PROJECT DISSERTATION

ON

Determinants Credit Default Swap and Co-Movement of Stock Return, Realised Volatility and CDS in USA and Asia

Submitted By

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CERTIFICATE

This is to certify that the dissertation report titled "Determinants Credit Default Swap and Co-Movement of Stock Return, Realised Volatility and CDS in USA and Asia", is a Bonafede work carried out by **Ms Rishibha Jain** of **MBA 2018-20** and submitted to Delhi School of Management, Delhi Technological University, Bhawana Road, Delhi-42 in partial fulfillment of the Requirement for the award of the Degree of Masters of Business Administration.

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DECLARATION

I, **Rishibha Jain**, student of MBA 2018-20 of Delhi School of Management, Delhi Technological University, Bhawana Road, Delhi – 42, hereby declare that thedissertation report "Determinants Credit Default Swap and Co-Movement of Stock Return, Realised Volatility and CDS in USA and Asia" submitted in partial fulfilment of Degree of Masters of Business Administration is the original work conducted by me.

The information and data given in the report is authentic to the best of my knowledge.

This report is not being submitted to any other University, for award of any other Degree, Diploma or Fellowship.

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Rishibha Jain

Determinants Credit Default Swap and Co-Movement of Stock Return, Realised Volatility and CDS in USA and Asia

ABSTRACT

Credit Default Swap is a financial contract or derivative that allows an investor to swap credit risk with another counterparty. Basically, it's an insurance against non-payment. CDS is the simplest form of credit derivative and has an impact on bond market as well as stock market.

CDS had been in existence from at least the early 1990s. As CDS were primarily used to hedge risk in connection with Bank's lending services, therefore, banks were the dominant players in the market. Banks also saw an opportunity to free up regulatory capital. By March 1998, the global market for CDS was estimated at about $300 billion. The Investors use Credit Default Swap for Speculation, Hedging, and Arbitraging.

This study works on the Effect of Theoretical determinants of CDS in USA and Asia at firm level as well as macro-economic level. As compared to Asia, USA has a developed CDS Markit. CDS played a huge role in Financial Crisis of 2008 and Euro Sovereign Crisis 2012.

Firm-level includes credit rating, leverage, RoE, Realised Volatility and Macro-economic level included inflation, implied volatility, consumer sentiments, Index Return, and Short-term interest rate.

Cross-sectional analysis of Determinants of CDS in USA and Asia using ordinary Least Square method of regression analysis.

Lead-Lag relationship between CDS spread, Realised Volatility, and Equity Return for USA and Asia.

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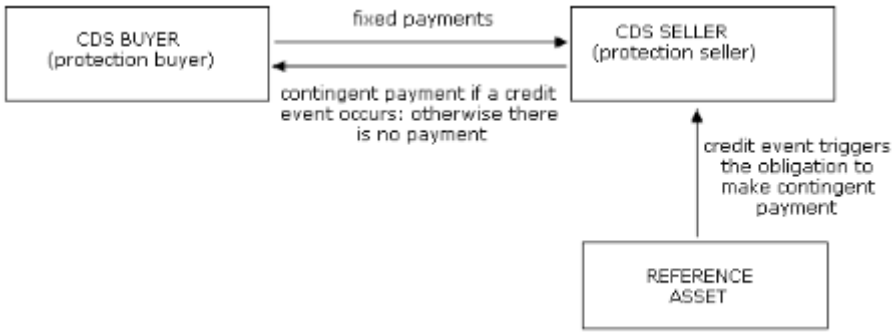
CHAPTER - 1
INTRODUCTION

1.1 OVERVIEW

Default risk of firms in efficient markets should be reflected by market prices of financial claims on these firms. As suggested by theory there is a close link between market prices of different financial claims, for example bonds and stocks, because their value is depended upon the distribution of the market value of a firm's assets. (L Norden 2004). The seminal work of Merton (1974) underlined the relationship between credit risk, stock volatility, and stock returns and initiated a large stream of research in successive decades. (J D Fonseca et al 2015)

Credit Default Swap is a financial contract or derivative that allows an investor to swap credit risk with another counterparty. Basically, it's an insurance against non-payment. CDS is the simplest form of credit derivative and has an impact on bond market as well as stock market. (J Hull et al 2003, P D Silva 2014). The Diagram below shows a typical CDS transaction.

