Systemwide Directional Connectedness from Crude Oil to Sovereign Credit Risk

Abstract

This study examines the spillovers from crude oil price fluctuations to sovereign credit risk, proxied by CDS spreads for 16 oil exporters and importers. We focussed on quantifying the transmissions from crude oil to oil exporting and importing countries. Integration makes diversification less beneficial, to find out the amplified impact of crude oil, we found systemwide spill over between sovereign risk of countries. Furthermore, the study finds the channels that has potential to act as a carrier of shocks from crude oil to sovereign risk considering 4 country specific and 2 global factors. Our study deployed Generalized Factor Error Variance Decomposition for being independent of ordering and aligned with network graphs that helps in visualization of complex interactions between countries and factors. Our results highlight higher spill overs to oil exporting countries from crude oil when compared to oil importers irrespective of their development stage. Interestingly, developed countries are getting these impacted severely by receiving net shocks from developing countries and oil exporting countries. Moreover, global factors are playing major role in carrying the shocks from crude oil to sovereign risk of countries. Inflation and Stock market indices are important amongst important domestic factors that acts as a carrier of shocks. In a system of 16 countries and 6 factors, Crude oil is the factor that is most critical and highest transmitter of shocks to oil dependant countries. Our results are valuable to Regulators, policymakers, portfolio managers, Banks and Financial institutions for proactively planning their respective policies.

Keywords: Sovereign Risk, CDS spreads, Crude Oil, GFEVD, Network Graphs

JEL Codes: H63, F36, O57, Q43

1. Introduction:

The increasing global debt accompanied by deteriorating fiscal statements of large number of countries has become a global issue and raised concerns about sovereign credit risk and financial sustainability of these countries. These concerns become daunting due to increased economic and financial interlinkages between countries that expose these countries to systemic risk. An example of this kind of episode has been the Global financial crisis where the problem initiated by a financial institution has been transmitted to entire financial system across globe. The result of such crisis has brought up CDS[1] into spotlight that witnessed huge surge and is criticized for triggering the event. Usually, the increased magnitude of credit spreads gauges the increased levels of credit risk pertaining to an economy (Lahiani et al. 2016, Shahzad et al. 2017). A economic event not only brings exponential changes in the credit spreads, but it also results in heavy volatilities in the commodity prices especially crude oil. This worsens the situation even further for the countries that has substantial part of their revenues and expenses dependent on crude oil prices. As per UNDP, high volatile prices of commodities lead to macroeconomic instabilities, volatilities in export earnings, forex reserves and economic growth of countries (UNDP, 2011). Moreover, the intensity of volatility determines the deterioration of economic fundamentals that further determines the likelihood to sovereign default. Lately, numerous finance news articles have highlighted the increasing costs of CDS to multi month high for Italy and Saudi[2]. Similar stories are published for various other oil exporters. Higher CDS spreads, an indication towards increased sovereign risk can be precarious as it can result in rising cost of debt to sovereigns reverberated to non-sovereign borrowings as well. Moreover, sovereign risk is critical determinant for macro-economic dynamics of a country and can ruffle entire financial system.

Since countries dependant on crude oil exports and imports has an important part of their revenues, expenditure and forex reserves dependent on crude oil prices, fluctuations in crude oil prices can be alarming to such nations and have repercussions on their debt servicing capabilities. An increasing (declining) oil price can increase (reduce) the cash balance of oil exporters where the same can ruin (saves) the forex reserves of oil importers. It raises a critical question whether oil price variations spill over to the sovereign credit risk? Literature has recorded the jumps from crude oil prices to sovereign risk (Shahzad et al. 2017) and mentioned it to be time varying and country specific (Sabkha et al. 2019). The relevance of oil price shocks and its impact on financial assets are well documented (Kilian and park 2009; Arouri et al. 2012; Malik and Umar 2019) however, less attention is devoted to spillovers from crude oil price fluctuations sovereign credit risk. Critically, the spill overs from crude oil to sovereign does not pause to one country but these have capacity to propagate to another connected countries as a part of the system due to boundless globalization. Therefore, this study addresses another question of systematic impacts of crude oil price fluctuations amongst various sovereign markets. The prevalence of systemic impacts can never operationalize in isolation, definitely there are some channels that becomes the instrument in such transmission. Chuffart and Hooper (2019) mentioned the role played by global and country specific factors in CDS spreads determination. The study conveys the role played by country specific and global factors in crude oil spill overs in order to determine such channels and provides a cross comparison to determine most important source of shock transmission for sovereign risk to account for the relevance of crude oil against other factors.

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[1] CDS is a credit derivative contract that offers protection to bondholder against defaults of bond issuer. The protection is promised in return of premium, commonly called as CDS spreads. Higher perceived risk of default would lead to higher CDS spreads and vice-versa.

[2] https://www.reuters.com/article/us-health-coronavirus-cds-idUSKBN20W1KJ

An examination into these queries is of value to its stakeholders that includes not only oil dependant sovereigns but also includes the countries connected to oil dependent countries through economic and financial mediums. Our findings are useful to energy regulators, banking regulators, policymakers, financial investors, and portfolio managers. Understanding the mechanism through which crude oil shocks are transmitted to one sovereign and the system is important for international portfolio management. Additionally, identification of factors that channelize the spill overs of crude oil prices to sovereign instabilities can be valuable to policymakers and Regulators enabling them to be proactive. Most importantly, directional predictability from crude oil for oil dependant countries is relevant to sovereign itself as increased riskiness makes their debt more expensive. A predictiveness of sovereign default risk is of even higher interest to banks and financial institutions as these have large portion of their reserves parked in sovereign securities and sovereign risk premium serves as a benchmark for non-sovereign borrowings.

Crude oil upheavals may have either of contemporaneous or long-run impact on sovereign credit risk. Sometimes, the impact is visible in long run only where short run seems to be unaffected by the crude oil price moves. Moreover, measuring system wide connectedness is a more complex and non-linear phenomena. There are numerous methods used to measure such issues in literature such as NARDL (Lahiani et al. 2016), Wavelet Coherence Framework (Yang et al. 2017), Cointegration (Hammoudeh et al. 2013), Multivariate regression quantile (Bouri et al. 2018), GARCH-Copula CoVar (Wang et al. 2020). However, we deployed Generalized Impulse Response Functions and Generalized Factor error variance decompositions (Diebold and Yilmaz, 2014) to study risk transfer in short run and long run from crude oil price fluctuations for G20 nations[3]. A Global VAR model (Pesaran et al. 2004) is built as instrumental for global and country specific variables of sample countries. The methodology is chosen as it is invariant to ordering and it also records shock dependence connectedness captured in VAR disturbance covariance matrix along with cross-variable dependence captured in VAR coefficients (Singh et al. 2018; Pesaran et al. 2004). Besides, the method is most often used to measure systemwide spillover studies (Singh et al. 2019; Pavlova et al. 2018). The spill overs have been depicted through network graphs (Erdos and Renyi, 1959) for clear visualization and understanding of complex structures. As mentioned, our sample includes Australia, Brazil, Mexico, Russia, South Africa, Argentina, China, France, Germany, Indonesia, Italy, Japan, South Korea, Turkey, UK and USA. Notably India, Canada and Saudi Arabia is not included in the study due to unavailability of CDS data for these countries for full sample time and European Union is not considered for the fact that it enjoys the status of a collaborative pact amongst countries and would not be justified to take it at par with individual nations. Literature outlined non-linear and asymmetric effects of crude oil price returns and volatilities on exporting and importing countries (Julio et al. 2019; Bouri et al. 2018). Our sample countries are a mix of developed and developing as well as are amongst major oil exporters and importers that enables us to capture the differentiating impact of oil price fluctuations for exporters and importers as well as for developed and developing nations.

The rest of the paper is structured and organized in 5 sections. Section 2 deals with brief review of contemporary literature and gap identification; Section 3 deals with Data and its sources; Section 4 explains the research methodology framework adopted for carrying out research and

[3] G20 nations contributes approx. 80% of the world's GDP and accounts for 75% of global trade. Besides, more than half of the G20 nations have their debt to GDP ratios above 60% and their credit ratings have seen a downside which seems an important contributor to increase in sovereign risk.

Section 5 discusses the findings of GIRFs and GFEVD outcome along with network graphs. Section 6 concludes the research and its findings.

2. Related Studies

In terms of sovereign credit risk, there exists two tranches of research in literature. First tranche investigates the determinants of sovereign risk and most of the scholars has described the influential role of global and country specific variables at different points of time (Pavlova et al. 2018; Sabkha et al. 2019; Rodrigues et al. 2015; Yorovaya et al. 2015). However, the different studies have considered discrete economic and financial factors relevant and assumed different set of global and country specific factors for their study. Fong et al. (2018) has considered Real GDP Growth, Inflation Rate, Net exports to GDP, Leverage of Banking sectors and Foreign investments as domestic factors that explain Sovereign Risk while VIX, COMM, MOVE and Foreign exchange expectations as global factors. In yet another study, Lahiani et al. (2016) considered Libor, Federal fund rate, T Bill Rate, VIX and WTI as explanatory variables. Likewise, discrete combinatory of economic and financial factors have been chosen by different studies. Commonly, Exports and Imports, Political stability, MSCI world Index, Crude oil, Local stock market Index, sectoral indexes, SMOVE, Housing Index are amongst few factors that has been paid attention by scholars (Pavlova et. al. 2018; Sabkha et al. 2019, Chuffart and Hooper 2019, Hkiri et al. 2018; Shahzad et al. 2017; Hammoudeh et al. 2013; Guo et al. 2011).

The second tranche deals with the connectedness between sovereign markets or oil markets and other financial markets such as stock markets (Tiwari et al. 2020), Forex Markets, Bond markets, commodity markets (Balcilar et al. 2020) etc. Literature has evidence on linkages between Oil prices and Sovereign risk although it is still young. Using VAR-GARCH-in mean model, Wegner et al. (2016) has proved that a positive shock to crude oil prices lower the CDS spreads of oil producing countries using 9 oil exporting countries. Likewise, Shahzad et al. (2017) studied Directional predictability from oil implied volatility to CDS spreads of four GCC Markets and 5 other oil exporting countries and found significant direction predictability from oil to CDS spreads for most of oil exporting countries especially during high volatile period. Pavlova et al. (2018) examined spillovers from oil price to oil exporting countries and recorded existence of spillovers to the extent of 4%-31%. Where oil exporting or producing countries are found to be impacted by crude oil price fluctuations, the same is examined for oil importing countries as well. Oil price Volatility and returns have non-linear and asymmetric causal effects on SCR of oil importers and exporters (Julio et al. 2019). Oil exporters are more sensitive to positive oil shocks whereas importers are more sensitive to negative oil shocks (Bouri et al. 2018). They also show that low volatility of oil market predicts low sovereign risk at various quantiles and lags and vice versa. Additionally, in 2019, Bouri et al. has highlighted the relation between CDS Spread of oil exporters with oil prices is negative, it is less pronounced for MENA oil importers. They used cross quantilogram approach and reported asymmetric effects of oil prices across quantiles. Wang et al. (2020) mentioned that extreme oil returns are risky phenomena for developed and emerging countries. Further, they added that oil importers behave differently to extreme oil returns as per their economic stability. Also, upward oil returns have a higher intensity of spillover to CDS spreads than of downward oil returns, specifically for oil exporters. Using wavelet analysis Yang et al. (2018) found time varying linkages and increasing co-movement between CDS spreads of G7 and BRICS nations with increasing crude oil price. Interestingly, Sun et al. (2018) has outlined that sovereign CDS of emerging markets causes higher spillovers to stock markets than developed markets

whereas developed markets cause larger spillovers from stock markets to CDS markets. They also pointed that CDS markets and commodity markets plays dominant role during some specific periods while stock markets are always dominant. Chen et al. (2020) worked on the interconnectedness of 27 Sovereign markets of European countries using causality analysis and Network Graphs. They found that the network varies with market conditions and are unstable. Network becomes complex and more connected during turbulent time period.

