

Determinants of the Systematic Risk of the Cement Industry of Bangladesh

Avijit Mallik¹, Tanveer Ahmed Khan² & Nazirul Azam Biswas²

¹ Assistant Professor, Institute of Business Administration, University of Dhaka, Dhaka, Bangladesh

² Graduate Student, Institute of Business Administration, University of Dhaka, Dhaka, Bangladesh

Correspondence: Tanveer Ahmed Khan, Flat: 6A, House: 13C&D, Road: 15, Bashundhara R/A, Dhaka 1229, Bangladesh. Tel: 88-017-1724-3939.

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Abstract

This study looks at how a cement manufacturing company's financial features affect the systemic risk or beta. We collected data regarding the financial performance of all the publicly traded cement manufacturing companies for a six-year period (from 2016 to 2021) to identify the determinants of systematic risk or beta. We used linear regression with panel corrected standard error model. The study evaluated seven performance measures, profitability (Return on Asset), solvency (Equity Ratio), inventory efficiency (Inventory Turnover), asset efficiency (Asset Turnover), liquidity (Cash Ratio), company's growth (Earnings before Interest and Tax growth) and company's cash generation capability (Operating Cash Flow to Sales) to see whether these factors had any statistically significant relationship with systematic risk or beta. The study found that solvency, asset efficiency, liquidity are statistically significant determinants of beta at five percent significance level. The Inventory Turnover is statistically significant determinant of beta at ten percent significance level. None of the other variables had any statistically significant relationship with beta.

Keywords: systematic risk, Beta, cement industry, Bangladesh, solvency, asset efficiency, liquidity, inventory efficiency, panel corrected standard error, correlation matrix, multicollinearity

1. Introduction

1.1 Introduction to the Issue

The cement sector provides a significant contribution to a country's infrastructure development. Bangladesh currently ranks fortieth in the global cement market, but the country has enormous potential in the coming years. Right now, fourteen companies export cement to various countries and the market is expanding (Cement Industry | Bangladesh Cement Manufacturers Association (BCMA), n. d.). Until the first half of the 1990s, imports covered around 95 percent of total cement demand in Bangladesh (Tuhin, 2019). With the help of the government, multinational manufacturers and local entrepreneurs, the cement industry of Bangladesh grew at 11.5 percent CAGR (Compound Annual Growth Rate) over the last seven years, doubling demand from 14.5 million metric tons per year to thirty-one million metric tons per year (Bangladesh Cement Industry: Resilient; Better Days Await, 2019). Global players such as Lafarge (France) and Holcim (Switzerland), as well as thirty smaller local and multinational companies now run the Bangladesh cement industry (Shehab, 2019). Seven cement businesses now trade in Dhaka Stock Exchange (DSEX).

Financial ratios are indicators of a company's performance and its prospects. An investor always looks at the financial ratios and the systematic risk of the company before investing. This study suggests the key financial ratios which have significant relationship with systematic risk.

The following sections covers the rationale for this study and the overview of the cement industry of Bangladesh. The literature review covers the previous studies on this topic, both domestic and international. After the literature review, the paper discusses the method of this study. The next section then entails the result in brief details. The discussion section provides the policy implications for companies, limitations, further study recommendations and a conclusive summary.

1.2 Justification of this Study

In previous studies, Mizan and Hossain (2014) studied about financial soundness of cement firms of Bangladesh. Similarly, Hossain and Moudud-Ul-Huq (2014) did an analysis of the credit strength of the firms. Hoque et al. (2015) and Rezina et al. (2020) both studied on profitability of the cement sector of Bangladesh and its determinants. However, no studies focused on identifying the financial ratios which are determinants of the systematic risk or beta of the firms of the cement industry of Bangladesh.

To an investor the systematic risk is the risk inherent in the entire market or market sector. Systematic risk impacts the whole market, not just one company or industry. The beta is a measure of systematic risk, which describes how an individual asset fluctuates when the stock market rises or falls. Financial ratios give business owners a means to assess their company's performance and contrast it with that of other companies in the same industry. Ratios gauge the connection between two or more financial statement elements. The financial ratios are most informative when results from multiple time periods are compared. This enables the owner of the business to monitor its performance over time and to spot any warning indications. The relationships between financial ratios and beta can be used to maintain the firm's beta by focusing on significant financial ratios.

