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Relationship between Stock and the Sovereign CDS markets: A Panel VAR Based Analysis

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Abstract: *This study explores the relationship between the Stock and the Sovereign Credit Default Swaps (SCDS) markets by using dataset of 36 countries.We apply Panel Vector Autoregressive (PVAR) model to gauge the impact of one market's shocks to the other. Our results decipher that changes in stock market returns explain the significant portion of the SCDS market spreads' changes. Furthermore, the magnitude of this explanation is linked with the volatility of the SCDS market. These analyses indicate that the firsthand information about the country's sovereign credit risk is contained in the respective stock market, and can be used by participants/investors to predict the SCDS market spreads.*

Keywords: Stock market, sovereign CDS, panel VAR, sovereign credit risk, informational efficiency.

Introduction

The recent default events of countries like Ecuador, Greece and Argentina moved the Sovereign Credit Risk (SCR) into the spotlight. SCR is a more important problem than the corporate credit risk due to two types of costs: First, direct cost, through which it can affect the country's borrowing costs and its access to global financial markets (Longstaff, Pan, Pedersen, & Singleton, 2011). Second, the indirect cost, where it can increase the corporate cost of the borrowings and decrease their access to credit in domestic markets by increasing the corporate credit risk. For instance, Bedendo and Colla (2015) find that credit risk of firms rises with an increase in the SCR, particularly for firms that are government backed, mostly trade in the domestic market and rely on heavy bank loans. Arteta and Hale (2008) show that sovereign renegotiation and restructuring agreements cause significant decline in credit access for private firms.

An unprecedented increase in the SCR, especially after the financial crisis of 2007, has placed the Sovereign Credit Default Swaps (SCDS) market into prominence. SCDS contracts provide insurance to their buyers against the SCR and allow them more accurate estimations about it (Longstaff et al., 2011). SCDS spreads, the premium paid by the buyer to the seller, are considered as an indicator of SCR. Thus, an increase in these spreads is

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an indication that the sovereign is going towards the default. The potential costs (e.g. penalties by external creditors; possible loss in output; and high portability for occurrence of domestic banking, debt and currency crises etc.) associated with default encourage sovereigns to repay their debts (Paoli, Hoggarth, & Saporta, 2011). Therefore, sovereign default must be triggered by weak economic conditions in a country as deliberate default is highly unlikely. Thus, one can say that increasing SCDS spreads are an indication of the weakening of economy.

On the other hand, the stock market is also considered as an economic barometer of the country (Chan, Fung, & Zhang, 2009). A high volatile stock market conveys negative information to investors about the country's economic fundamentals (Eyssell, Fung, & Zhang, 2013). During periods of high SCR, stock market prices of the country must fall due to indirect cost of raising SCR. In such a situation, SCDS spreads would be widened as the insurance against the country becomes expensive and market participants would require higher risk premiums. Thus, both markets are expected to move in the opposite direction, i.e. a negative correlation between both markets.

The theoretical relationship between these markets resembles to the equity-bond market relationship established in Merton (1974) model. Chan-Lau and Kim (2004) expand the Merton's model for SCDS and stock markets' relationship. In practice, both markets may be integrated due to capital structure arbitrage, which exploits the price inefficiencies in the markets. For instance, when SCR raises, the stock market of a country would fall due to worsening economic situation of the country, and SCDS spreads would rise. In such situations SCDS sellers would hedge their exposure by shorting equity (Chan et al., 2009). Moreover, hedger would be interested to know about the market which incorporates information prior to the other so that they can develop their strategies accordingly. Thus, the present study investigates the basic question: "Which market incorporates information related to SCR prior to the other market?" The other important aspects of the proposed question are: 1) it speaks about informational efficiency of the markets, and 2) it has implication for asset prices.

The present study makes at least threefold contributions to literature. First, it adds to the limited literature on the SCDS and stock markets' relationship. Studies on corporate level CDS and stock markets outnumber similar studies on the Sovereign level. Second, it is in response to the ongoing debate in the literature, which exists due to mix results about the leading role of both of the markets. For instance, Eyssell et al. (2013) find the leading role of SCDS market for China; Chan-Lau and Kim (2004) find mixed results regarding the leading role of both markets of different countries. Similarly, for a number of European countries, Silva (2014) findings are mixed as well.

Third, contrary to previous studies that focus on an individual or lesser number of countries, it uses a large dataset of countries along with more comprehensive technique, i.e. Panel Vector Autoregressive (PVAR), to address the informational efficiency issue of both markets. PVAR provides us advantage of traditional VAR model and panel data. Moreover, PVAR provides conclusive evidence about the informational efficiency of both markets in contrast to mix evidence from previous literature.