Fig 1.1



In theory, bond spreads and CDS should be roughly equal whereas, in practice, this equality does not hold for a number of reasons, due to the imperfect match between the types of contracts, although both have spreads that are highly correlated. (Coudert and Gex 2010).

Knowledge regarding the connection between CDS spreads, stock return volatilities, and stock prices is important not only for risk managers using CDS for hedging purposes but also to anyone trying to profit from arbitrage possibilities in this market. (HNE Byström 2005).

CDS spread widens when deterioration in credit risk is perceived or detected by the market, and tighten when there is less credit risk perceived. Moreover, changes in CDS spreads are expected to occur before the reaction of the stock market. (H G Fung et al 2008)

As predicted by Merton's model, a firm's equity and bond prices (credit spread) are positively (negatively) correlated when default risk is high or when debt-to-asset ratios are high. In an analogous way, a country's default risk, captured by CDS spreads, should be inversely related to stock prices. If the relationship between stock prices and CDS spreads does not hold, ideally, capital structure arbitrage should eliminate mispricing. However, the equilibrium relationship may not hold if a country has low default risk or due to market frictions. (KC Chan et al 2009)

In Asia, past decade saw rapid growth in CDS market, despite the fact that it is relatively illiquid and small compared to its counterparts in the United States and Europe. (I Shim, H Zhu 2010, 2014)

The Dow Jones CDX indices were launched in 2004 as a response to the tremendous growth in demand for trading and hedging broad-based credit risk in USA which enabled market participants to trade a well-diversified credit portfolio at low transaction costs in a liquid market. (HG Fung et al 2008).

1.2 CREDIT DEFAULT SWAP USES

Investors use Credit Default Swap for Speculation, Hedging, and Arbitraging.

- **Speculation** - CDS allows speculate on changes in CDS spreads of single names or of market indices such as the European iTraxx index or DowJones CDX index, to the investors. As a firms CDS spreads are relative to the entity's bond yields, an investor might believe that and attempt to profit from a trade that combines a CDS with an interest rate swap and cash bond also called as basis trade.

An investor might speculate on an entity's credit quality, since generally as credit-worthiness declines, CDS spreads increase, and CDS decline as credit-worthiness increases.

- **Hedging** - CDS are often used to manage the risk of default that arises from holding debt. Another kind of hedge is against concentration risk. A risk management team of the Bank may advise that the bank is overly concentrated with a particular industry or borrower. Hedging risk is not limited to banks as lenders. Holders of corporate bonds, such as pension funds, insurance companies or Banks, may buy a CDS as a hedge for similar reasons.

- **Arbitraging** - *Capital Structure Arbitrage* is an example of an arbitrage strategy that uses CDS transactions. The fact on which this technique relies is that a company's CDS premium and it's stock price and should exhibit negative correlation; i.e., if the outlook for a company improves then its CDS spread should tighten and its share price should rise, as it is less likely that it will default on its debt. However, if its outlook worsens then and its stock price should fall and its CDS spread should widen.

1.3 HISTORY

CDS had been in existence from at least the early 1990s. J.P. Morgan & Co. is widely credited with creating the modern credit default swap in 1994 and in that moment, J.P. Morgan had extended a $4.8 billion credit line to Exxon, which faced the threat of $5 billion in punitive damages for the major Exxon Valdez oil spill. To improving its own balance sheet a team of J.P. Morgan sold the credit risk from the credit line to the European Bank of Reconstruction and Development in order to cut the reserves that J.P. Morgan was required to hold against Exxon's default.

JPMorgan, in 1997, developed a proprietary product called Broad Index Securitized Trust offering (BISTRO) that used Credit Default Swap to clean up a bank's balance sheet. BISTRO became the first example of what later became known as CDOS (synthetic collateralized debt obligations) . There were two Bistros in 1997 for approximately $10 billion each.

Initially, banks were the dominant players in the market, as Credit Default Swaps were primarily used to hedge risk in connection with its lending activities and banks also saw an opportunity to free up regulatory capital as well.

By March 1998, the global market for CDS was estimated at about $300 billion. The high market share enjoyed by the banks was soon came to an end as more and more asset managers and hedge funds saw trading opportunities in credit default swaps. The scenario changed by 2002, investors as speculators, rather than banks as hedgers, dominated the market.