In this study we proposed seven hypotheses to identify whether the variables have significant relationships with the beta of cement industry of Bangladesh. This paper explored six years' data (from 2016 to 2021) of the seven companies. Time series data is a chronological data points over a time interval and Cross-sectional data is the examination of various variables at a given time. The collected data is a panel data. For panel data analysis we used Linear regression with Panel Corrected Standard Errors.

The next section provides an overview of the cement industry of Bangladesh. The literature review section of this paper summarizes the findings of analogous investigations conducted in other nations and Bangladesh. The following section covers the research hypothesis development. We covered the data sources, dependent and independent variables, and model definition in the methodology section. The analysis and findings section address the results of descriptive statistics, correlation matrix, and other tests, such as the test of multicollinearity and heteroskedasticity. This section also analyzes the statistically significant variables impacting systematic risk of the cement industry of Bangladesh.

1.3 Overview of Bangladesh Cement Industry

The cement industry of Bangladesh is not overly aged. The first cement factory was Chattak Cement Factory Limited (then Assam Bengal Cement Company Limited) which initiated in 1941 (Cement Industry | Bangladesh Cement Manufacturers Association (BCMA), n.d.). The second cement factory started in 1973 named Chittagong Cement Clinker and Grinding Factory Limited (Currently 'Heidelberg Cement'). The real pace began in the 1990s when Confidence Cement Limited, Hyundai Cement Bangladesh Limited, Meghna Cement Mills Limited of Bashundhara Group, Ahad Cement Factory Limited, Aramit Cement Limited, Mongla Cement Factory Limited of Sena Kalyan Sangstha, Diamond Cement Limited, Lafarge Surma Cement Limited, and Eastern Cement Limited started their operations. Later came Shah Cement Limited, M I Cement Factory Limited (Crown Cement), Unique Cement Industries Limited of Meghna Group of Industry, Premier Cement Limited, Seven Circle (Bangladesh) Limited, Heidelberg Cement Bangladesh Limited, Holcim (Bangladesh) Limited, Royal Cement Limited, and Cemex Cement Bangladesh Limited.

The fledgling industry received a boost from the increased infrastructural demand and thirst for single-family home construction. Meanwhile, with the introduction of the export market, particularly to northeast India, in the early 2000s, a fresh opportunity arose (Cement Industry | Bangladesh Cement Manufacturers Association (BCMA), n. d.). Even though this category is small in terms of volume, it has given the industry a boost. The cement industry of Bangladesh has made noteworthy progress in terms of product innovation, production method modernization, and distribution and marketing processes in a brief period. We can expect that the construction sector in general, and the cement sector, will continue to grow because of the huge population of Bangladesh, rising life expectancy, rapid construction of economic zones, significant investments in the socio-economic development of primarily common people, booming agriculture, and a thriving garment sector.

1.4 Literature Review

To understand the impact of financial features on the beta of the cement industry of Bangladesh, we explored relevant literature reviews. A study conducted by Gonedes (1973) suggested a statistically significant relationship between the market-based and accounting-based estimates of systematic risks with a provided condition that the accounting-estimates are conditional upon the differences in income figures. Hence, as per the finding from this study, it suggests that if properly transformed, accounting income numbers can provide

information regarding the risk of assets. Thus, based on this study, we can consider financial ratios to be the determinants of systematic risk of a company.

A reexamination-based study conducted by Huffman (1989) on manufacturing firms of the USA have resulted into a positive relationship between systematic risk and the degree of Financial Leverage. Furthermore, the study found a negative relationship between systematic risk and degree of Operating Leverage, which is contrary to its precursor study by Mandelker and Rhee (1984). There is a negative correlation between Operating Leverage and Financial Leverage obtained from this study by Huffman (1989).

Borde (1998) conducted an empirical study considering significant factors to construct and examine a weighted least-squares model. As per this study the level of liquidity is positively related to systematic and total risk of a firm. The dividend pay-out ratio is negatively related to systematic and total risks. They found Return on Assets to be negatively related to total risk whereas the growth opportunities as depicted by EBIT growth rate is positively related to the systematic and total risks. Finally, in this study leverage ratio had no correlation with any of the risks mentioned.

For Restaurants in USA, systematic risk has negative correlation with Assets Turnover but positive correlation with Quick Ratio in a weighted least-squares regression analysis (Gu & Kim, 2002). According to the data, high efficiency in creating sales revenue helps to reduce systemic risk, but excess liquidity tends to enhance it (Gu & Kim, 2002).