Particularly, our methodology enables us to account for the simultaneity that exists between the stock and SCDS markets, while allowing for country-specific unobserved het-

erogeneity (i.e. fixed effects). The issue of simultaneity arises because of considering both markets as an indicator of SCR. As both markets respond to deteriorating economic conditions of the country (i.e. increasing SCR), thus we have to model both markets as endogenous variables to understand true relationship. This issue is catered through VAR component of our methodology, which allows to study the potential bidirectional causal relationship between both markets.

The panel dimension of our methodology is important because different countries have different economic conditions and usage of conventional VAR model with time series dynamics might not be able to consider these differences. Additionally, the panel data provides us more comprehensive and efficient results by increasing the number of observations in the sample [1].

Our analysis highlights that the Stock market leads the SCDS market in incorporation of SCR information. Thus, market participants can look at the Stock market for SCDS market prediction. We further extend our analysis on the basis of SCDS market's volatility (i.e. standard deviation of SCDS spreads), and find that its increase further enhances the stock market's leading ability. For instance, the Stock market's predicting ability increases from 9.35% (for the lowest volatility of SCDS) to 18.34% (for the highest volatility of SCDS). This implies that equity markets are more useful to gauge SCDS markets during periods of high SCR (i.e. when countries face out of the money situations).

Literature Review

Relationship between SCDS and Stock Market

Increased sovereign risk, especially after the financial crisis of 2007, makes SCDS market center of attention for researchers and market participants. Different studies explore a variety of SCDS market lacuna's. For instance, Pan and Singleton (2008) develop a mechanism to study the default arrival and recovery of sovereign risk being captured by SCDS spreads; Longstaff et al. (2011) study the nature of sovereign risk by using SCDS spreads data for 26 countries. Another strand of literature focuses on the informational efficiency of SCDS market in comparison with other markets. For example, Kregzde and Murauskas (2015) explore the informational efficiency between SCDS and Bond market; Alper, Forni, and Gerard (2013) compare informational efficiency of SCDS with RAS (Relative Asset Swaps); and Chan et al. (2009); Eyssell et al. (2013); Silva (2014) investigate the SCDS market's informational efficiency in comparison with stock market. Moreover, various studies focus on the CDS-stock markets' efficiency nexus on the corporate level (Shahzad, Nor, Ferrer, & Hammoudeh, 2017; Narayan, Narayan, & Thuraisamy, 2014) [2]. Present study contributes to the strand of literature, which compares stock and SCDS markets' informational efficiency.

As discussed above, the SCDS market can indicate possible sovereign default. There is another market i.e. stock market, which is considered to predict sovereign default.

[1] The traditional VAR models are usually influenced by lesser number of observations in the sample.
[2] The Shahzad et al., (2017a) provide comprehensive detail of literature in this lieu.

Stock markets of countries, which are considered as an economic barometer, should also predict the sovereign's movement towards default. Silva (2014) notes that an increase in Sovereign default risk causes increase in taxes and cost of capital for domestic companies, which decrease their profit and stock prices. Decrease in corporate stock prices ultimately declines the stock market of the country. Furthermore, poor economic fundamentals of the country also cause negative impact on the stock market performance by declining the amount of available domestic investment.

The informational efficiency between SCDS and stock market is first explored by Chan-Lau and Kim (2004). They extend Merton (1974) model for sovereign markets and study relationship between SCDS, bond and stock market. They analyze sample of eight emerging countries: Brazil, Bulgaria, Colombia, Mexico, Philippines, Turkey, Russia and Venezuela. Their sample period consists of time span from March 2001 to May 2003. They do not find long relationship between these markets. In the case of price discovery, their findings are mixed. For instance, SCDS is price leader in Colombia and Russia, SCDS and bond market are the leaders in case of Brazil and Bulgaria, and equity market is leader in Russia. Chan et al. (2009) extend their analysis (for stock and SCDS market only) on Asian markets by including seven sovereigns (China, Japan, Korea, Thailand, Philippines, Indonesia and Malaysia) for the time span of January 2001 to February 2007. They find negative relationship between stock and SCDS markets of all countries except China. Use of Johnson's co-integration test reveals that China, Korea and Thailand have a long-run price equilibrium relationship for both of the markets. They find that SCDS market discovers new information on sovereign credit risk prior to the stock market, which is a signal of SCDS market's informational efficiency.

Eyssell et al. (2013) explore the role of both markets in price discovery for China between January, 2001 to December, 2010 and find that SCDS market leads the stock market in price discovery. Another interesting study for exploring relationships between these markets is conducted by Silva (2014). He studies the sample of eleven Eurozone countries (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, The Netherlands, Portugal, and Spain) during 2008-12. He explores whether the financial crisis has affected the dependency between SCDS and stock markets, and find that dependency between these markets do not increase in the crisis period. Furthermore, he finds mixed result of lead-lag relationship between volatilities of both markets.

