.526**	-0.624**	0.083	-0.332**	-0.606**
Financials	570	-0.117**	-0.013	-0.155*	0.021	-0.136*	0.008
Information Technology	448	-0.372**	-0.363**	-0.351**	0.057	-0.448**	-0.359**

Telecom-munications	70	-0.573**	-0.835**	-0.402**	-0.474**	-0.238	-0.237
Utilities	216	-0.696**	-0.323**	-0.118	0.022	-0.662	-0.480
Real Estate	136	-0.127	0.236	-0.188*	-0.002	-0.005	0.082

** correlation is significant at the 0.01 level *correlation is significant at the 0.05 level

Table 7 - Correlation results for 2012-16 period for different GICS sectors

	N	CV of Total Liabilities/ Total Assets	CV of Days Inventory	CV of Days Receivable	CV of Gross Margin	CV of Advertising Expenses/ Sales	CV of R&D Expenses/ Sales
All companies	4607	-0.347**	-0.262**	-0.287**	0.011	-0.250**	-0.337**
Energy	353	-0.497**	-0.378**	-0.163**	-0.054	-0.152	-0.361*
Materials	255	-0.456**	-0.433**	-0.285**	0.064	-0.079	-0.369**
Industrials	579	-0.443**	-0.318**	-0.291**	-0.004	-0.431**	-0.347**
Consumer Discretionary	595	-0.145**	-0.165**	-0.234**	0.020	-0.333**	-0.220**
Consumer Staples	194	-0.574**	-0.425**	-0.437**	0.386**	-0.182*	-0.329**
Health Care	495	-0.465**	-0.458**	-0.480**	0.245**	-0.455**	-0.427**
Financials	897	0.186**	0.035	-0.107*	-0.021	-0.067	0.145
Information Technology	704	-0.418**	-0.252**	-0.392**	0.064	-0.289**	-0.282**
Telecom-munications	83	-0.752**	-0.558**	-0.350**	0.116	-0.232	-0.176
Utilities	235	-0.338**	-0.146*	-0.367**	0.318**	1.000**	0.982
Real Estate	217	-0.288**	-0.238	-0.392**	0.181**	-0.113	-0.124

** correlation is significant at the 0.01 level *correlation is significant at the 0.05 level

The negative relationship between firm risk-taking and returns appear consistent across GICS sectors for all time periods, with the exception of Financials. Perhaps one explanation for this is the more direct role of some ratios (e.g. leverage) in the operation of firms in this industry.

Conclusion

The present paper set out to formulate a firm risk-taking measure that would provide a counter argument to Bowman's Paradox. The proposed measures are novel and appear to be intuitively more reflective of choices (i.e. managerial risk-taking) compared to popular measures which are closer to results (i.e.

organisational risk). The present paper somewhat disappointed in that the same counter-intuitive negative relationship between firm risk-taking and returns was observed in the results. However, it does open an area for future theory development that hopefully will lead to a firm risk-taking measure that will exhibit the elusive positive relationship with returns.

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