Kim et al. (2007) examined the effects of various financial ratios on the systematic risk of the restaurant industry in USA based on the fifty-eight publicly traded restaurant firms. By taking comparison between quick-service and full-service based segmentation analysis, they found the three important ratios of consideration are the profitability, leverage, and liquidity. There has been a strong negative correlation between profitability and systematic risk observed which confirms the concept that firms that face low probability of loss are also the firms with superior financial performance. In terms of leverage the firms must mind the possible elevated level of seasonality and economic downturn which can be fatal even with medium level debts. Restaurant firms are at a disadvantageous position in positions of borrowing from creditors. For liquidity ratio, the firm needs to have an adequate presence of it. However, investors often get negative signal when they observe an exceedingly high liquidity ratio as it suggests a lack of re-investments. Segmentation analysis of the restaurant industry revealed significant differences on the effects of financial ratios between full-service and quick-service cases. In the end they propose that the profitability is to be the most significant of all the ratios besides leverage and liquidity.

Ahmad et al. (2011) examined the impact of corporate tax rate on systematic risk for the cement industry of Pakistan. They have additionally considered the impact of three other financial ratios including the leverage, Return on Assets, and market value of equity. Even though the study revealed a negative and insignificant correlation between corporate tax rate and systematic security in the cement industry of Pakistan, it stated that the corporate tax rate can have significant impact on the systematic risk through the intermediate effect of leverage ratio. The study concluded that companies tend to utilize tax shield benefits and eventually this increases their leverage ratio which in turn increases the systematic risk. Furthermore, the study concluded with a positive relationship between Return on Assets and systematic risks. Additionally, they found market value of the equity to be negatively correlated with the effective tax rate. Thus, an increased market value might signal the investors being an overvalued equity and increases the systematic risk of the company.

In a study by Azhagaiah and Silambarasan (2014), 29 BSE-listed companies were examined to determine how business size affects the factors that determine corporate leverage. The research establishes that return on capital employed (ROCE), return on debt (ROD), and return on equity (ROE) have a significant impact on operating leverage (OL). As per the study of Huffman (1989) and Borde (1998) operating leverage has significant effects on the systematic risk of a firm. Therefore, the factors determined by Azhagaiah and Silambarasan (2014) are likely to impact the systematic risk of a firm.

Banerjee (2016) has investigated the impact of several factors that can impact the dividend policy of the cement sector in India. Dividend policy has impact on the systematic risk of firms and the firms often lower their dividend ratio to minimize the risk (Atia, 2015). Thus, the determinants of the dividend policy found by Banerjee (2016) can be considered to have effect on the systematic risk of cement companies. In his study the author found that leverage, PE ratio and return on equity have a significant impact on the dividend policy of cement sector in India based on the data of five fiscal years.

Hosseinpour, Saeidi (2016) assessed whether the systematic risk is dependent on variables like Quick Ratio, revenue of stockholders' salary, Return on Assets, Inventory Turnover, and growth rate of Earnings Before Interest and Tax. They suggest, based on multivariate regression analysis that, Revenue of Assets, Inventory

Turnover, and growth rate of Earnings Before Interest and Tax each has a significant relationship with systematic risk.

Kamran (2018) analyzed Panel data from the years 2005 to 2015 of the cement industry of Pakistan to determine the connection between systematic risk and key performance indicators (KPIs). The cement industry has been used to apply the methodology. The panel test (Fixed effect, Random effect, and Hausmann test) was used to analyze the literature-available panel data, and the results demonstrated that most KPIs have a substantial link with systematic risk (Beta).

Younas and Samad (2020) examined the effect of financial leverage and degree of operating leverage on the systematic risk of common stocks from the eight cement firms in Pakistan with a data range between 2014 and 2019 inclusive. Their analysis shows a strong positive correlation between systematic risk and financial leverage as well as between systematic risk and operating leverage. Their findings can be beneficial for cement companies while designing capital structure.

Arain et al. (2021) has examined the association between the determinants that are specific to cement firms and the performance of those cement firms in Pakistan between year 2010 and 2019 inclusive. In this work the ROI is considered as the dependent variable and the firm specific determinants are considered as the independent variables. Their result shows that liquidity, activity, and profitability are positively related with firm's ROI whereas the variables leverage, and growth are negatively correlated with the firm's performance (i.e., ROI). The final regression analysis shows that all variables (except growth) are significantly correlated with ROI.