Methodology

Data

The initial sample for this study consisted data for 41 countries (all countries included in the Data Stream Euro-denominated 5-year SCDS coverage) between periods of December, 2007 to October, 2016. However, five countries, which have either missing or no data after November 2008 are excluded [3]. Thus, final sample consists of weekly data from 3rd November, 2008 to 26th October, 2016 for 36 countries and analyzes 14,976 country-week

[3] The November, 2008 is taken as benchmark because the data is available for all countries (except the excluded five countries) onwards from this month. Table 1 in appendix provides list of countries included in this study.

observations [4]. The usage of weekly data can mitigate the problem of excessive noise which is mostly associated with the data of higher frequency (Shahzad, Nor, Hammoudeh, & Shahbaz, 2017). The data for 5 years Euro-denominated SCDS spreads and stock markets is obtained from Data Stream. Table 5 in Appendix provides list of countries for this study.

To further enhance analysis, we divide data into three panels on the basis of Standard Deviation (SD) of SCDS market. The motivation for this division stems from the fact that impact of both markets may change due to change in Sovereign credit risk. Specifically, the data is arranged in descending order on the basis of Standard Deviation (SD) of SCDS market. The first 12 countries with highest SD are placed in Panel A, the next 12 are in Panel B and the remaining 12 countries with lowest SD are placed in Panel C, respectively. Tables 1 to 3 present descriptive statistics for all panels in our data.

Table 1 of Descriptive Statistics; Panel (A) The table presents the Descriptive Statistics (DS) for both markets for Panel (A). The SD represents Standard Deviation, Max and Min represent Maximum and Minimum values of the markets respectively. The suffix CDS depicts the change in the Sovereign CDS spreads of the countries and the suffix SE represents returns of the stock exchanges of the countries.

Table 1
Descriptive Statistics Panel-A

Variable	SD	Mean	Max	Min
AUSCDS	0.0992	-0.0052	0.4022	-0.4560
AUSSE	0.0354	0.0005	0.1057	-0.1507
BELCDS	0.1032	-0.0026	0.2926	-0.4708
BELSE	0.0278	0.0012	0.0782	-0.1083
CHICDS	0.0944	-0.0020	0.5093	-0.4095
CHISE	0.0176	0.0014	0.0574	-0.0799
DENCDS	0.1107	-0.0033	0.5097	-0.3941
DENSE	0.0260	0.0024	0.0971	-0.1032
FRECDS	0.1085	-0.0016	0.3922	-0.4231
FRESE	0.0304	0.0006	0.1024	-0.1131
GERCDS	0.1190	-0.0031	0.4050	-0.4539
GERSE	0.0310	0.0018	0.1017	-0.1380
ITLCDS	0.1161	0.0000	0.4576	-0.6026
ITLSE	0.0378	-0.0005	0.1166	-0.1406
PORCDS	0.1200	0.0023	0.4742	-0.8438
PORSE	0.0323	-0.0008	0.0885	-0.0994
RUSCDS	0.0999	-0.0023	0.5525	-0.3018
RUSSE	0.0369	0.0023	0.1361	-0.2792
SPACDS	0.1141	-0.0012	0.4512	-0.6257
SPASE	0.0348	0.0000	0.0975	-0.1101
SWECDS	0.1324	-0.0036	0.5322	-0.5143
SWESE	0.0279	0.0019	0.0936	-0.1192
UKCDS	0.0985	-0.0013	0.3478	-0.5845
UKSE	0.0251	0.0024	0.0781	-0.1135

Table 1 presents Descriptive Statistics (DS) for highest volatile SCDS countries. The average SD for these countries is around 11% and most of the countries in this list are European countries. As our sample covers period for European debt crisis period, hence high volatilities in these countries are not surprising. The Sweden SCDS spreads show

[4] Our results are robust to daily data as well.

highest fluctuations with a SD of more than 13% while Chile shows lowest variations with SD of 9.4%.

Table 2 of Descriptive Statistics; Panel B. The table presents the Descriptive Statistics (DS) for both markets for Panel (B). The SD represents Standard Deviation, Max and Min represent Maximum and Minimum values of the markets respectively. The suffix CDS depicts the change in the Sovereign CDS spreads of the countries and the suffix SE represents returns of the stock exchanges of the countries

