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LINKAGES BETWEEN FINANCIAL CREDIT DEFAULT SWAP (CDS) SECTORS: A FOCUS ON EU-USA-UK MARKETS

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ABSTRACT

This study has examined the dynamic relationships between the United States (US) – Europe (EU) – United Kingdom (UK) five-year financial credit default swap (CDS) sector index spreads for the banking and insurance sector. The data used for this work comprised of the daily data on five-year CDS indexes from January 1, 2004 to February 2, 2015. This study has used 5-time varying copulas (Gaussian, Student, Gumbel, Frank and Symmetrical Gumbel) for data analysis. The data was split into two sub sample periods, which were before crisis and after crisis. The result of this work has shown that US insurance CDS was the most effected among the other regions, due to the direct relationship with the US bank CDS. Furthermore, the result has shown that the fall of the US market has contributed to the fall of the other global financial markets. In addition, results have shown that the linkage between sectorial CDS markets for US, UK and EU is connected and correlated.

INTRODUCTION

After its initiation in the mid-1990s, the credit default swap (CDS) market evolved as a major component of the capital markets that exhibited consistent increment in volumes, trailed by a fast flood in development in the run-up to the global financial crisis (GFC) of 2007-2009 [1]. CDS is expected to lead further market growth following the removal of current regulatory uncertainty Basle II [2]. Sovereign CDS are considered the most liquid derivatives in the emerging markets and therefor it's considered the focus of emerging markets [3].

The CDS is a basic subsidiary contract that has transformed the exchanging of credit risk. In its most straightforward structure, a CDS is utilized to exchange

the credit risk between a reference element, which may be sovereign or corporate [4]. In a standard CDS contract, one alliance buys credit insurance from another alliance, to cover the loss of the presumptive worth of a chattel following a credit occasion [5]. CDS permit credit dangers to be isolated from the fundamental credit relationship and to be exchanged independently. Moreover, CDS even accommodates more serious risk conveyance in those areas which could not function as an immediate loan creditor in credit tasks [6]. Thus, CDSs are the most important and widely used instruments in the credit derivatives market.

There are different types of main credit default swaps, these are: naked credit default swaps, basket default swaps, index credit default swaps and funded credit default swaps [7]. The benefits of using CDS are, it assists to complete markets, provide an effective mean to hedge, and trade credit risk [8]. CDS also exposes firms to significant risk of losses from a breakdown in markets and where the hedges do not work as intended due to either problems in the design of the hedge or counterparty risk [9]. Furthermore, CDS enables money related foundations to deal with their exposures and shareholder exploits advantage from an improved venture universe [10].

Several studies have been conducted in analyzing the relationship between CDS sectors. Tellalbaşı [11] studied the risk structural of European sovereign credit default swap before and after in European periphery counties, and found that there is a positive relationship between volatility index and CDS spreads. Lahiani et al. [12] examined the association between money related segment CDS spreads and macroeconomic impact, and found that the federal funds rate and the treasury bill rate have a symmetric effect on CDS index in the short and long term. Hilscher et al. [13] investigated the connection between value returns and CDS market and found that educated merchants are fundamentally dynamic in the equity market as opposed to the credit default swap (CDS) market. Arouri et al. [14] researched the dynamic connections between the US five-year budgetary CDS division list spreads for the banking and money related administrations, and found huge long-run balance interfaces between the CDS indicators. Tamakoshi et al. [15] analyzed the reliance structure of assurance sector CDS records between the US, EU, and UK, and found that rank relationship estimates expanded significantly during the monetary catastrophe period. Kallestrup et al. [16] studied the money related segment linkages and the elements of bank and sovereign credit spreads, and found that bank CDS spreads and sovereign CDS spreads are firmly impacted by bank overseas resource property. Thalassinos et al. [17] investigated the CDS spread that has been utilized as factor for the market valuing of sovereign default hazard, and found systemic changes in the arrangement of CDS spreads. Luo et al. [18] examined the execution of credit scoring models connected to CDS information sets, and found that deep belief networks (DBN) yield the best execution for credit scoring of CDS. D'Errico et al. [19] presented a system to analyze CDS sector as a framework of risk exchanges among investors, and found that bow-tie network architecture exhibited consistent CDS analysis. Arakelyan et al. [20] studied the connection among liquidity and CDS spreads, and found that commotion measures is a significant factor in clarifying the illiquidity of CDS spreads.