Table 1. Significant variables impacting beta based on various studies

Study by	Significant Variables	The Industry/Firms Under the Study
Mandelker, G., & Rhee, S. (1984)	Degree of operating leverage	Manufacturing firms of the USA
Huffman, S. (1989).	Degree of financial leverage and operating leverage	Manufacturing firms of the USA
Borde, S.F. (1998)	Liquidity ratio, dividend payout ratio, Return on Assets, EBIT growth rate.	Restaurant Industry of the USA
Gu and Kim (2002)	Assets turnover, Quick Ratio.	Restaurant Industry of the USA
Kim et al. (2007)	Profitability, leverage, liquidity.	Restaurant Industry of the USA
Ahmad F. et al. (2011)	Market Value of equity, Return on Assets, leverage ratio	Cement Industry of Pakistan
Azhagaiah, R., & Silambarasan, D. (2014), Huffman, S. (1989) and Borde, S.F. (1998)	Return on Capital Employed, Return on Equity, Return on Debt.	29 listed companies of Bombay Stock Exchange, India
Atia, O., (2015) and Banerjee S. (2016)	Leverage, Price Earnings ratio, Return on Equity.	Cement Industry of India
Hosseinpour and Saeidi (2016)	Return on Assets, Inventory Turnover, EBIT growth.	Cement Industry of Iran
Kamran (2018)	KPI	Cement Industry of Pakistan
Arain, T et al. (2021)	Liquidity, profitability, activity, leverage, and growth.	Cement Industry of Pakistan

1.5 Hypothesis Development

The hypotheses suggested in this study attempt to confirm the effect of financial factors on systematic risk due to the uncertain link between systematic risk and financial variables (determinants of systematic risk) in prior literature in the finance area. The proposed (alternate) hypotheses are:

Hypothesis 1: There is a significant negative relationship between the profitability of the company and the systematic risk.

For profitability measure, we took Return on Assets. The proposed hypothesis suggests that the relationship between Return on Assets and Systematic Risk is negatively related. That means, the higher the profitability, the lower the systematic risk.

Hypothesis 2: There is a significant negative relationship between the solvency of the company and the systematic risk.

We chose Equity Ratio as the solvency measure. The proposed hypothesis suggests that the relationship is negative, meaning the greater the solvency, the lower the systematic risk.

Hypothesis 3: There is a significant negative relationship between the inventory efficiency and the systematic risk.

We chose Inventory Turnover as the inventory efficiency measure. The proposed hypothesis suggests that a negative relationship exists between Inventory Turnover and systematic risk. The higher the inventory efficiency,

the lower the systematic risk.

Hypothesis 4: There is a significant negative relationship between the asset efficiency and the systematic risk.

For measuring the asset efficiency, we calculated the Asset Turnover. The proposed hypothesis suggests that a negative relationship exists between asset turnover and systematic risk. The higher the asset efficiency, the lower the systematic risk.

Hypothesis 5: There is a significant negative relationship between the liquidity and the systematic risk.

For measuring the liquidity, we chose the Cash Ratio. The proposed hypothesis suggests that a negative relationship exists between cash ratio and systematic risk. The higher the cash ratio, the lower the systematic risk.

Hypothesis 6: There is a significant positive relationship between the company's growth and the systematic risk.

For measuring the firm's growth, we chose the Earnings before Interest and Tax growth. The proposed hypothesis suggests that a positive relationship exists between firm's growth and systematic risk. The faster the growth, the higher the systematic risk.

Hypothesis 7: There is a significant negative relationship between the company's cash generation capability and the systematic risk.

For measuring the firm's growth, we chose the Operating Cash Flow to Sales ratio. The proposed hypothesis suggests that a negative relationship exists between the cash generation capability and systematic risk. The greater the cash generation, the lower the systematic risk.

2. Method

To perform the study, we collected secondary data and further processed the data for subsequent analysis. The secondary data included the four financial statements for all the seven chosen cement production companies enlisted under the Dhaka Stock Exchange limited. The processed data included the calculation of different liquidity ratio, solvency ratio, profitability ratio, efficiency ratio and any other relevant ratio.

2.1 Independent Variables

As per the literature review and judgment calls of the authors, this study considers a total of seven ratio and rate as the independent variables to begin the analysis, where beta is the only dependent variable. The seven independent variables include Equity Ratio, Earnings before Interest and Tax (EBIT) Growth, Inventory Turnover, Cash Ratio, Operating Cash Flow (OCF) to Sales Ratio, Asset Turnover Ratio, Return on Assets (ROA).