Where cross markets spillovers has been focussed on one side, the other side studies the spillover between sectoral CDS. Hammoudeh et al. (2013) has studied transmission amongst US measures of credit and market risk focussing on four oil related sectors and recorded responsiveness of oil related CDS to VIX in long and short run. Lahiani et al. (2016) examined short and long run linkages between CDS of Banks, Insurance and Financial service sectors. They found long and short run asymmetric changes in CDS spreads to change in federal funds and T-bills rate. They do not find any impact of WTI on short run dynamics of CDS of bank and financial service sector. US short term interest rates are more sensitive to credit event than to WTI. Using NARDL approach, Shahzad et al. (2017) have found the asymmetric non-linearity between industry CDS index spreads of 10 US industries in long and short run. They observed crude oil to be one of the contributors to such linkage along with equity prices, VIX and Bond rates with higher contribution than crude oil. They also mentioned that positive and negative shocks to macro-economic variables have different impact on industry CDS spreads. Balcilar et al. (2020) has analysed spillover effects across oil related CDS, oil markets and financial market risk for US during and after subprime crisis. They found oil market is main source of risk transmission to oil related CDS whereas bond markets transmit highest risk to stock markets. Further, oil price shocks are found to be more significant for oil related CDS than demand and supply shocks.

It is natural to expect serious structural changes in return and volatility transmission from oil to sovereign markets during global crisis events. Noteworthy, Studies have captured this time varying behaviour and intensified spillovers from crude oil to sovereign markets during crisis. A few of such studies includes Guo et al. (2011) who found that during crisis, apart from own shocks, shocks from stock market and oil market are the driving force behind credit default market and stock market variation. Additionally, an increased sensitiveness of CDS volatility to oil market conditions during risky regime has been documented by (Sabkha et al. 2019). They also found dissimilarities between explanatory power of exogeneous variables during turbulent and tranquil regime. On the contrary, Bouri et al (2017) found that some of the major commodity exporters and importers are lacking contribution of commodity spillover to CDS. They suggest there can be other macro-economic variables that contribute to volatility in sovereign CDS. There is direct impact of oil price fluctuations on CDS spreads in Venezuela but Russian CDS spread is impacted indirectly through forex as it has flexible exchange rate system (Chuffart & Hooper, 2019). They also mentioned that determinants of CDS spreads do not have same impact at the time of crisis and calm. Fonseca et al. (2016) found future negative jumps have higher impact than positive jumps, while explaining CDS Spreads during crisis.

A careful examination of literature outlined that there are time varying linkages between oil prices and sovereign risk. Additionally, the spillovers from oil to sovereign markets are different for countries caused by their economic and financial connections with other countries. We, through this study, are trying to contribute to the existing literature of crude oil and sovereign market linkages through 4 ways. First, we focus on measuring the intensity of crude oil shock spill over for G20 nations in short run and long run. Secondly, we would be examining the systemwide spillover amongst sovereign markets. Thirdly, we would be capturing other

global and country specific channels along with crude oil that contributes to the systemic spillover between countries and becomes medium for such transmission. Lastly, a cross comparison between factors is done to understand the relevance of crude oil for sovereign risk. Since, literature has used numerous methods to study the connectedness issues, we are relying on GIRFs and GFEVD (Diebold and Yilmaz, 2014) to study risk transfer in short run and long run. To resolve the issue of dimensionality, we exploited Global VAR model (Pesaran et al. 2004). The methodology is chosen as it is invariant to ordering and it also records shock dependence connectedness captured in VAR disturbance covariance matrix along with cross-variable dependence captured in VAR coefficients (Singh et al. 2018; Pesaran et al. 2004). Besides, the method is most often used to measure systemwide spillover studies (Singh et al. 2019; Pavlova et al. 2018). The spill overs have been depicted through network graphs (Erdos and Renyi, 1959) for clear visualization and understanding of complex structures.

3. Data collection and Sources

Our primary interest is understanding the spillovers between Crude oil and CDS for which Monthly data for crude oil and 5-year sovereign CDS has been sourced from Bloomberg for a time period from January 2008 to December 2019. Further, to meet another objective of finding out the channels that dilute the shocks arising from crude oil to CDS, we have collated the monthly Data for 4 country specific variables and 2 global variables for the same time period that includes; Stock Market Index, Real effective exchange rate, 10-year bond yield, Inflation, Libor and Federal Rate. These factors are chosen based on literature and data availability. Data for Stock Market Indices, 10-year bond yield, LIBOR and Federal rates has been sourced from Bloomberg. Monthly data for Inflation is taken from the database of International Monetary Fund and Real effective exchange rate has been collected from Federal Reserve Bank of st. Louis. The collected monthly data results in 144 data points for each variable per country per year. Total data points collected are 11,376 per country (2304 per country per variable except for inflation which is available for 12 countries) for country specific variables and 144 for global variables resulting in 432 datapoints. Logarithmic conversion of the entire data has been done except for Bond Yields and Federal rates in order to stabilize the variation in data.

The 16 countries considered for the study includes Australia, Brazil, Mexico, Russia, South Africa, Argentina, China, France, Germany, Indonesia, Italy, Japan, South Korea, Turkey, UK and USA[4]. The countries selected are a mix of developed and developing countries[5] and oil exporters and oil importers[6]. Additionally, cross border balance of payment amongst each countries pair and GDP PPP 2018 (in USD) has been fetched to construct the weights for GVAR modelling from WITS World Bank's Database from year 2008 to 2018. Logarithmic conversion has been done for each year balance of payment value for each country pair.

[4] USA became net exporter in the year 2020, Our study considers data till 2019. Therefore, It is considered as net oil importer for our study. For details, https://www.eia.gov/energyexplained/oil-and-petroleum-products/imports-and-exports.php

[5] We have categorized countries as developed or developing as per the criteria given by world bank i.e. Gross National Income (GNI) per capita as per GNI of 2018. We have considered High Income countries ($12,376 or More) as developed countries whereas Lower ($1026 to $3995) and Upper Middle-income ($3996 to $12,375) economies are considered as developing economies.

[6] The countries are divided amongst oil exporting and importing countries based on net oil export or import.

4. Research Methodology

Since our sample has 16 countries for which data of 5 country specific and 4 global variables is considered, the kind of problem that we are dealing into is having the dimensionality problem i.e. 'Curse of Dimensionality' which arises when the number of countries chosen becomes relatively large than the available time dimensions which makes it impossible to achieve unrestricted GVAR even with small number of variables (Bussiere et al. 2009). Global VAR modelling is an alternative to overcome this problem which was developed by Pesaran, Schuermann and Weiner (2004). Under GVAR model, firstly country specific small dimension models are estimated that includes domestic variables and its cross-section averages of foreign variables. The resultant coefficients can be solved as one big system in second step.

We have built a GVAR model covering 16 countries using monthly data for 5 country specific variables, 5 country specific foreign variables and 4 global variables. The foreign specific variable has been computed as weighted average of the corresponding variable of other nations, with fixed weight computed based on average balance of payment from year 2008-2019.

$$\text{Foreign specific variable } (x_{it})^{*} = \sum_{j=0}^{N} (w_{ij} * x_{it})$$

Where w_{ij} is the weight computed from average Balance of Payment amongst the country. Here (ij) reflects share of country "j" in net trade exports of country "i".

Table 3.1: Export from country (i -> j)

	x_1	$x_2 \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots x_N$	$Total\ trade\ flow$
x_1	0	$d_{12} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots d_{1N}$	$\sum_{j=1}^{N} d_{1j}, j \neq 1$
x_2	d_{21}	$0 \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots d_{2N}$	$\sum_{j=1}^{N} d_{2j}, j \neq 2$
$\vdots$	$\vdots$	$\vdots \vdots \vdots \vdots \vdots \vdots \vdots \vdots \vdots \vdots \vdots \vdots \vdots$	$\vdots$
x_N	d_{N1}	$d_{N2} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots 0$	$\sum_{j=1}^{N} d_{Nj}, j \neq N$

Hence, corresponding weight can be computed as

$$W_{kj} = \frac{d_{kj}}{\sum_{j=1}^{N} d_{kj}, j \neq k}$$

Using inter country trade data serves the purpose of capturing the shock propagation from country specific and global variables to one country and then passed on to another via the trade channel with the country specific variable acting as the medium $\{g_i \rightarrow x_i \rightarrow x_j\}$. Noteworthy, all the global variables and foreign specific variable have been chosen as weakly exogenous for

all the country specific models. The lag order has been based on Akaike information criterion (AIC).

4.1 Generalized Impulse response function.

The methodology was introduced by introduced in Koop, Pesaran and Potter (1996). The GIRF is based on the definition.

$$GIRF\ (x_{t;}\ u_{lt,}\ n) = E(x_{t+n} \mid u_{ilt} = \sqrt{\sigma_{ii,ll}}\ I_{t-1}) - E(x_{t+n} \mid I_{t-1}),$$

where I_{t-1} is the information set at time t-1, $\sigma_{ii,ll}$ is the diagonal element of the variance-covariance matrix Σ_u which corresponds to the l^{th} equation in the i^{th} country, where "n" is the horizon. Thus, the shock of one standard error on the j^{th} variable at time step t+n can be illustrated for the l^{th} equation as:

$$GIRF\ (x_{t;}\ u_{lt,}\ n) = \frac{e\prime_j * A_n * G_0^{-1} * \sum_u e_l}{\sqrt{e\prime_l * \sum_u e_l}} \text{ where n = 0,1…..2; l,j = 1,2,…k}$$

For our study, we have given a positive and negative shock to Crude oil to capture its impact on CDS of countries. Further, we have given a positive and negative shock to CDS to understand the role played by country specific factors in carrying out these shocks to CDS. This would aid us in measuring the magnitude of shock spillover from crude oil to CDS and also understanding role of other country specific and global variables in shock transmission.

4.2 Generalized Forecast Error Variance Decomposition:

In the Generalized Forecast Error Variance Decompositions (GFEVD) framework, the forecast error variance equations can be decomposed to see how much variance is caused by self for a variable 'i' and how much is contributed by the rest. Utilizing the concept, Diebold and Yilmaz (2012) derived a set of connectedness measures and deployed to different levels of granularity from pairwise to system-wide "FROM," "TO," "NET" and "TOTAL" connectedness value (for details, please see Diebold and Yilmaz, 2012)

$$C_{FROM(i\leftarrow\blacksquare)}(H) = \frac{\sum_{j=1\ i\neq j}^{N} \tilde{\vartheta}_{ij}^{g}(H)}{\sum_{i,j=1}^{N} \tilde{\vartheta}_{ij}^{g}(H)} \times 100 = \frac{\sum_{j=1\ i\neq j}^{N} \tilde{\vartheta}_{ij}^{g}(H)}{N} \times 100 \quad (1)$$

$$C_{TO\ (\blacksquare\leftarrow i)}(H) = \frac{\sum_{j=1\ i\neq j}^{N} \tilde{\vartheta}_{ji}^{g}(H)}{\sum_{i,j=1}^{N} \tilde{\vartheta}_{ji}^{g}(H)} \times 100 = \frac{\sum_{j=1\ i\neq j}^{N} \tilde{\vartheta}_{ji}^{g}(H)}{N} \times 100 \quad (2)$$

$$C_{i\ (NET)}(H) = C_{\blacksquare\leftarrow i}(H) - C_{i\leftarrow\blacksquare}(H) \quad (3)$$

$$C_{TOTAL}(H) = \frac{\sum_{i,j=1\ i\neq j}^{N} \tilde{\vartheta}_{ij}^{g}(H)}{\sum_{i,j=1}^{N} \tilde{\vartheta}_{ij}^{g}(H)} = \frac{\sum_{i,j=1\ i\neq j}^{N} \tilde{\vartheta}_{ij}^{g}(H)}{N} \quad (4)$$

4.3. Preliminary Statistics

First of all, we have dealt in with the missing values of data by filling it with moving mean of next 5 variables. With the help of scatter plot graphs, we found a few outliers but decided to retain the values as these are not too extreme values. Removing or replacing these variables may cause data to lose some sensitive information and can manipulate the results. Therefore, we decided to retain the variables that has not too extreme values.