Table 2
Descriptive Statistics Panel-B

Variable	SD	Mean	Max	Min
BRSCDS	0.0781	-0.0007	0.3216	-0.2604
BRZSE	0.0328	0.0012	0.1193	-0.1074
COLCDS	0.0806	-0.0016	0.3625	-0.3746
COLSE	0.0241	0.0008	0.1197	-0.0921
CYPCDS	0.0814	0.0026	0.4563	-0.3365
CYPSE	0.0655	-0.0077	0.2357	-0.2315
INDCDS	0.0774	-0.0037	0.3724	-0.2793
INDSE	0.0256	0.0033	0.1227	-0.1127
IRECDS	0.0926	-0.0023	0.4187	-0.3993
IRESE	0.0314	0.0016	0.1122	-0.1296
KAZCDS	0.0765	-0.0033	0.3213	-0.3877
KAZSE	0.0397	0.0004	0.1634	-0.2166
MALCDS	0.0814	-0.0016	0.3815	-0.2644
MALSE	0.0153	0.0015	0.0568	-0.0694
PANCDS	0.0764	-0.0023	0.3427	-0.2448
PANSE	0.0121	0.0012	0.1159	-0.1253
PERCDS	0.0798	-0.0029	0.3278	-0.2827
PERSE	0.0328	0.0016	0.1515	-0.1093
SACDS	0.0798	-0.0011	0.3795	-0.2739
SASE	0.0238	0.0021	0.0937	-0.1088
TURCDS	0.0797	-0.0014	0.4416	-0.2795
TURSE	0.0348	0.0025	0.0922	-0.1623
USDCDS	0.0811	-0.0012	0.3927	-0.3646
USSE	0.0252	0.0013	0.1020	-0.0861

The table 2 shows DS for average volatile countries. The average SD for SCDS spreads of these countries is around 8%. The countries of this panel are from different continents. Ireland shows highest volatile SCDS market among these countries while Panama is the least volatile one.

Table 3 shows DS for least volatile countries with respect to SCDS spreads. The average SD for this is around 6.5%. The highest volatile country in this panel is Republic of Slovenia with SD of 7.5% and Iceland is the least volatile country with SD of 4.2%. The comparison of all panels show that countries in European region, showed the highest volatility in SCDS spreads. This high volatility can be attributed towards Euro debt crises, which started from Greece and spread to other European countries. Due to this crisis, the more stable countries like UK, Germany and France etc. also faced high fluctuations in their SCDS spreads.

Table 3 of Descriptive Statistics; Panel (C) The table presents the Descriptive Statistics (DS) for both markets for Panel (C). The SD represents Standard Deviation, Max and Min represent Maximum and Minimum values of the markets respectively. The suffix

CDS depicts the change in the Sovereign CDS spreads of the countries and the suffix SE represents returns of the stock exchanges of the countries.

Table 3
Descriptive Statistics Panel-C

Variable	SD	Mean	Max	Min
BULCDS	0.0755	-0.0028	0.3522	-0.4260
BULSE	0.0278	0.0002	0.1609	-0.2541
CROCDS	0.0670	-0.0010	0.3689	-0.3689
CROSE	0.0243	-0.0003	0.1094	-0.1419
CZECDS	0.0736	-0.0037	0.4142	-0.4142
CZESE	0.0293	0.0000	0.1333	-0.1639
ESTCDS	0.0582	-0.0048	0.2889	-0.2624
ESTSE	0.0267	0.0027	0.1525	-0.1518
HUNCDS	0.0687	-0.0024	0.3716	-0.3228
HUNSE	0.0339	0.0018	0.1507	-0.1255
ICECDS	0.0423	-0.0054	0.2490	-0.2162
ICESE	0.0275	0.0007	0.0654	-0.3861
ISRCDS	0.0522	-0.0023	0.2800	-0.2283
ISRSE	0.0240	0.0015	0.0905	-0.1729
PHICDS	0.0703	-0.0034	0.3174	-0.2428
PHISE	0.0260	0.0032	0.0913	-0.0990
QATCDS	0.0638	-0.0020	0.2814	-0.3920
QATSE	0.0340	0.0009	0.1264	-0.2773
ROCDS	0.0641	-0.0037	0.2566	-0.2624
ROSE	0.0309	0.0020	0.1366	-0.1239
SLOCDS	0.0757	0.0002	0.3285	-0.2763
SLOSE	0.0237	-0.0010	0.0925	-0.1352
SLVCDS	0.0742	-0.0031	0.3576	-0.3567
SLVSE	0.0242	-0.0004	0.1383	-0.1481

Model

We employ PVAR model Holtz-Eakin, Newey, and Rosen (1988); Love and Zicchino (2006) to explore the dynamic relationship between the SCDS and stock market. The model can be written as:

$$M_{it} = \alpha_0 + \alpha_1 M_{it-1} + f_i + h_t + \epsilon_{it} \tag{1}$$

Where M_{it} is the two variables vector: RSE, the log returns of the Stock index, and CCDS, the log returns of the SCDS spreads for each country, f_i represents fixed effects (to capture country-specific unobserved heterogeneity); and h_t represents Helmert procedure (also known as forward mean differencing), which is applied to preserve the orthogonality between lagged regressors and transformed variables. The model is estimated through General Method of Moments (GMM) [5] while using lagged regressors as instruments for the endogenous variables [6].

The output of the PVAR model includes orthogonal impulse response functions (OIRF) and variance decomposition. The OIRF shows the response of one variable due to the

[5] The use of GMM estimators overcome the Hurwicz-type bias, which is associated with conventional OLS estimators.