Recent financial and debt crises changed the perception of common linkages within financial sectors. Since the collapse of Lehman Brother in September 2008, the shocks increased and involved many countries such as US, UK and EU [21]. Several unusual effects were observed such as the spillover effects to emerge from US to other countries, and vice versa especially within the financial sectors [21]. In the light of these changes, it is important for financial economists, traders and regulators to understand which CDS sectorial market tends to incorporate credit risk related information more quickly. To achieve this, this study was done to analyze the connection between the US – EU – UK five-year financial CDS sector index spreads for the banking and insurance sector over the recent period that was affected by the global financial crisis.

METHODOLOGY

CDS spreads and systemic financial risks require dynamic copulas. Thus, in this work, time-varying (TV) copulas such as Gaussian, Student, Gumbel, Frank and Symmetrical Gumbel was used. In addition, conditional value at risk (CoVaR) was used to assess the systemic risk. This paper employs the modified version of CoVaR propose by Girardi et al. [22]. The purpose to compute CoVaR is to find the conditional probability distribution function. In terms of data, this work has used daily data on five-year CDS indexes for the US, Europe and United Kingdom and for two financial sectors (banking and life insurance), ranging from January 1, 2004 to February 2, 2015. The data was split into two sub sample periods, which was before and after the onset of the US financial crisis. The pre-crisis period ran from 1 January 2004 through 10 September 2008 and the post-crisis period from 11 September 2008 to 02 February 2015.

RESULT AND DISCUSSION

Descriptive Statistics

The return series are obtained by using the logarithmic differences of the CDS spread values expressed in percentage. Basic characteristics of the data is shown in Table 1. The Phillips-Perron (PP) unit root test and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) stationarity test for all sector CDS indexes was conducted. Based on Table 1, PP test with constant for unit root (fails to reject H0, there is a unit root for all series) and KPSS stationarity tests with constant and trend reject the null that the series are I (0) at 5% level except for US. All series present significant kurtosis and all the Jarque-Bera tests reject the normality. The ARCH LM test indicates the series are suitable for ARCH type modeling.

Table 1. Summary Statistic of CDS Index Spreads

Variable	EUBCDS	UKBCDS	EUICDS	UKICDS	USICDS	USBCDS
PP	-46.84	-51.43	-47.73	-48.7	-49.72	-48.72
KPSSct	0.1.65**	0.147**	0.153**	0.192**	0.077	0.079
Q12	130.251*	44.653*	63.886*	118.989*	133.248*	127.120*

Q12^2	895.618*	354.881*	12.522*	338.283*	50.955*	1068.233*
JB	42600.968*	17212.558*	591975.496	7425.632*	37056608.147*	116658.934*
ARCH	494.529*	184.487*	10.992*	176.961*	50.574*	614.193*

Unconditional Correlation

The Pearson correlation coefficients between CDS spread indexes for the two sub-periods are reported in Table 2. Based on Table 2, the lower triangular matrix reports the correlation coefficient in the pre-onset period and the upper triangular matrix shows the correlation coefficient in the post-onset period. Thus, based on Table 2, the CDS indexes of the banking and insurance sectors within the same country show higher positive correlation. These coefficients remain higher after the onset of the financial crisis, except for the US.

Table 2. Unconditional Correlation Results.