Table 2A to E in annexure shows the basic descriptive statistics of logarithmic data considered for all domestic variables. Table 2A displays falling CDS returns for all countries but for Mexico, Argentina, China, Italy and USA. Though these five countries are having positive CDS returns that indicates deteriorating creditworthiness of country, the increase in average return over time is very minimal barring Argentina which also has highest standard deviation amongst other countries inferring it have highly unstable credit markets. Interestingly, CDS returns are highly volatile in nature compared to stock markets and Bond markets. Moreover, CDS returns of all markets are volatile in same range irrespective of their oil dependency and development status. CDS returns are skewed and not normally distributed which is confirmed with Jarqee-Bera test. ADF results shows the logarithmic series of CDS is stationary. Table 2B displays the mean of China and Italy stock market is negative implying falling logarithmic returns of two markets. Stock market of Argentina is having highest positive mean amongst oil exporters and its standard deviation shows its highly volatile behaviour amongst other markets. All the markets are volatile but the instability of China, Italy and Turkey is higher. Skewness and kurtosis define that all countries have negatively skewed and heavy tailed data for their stock returns implicit its deviation from normal distribution. The results of skewness and Kurtosis are confirmed by Jarquee Bera results and ADF results confirms the stationarity of series.

Table 2C displays negative mean for REER of all countries except China, Indonesia and USA implying a depreciation of their currencies against a basket of currencies. However, the developing countries are showing comparatively higher negative returns than developed countries barring China. Similarly, oil exporters are having high negative mean compared to oil importers with Russia as an exception. The standard deviation shows a good stability in the REER of Germany, France, Italy and USA where REER of Russia has been highly volatile. Their skewness and Kurtosis are reflecting negatively skewed data with heavy tails except for France, Germany and Italy which shows moderately skewed data. Jarque-Bera results are confirming non normalcy of data and series stationarity is confirmed by ADF test results. Table 2D displays downward movements in bond yields of all countries except for Russia, South Africa, Argentina, Japan and Turkey. Though these countries are showing non-negative returns for bond yields but their returns are abysmally low. All oil importers are having negative mean returns except Turkey, Japan and South Africa. Notably, Bond yields of Japan are highly volatile amongst all other markets followed by France and Germany. Oil exporting markets have recorded low volatility in their bond yields. Skewness and Kurtosis values reflects moderate to highly skewed heavy tailed data. Non-Normalcy of data is confirmed by Jarque-Bera test and stationarity by ADF test.

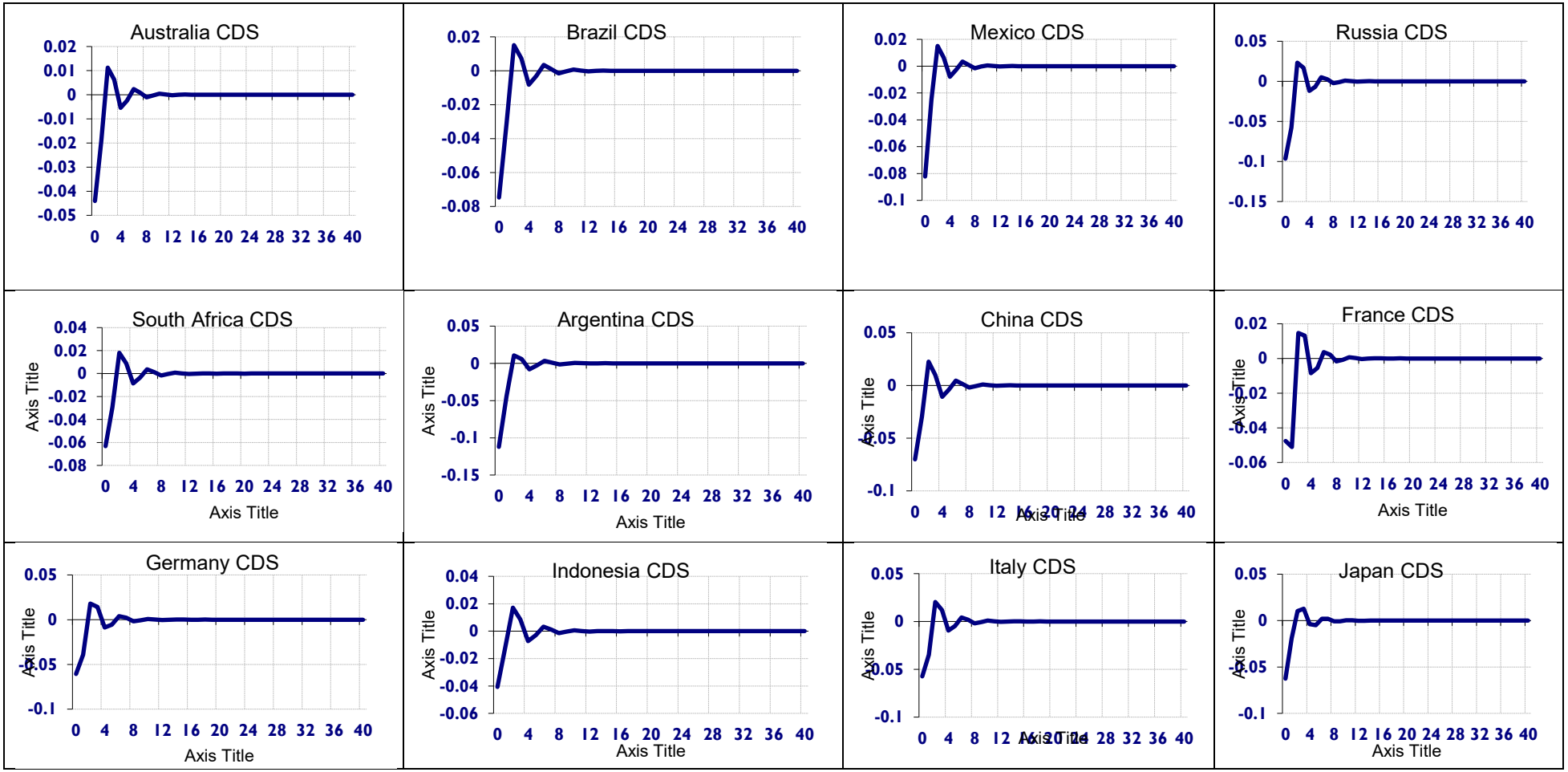
Table 2E shows the central tendency measures of inflation. An average increase is recorded in the inflation of all countries with France as an exception. The mean values are indicating almost similar rise in inflation of all countries but France which has negative mean inflation and at the same time it has highest variation as observed from Standard deviation. Though the average

rate of increase in price rise is similar for countries but we can observe the standard deviation of oil exporting countries is in a range and the instability of prices for oil importing countries is comparatively less except Turkey, France and Italy. ADF shows the series is stationary at first difference. The table 2F shows Crude oil has remain negative throughout but value is extremely low but volatility is high though it is comparatively lower as compared to the volatility of other global factors. Federal rate has positive mean signifying upside movement throughout the period with high volatility. Noteworthy, LIBOR is more volatile as compared to Crude oil and Federal rate with negative mean returns. Federal rate is highly skewed whereas Crude oil and LIBOR are moderately skewed. Jarquee Bera is confirming non-normalcy of data distribution. All the series are stationary.

Table 2G shows the correlation of primary variables i.e., sovereign CDS and Crude oil. It is observed that crude oil has negative correlation with CDS of all the countries. Intuitively, degree of correlation of crude oil is comparatively high for oil exporting countries than oil importing countries. On the other hand, developing countries also are having high degree of negative correlation with crude oil as compared to developed countries. South Africa is one developed country having high degree of negative correlation with crude oil and UK is the one with least degree of negative correlation with crude oil. Besides, CDS of oil exporting countries with each other is showing strong positive correlation. Amongst oil importing countries, China, Indonesia and South Korea are having high degree of positive correlations with other countries.

4.1 Generalized Impulse Response Functions of one standard error shock to crude Oil Price Shock

Figure 1 (Panel A) exhibit the Generalized Impulse Response Functions of credit default swaps for one standard error shock simulated in crude oil. Theoretically, a positive shock to oil prices would increase the revenues of oil exporting countries, thereby, enhances the public finances and its creditability. Higher paying capacity would boost the investor's confidence on the economy resulting in falling CDS spreads. The vice-versa would hold true for oil importing countries. Hence, a negative relationship of crude oil and CDS is anticipated for oil exporting countries and positive relation is expected for oil importing countries accordingly. Surprisingly, the impulse responses are showing negative logarithmic returns of all the countries to positive shock to crude oil irrespective of it being an oil exporting or importing country. These responses remained for consecutive 2 time periods and started correcting thereafter. Though all countries are responding in same direction, the impulse responses for oil exporting countries are stronger and are in the range of 7.4% to 11.2% as compared to oil importing countries that ranges from 2.2% to 7.0%. However, the negative responses of oil exporting countries have witnessed a faster recovery in period 1 than oil importing countries. The results are in tandem with theory with respect to oil exporting countries but not for oil importing countries. This may be attributed to presence of oil reserves, sovereign wealth funds (Naifar et al. 2017) and other resources available with these nations. Furthermore, developed and developing nations are not showing any heterogeneous behaviour towards changing crude oil prices. The CDS returns started rising after period 2 and shows mixed movements for CDS returns before Crude oil shock dies out in period 9. Figure 1 (Panel B) shows the impulse responses of CDS for a Negative oil shock and the results shows the similar trends in opposite direction. As anticipated, for one standard error negative shock to crude oil, oil exporting countries should witness an increase in their CDS returns and importing countries CDS return should see a decline. From the impulse responses, we can infer that oil exporting countries are more sensitive to crude oil shocks than oil importing countries. Developing and developed economies do not behave differently to crude oil shocks.