1.4 OBJECTIVES OF THE STUDY

This study works on the following objectives –

Effect of Theoretical determinants of CDS in USA and Asia at firm level as well as macro-economic level. Firm-level includes credit rating, leverage, RoE, Realised Volatility and Macro-economic level included inflation, implied volatility, consumer sentiments, Index Return, and Short-term interest rate.

Cross-sectional analysis of Determinants of CDS in USA and Asia using ordinary Least Square method of regression analysis.

Lead-Lag relationship between CDS spread, Realised Volatility, and Equity Return for USA and Asia.

CHPATER - 2
LITERATURE REVIEW

In a macroeconomic sense, risk exposures are looked as to changes in fundamental and aggregate economic factors as a whole, or the banking sector and the financial markets in particular. on a macro scale, we should consider what would be more likely to influence the incidence of credit events, if the execution of CDS is triggered by such events (Weithers, 2007).

Various papers have considered aggregate economic variables as potential predictors of credit conditions, like they included the aggregate level of leverage, interest rates, inflation, consumer confidence, unemployment, aggregate measures of indebtedness, changes in GDP growth rates, real and nominal GDP growth rates, market liquidity premiums, national savings rates, the ratio of high yield debt to total debt outstanding, and returns as well as volatility of equity indices (Tang and Yan, 2008; Imbierowicz, 2009; Pu and Zhao, 2010).

These variables are also examined with firm-level as well as industry level variables like Earnings Before Interest and Tax (EBIT), Return on Asset (RoA), Return on Equity (RoE), Firm-Level Leverage, Dividend Payout, Interest Coverage ratio, treasury yield, credit rating, and default probability. (Hull et al, 2004; Ericsson et al, 2004; Longstaff et al, 2005; Tang and Yan, 2006; Tang and Yan, 2008; Cremers et al, 2008; Li, 2007; Zhang et al, 2009; Imbierowicz, 2009; Pu and Zhao, 2010).

From past research work we found the literature summary of these determinants. (M K Hassan et al 2013)

Blanco et al (2005) found that CDS prices are better integrated with macro-economic variables in the long run and with firm-specific variables in the short run. Ericsson et al (2004) found that default-risk determinants such as firm-leverage, volatility are significant determinants of CDS spread. Zhang et al (2009) focuses on the effects of jump risks and equity volatility on CDS spreads. Altman et al (2005) found that Firm-specific variables only adds a little in terms of explanation to the CDS spread. Tang and Yan (2008) observed a significant impact of Macroeconomic conditions on CDS spreads.

Merton (or Black-Scholes), models explicitly the firm value process and value corporate bonds using modern option theory. In the framework, a firm issues two types of assets: bonds and equities. When total asset value falls below a default boundary, default occurs.

By contrast, intensity-based models (reduced-form models), represented by Jarrow and Turnbull (1995), Duffie and Singleton (1999) and Madan and Unal (2000), typically treat default as a random stopping time with a stochastic arrival intensity.

The credit spread is determined by risk neutral valuation under the absence of arbitrage opportunities. This method has been widely used in the pricing of credit default swaps, such as Acharya et al. (2002), Das (1995), Das and Sundaram (2000), Das et al. (2003), Duffie (1999), Hull and White (2000, 2001), Jarrow and Yildirim (2002), Scho¨ n bucher (2003) and many others. (H Zhu 2006)

CHAPTER - 3

RESEARCH METHODOLOGY

3.1 DATA SOURCES

For our analysis, we have taken two regions Asia and USA. Asia includes 62 firms from seven countries – China, Hong Kong, Japan, India, Singapore, and South Korea. USA has 111 firms. The data has been collected for the period 2008 to 2018.

Table 3.1.1

Region	Countries	No. of Firms
Asia	China, Hong Kong, Japan, India, Singapore, and South Korea	62
USA	All over the region	111

3.2 DESCRIPTION OF VARIABLES

For Cross-Sectional Analysis

For firm level data (Leverage, RoE, dividend payout, equity volatility) has been obtained from orbis (Bureau Van Dijk – A Moody's Analytics Company). Macroeconomic variables (inflation, credit rating, implied volatility, and index return) from World Databank, Fitch rating agency, CBoE, MSCI, and Investing.Com. Consumer has not been included as an independent variable due to availability of insufficient data.