2.2 Approach of Analysis

This paper has followed a quantitative approach keeping in mind that the factors of consideration will be analyzed objectively, and the conclusion obtained in the end will be backed by the relevant data used during the study. We carefully omitted Any qualitative approaches to eliminate subjectivity from the side of cement industries, even though important qualitative information was available in the annual reports of most of the chosen cement companies. The followed quantitative approach is inspired from other explored studies summarized as in Table 1. Some of the used quantitative techniques are described below.

2.2.1 Descriptive Statistics

The descriptive statistics explore general characteristics of a dataset through using calculations of mean, median, mode, standard deviation, minimum, maximum etc. The output of the descriptive table is helpful to assess the general feature of the cement industry from a static point of view.

2.2.3 Correlation Matrix

The correlation matrix observes the correlation of the independent variables with the dependent variable beta, as well as inter-correlation among the independent factor variables.

2.2.4 Variance Inflation Factor (VIF) Test

This study used the VIF test to identify the multicollinearity among the independent variables that impact the beta. This study considered cutoff value of 5 for VIF test (James et al., 2017).

2.2.5 Breusch-Pagan Test

This study conducted Breusch-Pagan test to identify any heteroskedasticity present in the processed data specially because it is a panel data.

2.2.6 Panel Corrected Standard Error (PCSE) Based Linear Regression

Researchers distinguish time-series, cross-section (TSCS) data by repeated observations across time on a set of units. The presence of both contemporaneous correlation across units and unit level heteroskedasticity in TSCS data makes inference from standard errors derived by regular least squares inaccurate. Panel-corrected standard errors (PCSE) account for these spherical error variances and enable for more accurate inference from linear models generated from TSCS data.

3. Results

This section used a variety of statistical tools and approaches to examine the processed data. The descriptive statistics depicts the mean score of all the variables. The study used the correlation matrix, multiple linear regression analysis and PCSE based regression analysis to analyze the link among the variables and eventually the relation of the significant independent variables with the dependent variable beta. The VIF test identified whether any multicollinearity is present, and the Breusch-Pagan test confirmed the presence of absence of any heteroskedasticity in this panel data.

3.1 Descriptive Statistics

Table 2. Descriptive statistics of the variables

Variable	Observations	Mean	Standard Deviations	Minimum	Maximum
Beta	42	1.12776	0.19777	0.65933	1.46238
Equity Ratio	42	0.37151	0.19631	0.01390	0.73273
EBIT Growth	42	0.21236	0.44339	-0.77165	1.46474
Inventory Turnover	42	8.14011	3.72723	-6.69596	17.23217
Cash Ratio	42	0.24207	0.36607	0.00925	1.28364
OCF to Sales Ratio	42	0.07270	0.13466	-0.30736	0.29594
Asset Turnover Ratio	42	0.70881	0.29650	0.28807	1.64253
Return on Assets (ROA)	42	0.03644	0.04418	-0.03771	0.14800

Referring to the descriptive data of Table-1, we can infer that the financial condition of the cement industry of Bangladesh is not very promising. We can say this because the overall mean of the Return on Asset (ROA) is 3.64%, which is extremely poor compared to the overall global ROA of the cement industry. Also looking at the Beta of the companies the mean beta is 1.12776 with a standard deviation of 0.19777 which means that the cement industry is very risky, and the standard deviation of such a large value means that the volatility is remarkably high as compared to the global market.

The rest of the metrics like the Equity Ratio give us the view of how leveraged the cement industries are, and a mean equity ratio of 0.37151 means that the industry has a high debt attached to it which is more than the equity value, and this is a huge setback, as the industry is not able to generate enough ROA to already support the growth, and with this much leverage the interest will take away most of the profits.

The cash Ratio and other turnover ratio are satisfactory for the industry, indicating that the turnover and the cash the industry is generating is good.

Overall, we can surmise from the static view that the cement industry of Bangladesh looks promising, but when looked at the future and the profitability, the industry is not doing great with low ROA and high debt.