Australia CDS
0.02
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-0.01
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-0.04
-0.05
0 4 8 12 16 20 24 28 32 36 40
Brazil CDS
0.02
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-0.02
-0.04
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-0.08
0 4 8 12 16 20 24 28 32 36 40
Mexico CDS
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0 4 8 12 16 20 24 28 32 36 40
Russia CDS
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South Africa CDS
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China CDS
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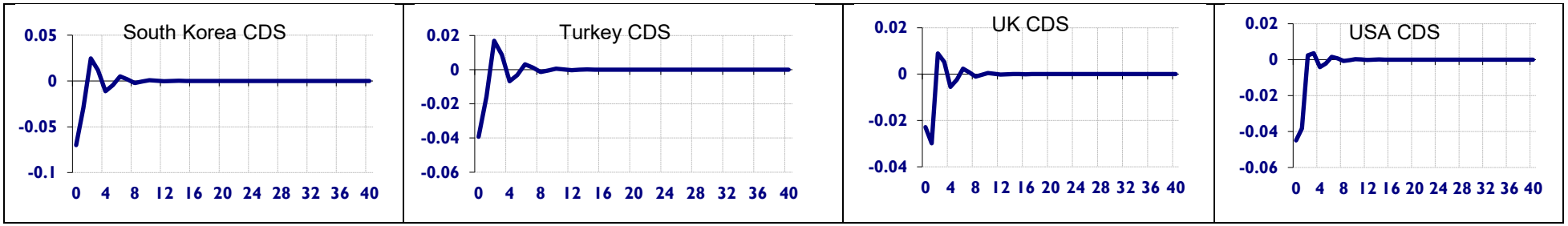
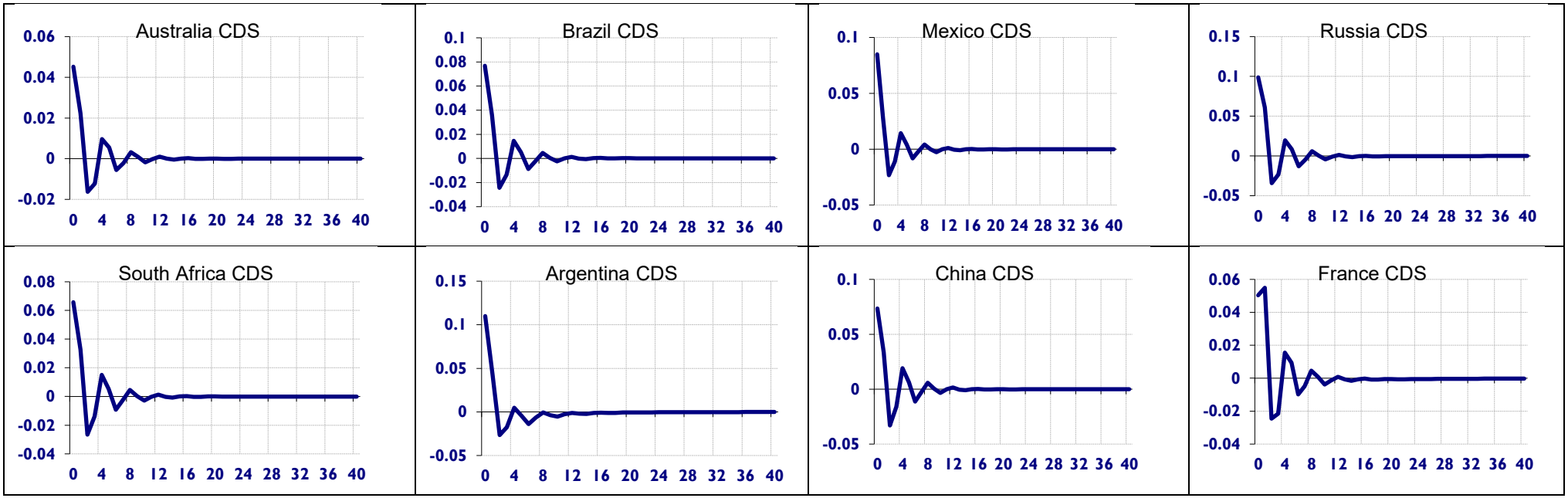


Figure 1 (Panel A): Generalized Impulse Response Functions of Credit Default Swaps to one Standard Error positive shock in Crude Oil.



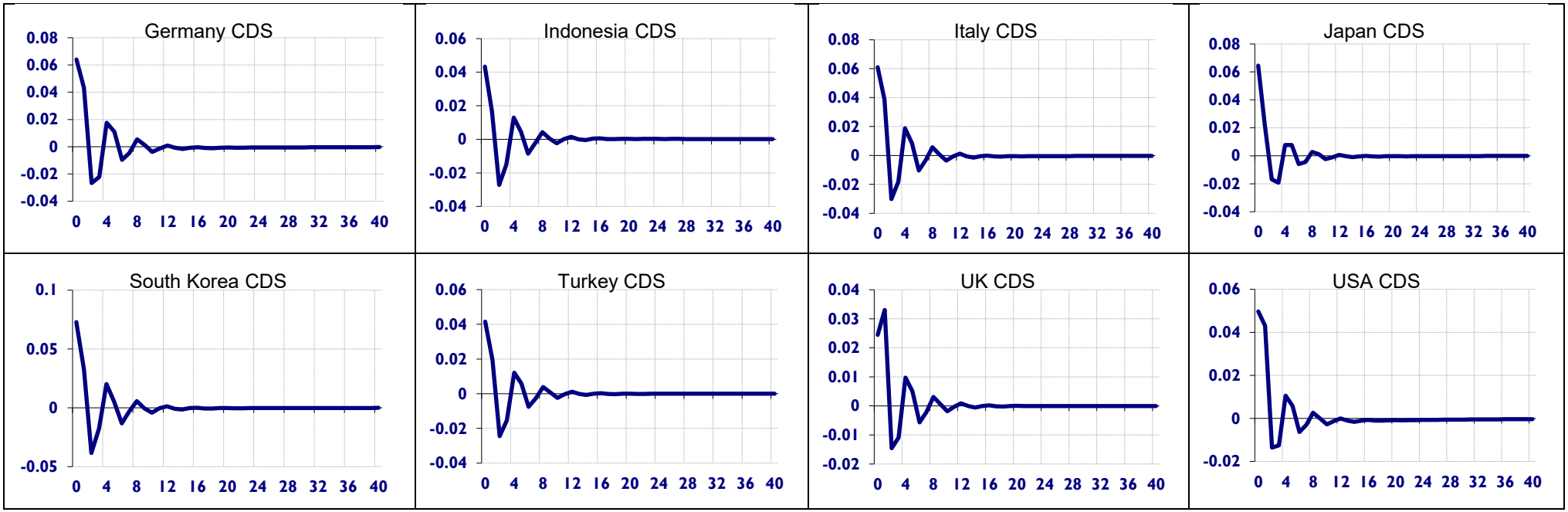


Figure 1 (Panel B): Generalized Impulse Response Functions of Credit Default Swaps to one Standard Error Negative shock in Crude Oil.

Since the results of GIRFs of CDS to Crude oil positive and negative shocks established a quantifiable response, we have checked for the Impulse Responses of all country specific factors and global variables to crude oil positive and negative shock to make sure if these can be possible channels of the shocks from crude oil to CDS. Undoubtedly, countries try to offset the impact crude oil price changes by making the adjustments in Interest rates. Federal rate and LIBOR regarded as marginal cost of borrowing normally sees an upside (downside) to a positive (negative) shock to crude oil price which is generally followed by other countries. We found positive shock to Crude oil is giving immediate impact of 0.61% to Federal Rate and 0.89% to LIBOR rate in inverse direction (Figure 1- Panel C). However, this negative effect is contemporaneous only and both the global variables turned positive from period 1 onwards. Clearly, crude oil shocks are giving 1 period lagged impulse responses to both the global variables till it the shock dies out.

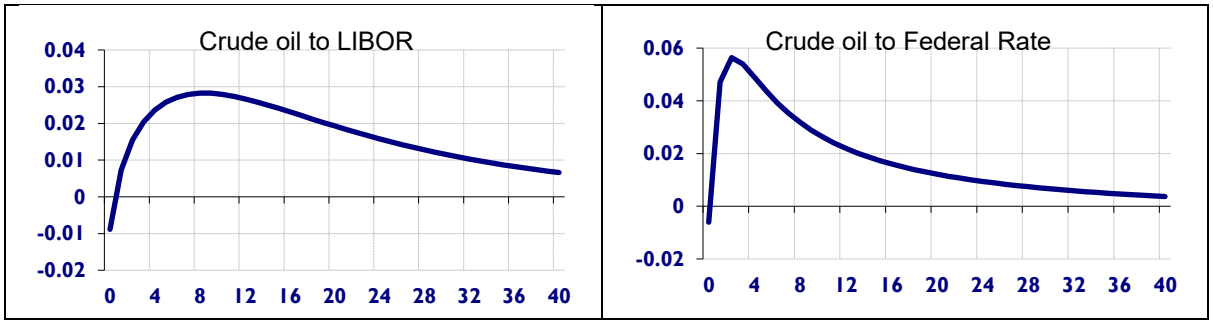


Figure 1 (Panel C): GIRFs of Global Variables to Crude oil Shocks

The GIRFs of country specific variables have been shown in table 3 (due to space constraints we have not shown GIRF graphs and also the responses are shown for contemporaneous moves and further 3 months move). Expectedly, All the chosen variables are responding to one standard error shock to crude oil. REER is the one such factor that is highly sensitive to crude oil shocks. This may be due to the fact that crude oil is denominated in US Dollars and an increase in oil prices would result in decline in purchasing power of USD. Our results show the decline in REER of USD by 46.2%. The declining power of USD is advantageous for other countries when their exchange rate is expressed in terms of USD. Table 4 shows REER of oil exporting countries is highly and positively sensitive to crude oil shocks ranging 43.7% to 84.8%, barring Argentina which is highly sensitive but its REER decreased by 45.9% to positive shock to crude oil. Argentina's domestic economic issues might have higher contribution to peso depreciation. Owing to history of intemperate borrowings with insufficient fiscal and monetary restrains, the country fell into default for ninth time[7]. With an increase in oil prices the REER of oil exporting countries witness an appreciation which undercuts its trade competitiveness with expensive exports and cheaper imports. It is often difficult to reconstruct the lost competitiveness when prices of crude oil falls. Therefore, the regulatory institutions try to offset these adverse effects by adjusting the interest rates that has domino effect on inflation, aggregate demand and supply and overall economic growth. Noticeably, REER of all oil exporting countries started correcting in period 1 but for Russia which further increased, due to highest contribution of crude oil exports in its GDP. On the flip side, oil importers are also sensitive to crude oil shocks but the degree of response varies from low of 7.5% to a high of 69.1%. Logically, an increase in oil prices depletes the forex reserves of an importing country,

[7] https://www.bloomberg.com/news/photo-essays/2019-09-11/one-country-eight-defaults-the-argentine-debacles

therefore we expected a fall in their REER which is holding true for China, Japan and Turkey with REER falling by 33.5%, 59.8% and 8.3% on impact respectively. In reality, the theory may not always hold true as there are other factors that play their part. Such as for other oil importers the REER is positive though the change is relatively lower than exporters. South Korea and Australia are showing highest positive sensitivity amongst oil importers. A fall in USD must definitely strengthen the currency of oil importers also that may have counterbalanced the loss due to depleting forex reserves.

Similarly, the response of Stock Market Indices of oil exporting countries is comparatively higher than oil importing countries falling in a range of 1.9% to 4.3%. Certainly, there are expectations of rising indices on positive shock to crude oil for oil exporters and a reverse trend for oil importers as rising oil prices will increase cost of production, reduce profit margins for many companies constituting an Indices. Strangely, Indices of oil importing countries are noticed to behave positive to positive oil price shock in a range of 1.4% to 2.4%. Importantly, the responses of stock market indices to crude oil are majorly contemporaneous and reduced in next month and almost fade away from period 2. Bond Yields are another important indicator that reflects confidence of investors amongst the sovereign. A positive shock to crude oil increases the revenues of oil exporters indicating positive moves in macro-economic factors of a country such as high GDP, high forex reserves, strong currency etc. This in turn attracts the investors towards sovereign bonds, raises the bond demand and in turn reduces the bond yields. Our results are reflecting a negative effect in the bond yields of oil exporters barring Mexico that shows a positive move in bond yield but the number is abysmally low. Even for other oil exporters though the move in bond yields is negative but the move is low with Brazil 0.1% and Argentina 0.8%. Only Russia's Bond yields are declining to an extent of 2.1%. Russia's bond market has major issues from oil and gas companies. On the contrary, all oil importing countries have witnessed increase in their bond yield as a result of positive shock to crude oil. Australia, France, Germany, UK and US are amongst the countries that witness a high change in their bond yields. Obviously, developed markets have active and sizeable bond markets than developing countries. Surprisingly, Japan sees a nominal increase in bond yields on impact but the yield increases by 10.7% in period 1 and similar is the case with Germany which sees an increase in period 1 than on impact. Rest the impact settles for all the countries in period 1. USA being the largest bond market witness an increase of 3.9%. Clearly, bond yields impact shows that developed markets are most sensitive to crude oil prices owing to their sizable bond markets. The bond markets of developing nations are still at developing stage and hence, witness small changes barring Russia'a bond market.