For Lead-Lag effect

For CDS spread, the data has been obtained from orbis (Bureau Van Dijk – A Moody's Analytics Company). Realised Volatility and Equity Returns have been calculated using the monthly data which has been obtained from orbis (Bureau Van Dijk – A Moody's Analytics Company) for the period 2008-2018.

One of the aims is to study the determinants of CDS theoretically and using Linear regression method (OLS).

Cross-sectional regression analysis is a type of regression in which the explanatory and explained variables are all associated with a point in time or the same single period. Cross-sectional is in contrast to a longitudinal regression or time-series regression in which the variables are considered to be associated with a sequence of points in time.

OLS is method to estimate the unknown parameters in a linear regression model.

For Theoretical Determinants of Credit Default Swap we closely follow Hassan et al. (2006). The determinants are categorised into two groups Macroeconomic and Firm-Level variables.

Macroeconomic conditions include the effect of consumer sentiment, inflation, index return, implied volatility, and the short-term interest rate on CDS pricing.

Firm-Level variables include equity volatility, leverage, ROE, Credit rating, and Dividend payout.

Highly levered firm is the one which has more debt content than equity in the balance sheet. Therefore, higher the firm-leverage, higher is the probability on the default. Uncertainty of the security's value is being measured by the volatility, therefore higher the equity, higher the risk of default. Similarly, higher default risk translates to higher dividend payout ratio.

With equity returns the relationship is opposite in nature i.e. higher the return on equity, lower the default risk. Credit Rating is also an essential determinant. Hassan et al (2006) predicts that credit spreads are negatively related to market index return, and positively related to market leverage and implied volatility, which are also consistent with empirical results (Ericsson et al, 2004; Tang and Yan, 2008; Zhang et al, 2009; Pu and Zhao, 2010)

In addition, short-term interest rate level has a significant impact on the security's value. A negative relationship between default risk and short-term interest rate is usually being predicted by the theoretical model of credit risk.

The table below provides with the predicted effects of Firm-level and Macroeconomic variables on CDS Spreads (Hull et al 2006)

Table 3.2: Description of Variables

Variable	Sign	Explanation	Data Source
Firm-Level Leverage	+	Highly leveraged is the one having high amount of debt in the balance sheet. It has been calculated as Total Liability to Shareholder's Fund.	orbis (Bureau Van Dijk)
Realised Volatility	+	Uncertainty of the security's value is being measured by the volatility, therefore higher the equity, higher the risk of default. It is calculated as standard deviation of daily logarithmic returns	orbis (Bureau Van Dijk)
Firm's RoE	-	It is assumed that higher the profitability lower is the probability of default.	orbis (Bureau Van Dijk)
Dividend Payout	+	Higher dividend payout ratio leads to higher default risk as it reduces the value of the underlying asset.	orbis (Bureau Van Dijk)
Credit Rating	-	Better credit rating means less chance of default.	Fitch Rating Agency
Consumer Sentiments	-	Investor's attitude towards risk and uncertain economic prospects affects credit spread.	Hassan et al (2006)
Inflation	+	Positive relation between Inflation and CDS is expected.	World Databank
Implied Volatility	+	Lower volatility generally means better market conditions.	CBoE
Index Return	-	Higher index return means better economic conditions.	Morgan Stanley Capital International (MSCI)
Short-term interest rate	+/-	A negative relationship between default risk and short-term interest rate is usually being predicted by the theoretical model of credit risk.	World Databank/investing.com

The other objective of the study to establish a lead-lag relationship between CDS spread, Realised Volatility, and Equity Return.

A lead–lag effect, describes the situation where leading variable is cross-correlated with the values of lagging variable at later times.

For lead-lag effect we closely follow Fonseca et al (2015).

CDS Spread is the premium paid by the buyer for protection to the seller of the credit default swap. Which have been determined using the Cross-sectional analysis mentioned above. Realised Volatility is calculated using the historical volatility of the security. It is also called as Statistical Volatility. It measures what happened in the past

3.3 THE MODEL

3.3.1 Cross-Sectional Regression Model

We follow the linear regression model used by Hull et al (2006) to find the significance and association of theoretical determinants of CDS premium using ordinary Least Square.