	EUBCDS	UKBCDS	EUICDS	UKICDS	USICDS	USBCDS
EUBCDS	1.000	0.656	0.655	0.576	0.148	0.292
UKBCDS	0.587	1.000	0.603	0.616	0.187	0.354
EUICDS	0.688	0.444	1.000	0.687	0.189	0.295
UKICDS	0.528	0.374	0.667	1.000	0.180	0.235
USICDS	0.452	0.324	0.418	0.387	1000	0.193
USBCDS	0.358	0.288	0.334	0.281	0.528	1000

Estimation of Copula Parameters

Table 3 presents the estimates for copula models in the period before crisis onset for bank and insurance CDS vs. USBCDS. In the period before the crisis Table 3, the TVP-Student parameter gave the best estimate for (EUBCDS, UKBCS, and USICDS). The EUICDS best estimate was in the TVP-Gaussian parameter while the UKICDS best estimate was in the TVP-Frank parameter.

Table 3. Parameters Estimates of The TV Copulas for Period Before Crisis.

	EUBCDS	UKBCDS	EUICDS	UKICDS	USICDS
TVP-Gaussian Ψ_0	-	-	-	-	-
Ψ_1	-1.133	-0.717	-1.178	-1.155	-0.909
Ψ_2	0.389	0.107	0.337	0.423	0.927
AIC	-90.600	-63.130	-100.390	-61.143	-272.681
TVP-Student Ψ_0	0.672	0.158	0.709	0.189	0.577
Ψ_1	-0.813	1.265	-0.782	1.094	0.174
Ψ_2	0.270	0.089	0.265	0.119	0.541
N	8.883	13.696	12.765	8.397	7.644
AIC	-99.556	-70.356	-97.906	-69.040	-290.316
TVP-Gumbel $\bar{\omega}$	-0.896	-1.633	-0.779	-2.810	-0.153
$\bar{\beta}$	0.294	-0.022	0.374	-0.698	0.465
$\bar{\alpha}$	-0.114	-1.189	-0.915	-1.280	-1.499

AIC	-86.573	-54.016	-89.973	-56.463	-267.295
TVP-Frank $\bar{\omega}$	0.310	0.104	0.655	0.826	1.411
$\bar{\beta}$	0.349	0.904	-0.129	-0.329	-0.270
$\bar{\alpha}$	-0.246	-0.255	-0.703	-1.349	-2.619
AIC	52.106	294.794	164.259	-79.392	110.979
TVP-Joe $\bar{\omega}$	-1.878	0.035	-1.441	-3.395	0.012
$\bar{\beta}$	-0.725	0.863	-0.060	-0.911	0.802
$\bar{\alpha}$	-6.563	-1.615	-2.616	-3.143	-1.124
AIC	-66.262	-37.649	-65.321	-40.563	-223.986
TVP- S. Gumbel $\bar{\omega}$	-2.024	-0.796	-0.983	-0.326	0.731
$\bar{\beta}$	-0.843	0.471	-0.890	-0.186	-0.623
$\bar{\alpha}$	-3.563	-0.660	-8.383	-7.270	-9.978
AIC	-86.157	-59.698	-81.945	-59.597	-252.560

Table 4 shows the estimates for copula models in the period after crisis onset, for bank and insurance CDS vs. USBCDS. Thus, based on Table 4, in the period after the crisis, all CDS in both sectors were estimated the best in TVP-Student copula.

Table 4. Parameters Estimates of The TV Copulas for Period After Crisis.