	SMI				REER				BY				CDS			
	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3
AUSTRALIA	1.4%	1.1%	-0.3%	-0.1%	69.1%	51.7%	11.8%	-4.6%	3.6%	0.7%	0.2%	0.0%	-4.4%	-1.9%	1.1%	0.6%
BRAZIL	2.9%	1.2%	-0.7%	-0.2%	84.8%	54.3%	17.4%	0.1%	-0.1%	-0.1%	0.0%	0.0%	-7.5%	-3.1%	1.5%	0.7%
MEXICO	1.9%	0.7%	-0.5%	-0.1%	61.5%	46.9%	8.9%	-5.7%	0.3%	0.8%	0.2%	-0.1%	-8.2%	-2.5%	1.5%	0.6%
RUSSIA	3.2%	0.7%	-0.4%	-0.4%	43.7%	108.9%	57.9%	5.3%	-2.1%	-1.1%	-0.3%	-0.2%	-9.7%	-5.8%	2.3%	1.7%
SOUTH AFRICA	2.2%	0.3%	-0.2%	-0.1%	42.2%	42.1%	14.8%	-1.2%	0.7%	0.4%	0.1%	-0.1%	-6.3%	-2.9%	1.8%	0.9%
ARGENTINA	4.3%	1.2%	-1.2%	-0.4%	-45.9%	-24.4%	-2.9%	3.5%	-0.8%	0.5%	0.3%	0.0%	-11.2%	-4.4%	1.1%	0.6%
CHINA	1.9%	0.7%	-0.5%	-0.1%	-33.5%	-34.1%	-15.2%	-3.4%	1.1%	1.2%	0.5%	0.1%	-7.0%	-2.9%	2.3%	1.0%
FRANCE	1.9%	0.8%	-0.5%	-0.1%	13.4%	4.8%	2.0%	2.0%	5.8%	3.2%	-0.4%	-0.9%	-4.8%	-5.1%	1.5%	1.3%
GERMANY	1.7%	1.0%	-0.5%	-0.1%	12.4%	7.0%	1.3%	1.6%	2.9%	6.3%	-0.7%	-0.2%	-6.1%	-3.9%	1.8%	1.4%
INDONESIA	1.8%	0.9%	-0.3%	-0.2%	7.5%	17.5%	13.1%	1.5%	-0.5%	0.9%	0.5%	-0.2%	-4.1%	-1.2%	1.7%	0.9%
ITALY	2.3%	1.1%	-0.5%	-0.1%	8.5%	2.5%	1.2%	1.8%	1.9%	1.8%	0.4%	0.1%	-5.7%	-3.5%	2.0%	1.2%
JAPAN	2.3%	1.0%	-0.2%	-0.1%	-59.8%	-69.3%	-31.8%	-8.6%	0.4%	10.7%	-0.9%	-1.7%	-6.3%	-1.9%	1.0%	1.3%
SOUTH KOREA	2.4%	0.5%	-0.6%	-0.1%	59.4%	35.6%	4.1%	-6.9%	1.9%	0.0%	0.1%	-0.1%	-7.0%	-2.9%	2.5%	1.2%
TURKEY	1.7%	0.9%	-0.6%	-0.2%	-8.3%	9.4%	2.6%	-6.8%	-0.1%	0.6%	0.3%	-0.2%	-3.9%	-1.6%	1.7%	0.9%
UK	1.7%	0.5%	-0.4%	0.0%	23.9%	43.4%	22.5%	10.1%	4.8%	1.0%	-0.5%	-0.3%	-2.3%	-3.0%	0.9%	0.5%
USA	2.1%	1.1%	-0.3%	-0.1%	-46.2%	-29.0%	-6.8%	3.4%	3.9%	1.8%	-0.3%	-0.3%	-4.5%	-3.8%	0.2%	0.4%

Table 3: Generalized Impulse Response Functions of Domestic Factors to one standard error positive shock to crude oil; SMI: Stock market Index; REER: Real Effective Exchange Rate, BY: Bond Yields; CDS: Credit Default Swaps

The above GIRFs graphs and Table clearly shows that all the selected variables are responding to crude oil price shocks. Hence, there can be a possibility for any of these variables to act as a potential channel of shock transmission from crude oil to CDS. In next section, we showed the medium to long term impact of crude oil price shocks to CDS.

Generalized Factor Error Variance Decomposition

GIRF has made it clear that all the select variables are responding to the oil price shocks on immediate basis. These interesting findings have laid the foundation and open the doors to dig into medium to long-term effects of crude oil price fluctuations on CDS. To understand the static view of such shocks, we have made use of Generalized factor error variance decompositions (Diebold and Yilmaz, 2012,2014). The purpose of deploying this method is giving equal weightage to all countries and GFEVD is a methodology that is invariant of ordering. We have selected the forecast

horizon of 60 periods. The findings from GFEVD explains the contribution of crude oil to a shock to oil dependant country. The higher the contribution, more is crude oil impacting such country in long term. We have made use of Network spillover graphs to highlight the long run effect along with tabular data. The network graphs make the understanding of complex system easier with the help of nodes and edges. The nodes represent the size of shock received or transmitted by a country or a factor where edge represents the directional relation between a pair of country or factor. We have assigned appropriate colour codes and sizes to nodes and edges for categorization. For network displaying spillovers from crude oil to oil dependant countries, we have assigned the colour codes as mentioned in table 4:

Nodes Colour Codes	**Meaning**	**Threshold**	**Edges Colour Codes**	**Meaning**	**Threshold**
Red	Strong Receiver	Above 75 Percentile	Red	Strong	Above 75 Percentile
Blue	Moderate Receiver	Between 50 to 75 Percentile	Blue	Moderate	Between 50 to 75 Percentile
Green	Weak Receiver	Below 50 Percentile	Green	Weak	Below 50 Percentile
Since crude oil is taken as only transmitter here, it has been assigned red colour being strong transmitter and its size reveals the intensity of transmission.					

Table 4: Colour Codes and threshold for Nodes and Edges

The colour codes are assigned to receptors based on quartiles of net spillovers received by country from crude oil. Thus, the total spillover is segregated into quartiles and receivers with more than 75% of spillovers are categorized as strong receptors demarcated as Red, receivers above 50% and below 75% are considered as moderate receptors and demarcated Blue. Similarly, receivers below 50% of spillovers are weak receivers and demarcated as Green. Further, to make distinction amongst the same colour node, a size has been allocated to each node. Thus, the size of the node is indicative of how strong the receiver is. The size of third quartile (75 percentile) has been set as reference point to allocate size to the nodes. Since, we have only one transmitter, size of crude oil itself is taken as reference point to allocate the size to transmitter node. The colour codes of Edges have also been set on the similar pattern i.e. quartiles. The edges which weight higher than 75 percentiles are considered to be strongly connected, between 50 to 75 percentiles are taken as moderately connected and below 50 percentiles are taken as weakly connected and are assigned colour codes as Red, Blue and Green respectively. Further, the width of edges is indicative of the strength spill over between from crude oil to country.

GFEVD Spillover from Crude oil to Credit Default Swaps

First, we have computed a total spillover of 146.87% from crude oil to all 16 sample countries with varied degrees to different countries shown in table 5. Obviously, oil exporting countries are receiving highest spillovers from crude oil i.e. Russia being the highest receiver with 20.87% of spillover from crude oil followed by Mexico (16.15%), Brazil (12.78%) and Argentina (11.16%). This can be attributed to the fact that their balance sheets are more dependent on oil-based revenue and an increase in price would lead to inflated balances. The

shock is nearly proportional to the oil exports of these countries[8]. For Russia, frequent sanctions also proliferated the domestic issues. We can visualize the same in network graph (Figure 2) which shows highest transmitters in red coloured nodes. The largest node size of Russia is indicating it to be highest receiver of shocks from crude oil followed by Mexico and Brazil. Noteworthy, Argentina is the only oil exporting countries which is receiving moderate spillovers relative to other countries, but the percentage transmission is quite high[9]. All oil importing countries are receiving low to moderate degree of spillovers from crude oil barring South Africa which is vulnerable to oil shocks to the extent of 12.36%. South Africa fulfils majority of crude oil requirements from crude oil imports. China and USA are receiving relatively similar degree of shocks from crude oil being largest oil consumers and dependence on oil imports. European countries are amongst the lowest receiver of the shocks from crude oil with UK receiving the lowest of 3.57%.

Argentina	11.16%	France	6.12%
Australia	6.14%	Germany	5.88%
Brazil	12.78%	Indonesia	4.53%
China	9.59%	Italy	5.68%
Japan	7.99%	South Korea	9.75%
Mexico	16.15%	Turkey	5.18%
Russia	20.87%	UK	3.57%
South Africa	12.36%	USA	9.12%

Table 5: Country wise Spillover from crude oil to CDS

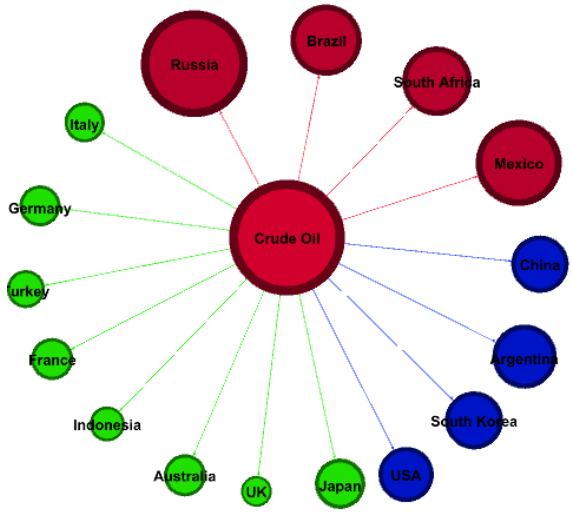


Figure 2: Network Graph showing Spillovers from Crude oil to Country Specific CDS

Through above table and figure, it is very much clear that there exist medium to long term shock spill over from crude oil to oil exporting and importing countries and the quantum is also high, with oil exporters receiving relatively highest spillovers. The picture is still illusive here. The spillover mechanism does not stop by hitting one country but it further spills over to other countries that are linked through any economic or financial medium. To understand the larger full-scale impact of crude oil spillovers to sovereign risk of country, we have analysed the systematic impacts of such shocks for example, Crude oil shock → Oil exporting countries → interconnected country via bilateral trade ties or other channels. Understanding of systematic impacts of such spillover is critical as these proliferating shocks can be more detrimental to economy than they appear. Here, we have constrained our system to 16 oil exporting and

[8] https://www.ceicdata.com/en/indicator/russia/crude-oil-exports

[9] Shocks to Argentina can be considered as High transmitters as it is slightly low to 75th percentile. Here, we can say due to our methodology used, Argentina is recorded as a moderate transmitter.