The function is –

$CDS_{premium} = f$ *(Firm - Level Leverage, RoE, Realised Volatility, Credit Rating, Dividend Payout, Consumer Sentiment, Inflation, Implied Volatility, Index Return, Short - Term Interest Rate)*

Firm-level factors Firm-Level leverage is the financial leverage of the firm i.e. Total Liabilities to Shareholder's Fund. RoE (Return on Equity) is the firms annual return on its securities. Realised Volatility (Equity Volatility) is calculated from historical monthly stock prices calculated over each year during the study period (2008-2018). Dividend Payout is the payout ratio of the firm.

Macroeconomic factors - Inflation s a weighted-average percentage change in Consumer Price Index. Implied volatility is being given by CBOE (based on VXFXI, VHSI, JNIV, NIFVIX, KOSPI, and TYVIX). Index Return has been taken from MSIC. 3-month Treasury Bill yield has been chosen as the proxy for short-term interest rate. Credit rating given by Fitch rating agency has been given a numerical Value.

This table explains the conversion code for Credit Rating provided by Fitch. 1 being the lowest and 22 being the highest.

Table 3.3.1

Credit Rating	Numerical Code
AAA	22
AA+	21
AA	20
AA-	19
A+	18
A	17
A-	16
BBB+	15
BBB	14
BBB-	13
BB+	12
BB	11
BB-	10
B+	9
B	8
B-	7
CCC+	6
CCC	5
CCC-	4
CC	3
C	2
D	1

3.3.2 Lead-Lag Regression Model using VAR

For Lead-Lag Regression Model, we closely follow DaFonseca et al (2015) and Norden and Weber (2009). With the previous linear regression model, we were able to establish the relationship between the firm-level and macroeconomic determinants of CDS spread.

Under this model we will restrict the number of variables to three – Realised Volatility, Equity Return, and CDS spread.

The Lead-Lag effect is given by the following VAR model:

$$\begin{aligned}
\log \mathrm{Ret}_t &= \alpha_1 + \sum_{i=1}^{p} \beta_{1i} \log \mathrm{Ret}_{t-i} + \sum_{i=1}^{p} \gamma_{1i} \Delta \log \mathrm{RV}_{t-i} + \sum_{i=1}^{p} \nu_{1i} \Delta \log \mathrm{CDS}_{t-i} + \epsilon_{1t} \\
\Delta \log \mathrm{RV}_t &= \alpha_2 + \sum_{i=1}^{p} \beta_{2i} \log \mathrm{Ret}_{t-i} + \sum_{i=1}^{p} \gamma_{2i} \Delta \log \mathrm{RV}_{t-i} + \sum_{i=1}^{p} \nu_{2i} \Delta \log \mathrm{CDS}_{t-i} + \epsilon_{2t} \\
\Delta \log \mathrm{CDS}_t &= \alpha_3 + \sum_{i=1}^{p} \beta_{3i} \log \mathrm{Ret}_{t-i} + \sum_{i=1}^{p} \gamma_{3i} \Delta \log \mathrm{RV}_{t-i} + \sum_{i=1}^{p} \nu_{3i} \Delta \log \mathrm{CDS}_{t-i} + \epsilon_{3t}
\end{aligned}$$

These equations are used determine the impact of lagged realized volatility, equity returns, and CDS spreads on each of the other two variables. These are based on the Granger Model explained in Granger (1969).

The first equation determines, if the change in CDS spread granger caused change in equity returns. The second equation determines, if change in CDS spread granger caused change in realised volatility. For each set of coefficients, and the set of lagged explanatory variables and corresponding equation leads to a conclusion about Granger causality from a given market to another.

3.3.3 Descriptive Statistics

Descriptive statistics is the discipline of quantitatively describing the patterns and general trends of a dataset and summarize it in single value. It enables a reader to quickly understand and interpret the set of data that has been collected. In our study, it provided us with a quick summary for USA as well as Asia for comparison.

CHAPTER - 4

EMPIRICAL ANALYSIS

4.1 DESCRIPTIVE STATISTICS

4.1.1 Descriptive Statistics for Asia

The table 4.1.1 shows the summary for the theoretical determinants of Credit Default Swap premium for the period 2008-2018, for 64 firms of Asia (6 countries).