	EUBCDS	UKBCDS	EUICDS	UKICDS	USICDS
TVP-Gaussian Ψ_0	2.532	2.404	1.869	1.841	1.787
Ψ_1	-2.730	-2.613	-2.007	-2.260	-1.921
Ψ_2	0.108	0.135	0.606	0.226	0.752
AIC	-500.039	-467.722	-492.904	-337.442	-533.659
TVP-Student Ψ_0	0.230	0.600	0.273	0.295	0.325
Ψ_1	1.714	0.983	1.615	1.447	1.494
Ψ_2	0.060	0.072	0.127	0.054	0.155
N	7.079	6.319	8.291	6.810	5.756
AIC	-554.563	-520.361	-545.659	-380.339	-614.199
TVP-Gumbel $\bar{\omega}$	-0.207	-0.173	0.051	-0.002	0.334
$\bar{\beta}$	-0.082	0.100	0.024	-0.247	-0.157
$\bar{\alpha}$	-2.483	-2.233	-3.305	-5.195	-5.084
AIC	-495.655	-455.245	-493.779	-340.283	-581.417
TVP-Frank $\bar{\omega}$	1.814	0.966	1.229	0.099	0.446
$\bar{\beta}$	-0.850	0.074	-0.947	0.702	0.693
$\bar{\alpha}$	-1.593	-1.256	0.641	0.317	-0.924
AIC	-541.920	-333.326	-411.689	-318.818	-532.082

TVP-Joe $\bar{\omega}$	-0.528	-0.387	-0.244	-0.414	0.382
$\bar{\beta}$	0.007	0.074	-0.065	-0.165	-0.269
$\bar{\alpha}$	-2.227	-2.867	-3.948	-4.747	-7.789
AIC	-384.121	-339.242	-382.776	-255.419	-455.764
TVP- S. Gumbel $\bar{\omega}$	-0.300	0.077	0.152	-0.209	1.123
$\bar{\beta}$	0.004	0.127	-0.210	-0.150	-0.671
$\bar{\alpha}$	-1.561	-3.095	-4.515	-3.736	-10.323
AIC	-487.202	-481.871	-476.914	-332.381	-585.830

Interactions Between Sectorial Financial Cds Markets

In this section, the linkages between sectorial CDS markets are presented. Figure 1 illustrates the effects of collapse of US banking market on all other markets (banking and insurance). Based on Figure 1, it is observed that the burden effect on UK sectorial markets and the EU insurance market. For the linkage between US banking and insurance, the nature of the impact before and after the financial crisis remained unstable given the strong relationship between two sectors. The collapse of US banking sector was transferred to Europe market, rather than US market.

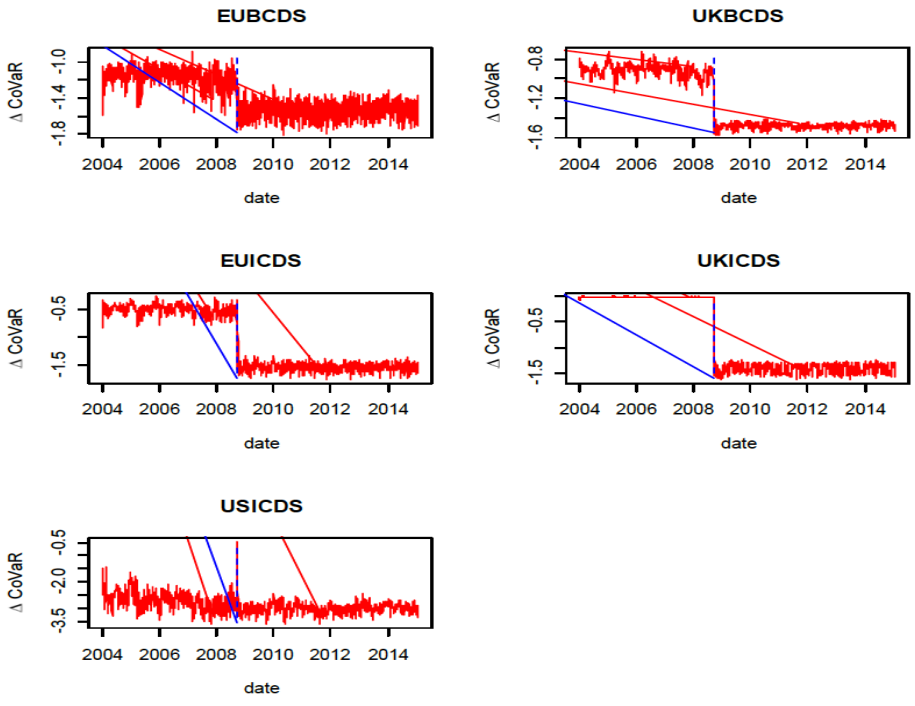

Figure 1. Delta Covar For UK, USA And EU CDS Markets.