importing countries to understand the mechanism. We have shown the spillover Index (Table 7) and Network Graph (Figure 3) based on generalized factor error variance decompositions. Noteworthy, the analysis here deals with interactions of CDS across all countries. The similar methodology is adopted to create network as used for Figure 2. Here, Figure 3 shows the spillover graph based on net receivers and net transmitters which have been distinguished using 6 colour codes. The specification of colour codes used is as follows:

Nodes Colour Codes	**Meaning**	**Node Colour Code**	**Meaning**	**Threshold**	**Edges Colour Codes**	**Meaning**	**Threshold**
Red	Strong Transmitter	Pink	Strong Receiver	Above 75 Percentile	Red	Strong	Above 75 Percentile
Blue	Medium Transmitter	Orange	Moderate Receiver	Between 50 to 75 percentiles	Blue	Moderate	Between 50 to 75 percentiles
Green	Weak Transmitter	Sky blue	Weak Receiver	Below 50 percentiles	Green	Weak	Below 50 percentiles

Table 6: Colour codes for Nodes and Edges for Systematic Shock transmission

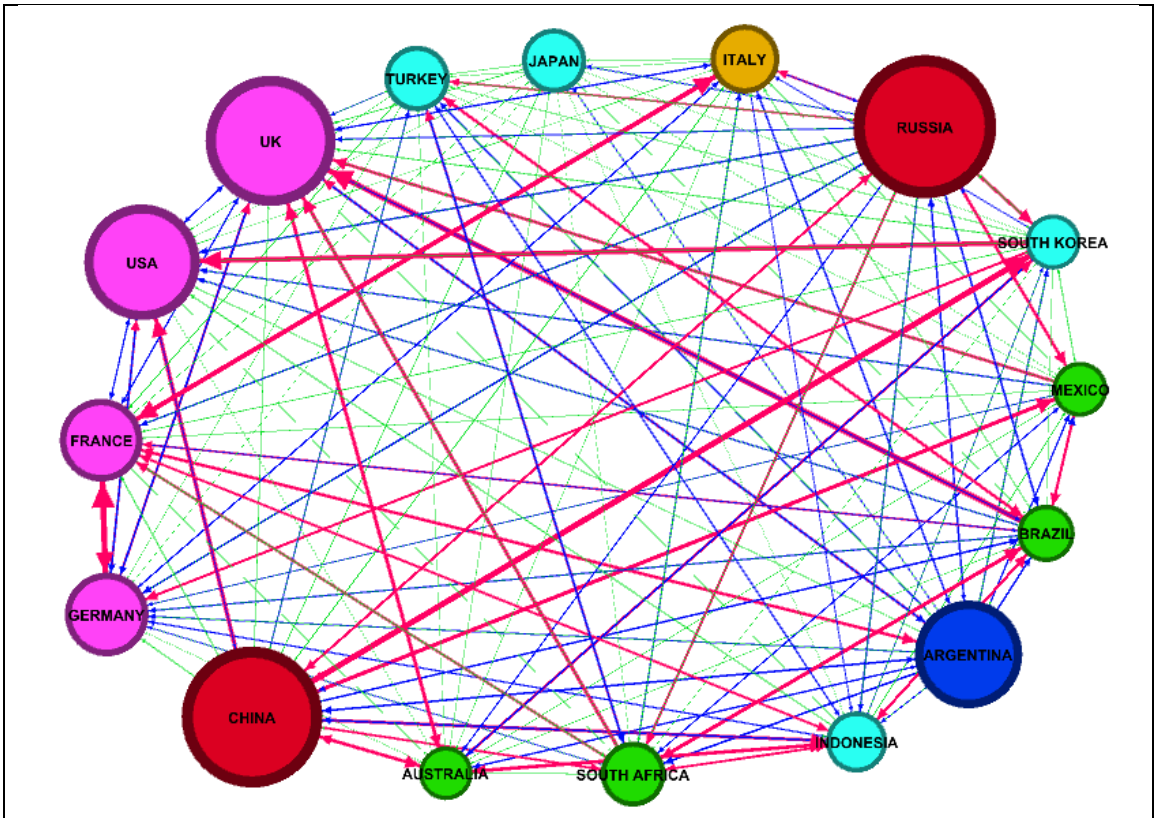


Figure 3: Systemwide Spillover amongst Sample Country's CDS

From Figure 3, it is evident that CDS of most of the developed countries such as USA, UK, France and Germany are the net receivers of shocks. Strange, countries which received lowest shocks from crude are highest receivers of system wide shocks. Even if the oil exporters are amongst the highest receivers of shocks from crude oil, they are prone to transmit the same to other countries existing in the system. An interesting finding from the spillover Index indicates

that developed countries are net recipients of shocks in the system. On the other front, Oil exporting countries managed to hold the position of net transmitters in the system with Russia and Argentina being the highest and moderate transmitters, respectively. China, one of the top oils importing country is also active in transmitting strong shocks especially to South Korea as indicated by Edge emanating from it. Our findings are in tandem with the findings of (Sun et al. 2018) who outlined that sovereign CDS of emerging markets causes higher spillovers. More number of red edges towards UK shows it is receiving strong shocks from Mexico, Brazil, Australia, and South Africa. USA although is the net recipient is receiving major contribution from China and South Korea. USA is receiving 9.12% shocks from Crude oil, nonetheless USA has net spill over of approximately 25.81% with major systematic shocks transmitted from China and South Korea being China as their top trading partner and South Korea as another most important strategic and economic partner. Where China is the major transmitter to USA, a bilateral edge is connecting both the countries with higher intensity shocks from China to South Korea. For that matter, South Korea has long historical alliance with China and USA, hence net transmitter for USA. Besides China -South Korea, being extremely intertwined and complementary economies Germany and France are transmitting bilateral shocks to each other. Similar is the case for France and Italy. Turkey, Japan, South Korea, and Indonesia are amongst the weak receivers with Brazil, Mexico, South Korea and Australia being the weak transmitters. Being weak transmitter, Mexico is sending high shocks to Brazil and receiving high shocks from Russia. Brazil is also sharing strong bidirectional ties with South Africa. Similarly, Brazil-Turkey, UK-Australia, Australia- South Africa are transmitting strong shocks amongst them. The system seems complex with multiple strong emanating edges that signifies the indirect spillovers in the system which multiplies the size of crude oil shock and enlarges the threat. It is obvious that these shocks are transmitted to interconnected countries via some financial and economic linkages between the countries. For example, Higher trade ties between China and USA can be one of the possible reasons why China is emanating strong transmissions to USA. Identification of such channels that can act as a carrier of the shocks to other countries in the system can be helpful in managing the stress. Identification of such channels and its contribution can be used for proactive policy decisions and provide some time to manage the stress carried by such factors.

We have analysed the contribution and role of two global factors and 4 domestic factors for carrying out these shocks. LIBOR and Federal Rates are two global factors considered and REER, Inflation, Bond Yields, and stock market index are the domestic factors. These factors are chosen based on extant literature and data availability. The foremost thing that we need to make sure here is the chosen variables should be impacted by crude oil price fluctuations. GIRFs explained above has already depicted that these all variables are prone to receive shocks from crude oil. Besides, the long run impact of crude oil price fluctuations to the selected variables is also stupendous as shown in table 8. Nevertheless, our curiosity lies in finding what role does these factors play as channel to carry these shocks to Sovereign Risk. Table 9 shows the contribution of all global and domestic factors to CDS spreads. The results reveal CDS and Crude oil are the biggest contributories of shocks in the system which is inclusive of other global and country specific variables. With crude oil being most powerful transmitter, particularly for oil exporting countries. Federal rate is another global variable that is playing an important role in carrying the shocks of crude oil to countries with largest contribution to Argentina and USA. Ofcourse, being central and domestic rate to USA, the supremacy would be high. Libor is another global variable that is transmitting the indirect shocks, but its role is

relatively smaller than Federal rate. Of the country specific variables, Inflation is posing threat to transmit the shocks indirectly. Positive shock to crude oil results in increased cost to any economy and will result in cost push inflation. Noteworthy, Inflation was not playing any major role while we measured impulse responses but when it comes to long run dynamics inflation has a prominent place in spillover index. A network Graph (Figure 4) is depicting the complex relationship in graphical form for better clarity. Figure 4 shows that in long run oil exporting countries are receiving high shocks collectively from all the variables barring Brazil who acts as a moderate receiver. Libor and Federal rates are transmitting moderate shocks against crude oil and CDS. Where domestic variables are transmitting weak shocks relative to global factors. Of the domestic shocks, Stock Market Index and Inflation are amongst important factors. Our findings are consistent to the findings of Longstaff et. al (2011) who reported global factors to be more significant while explaining CDS spread. Additionally, Our findings are contradicting the findings of (Kocsis and Monostori, 2016 and Pavlova et al. 2018) who mentioned the dominant role of domestic factors in explaining the CDS spreads/sovereign risk. Furthermore, a cross comparison of the contribution amongst all the variables shows Crude oil to be the pivotal factor amongst all.

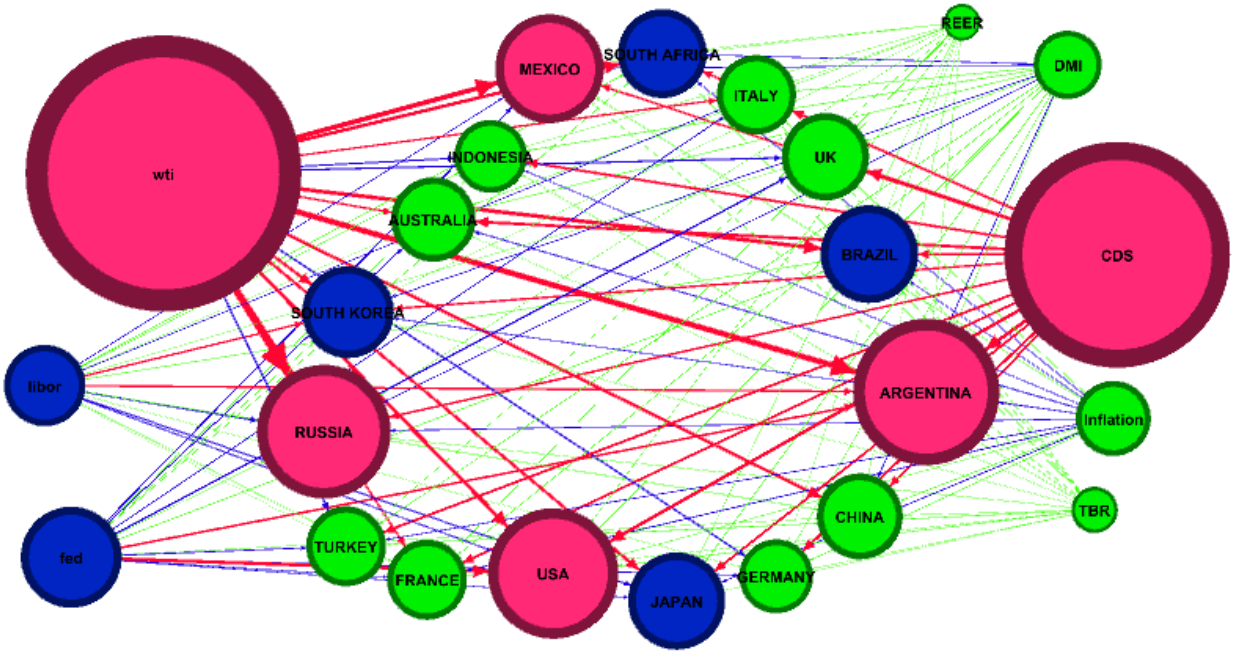


Figure 4: All Factor's Contribution to Spillovers

The investigation is valuable for numerous stakeholders as almost entire financial system is directly or indirectly linked to sovereign credit risk. For a sovereign it becomes supreme to safeguard it's creditability as it reduced credit worthiness can bring the sovereign itself in big trouble by raising the cost of further debt. An understanding into its own vulnerability to crude oil price fluctuations directly from crude oil and its systemwide impact can provide an insight into rebalancing the business portfolio and their dependence on crude oil. Since,

rebalancing business portfolio is not a possibility due to availability of resources, preparations for such a shock becomes mandatory which requires a deep understanding of channels that influence the economy and acts as carriers of such shocks. The identified channels such as Federal rates, Libor, Inflation etc has to be given due consideration while framing policies by policymakers and regulators. Besides, Sovereign cost of debt is usually taken as risk-free rate of interest and serves as a benchmark for corporate borrowings, increased sovereign risk are inevitable for corporates and requires them to be ready to manage such shocks. Furthermore, Banks and Financial Institutions has majority of their reserves invested in government securities, an apprehension of the increased sovereign risk and proactive measures to overcome the increased sovereign risk can survive the Banks and ultimately entire financial system.