[6] To check stationarity of the RSE and CCDS, Fisher-type unit root tests, based on Augmented Dicky Fuller (ADF) tests are executed. The null of "All panels contain unit roots" is rejected against "At least one panel is -stationary". Thus, both variables are stationary.

shock in the other variable. For example, through OIRF, we can analyze the response of the SCDS market because of a shock in the Stock market. It further enables us to analyze the magnitude of the shocks and statistical significance of its effect over time. Thus, whole dynamic processes of both markets from the initial shock to the steady state position can be analyzed. Variance decomposition describes the percentage of variations in one market that is being explained by the second market for given time periods ahead.

Results and Discussion

We estimate the equation (1) using GMM and use the obtained coefficients to build OIRF as presented in figures 1-4 [7]. The solid line in the figure shows the impulse response of one market to one standard deviation shock to the other market. While the shaded area around the line depict 95% confidence interval, which is built by using 1000 Monte Carlo simulations. The numbers on X-axis (0 to 10) and Y-axis show the duration of persistence and magnitude of the shocks respectively. Our main interest lies in the response of both markets to the shocks in each other i.e. off-diagonal portions in all figures.

We begin our analysis with the figure 1, where the upper row shows responses of SCDS and stock markets to shocks in SCDS market, whereas lower row shows the responses of both of the markets to shocks in stock market, respectively. One Standard Deviation (SD) shock to SCDS market creates -.06% impact on the stock market. While on the other hand, the same magnitude shock in the stock market has significant and greater impact on the SCDS market. Specifically, one SD change in the stock market causes more than -3.2% variations in the SCDS market. And SCDS market adjusts to this shock within one week. These results are similar to the findings of previous studies (Shahzad, Nor, Mensi, & Kumar, 2017; Narayan et al., 2014). However, our findings are for sovereign markets in comparison with industry level findings of these studies.

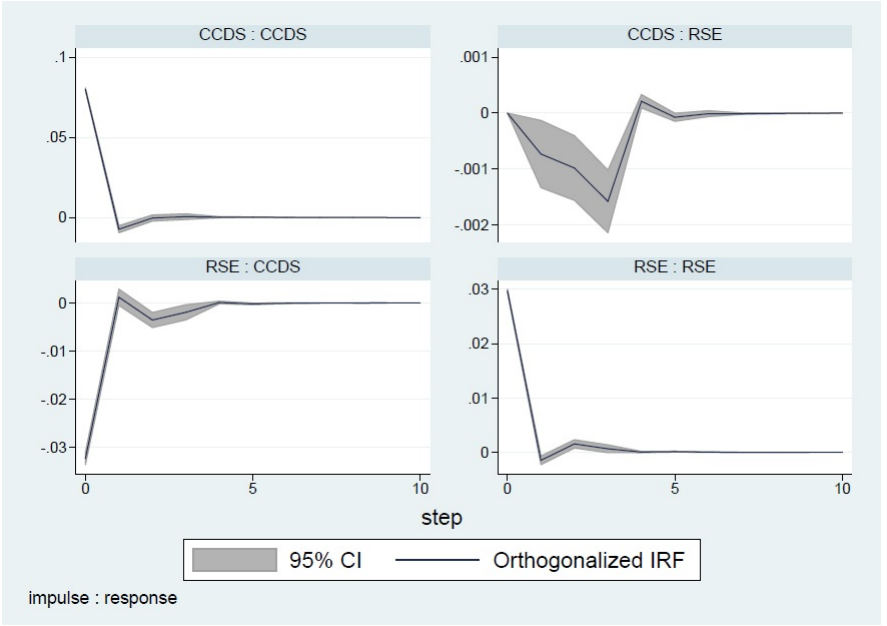
At SCDS-stock market nexus, our findings are similar to the findings of the Coronado, Corzo, and Lazcano (2012). However, our results contradict the findings of Eyssell et al. (2013) who find leading role of the SCDS market for China. The contradiction might exists due to the high volatility and underdevelopment of the stock market of china during the analysis period of these authors. Our results partially negate the findings of Chan et al. (2009); Boubaker and Raza (2017). These authors document leading role of the SCDS market for five out of seven countries. However, the authors analyze the markets before financial crisis 2007-08. This period can be attributed as developing stage of the SCDS market. But after the crisis, the dynamics of SCDS market has changed dramatically and it has observed periods of high volatility, thus its leading role may have vanished.

Our findings indicate that growth of stock market can decrease the SCDS spreads, which can create positive signal for international investors regarding economic fundamentals of countries. These positive signals can decrease the cost of borrowings for countries as lenders would ask for lower premium from less risky countries. The negative response

[7] Appendix table **??** shows the PVAR coefficients obtained after estimation of equation 1. All the coefficients that elaborate Stock and SCDS markets' responses to each other show negative signs, which mean both markets are inversely correlated. These findings are in line with the previous literature.

of both of the markets to shocks of each other, depicts that the markets are inversely correlated, which is in line with findings of literature.