3.2 Correlation Matrix

Table 3. Pearson's Correlation Matrix for the variables

	Beta	Equity Ratio	EBIT Growth	Inventory Turnover	Cash Ratio	OCF to Sales	Asset Turnover	ROA
Beta	1.00000							
Equity Ratio	-0.54040	1.00000						
EBIT Growth	0.17170	0.08080	1.00000					
Inventory Turnover	0.49330	-0.59790	-0.03980	1.00000				
Cash Ratio	-0.55540	0.61900	-0.26570	-0.44200	1.00000			
OCF to Sales	-0.24950	-0.55680	0.11990	-0.32690	0.35100	1.00000		
Asset Turnover	-0.39030	0.06790	-0.00870	-0.24180	0.20600	0.22310	1.00000	
ROA	-0.35800	0.76600	0.28430	-0.46670	0.57140	0.58180	0.16430	1.00000

Referring to Table 2.

Rumsey (2021) proposed different ranges for different strengths of correlations. He suggests that the correlation range between 0 and 0.19 is very weak correlation, the range between 0.2 and 0.39 shows weak correlation, the range between 0.4 and 0.59 shows moderate correlation and the range between 0.6 and 0.79 shows strong correlation.

In our analysis we found three strong correlations. The Cash Ratio and the Equity Ratio have positive correlation of 0.619. The Inventory Turnover and the Equity Ratio have negative correlation of -0.5970. Another strong positive correlation exists between ROA and Equity Ratio.

We therefore performed a multicollinearity analysis to be sure of any interdependence among the determinant variables.

3.3 Multicollinearity Analysis

Table 4. VIF for Multicollinearity

Variable	VIF	1/VIF
Equity Ratio	3.59	0.27847
ROA	3.53	0.28316
Cash Ratio	2.38	0.42057
Inventory Turnover	1.68	0.59519
OCF to Sales	1.66	0.60270
EBIT Growth	1.56	0.64306
Asset Turnover	1.19	0.84370
Mean VIF	2.23	

Any VIF value above 5 indicates a high correlation among the independent factors and offers for omission of certain variables (James et al., 2017). Referring to the Table 3 there are no VIF value above 5 (VIF Cutoff value) and therefore we can determine that none of the independent variables are causing multicollinearity. Next, we check for any possible heteroskedasticity in our data. Shown below is the result of the Breusch-Pagan test:

3.4 Analysis for Heteroskedasticity

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

H₀: Constant variance

Variables: fitted values of Beta

Chi-squared value = 3.25

p-value = 0.0712

Since the p-value of the Breusch-Pagan test (0.0712) is higher than 0.05, we cannot reject the null hypothesis. Alternatively, we can use chi-squared value for the conclusion of the test since chi-squared value is lower than 7.18, we fail to reject the null hypothesis. The chi-squared value here is 3.25. Hence, there is no heteroskedasticity present in our data.

3.5 Regression Analysis

Table 5. Linear regression output for correlated panels corrected standard errors (PCSEs)

Group variable: ID			Number of observations = 42			
Time variable: Year			Number of groups = 7			
Panels: correlated (balanced)			Observations per group: min = 6			
Autocorrelation: no autocorrelation			avg = 6			
			max = 6			
Estimated covariances = 28			R-squared = 0.52000			
Estimated autocorrelations = 0			Wald chi-squared = 64.99000			
Estimated coefficients = 8			Prob > chi-squared = 0.00000			
Beta	Coefficient	Panel Corrected Standard Error	Z	p > z	[95% Confidence Interval]	
Equity Ratio	-0.51041	0.21861	-2.33	0.020	-0.93888	-0.08195
EBIT Growth	0.03509	0.07558	0.46	0.642	-0.11304	0.18322
Inventory Turnover	0.00715	0.00502	1.42	0.155	-0.00270	0.01699

Cash Ratio	-0.13378	0.05574	-2.40	0.016	-0.24303	0.02454
OCF to Sales	0.16144	0.13013	1.24	0.215	-0.09361	0.41649
Asset Turnover	-0.21971	0.09051	-2.43	0.015	-0.39712	-0.04231
ROA	0.90526	1.16499	0.78	0.437	-1.37808	3.18860
Constant	1.39515	0.12433	11.22	0.000	1.15146	1.63884

Referring to the Table 5, $R^2 = 0.52000$ meaning that the variables in the model cause the 52% of the variation in beta while the other factors, not from this model, cause 48% of the variation in beta.

For Equity Ratio, coefficient of -0.51041 implies that a unit increase in Equity ratio leads to a 0.51041 decrease in beta. The p-value of $0.020 < 0.05$ therefore means that Equity ratio is a significant estimator of beta. This is contradictory with the findings of Borde (1998) where equity ratio was not significant determinant for the systematic risk of restaurant industry of the USA.