	AUSTRALIA	BRAZIL	MEXICO	RUSSIA	SOUTH AFRICA	ARGENTINA	CHINA	FRANCE	GERMANY	INDONESIA	ITALY	JAPAN	SOUTH KOREA	TURKEY	UK	USA	From Connectedness
AUSTRALIA	0.6130	0.0045	0.0082	0.0039	0.0046	0.0183	0.0491	0.0023	0.0025	0.0667	0.0031	0.0064	0.0549	0.0039	0.0673	0.0035	0.2994
BRAZIL	0.0080	0.2712	0.0361	0.0029	0.0513	0.0019	0.0041	0.0396	0.0282	0.0431	0.0120	0.0020	0.0025	0.0475	0.1046	0.0277	0.4115
MEXICO	0.0031	0.0501	0.2287	0.0186	0.0244	0.0075	0.0300	0.0090	0.0190	0.0060	0.0091	0.0020	0.0131	0.0028	0.0580	0.0289	0.2815
RUSSIA	0.0237	0.0357	0.0562	0.3997	0.0460	0.0212	0.0449	0.0305	0.0335	0.0280	0.0412	0.0216	0.0602	0.0378	0.0251	0.0331	0.5385
SOUTH AFRICA	0.0082	0.0713	0.0232	0.0087	0.2206	0.0065	0.0068	0.0494	0.0190	0.0422	0.0271	0.0010	0.0019	0.0457	0.0662	0.0017	0.3788
ARGENTINA	0.0308	0.0324	0.0275	0.0332	0.0365	0.7127	0.0367	0.0482	0.0255	0.0207	0.0311	0.0178	0.0277	0.0294	0.0490	0.0109	0.4576
CHINA	0.0623	0.0348	0.0747	0.0474	0.0414	0.0326	0.3536	0.0150	0.0156	0.0632	0.0152	0.0115	0.1140	0.0238	0.0096	0.0777	0.6388
FRANCE	0.0083	0.0159	0.0031	0.0043	0.0158	0.0576	0.0020	0.4207	0.0878	0.0438	0.0911	0.0057	0.0032	0.0122	0.0264	0.0228	0.4000
GERMANY	0.0043	0.0024	0.0009	0.0021	0.0004	0.0068	0.0003	0.1141	0.4542	0.0141	0.0278	0.0002	0.0041	0.0015	0.0471	0.0433	0.2695
INDONESIA	0.0529	0.0515	0.0122	0.0047	0.0405	0.0019	0.0319	0.0435	0.0256	0.4288	0.0117	0.0022	0.0167	0.0266	0.0046	0.0154	0.3418
ITALY	0.0063	0.0088	0.0081	0.0167	0.0134	0.0244	0.0056	0.0885	0.0169	0.0174	0.3976	0.0079	0.0096	0.0069	0.0288	0.0027	0.2621
JAPAN	0.0013	0.0047	0.0045	0.0008	0.0028	0.0017	0.0022	0.0037	0.0019	0.0011	0.0031	0.5643	0.0037	0.0026	0.0125	0.0009	0.0474
SOUTH KOREA	0.0286	0.0038	0.0075	0.0131	0.0041	0.0091	0.0439	0.0115	0.0476	0.0054	0.0174	0.0026	0.2077	0.0094	0.0149	0.0933	0.3123
TURKEY	0.0038	0.0550	0.0040	0.0087	0.0370	0.0079	0.0035	0.0146	0.0057	0.0229	0.0024	0.0079	0.0023	0.3835	0.0159	0.0082	0.1998
UK	0.0523	0.0190	0.0048	0.0010	0.0061	0.0346	0.0003	0.0269	0.0332	0.0001	0.0299	0.0047	0.0004	0.0019	0.7081	0.0227	0.2378
USA	0.0016	0.0021	0.0013	0.0019	0.0041	0.0004	0.0159	0.0267	0.0345	0.0024	0.0076	0.0019	0.0084	0.0004	0.0255	0.7330	0.1347
to Connectedness	0.2953	0.3921	0.2723	0.1679	0.3284	0.2322	0.2773	0.5236	0.3966	0.3773	0.3298	0.0954	0.3228	0.2526	0.5552	0.3929	5.2116
Net Connectedness	0.0041	0.0194	0.0092	0.3706	0.0504	0.2253	0.3616	-0.1236	-0.1271	-0.0355	-0.0677	-0.0480	-0.0105	-0.0528	-0.3174	-0.2581	

Table 7: Systemwide Spillovers amongst the sample countries with from, to and net connectedness

	AUSTRALIA	BRAZIL	MEXICO	RUSSIA	SOUTH AFRICA	ARGENTINA	CHINA	FRANCE	GERMANY	INDONESIA	ITALY	JAPAN	SOUTH KOREA	TURKEY	UK	USA
DMI	0.64%	0.68%	0.82%	0.82%	0.85%	0.50%	0.93%	0.61%	0.50%	0.73%	0.66%	0.74%	0.83%	0.66%	0.55%	0.45%
REER	0.42%	0.29%	0.31%	0.27%	0.23%	0.30%	0.25%	0.25%	0.20%	0.30%	0.22%	0.37%	0.23%	0.23%	0.50%	0.39%
TBR	0.28%	0.53%	0.39%	0.46%	0.38%	0.43%	0.35%	0.29%	0.28%	0.45%	0.42%	0.31%	0.30%	0.74%	0.33%	0.71%
CDS	3.04%	2.47%	2.01%	2.18%	2.03%	3.71%	2.26%	2.47%	2.69%	2.54%	2.59%	2.48%	2.03%	2.59%	3.51%	3.52%
Inflation	1.11%	0.74%	0.64%	0.91%	0.86%	0.80%	0.66%	1.05%	0.67%	0.77%	0.53%	0.97%	0.85%	0.89%	0.38%	0.49%
wti	1.90%	4.10%	5.18%	7.76%	3.58%	6.12%	3.26%	2.07%	1.62%	1.43%	1.81%	3.06%	2.91%	1.76%	1.64%	3.84%
libor	0.13%	0.65%	0.85%	1.63%	0.73%	1.94%	0.67%	0.59%	0.28%	0.55%	0.75%	1.39%	1.87%	0.08%	0.30%	1.16%
fed	1.06%	0.71%	1.30%	0.45%	0.46%	2.22%	0.37%	0.75%	1.08%	0.43%	1.00%	0.81%	0.45%	1.08%	1.73%	3.54%

Table 9: Factor contribution for systemwide spill overs

Conclusion:

The study investigated into three important questions, firstly, whether the fluctuations in crude oil prices spill over to developed and developing oil exporting and importing countries; secondly, if the spill overs are establised what would be the system wide impact of such spill overs; finally we made a cross comparision between global and domestic factors that can influence sovereign credit risk of oil dependant countries and can play an important role as carriers of shock transmission from crude oil to sovereign risk. The study took 16 economically significant countries as sample and deployed GIRFs and GFEVDs methodology to establish the results. Encompassing monthly data for 12 years (2008-2019) for 16 countries and 4 domestic and 2 global variables along with 5 year sovereign CDS and crude oil makes the results complex and difficult to understand. Therefore, we created Network graphs to understand the complex system in a comprehensive manner for which GFEVD is used as underlying method. Our results indicated that crude oil price fluctuations impact sovereign risk of oil exporting countries higher which inturn can spill over to other countries and create gigantic complications in the system. On the other hand, oil importing countries are not behaving as per anticipation and their CDS is also declining but the percentage is lower than oil exporters. This highlights there are other factors that can pacify the impact of crude oil price flucatuations on sovereign risk of oil importers such as sovereign wealth funds or oil reserves etc. Another important finding of our study outlines that oil price fluctuations are exhorbitantly governing the sovereign markets of developed countries and these countries are receiving major shocks from developing countries like Russia and China as a part of the system. Oil prices although do not show much influence over developed nations directly, but indirect shocks are mammoth and developed nations are sorely impacted. Thirdly, we found global factors play a major role in carrying the shocks from crude oil to sovereign risk of a country. Federal rate is rousing amongst global factors and Inflation and stock market index are robust amongst domestic factors. Neverthless, a cross comparison between global and country specific factors highlights Crude and CDS is most important components transmitting highest shocks to all countries. Since CDS spreads is our proxy to sovereign risk, the only critical factor influencing other factors and sovereign risk is Crude oil and sovereign risk determines the move in other variables. An examination of how crude oil prices are impacting oil dependat countries is of value to regulators of major oil dependants as well as other connected countries to design their strategies for maintaining their energy security and international portfolio management. Additionally, a cross comparison of factors enables policymakers to understand the factors that need more weightage while framing the policies. Also, Banks and financial institutions are interested in the examination of critical factors that increases sovereign risk due to their holdings in sovereign bonds as a regulatory requirement. Government yields being a benchmark for corporate borrowings has an impact on the corporate borrowings as well, hence, our results can be of interest to them.

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Annexures:

	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	ADF*
AUSTRALIA	-0.0127	-0.0066	0.4520	-0.5108	0.1572	-0.1490	4.0432	0.0202	-8.5754
BRAZIL	-0.0020	-0.0064	1.0353	-0.3787	0.1682	1.6370	11.7628	0.0000	-6.0816
MEXICO	0.0001	-0.0165	0.7804	-0.4110	0.1575	1.0856	6.6741	0.0000	-6.6723
RUSSIA	-0.0046	-0.0153	0.8319	-0.4246	0.1842	1.0290	6.1844	0.0000	-6.1880
SOUTH AFRICA	-0.0015	0.0000	0.8774	-0.4133	0.1417	1.4030	12.0271	0.0000	-6.5924
ARGENTINA	0.0224	0.0000	1.8630	-1.7200	0.3168	0.8526	17.3510	0.0000	-8.3585
CHINA	0.0023	-0.0110	0.7517	-0.6394	0.1881	0.4419	5.3174	0.0000	-6.4374
FRANCE	-0.0029	-0.0268	0.8855	-0.5305	0.2096	0.7864	5.3155	0.0000	-6.0968
GERMANY	-0.0017	0.0000	1.0546	-0.7082	0.2240	0.7390	6.3875	0.0000	-6.2797
INDONESIA	-0.0165	-0.0250	0.5175	-0.4907	0.1582	0.0133	3.9649	0.0439	-9.2409
ITALY	0.0024	-0.0128	0.8254	-0.5116	0.2112	1.0877	6.2118	0.0000	-5.5341
JAPAN	-0.0048	-0.0149	1.0678	-0.5596	0.1932	1.3160	9.7610	0.0000	-6.1208
SOUTH KOREA	-0.0041	-0.0185	0.7472	-0.4507	0.1825	0.6755	4.8842	0.0000	-6.5643
TURKEY	-0.0021	0.0000	0.6057	-0.4491	0.1452	0.7593	5.7782	0.0000	-8.6428
UK	-0.0146	-0.0190	0.3734	-0.5817	0.1682	-0.2671	3.7252	0.0680	-8.3104
USA	0.0036	-0.0117	0.8873	-0.4733	0.1711	1.2970	8.6838	0.0000	-5.6969