Figure 1
OIRF for Panel A.This Figure presents responses of one market to the shock of other market in case of high volatility of SCDS markets. CCDS and RSE represents change in SCDS and stock market respectively.



Stock Market Impact and SCDS Market Volatility

To analyze whether stock market shocks have different impact for different volatility of SCDS market, the current study divides its sample into three panels on the basis of SCDS volatility (i.e. standard deviation of SCDS spreads). It gets 12 countries in each panel on the basis of highest (for Panel A) to the lowest volatility (for Panel C). Figure 2 shows results for panel A, and depicts that one SD shock in stock market causes more than 4% decrease in the SCDS market. Contrarily, shocks in SCDS market have very lower impact on returns of stock market.

Figure 3 and 4 show responses of both markets to each other's shocks for lesser volatility of SCDS market. It is noteworthy that impact of stock market on SCDS market decreases with the decrease in SCDS market's volatility. For instance, the impact decreases from -3.1% to -1.9% i.e from highest to lowest volatility of SCDS market. These findings suggest that impact of stock market becomes more dominant for volatile SCDS markets. And equity markets convey more information about sovereign credit risk during periods of high sovereign risk.

Figure 2
OIRF for Panel A.This Figure presents responses of one market to the shock of other market in case of high volatility of SCDS markets. CCDS and RSE represents change in SCDS and stock market respectively.

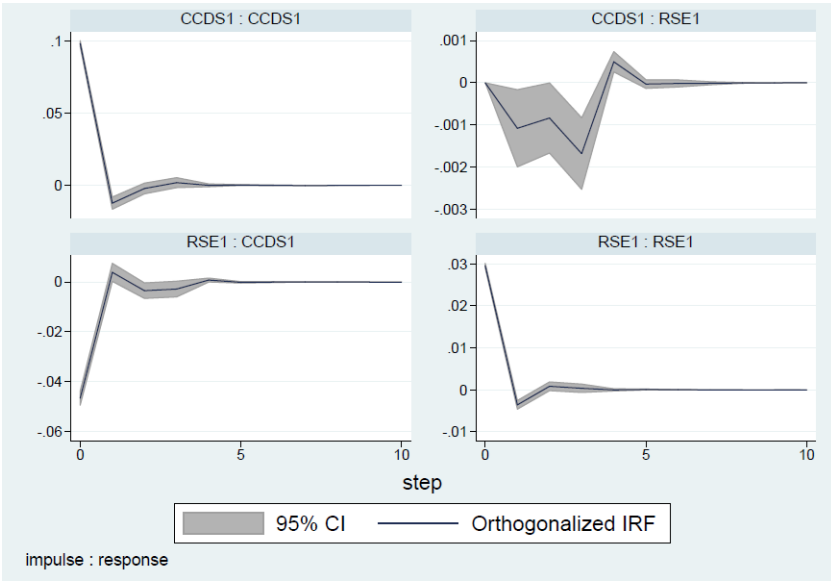


Figure 3
OIRF for Panel B.This Figure presents responses of one market to the shock of other market in case of moderate volatility of SCDS markets. CCDS and RSE represents change in SCDS and stock market respectively.

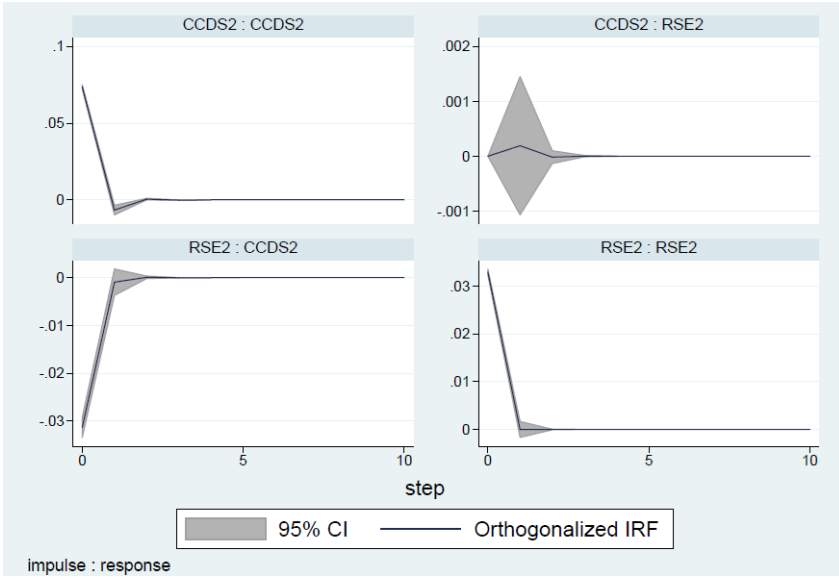
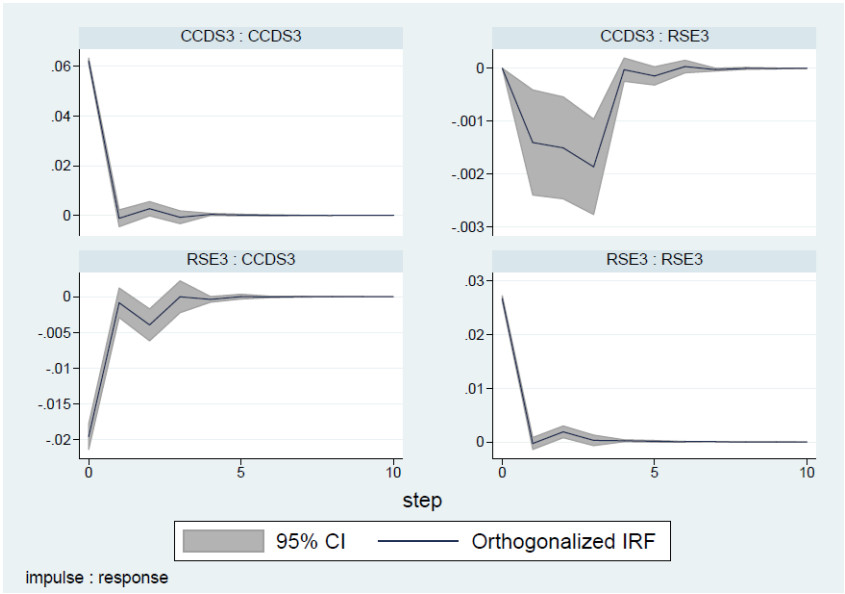