Table 4.1.1: Descriptive Statistics for Asia

Variable	Mean	Median	S.D.	Min	Max
CDS Spread	0.107	0.118	0.0482	0.0347	0.172
RoE	0.893	0.892	0.291	0.423	1.28
Dividend Payout	5.85	5.55	1.50	4.11	8.84
Firm-Level Leverage	0.306	0.273	0.0951	0.213	0.488
Equity Volatility	0.197	0.197	0.0680	0.0860	0.313
Credit Rating	18.6	18.5	0.609	18.0	19.4
Inflation	5.07	5.82	1.85	1.85	7.20
Index Return	1.80	2.33	22.1	-43.2	34.5
Implied Volatility	1.18	-4.06	25.7	-34.9	41.9
Short-Term Interest rate	3.78	4.03	0.781	1.99	4.55
Equity Return	0.0264	0.0333	0.0274	-0.0369	0.0603

CDS spreads have a sample mean of 100 basis points (bps) for Asia, with Japan having 405 basis points (bps) which is followed by Hong Kong with 201 basis points (bps), India with 127 basis points (bps). The standard deviation stands at 48 basis points (bps).

The average realised volatility (annualised) is 19.7%. 3-month Treasury Bill yield which has been used as the proxy for Short term interest rate has the average of 3.75%. The mean return on equity (RoE) 89.3% with standard deviation being 29.1%. The average Dividend payout for Asia is 5.85%.

4.1.2 Descriptive Statistics for USA

The table 4.1.2 shows the summary for the theoretical determinants of Credit Default Swap premium for the period 2008-2018, for 111firms of USA

Table 4.1.2: Descriptive Statistics for USA

Variable	Mean	Median	S.D.	Min	Max
CDS Spread	1.21	1.20	0.0808	1.07	1.36
ROE	13.0	13.3	1.31	10.2	15.6
Dividend Payout	67.3	67.5	4.33	58.2	76.4
Firm-Level Leverage	2.11	2.28	0.495	1.13	2.80
Equity Volatility	0.115	0.115	0.0165	0.0743	0.141
Credit Rating	21.9	22.0	0.302	21.0	22.0
Inflation	1.76	1.64	1.20	-0.356	3.84
Implied Volatility	-1.95	4.29	30.0	-49.5	48.1
Short-Term Interest rate	0.461	0.144	0.651	0.0300	1.99
Index Return	6.80	11.1	18.6	-38.6	29.9

CDS spread has a sample mean of 121 bps (Basis point) for USA. The average Return on Equity stands at 13%. USA has a high credit rating with a mean of 21.9. The index return is averaged at 6.80. The inflation average stands out at 1.76. 3-month Treasury Bill yield which has been used as the proxy for Short term interest rate has the average of 0.461%

Comparison

The CDS spread, Return on Equity, Dividend Payout Ratio, Firm-Level Leverage, and Credit Rating was more for USA as compare to Asia, but Asia has higher average for inflation, Implied Volatility, and Equity Volatility than USA.

4.2 Cross Sectional Analysis

4.2.1 Cross Sectional Analysis of CDS premium (Asia) using ordinary Least Square Method

The table 4.2.1 shows the Cross-Sectional Analysis of Credit Default Swap premium for the period 2008-2018, for 64 firms of Asia (6 countries).

Table 4.2.1 Cross-Sectional Analysis for Asia

Variable	*Coefficient*	*t-ratio*	*p-value*	
RoE	0.294517	4.893	0.0393	**
Dividend Payout	0.0943174	2.950	0.0983	*
Firm-Level Leverage	−1.48791	−4.974	0.0381	**
Equity Volatility	0.513119	3.259	0.0827	*
Credit Rating	−0.0230921	−2.186	0.1604	
Inflation	0.00385652	0.7513	0.5308	
Index Return	0.000659249	0.6008	0.6090	
Implied Volatility	5.16259e-05	0.1163	0.9180	
Short-Term Interest rate	0.0147236	0.6877	0.5627	

Note: The table reports the results of a regular oLS regression based on annual data for 62 Asia firms from 2008 to 2018. Equity Volatility (Realised Volatility) is the firm's yearly equity volatility (%) computed from monthly stock prices. Firm-Level Leverage is the ratio of Total Liabilities to Shareholder's Fund. RoE is a firm's annual total return on security. Dividend Payout is dividend payout ratio. Credit Rating is obtained from Fitch Rating Agency and assigned a numerical value. Inflation is a weighted-average percentage change in CPI. Implied Volatility is a weighted-average volatility (proxied by VXFXI, VHSI, JNIV, NIFVIX, and KOSPI). Index Return is a percentage change in MSCI Asia-Pacific Index.