To provide further understanding these linkages, the following Table 5 and Table 6 summarized the ranking of these markets before and after the financial crisis based on the estimation of Copula-CoVaR model. Based on Table 5 and

Table 6, it is noted that from the ranking of estimated copula-based delta CoVaR, that there is direct relation between all financial markets. In addition, it is also observed that that USICDS was the worst one of them all due to the direct relationship with the US banks, which was the first and the most affected by the global financial crisis. Because of the strong relationship that binds the global financial markets to each other, the fall of the US market has contributed to the fall of the other global financial markets, where EUBCDS came in the second place, followed by UKBCDS, EUICDS and UKICDS, respectively. Based on Table 5 and Table 6, the ranking is the same in both pre and post crisis except in the UKBCDS and EUICDS.

Table 5. Statistics Summary of Estimated Copula-Based Delta Covar Before Crisis Onset

	EUBCDS	UKBCDS	EUICDS	UKICDS	USICDS
Mean	-1.169	-0.916	-0.516	-0.012	-2.695
Std	0.105	0.068	0.087	0.003	0.348
Max	-0.886	-0.720	-0.283	-0.001	-1.447
Min	-1.590	-1.176	-0.833	-0.068	-3.596
Rank	2	3	4	5	1

Table 6. Statistics Summary of Estimated Copula-Based Delta Covar After Crisis Onset

		EUBCDS	UKBCDS	EUICDS	UKICDS	USICDS
Mean		-1.537	-1.486	-1.536	-1.419	-3.021
Std		0.092	0.032	0.103	0.090	0.234
Max		-1.176	-1.169	-0.352	-0.951	-0.450
Min		-1.806	1.575	-1.758	-1.634	-3.637
Rank		2	3	4	5	1

OVERALL DISCUSSION

Based on the analysis done, it was observed that that both sectors (banking and insurance) were affected by the global financial crisis in all the markets (US – EU – UK). The results have shown that the most affected sector by the global financial crisis is the US insurance sector. The collapse that happened in the insurance sector in the US market led to the collapse of the rest of the financial market eventually. This outcome was agreed by the work of Cummins et al. [23] where it was stated that the collapse of US insurance and banking sector during the financial crisis period has affected the neighboring financial market as well which were EU and UK.

The finding of this work has also shown that the linkage between sectorial CDS markets for US, UK and EU correlated as all of these markets are tied together. Kiviaho et al. [24] has also confirmed that the CDS sectorial markets of US, EU and UK are correlated and the outcome or trend of one market may affect the other markets as well. Furthermore, the outcome of this work has shown that both sectors (insurance, banking) are related to each other. Work of Chen et al. [25] has also stated that there is relation between banking and insurance sector, and it is consistent with the finding of this current work. The

change that happened in US CDS market affected the EU CDS market. Due to the strong relationship that binds the global financial markets to each other, the fall of the US market led to the fall of the rest of the global financial markets, respectively.

In addition, the work of Black et al. [26] has confirmed that both of these sectors (insurance, banking) affect the economic health of the countries. Black et al[26] has stated that the recent significant changes in financial systems and countries' economies in general make the relationship between banking CDS and insurance CDS to exhibit diversity.

CONCLUSION

This work has investigated the association between the US – EU – UK five-year financial CDS sector index spreads for the banking and insurance sector that was marked with the incepted global financial crisis. The key findings of this work have shown that the US insurance sector was the most effected sector by the global financial crisis. Furthermore, the finding of this work showed that the collapse of US market has caused the collective collapse of UK and EU's financial market. On the other hand, this work has found that the sectorial CDS markets for US, UK and EU is linked and correlated. For future work, the authors recommend to analyze the CDS sector from the Islamic finance point of view.

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