Figure 4
OIRF for Panel C.This Figure presents responses of one market to the shock of other market in case of low volatility of SCDS markets. CCDS and RSE represents change in SCDS and stock market respectively



Variance Decompositions

To augment the results of OIRF, we present variance decomposition results in table-4, which shows variations of one market, being explained by the other market. The standard errors and confidence interval of variance decomposition are calculated through 1000 Monte Carlo simulations. The results show that the stock market explains a big portion of variations in the SCDS market i.e. 14.18%. On the other hand, the SCDS market just explains .4% variations in the stock market. These findings suggest that stock market has greater predictability of SCDS market. Thus, its information can be used to predict variations in SCDS market.

The panel results show that the explaining power of the stock market is higher for more volatile SCDS markets i.e. around 18%. And it decreases with the decrease in the SCDS market's volatility. These findings suggest that during periods of high Sovereign risk, stock market holds even more information than SCDS market and its role as explanatory market becomes more prominent.

Table-4.Variance decomposition depicts the percentage of row variables (10 forecast horizons ahead) that is being explained by column variables. SCDS represents Sovereign Credit Default Swaps market, SE represents stock market, and FH stands for forecast horizons ahead. Panel A,B and C represent results from highest to lowest SCDS market's volatility categories respectively.

Table 4
Variance decomposition

Variable	FH	SCDS	SE
SCDS	5	85.82	14.18
SCDS	10	85.82	14.18
SE	5	0.45	99.55
SE	10	0.45	99.55
Panel A			
SCDS	5	81.66	18.34
SCDS	10	81.66	18.34
SE	5	0.14	99.86
SE	10	0.14	99.86
Panel B			
SCDS	5	85.2	14.8
SCDS	10	85.2	14.8
SE	5	0.01	99.99
SE	10	0.01	99.99
Panel C			
SCDS	5	90.65	9.35
SCDS	10	90.65	9.35
SE	5	1.07	98.93
SE	10	1.07	98.93

Conclusion

This study augments the literature on SCDS and stock markets' relationship (Eyssell et al., 2013; Chan et al., 2009) by using Panel VAR approach on the sample of 36 countries. Usage of PVAR model provides an edge over the previous literature by allowing for incorporation of country specific heterogeneity. The findings suggest that both markets are inversely correlated.

The OIRF analysis shows that shocks in stock market have significant and negative impact on SCDS market. While shocks of SCDS market have little or no impact on stock market. In addition to this, the impact of stock market is more prominent in the case of high volatile SCDS market.

Variance decomposition results show that stock market explains variations in SCDS market. And this explanatory power of stock market increases with an increase in volatility of SCDS market. Contrarily, the SCDS market explains lesser variations in the stock market.

Overall analysis from this study illustrates that information related to sovereign credit risk is incorporated by stock market at first and afterward it diffuses in SCDS market, due to which SCDS market responds to variations of stock market. These results can be helpful for investors and policy makers as well. For instance, investors can use stock market's information for the prediction of the SCDS market and can formulate their investing/hedging strategies accordingly. While policy makers can focus on growth of stock market to decrease SCDS spreads, which in return can decrease the negative perception about the sovereign credit risk.