Table 2A: Descriptive Statistics of logarithmic returns of 5-year sovereign CDS spreads
*Critical value for ADF is -3.45,

	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	ADF*
AUSTRALIA	0.0015	0.0054	0.0705	-0.1354	0.0388	-0.6800	3.3817	0.0020	-5.5378
BRAZIL	0.0045	0.0062	0.1567	-0.2850	0.0638	-0.5405	4.9087	0.0000	-6.0651
MEXICO	0.0030	0.0053	0.1095	-0.1967	0.0453	-0.6852	5.3428	0.0000	-4.8156
RUSSIA	0.0047	0.0123	0.1993	-0.3393	0.0696	-1.2241	8.2396	0.0000	-6.0230
SOUTH AFRICA	0.0048	0.0051	0.1210	-0.1614	0.0455	-0.2931	4.1173	0.0055	-7.7341
ARGENTINA	0.0208	0.0163	0.2455	-0.5359	0.1127	-1.1883	7.5686	0.0000	-9.3463
CHINA	-0.0010	0.0040	0.2296	-0.2991	0.0831	-0.7140	5.0284	0.0000	-7.8082
FRANCE	0.0012	0.0028	0.1183	-0.1452	0.0482	-0.4319	2.9864	0.1015	-6.3209
GERMANY	0.0044	0.0071	0.1550	-0.2131	0.0526	-0.6227	4.7902	0.0000	-6.5010
INDONESIA	0.0057	0.0114	0.1834	-0.3772	0.0578	-1.9767	15.6601	0.0000	-5.3390
ITALY	-0.0027	0.0050	0.1889	-0.1780	0.0636	-0.3028	3.1194	0.3003	-6.1745
JAPAN	0.0037	0.0120	0.1209	-0.2722	0.0578	-1.0374	5.6710	0.0000	-6.1761
SOUTH KOREA	0.0018	0.0061	0.1268	-0.2631	0.0488	-1.1590	8.6218	0.0000	-5.2434
TURKEY	0.0071	0.0074	0.2058	-0.2587	0.0734	-0.1851	3.3281	0.4311	-8.4729
UK	0.0015	0.0078	0.0811	-0.1395	0.0390	-0.5138	3.5527	0.0132	-4.7959
USA	0.0059	0.0118	0.1023	-0.1856	0.0434	-1.0125	5.2506	0.0000	-8.3367

Table 2B: Descriptive Statistics of logarithmic returns of Stock Market Index
*Critical value for ADF is -3.45

	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	ADF*
AUSTRALIA	-0.0634	0.1500	4.2300	-11.8300	2.1430	-1.2939	8.3225	0.0000	-7.1584
BRAZIL	-0.1072	-0.1200	6.8500	-12.3600	2.6844	-0.9020	5.6286	0.0000	-7.6328
MEXICO	-0.1350	0.0400	7.2300	-14.1600	2.4319	-1.2015	9.9229	0.0000	-9.1397
RUSSIA	-0.0637	0.4750	10.4800	-13.0400	3.0323	-0.8013	6.1587	0.0000	-8.1009
SOUTH AFRICA	-0.0806	0.2400	7.0800	-11.1400	2.5845	-0.6781	4.8061	0.0000	-8.8273
ARGENTINA	-0.3799	-0.1850	6.6000	-11.1300	2.6634	-1.1567	5.6907	0.0000	-7.4605
CHINA	0.2277	0.3000	4.2200	-3.6100	1.4963	-0.1135	2.7767	0.7711	-6.9138
FRANCE	-0.0800	-0.1350	2.2300	-2.3200	0.6931	0.0829	3.6626	0.1991	-8.1969
GERMANY	-0.0814	-0.0850	3.5500	-2.8000	0.8408	0.1258	5.2608	0.0000	-8.0683
INDONESIA	0.0485	0.1300	4.5400	-12.2400	1.8536	-2.2364	15.8511	0.0000	-8.8414
ITALY	-0.0699	-0.1000	2.4400	-1.8200	0.6960	0.1865	3.7513	0.0939	-8.4071
JAPAN	-0.0635	-0.1400	9.6300	-6.1300	2.1321	0.4162	5.8842	0.0000	-6.3096
SOUTH KOREA	-0.0900	0.1700	6.7900	-12.4500	2.1565	-1.4241	10.3993	0.0000	-5.7922
TURKEY	-0.2831	-0.1450	6.3700	-10.5200	2.4597	-0.4359	5.4188	0.0000	-6.5750
UK	-0.1005	0.0450	4.4400	-6.8000	1.8039	-0.8961	4.8651	0.0000	-7.9078
USA	0.1138	0.1150	5.7100	-3.1900	1.3230	0.5627	4.4460	0.0000	-7.8666

Table 2C: Descriptive Statistics of logarithmic returns of Real Effective Exchange Rate
*Critical value for ADF is -3.45

	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	ADF*
AUSTRALIA	-0.0129	-0.0067	0.2821	-0.3647	0.0828	-0.4672	6.0807	0.0000	-4.9245
BRAZIL	-0.0043	0.0000	0.1658	-0.1517	0.0459	0.0708	5.7472	0.0000	-8.0058
MEXICO	-0.0010	-0.0036	0.1994	-0.1389	0.0486	0.5840	5.0030	0.0000	-6.9370
RUSSIA	0.0000	-0.0068	0.2837	-0.1810	0.0665	1.0000	6.6523	0.0000	-8.1838
SOUTH AFRICA	0.0003	0.0000	0.1368	-0.1496	0.0420	-0.1709	5.3345	0.0000	-5.7163
ARGENTINA	0.0145	0.0003	0.7592	-0.4440	0.1377	1.7952	14.0917	0.0000	-9.2218
CHINA	-0.0024	-0.0085	0.1136	-0.1983	0.0445	-0.2516	5.5813	0.0000	-6.6415
FRANCE	-0.0193	-0.0300	3.2798	-1.0289	0.3742	4.5262	43.5391	0.0000	-6.9012
GERMANY	-0.0242	-0.0307	0.8412	-1.1173	0.2891	-0.1185	4.8212	0.0000	-8.8580
INDONESIA	-0.0028	-0.0033	0.2719	-0.2706	0.0674	0.2896	5.5815	0.0000	-8.1604
ITALY	-0.0106	-0.0145	0.4415	-0.4368	0.1199	0.0404	5.6487	0.0000	-8.1170
JAPAN	0.0007	-0.0227	2.7081	-2.9312	0.5669	0.3434	13.9223	0.0000	-7.2331
SOUTH KOREA	-0.0084	0.0000	0.2438	-0.6764	0.0863	-3.2471	27.4386	0.0000	-8.9157
TURKEY	0.0004	0.0000	0.3204	-0.1932	0.0718	0.5387	5.4654	0.0000	-8.2279
UK	-0.0151	-0.0110	0.5103	-0.4965	0.1364	-0.1373	5.0691	0.0000	-8.0069
USA	-0.0060	0.0058	0.2658	-0.3027	0.1018	-0.4177	3.9633	0.0052	-9.1082

Table 2D: Descriptive Statistics of 10-year Bond Yields
*Critical value for ADF is -3.45

INFLATION	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	ADF*
BRAZIL	4.4985	4.4860	4.8157	4.1545	0.2071	-0.0245	1.5774	0.0028	-1.7284
RUSSIA	4.4390	4.4144	4.7895	3.9557	0.2518	-0.1496	1.6666	0.0044	-1.6462
CHINA	4.5661	4.5841	4.7113	4.4262	0.0826	-0.2708	1.8569	0.0096	-2.0922
FRANCE	-0.2217	0.0812	1.2847	-3.5058	1.0999	-1.0398	3.2876	0.0000	-2.3192
GERMANY	4.5870	4.5949	4.6655	4.5094	0.0436	-0.0885	1.8862	0.0262	-3.0381
INDONESIA	4.5019	4.5183	4.7491	4.1848	0.1695	-0.1530	1.6348	0.0034	-1.0967
ITALY	4.7159	4.6691	4.9481	4.5992	0.1258	1.0296	2.2284	0.0000	-2.0594
JAPAN	4.5915	4.5981	4.6279	4.5612	0.0206	0.0695	1.5141	0.0015	-2.1167
SOUTH KOREA	4.5759	4.5915	4.6601	4.4282	0.0622	-0.6331	2.2754	0.0017	-2.0714
TURKEY	4.5146	4.4858	5.1302	4.0323	0.3032	0.3414	2.0767	0.0218	0.0813
UK	4.5775	4.5946	4.6868	4.4320	0.0695	-0.3223	2.0117	0.0176	-2.1194
USA	5.4512	5.4584	5.5547	5.3537	0.0562	-0.0360	1.9483	0.0423	-3.4164

Table 2E: Descriptive Statistics of logarithmic series of Inflation
*Critical value for ADF is -3.45

	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis	Jarque-Bera	ADF*
Crude Oil	-0.0040	0.0090	0.2602	-0.3948	0.0965	-0.6902	4.4702	0.0000	-6.6390
LIBOR	-0.7293	-1.2741	1.3677	-1.8938	1.0286	0.5972	1.7345	0.0001	-2.9941
FED RATE	0.6610	0.1800	3.2200	0.0400	0.8554	1.2652	3.1194	0.0000	-3.5651

Table 2F: Descriptive Statistics of Global Factors i.e. logarithmic returns of crude oil and Libor, Federal Rate
*Critical value for ADF is -3.45

	Australia	Brazil	Mexico	Russia	South Africa	Argentina	China	France	Germany	Indonesia	Italy	Japan	South Korea	Turkey	UK	USA	WTI
Australia	1																
Brazil	0.431	1															
Mexico	0.481	0.803	1														
Russia	0.356	0.612	0.711	1													
South Africa	0.439	0.826	0.765	0.687	1												
Argentina	0.167	0.477	0.395	0.453	0.503	1											
China	0.558	0.666	0.773	0.646	0.653	0.304	1										
France	0.323	0.433	0.531	0.484	0.461	0.191	0.485	1									
Germany	0.335	0.483	0.525	0.464	0.522	0.284	0.496	0.728	1								
Indonesia	0.580	0.709	0.633	0.520	0.732	0.395	0.632	0.303	0.358	1							
Italy	0.386	0.528	0.566	0.477	0.513	0.290	0.522	0.730	0.599	0.414	1						
Japan	0.367	0.505	0.488	0.431	0.504	0.319	0.399	0.359	0.373	0.421	0.373	1					
South Korea	0.595	0.674	0.768	0.696	0.674	0.394	0.853	0.534	0.487	0.631	0.557	0.472	1				
Turkey	0.381	0.739	0.589	0.590	0.737	0.441	0.522	0.384	0.435	0.632	0.489	0.387	0.533	1			
UK	0.477	0.213	0.287	0.290	0.284	0.075	0.342	0.463	0.489	0.303	0.475	0.199	0.367	0.269	1		
USA	0.204	0.290	0.311	0.281	0.385	0.219	0.153	0.457	0.473	0.257	0.376	0.288	0.216	0.279	0.350	1	
WTI	-0.276	-0.444	-0.484	-0.529	-0.437	-0.355	-0.327	-0.243	-0.260	-0.243	-0.262	-0.331	-0.339	-0.262	-0.157	-0.295	1

Table 2G: Correlation between Sovereign CDS and Crude Oil