In the case of EBIT Growth, coefficient of 0.03509 signifies that a unit increase in EBIT growth will lead to a 0.03509 increase in beta. The p-value is $0.642 > 0.05$, which means that EBIT growth is not a significant estimator of beta.

Looking at the Inventory turnover, coefficient of 0.00715 means that a unit increase in Inventory Turnover leads to a 0.00715 increase in beta. The p-value of $0.155 > 0.05$ implies that Inventory Turnover is not a significant estimator of beta. This is coherent with the findings of Hosseinpour and Saeidi (2016).

Coefficient of Cash Ratio is -0.13378 and it means that a unit increase in cash ratio leads to a 0.13378 decrease in beta. The p-value of $0.016 < 0.05$ means that Cash ratio is a significant estimator for beta. In the previous studies Gu and Kim (2002) found the Quick Ratio as significant determinant of beta. We took cash ratio in this study because it is also an indicator of financial health of a company, and it shows company's ability to meet short term debts.

For the OCF to Sales, coefficient of 0.16144 means that a unit increase in OCF to sales leads to a 0.16144 increase in beta. The p-value of $0.215 > 0.05$ implies that OCF to sales is not a significant estimator of beta.

Asset Turnover has a coefficient of -0.21971 and it implies that a unit increase in Asset turnover leads to a 0.21971 decrease in beta. The p-value of $0.015 < 0.05$ implies that Asset turnover is a significant estimator for beta. This finding is coherent with the study of Gu and Kim (2002) where the researchers have found asset turnover to be a significant determinant of risk for the restaurant industry of the USA.

Lastly, the ROA Coefficient of 0.90526 implies that a unit increase in ROA leads to a 0.90526 increase in beta. The p-value of $0.437 > 0.05$ implies that ROA is not a significant estimator for beta. Hosseinpour and Saidi (2016), Ahmed F. et al (2011) and Borde (1998) all found ROA as a significant predictor of beta. This incoherency is due to previous studies being of different industries or different stock markets.

After each run of PCSE estimator we eliminated the variable with highest p-value. In the end we developed a parsimonious model with only four independent variables. The table 6 shows the final regression results.

Table 6. Linear regression output for correlated panels corrected standard errors (PCSEs) taking only the significant variables

Group variable: ID		Number of observations = 42				
Time variable: Year		Number of groups = 7				
Panels: correlated (balanced)		Observations per group: min = 6				
Autocorrelation: no autocorrelation		avg = 6				
		max = 6				
Estimated covariances = 28		R-squared = 0.4754				
Estimated autocorrelations = 0		Wald chi-squared = 45.05				
Estimated coefficients = 6		Prob > chi-squared = 0.0000				
Beta	Coefficient	Panel Corrected Standard Error	z	p> z	[95% Confidence Interval]	
Equity Ratio	-0.27065	0.12484	-2.17	0.03000	-0.51532	-0.02597
Inventory Turnover	0.007794	0.00463	1.68	0.09300	-0.00129	0.01688
Cash Ratio	-0.14379	0.07279	-1.98	0.04800	-0.28645	0.00112
Asset Turnover	-0.18792	0.07967	-2.36	0.01800	-0.34407	-0.03176
Constant	1.33286	0.08718	15.29	0.00000	1.16199	1.50373

Based on the final findings of this regression model, we found equity ratio, cash ratio and asset turnover to be significant at five percent level whereas Inventory Turnover of the cement industry of Bangladesh is significant at ten percent level.

4. Discussion

4.1 Summarized Findings

Table 7. The findings from hypothesis testing

Hypothesis	Variable	Obtained Significance	Expected Impact	Obtained Impact	Results
H ₁	ROA	Insignificant	Negative	Negative	Rejected
H ₂	Equity Ratio	Significant*	Negative	Negative	Accepted
H ₃	Inventory Turnover	Significant**	Negative	Positive	Accepted
H ₄	Asset Turnover	Significant*	Negative	Negative	Accepted
H ₅	Cash Ratio	Significant*	Negative	Negative	Accepted
H ₆	EBIT Growth	Insignificant	Positive	Positive	Rejected
H ₇	OCF to Sales	Insignificant	Negative	Negative	Rejected

*Significant at 5-percent level.