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Appendix

Table 1
List of countries and stock indexes

Abbreviation	Country	Index
AUS	REPUBLIC OF AUSTRIA	ATX-AUSTRIAN TRADED INDEX
BEL	KINGDOM OF BELGIUM	BEL 20
BRS	FEDERATIVE REP OF BRAZIL	BRAZIL BOVESPA
BUL	REPUBLIC OF BULGARIA	BULGARIA SE SOFIX
CHI	REPUBLIC OF CHILE	CHILE SANTIAGO SE GENERAL (IGPA)
COL	REPUBLIC OF COLOMBIA	COLOMBIA IGBC
CRO	REPUBLIC OF CROATIA	CROATIA CROBEX
CYP	REPUBLIC OF CYPRUS	CYPRUS GENERAL
CZE	CZECH REPUBLIC	PRAGUE SE PX
DEN	KINGDOM OF DENMARK	OMX COPENHAGEN (OMXC)
EST	REPUBLIC OF ESTONIA	OMX TALLINN (OMXT)
FRE	FRENCH REPUBLIC	FRANCE CAC 40
GER	FEDERAL REP GERMANY	DAX 30
HUN	HUNGARY	BUDAPEST (BUX)
ICE	REPUBLIC OF ICELAND	OMX ICELAND ALL SHARE
IND	REP OF INDONESIA	IDX COMPOSITE
IRE	IRELAND	IRELAND SE OVERALL (ISEQ)
ISR	STATE OF ISRAEL	ISRAEL TA 100
ITL	REPUBLIC OF ITALY	FTSE MIB INDEX
KAZ	REP OF KAZAKHSTAN	KAZAKHSTAN SE KASE
MAL	MALAYSIA	FTSE BURSA MALAYSIA KLCI
PAN	REPUBLIC OF PANAMA	PANAMA SE BVPSI
PER	REPUBLIC OF PERU	S&P/BVL GENERAL(IGBVL)
PHI	REP OF PHILIPINES	PHILIPPINE SE I(PSEi)
POR	REPUBLIC OF PORTUGAL	PORTUGAL PSI-20
QAT	STATE OF QATAR	QATAR SE INDEX
RO	ROMANIA	ROMANIA BET
RUS	RUSSIAN FEDERATION	RUSSIAN MICEX
SA	REP OF SOUTH AFRICA	FTSE/JSE ALL SHARE
SLO	REPUBLIC OF SLOVENIA	SLOVENIAN BLUE CHIP
SLV	SLOVAK REPUBLIC	SLOVAKIA SAX 16
SPA	KINGDOM OF SPAIN	IBEX 35
SWE	KINGDOM OF SWEDEN	OMX STOCKHOLM 30 (OMXS30)
TUR	REPUBLIC OF TURKEY	BIST NATIONAL 100
UK	UK AND NI	FTSE 250
USD	US DEPT OF TRSY	NYSE COMPOSITE

Table 2
The table depicts the coefficients obtained through equation (1).
SE represents Stock Exchange and SCDS represents Sovereign Credit Default Swaps market.
The reported numbers show output of regressing column variables on lags of row variables in PVAR mechanism.

	Response of	**SE**		**SCDS**	
Response to	**Number of Lags[1]**	**Coefficient**	**Standard Error**	**Coefficient**	**Standard Error**
Full sample					
	1	-0.05932***	0.01459	-0.05967**	0.029089
SE	2	0.035033**	0.014212	-0.13287***	0.028859
	3	0.003122	0.013487	-0.07565*	0.028965
	1	-0.00916**	0.003887	-0.0911***	0.013931
SCDS	2	-0.01367***	0.003576	-0.01263	0.012043
	3	-0.02147***	0.003542	0.003497	0.01171
		Panel A			
	1	-0.13799***	0.018478	-0.06623	0.063068
SE	2	-0.00439	0.019296	-0.16943***	0.059715
	3	-0.01507	0.018123	-0.10962*	0.059247
	1	-0.011**	0.00484	-0.12448***	0.021457
SCDS	2	-0.0114***	0.004199	-0.03759**	0.018885
	3	-0.02***	0.00436	0.009875	0.018828
		Panel B			
	1	-0.03084	0.029051	-0.05704	0.045127
SE	2	0.045273	0.028345	-0.11514**	0.045652
	3	0.016664	0.027419	-0.09972**	0.04567
	1	-0.00514	0.008687	-0.08068***	0.021862
SCDS	2	-0.01385*	0.008068	-0.01073	0.019669
	3	-0.02246***	0.007837	-0.00733	0.018566
		Panel C			
	1	-0.02745	0.022621	-0.04559	0.041612
SE	2	0.050646**	0.022129	-0.11812***	0.045174
	3	-0.01218	0.019172	-0.01041	0.044538
	1	-0.02264***	0.008014	-0.01821	0.028
SCDS	2	-0.02531***	0.00812	0.042296*	0.02286
	3	-0.02906***	0.007288	-0.01393	0.020031

***,**,* represents 1%,5% and 10% level of significance respectively.