We first analyse the CDS market in Asia for seven countries. From the above table we observe highest p-value for Implied Volatility (proxied by VXFXI, VHSI, JNIV, NIFVIX, and KoSPI).

Return on Equity (RoE) and Equity Volatility are significant and positive at 10%. Dividend Payout is significant and positive at 5%. We only observe negative and significant level at 5% only from Firm-Level Leverage.

4.2.2 Cross Sectional Analysis of CDS premium (USA) using ordinary Least Square Method

The table 4.2.2 shows the Cross-Sectional Analysis of Credit Default Swap premium for the period 2008-2018, for 111 firms of USA.

Table 4.2.2: Cross-Sectional Analysis for USA

Variable	*Coefficient*	*t-ratio*	*p-value*	
RoE	0.0724385	12.03	0.0068	***
Dividend Payout	−0.00605404	−5.185	0.0352	**
Firm-Level Leverage	−0.139170	−3.913	0.0595	*
Equity Volatility	−0.00370601	−0.01137	0.9920	
Credit Rating	0.0438149	7.833	0.0159	**
Inflation	0.00931421	1.623	0.2460	
Implied Volatility	−0.000363517	−1.740	0.2240	
Short Term Interest rate	−0.0249083	−0.9064	0.4604	
Index Return	−0.000388941	−0.6610	0.5765	

Note: The table reports the results of a regular oLS regression based on annual for 111 US firms from 2008 to 2018. Firm-Level Leverage is the ratio of Total Liabilities to Shareholder's Fund. Equity (Realised) Volatility is the firm's annual equity volatility (%) computed from daily stock prices. RoE is a firm's yearly total return on security. Dividend Payout is dividend payout ratio. Credit Rating is obtained from Fitch Rating agency and assigned a numerical value. Inflation is a weighted-average percentage change in Consumer Price Index. Implied Volatility is TYVIX (US 10 Year Treasury Bond Yield Implied Volatility). Index Return is a percentage change in MSCI US Index. Short-term interest rate is the 3-month Treasury Bond Yield.

From the above table we observe highest p-value for equity volatility which is the firm's yearly equity volatility (%) computed from monthly stock prices.

Return on Equity is significant and positive at 1% level. Credit Rating is significant and positive at 5% level, whereas, Dividend payout is negative and significant at 5% level. Firm level leverage is also negative and significant at 10% level.

Comparison

From both the table it is observed that Return on Equity (RoE) is positive and significant for US and Asia but the level of significance was different for both the countries. For Asia the

level of significance was at 5%, where as for US it was 1%. Though Firm-level leverage and Dividend Payout Ratio are significant for both the regions, it was positive for Asia but was negative for US. Equity Volatility was positive and significant for Asia but same cannot be said for USA. Credit rating was positive and significant for USA but same cannot be said for Asia.

The p-value for Asia was highest for Implied Volatility, whereas, for US p-value was highest for Equity (Realised) Volatility.

None of the variable was significant at 1% for Asia.

4.3 Lead-Lag Relationship using VAR

The VAR models given by three equations have been estimated at p = 2 for Asia and USA. The VAR model included – Realised Volatility, CDS Spread, and Equity Return.

4.3.1 VAR Model for Asia

The following outputs below, shows the co-movement of Realised Volatility, Equity Return, and Credit Default Swap Premium for Asia.

Output of Equation 1

Table 4.3.1.1: Equation 1, Asia

	Coefficient	*t-ratio*
Const	−3.94234	−0.6122
$LogRe_{t-1}$	2.00603	1.231
$LogRe_{t-2}$	−1.69699	−0.5342
$\triangle \log RV_{t-1}$	17.5192	1.044
$\triangle \log CDS_{t-1}$	−6.13752	−0.4389

For equation at lag=2, we observe that none of the variable is significant at 1%, 5% or 10% for Asia.

Output of Equation 2

Table 4.3.1.2: Equation 2, Asia

	Coefficient	*t-ratio*	
Const	0.274885	2.548	*
$\triangle$ log RV_{t-1}	−2.58377	−3.941	**
$\triangle$log RV_{t-2}	−1.88695	−3.770	**
Log Ret_{t-1}	−0.131512	−1.525	
$\triangle$log CDS_{t-1}	3.25112	2.473	*

For Equation 2, with lag = 2, we observe that, $\triangle$log CDS_{t-1} is significant at 10%, whereas, $\triangle$ log RV_{t-1} and $\triangle$log RV_{t-2} both have significant level of 5%.