**Significant at 10-percent level.

After comparing the finding of this study with those of the previous studies, we found only the asset turnover as a significant determinant of beta as agreed upon by the Study of Gu and Kim (2002). For the other three significant factors of the study namely equity ratio, Inventory Turnover and cash ratio, the explored studies either did not assess their impact or found their impact insignificant to be the determinant of beta. In this respect, the significant impacts of equity ratio, Inventory Turnover, and cash ratio alongside the asset turnover ratio for the beta of Cement Industry of Bangladesh are major new finding of the study.

4.2 Policy Implication for Cement Manufacturing Companies

The negative correlation between the asset turnover and beta found in this study confirms the finding of Gu and Kim (2002). This significant and negative impact of asset turnover suggest that it is important for the Cement Company owners of Bangladesh that they utilize their existing firm assets to generate increased sales revenue and thus maintain the desired level of systematic risk of the company.

One of the new findings of the study is the negative correlation between cash ratio and beta. The cash ratio being significant and negative with beta implies that with more available liquidity of the cement firms in the form of cash will significantly reduce their systematic risk.

A negative correlation between equity ratio and beta is also another new finding considering the context of the cement industry of Bangladesh. As per this significant and negative relationship, the higher the equity holders fund the investment the lesser is the expected systematic risk. Hence, we can expect the owners of these firms to invest more by themselves rather than seeking for external financing.

Finally, a significant positive correlation between Inventory Turnover and beta indicates that with higher the days on the inventory there is going to be lesser systematic risk for the firm. This is contrary to the finding of the Hosseinpor and Saeidi (2016) where there was no impact of Inventory Turnover on the beta of cement industry in Iran. However, another study by Elsayed and Wahba (2016) gives a more comprehensive explanation for the impact of Inventory Turnover on the risk of a firm. As per their study, even though in general an inconclusiveness persists regarding the impact of Inventory Turnover on the risk of a firm, there can be certain direction to the correlation between these two variables if we consider the life cycle of the firm. In the initial growth and maturity stages there appears to be positive relation between risk and Inventory Turnover and a negative correlation persists in the revival and rapid growth stages. Considering ongoing and planned megaprojects in Bangladesh (CemNet (Ed.)), local Cement Manufacturing firms are also adjusting their production, and this is triggering a growth phase for these companies which justifies our findings as per Elsayed and Wahba's (2016) conclusions. Hence, we suggest that the local Cement Manufacturing firms focus on keeping their Inventory Turnover low.

4.3 Conclusion

The aim of the study was to analyze the impact of various independent factors on the systematic risk (beta) of the cement industry of Bangladesh. The results indicate that that solvency (equity ratio), asset efficiency (asset

turnover), liquidity (cash ratio) are statistically significant determinants of beta at five percent significance level. The Inventory Turnover is also a statistically significant determinant of beta at ten percent significance level. Other variables did not have statistically significant relationship with beta.

This research focused on only the factors that previous studies suggested. Even though we added Cash Ratio and OCF to Sales initially as our independent variable of interest, the OCF to Sales was not statistically significant. Another issue that we faced is the limited source of data during the data collection. Out of the dozens of cement manufacturing companies in Bangladesh, only seven have enlisting in stock market as of June 2022.

The Cement Manufacturing Association of Bangladesh has forty-two registered market players in the cement industry. In future more of these companies will enlist in stock market. Also, as time passes, more financial data will be available of the publicly traded companies. This creates opportunities for reexamination. Also, our study did not consider the macroeconomic factors. The factors like inflation, oil prices, trade deficits, budget deficits are significant predictor of beta (Abell & Krueger, 2002). Chen et al. (1986) and Lockwood (1996) suggested that industrial production, variations in risk premium, bends in yield curve are also significant predictor of returns. Therefore, these variables might have relationships with beta. Bos and Newbold (1984) suggested unemployment as a contributor to systematic risk. The future studies should adopt this variable in the analysis on beta. This will increase the goodness of fit of the regression model and increase the accuracy of beta prediction.

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Appendix A. List of Abbreviations

BCMA – Bangladesh Cement Manufacturers Association
 BSE – Bombay Stock Exchange
 CAGR – Compound Annual Growth Rate
 DSEX – Dhaka Stock Exchange
 EBIT – Earnings Before Interest and Tax
 KPI – Key Performance Indicators
 OCF – Operating Cash Flow
 PCSE – Panel Corrected Standard Error

ROA – Return on Assets

ROCE – Return on Capital Employed

ROD – Return on Debt

ROE – Return on Equity

ROI – Return on Investment

TSCS – time-series, cross-section

VIF – Variance Inflation Factor

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