Output of Equation 3

Table 4.3.1.3: Equation 2, Asia

	Coefficient	*t-ratio*	
Const	0.212673	4.579	**
$\triangle$log CDS_{t-1}	−0.922710	−2.455	*
$\triangle$log CDS_{t-2}	0.262471	0.9696	
Log Ret_{t-1}	0.128386	5.928	***
$\triangle$log RV_{t-1}	0.626836	6.711	***

For Equation 2, with lag = 2, we observe $\triangle$log CDS_{t-1} has a significant level of 5%, whereas, both Log Ret_{t-1} and $\triangle$log RV_{t-1} have a significant level of 1%.

4.3.2 VAR Model for USA

The following outputs below, shows the co-movement of Realised Volatility, Equity Return, and Credit Default Swap Premium for Asia.

Output of Equation 1

Table 4.3.1.1: Equation 1, USA

	Coefficient	*t-ratio*
Const	0.425417	0.07671
$LogRet_{t-1}$	0.0945453	0.1122
$LogRet_{t-2}$	0.806031	0.4090
$\triangle$ $logCDS_{t-1}$	−0.714506	−0.3053
$\triangle$ $LogRV_{t-1}$	7.04421	0.9972

For equation at lag=2, we observe that none of the variable is significant at 1%, 5% or 10% for Asia.

Output of Equation 2

Table 4.3.2.2: Equation 2, USA

	Coefficient	*t-ratio*	
Const	3.15978e-05	0.01041	
$\triangle$ $LogRV_{t-1}$	−0.475216	−11.80	***
$\triangle$ $LogRV_{t-2}$	0.0669371	1.323	
$\triangle$ $LogCDS_{-1}$	0.164346	14.49	***
$\triangle$ Ret_{t-1}	0.00285989	8.001	***

For Equation 2, with lag = 2, we observe that, $\triangle$ $LogRV_{t-1,}$ $\triangle$ $LogCDS_{-1,}$ and $\triangle$ Ret_{t-1} all three have a significant level of 1%. All three variables are highly significant and change in CDS Spread caused the change in Realised Volatility.

Output of Equation 3

Table 4.3.2.3: Equation 3, USA

	Coefficient	*t-ratio*	
Const	0.145671	0.4783	
$\triangle$ Log CDS_{t-1}	−4.34273	−4.331	**
$\triangle$ Log CDS_{t-2}	−0.892930	−1.656	
Log Ret_{t-1}	−0.134946	−3.923	**
$\triangle$ Log RV_{t-1}	3.42252	0.7466	

For Equation 2, with lag = 2, we observe that, $\triangle$ Log CDS_{t-1} and Log Ret_{t-1} both have a significance level of 5%.

Comparison

For both USA and Asia, change in CDS spread granger caused the change in Realised Volatility, but same cannot be said for Equity Volatility. For equation 2, Equity Return was also significant.

CHAPTER – 5

CONCLUSION

This article studied the theoretical determinants of CDS premium using Cross-Section analysis for USA and Asia. This article also studied the Co-movement of Realised Volatility, Equity return, and CDS spread using VAR model for USA and Asia. For Asia we took seven countries: China, Hong Kong, Japan, India, Singapore, and South Korea.

The determinants were divided into two categories – Firm-Level and Macroeconomic Level. At Firm-Level, we analysed – Return on Equity (RoE), Dividend Payout Ratio, Firm-Level Leverage, Equity Volatility, and Credit Rating. Macroeconomic determinants include the effect of consumer sentiment, inflation, index return, implied volatility, and the short-term interest rate on CDS pricing.

We then compared the output generated from cross-sectional analysis for USA and Asia. Credit Rating was at significance level for USA but it was not significant for Asia. The differences lie due the stages of market development of CDS in both the regions. The linear relationship is being proved using the Cross-Sectional oLS regression.

The result of the VAR model for Realised Volatility, Equity Return, and CDS spread were significant for 5%. The results are in line with Norden and Weber (2009), and DaFonseca (2015) that there is a co-movement between Realised Volatility, Equity Return, and CDS spread. We also found that Realised Volatility is important in determining the Credit Default Swap Premium

The results extended their conclusion to the comparison between Asia and USA market.

CHAPTER – 6
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