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The influence of sovereign credit ratings on sovereign credit default swaps: do splits matter?

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Abstract

This paper compares the influence of sovereign credit ratings (SCRs) issue by three credit rating agencies (CRAs) on sovereign credit default swaps (SCDSs) that is adopted as a proxy for debt pricing. The sample covers quarterly observations from 2008 to 2020 for 32 countries that were graded by all the three CRAs. The generalized methods of moment based on forward orthogonal deviation transformation is used for estimation. During the period 2008-2011 when a divergence in the SCRs issued by the three CRAs was apparent, the SCRs were relevant for pricing of the SCDSs. The influence of the SCRs issued by Fitch and the combination of Fitch and Moody's on SCDSs is the largest. This indicates a market preference for the SCRs issued by specific CRAs and the splits in creditworthiness opinions matter for debt pricing. On the contrary, when such splits are almost negligible in the period 2012-2020, the convergence in the SCRs issued by the different CRAs did not have the expected influence on SCDSs. This calls for further investigation into the influence of non-sovereign risk factors on debt pricing.

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1. Introduction

The three leading credit rating agencies (CRAs), Moody's, S&P, and Fitch, have a combined 99% market share on sovereign credit ratings (SCRs).[1] It is common for a rated country to seek a second or even a third opinion on its creditworthiness from different CRAs. It is also common for multi-rated countries to be assigned with varying SCR notches, commonly known as split-SCRs, from competing CRAs. For instance, the sample of 48 countries employed by Cantor and Packer (1996) contained 48% split-SCRs. The sample of 97 countries in the study of Alsakka and Gwilym (2010) also comprised split-SCRs at 51% between Moody's and S&P, 47% between Moody's and Fitch, and 36% between S&P and Fitch. Based on the 2019 list of countries rated by these three CRAs,[2] 65% were rated by all 3 CRAs. Among the 103 multi-rated countries, 55 or 53% of them were rated with one SCR notch difference and 14 were rated with at least a difference of two SCR notches. These clearly indicate that split-SCRs is a going concern.

The dilemma of split-SCRs on rated countries is equivalent to countries having multiple creditworthiness profiles. This causes confusion between rated countries and institutional investors on the cost of borrowing and the expected yield. When split-SCRs fall in between the investment grade and speculative grade categories, the effect of the dilemma amplifies. This is because the speculative-grade rated debts do not have the same level of access to funds as compared to investment grade rated debts.

In response to split-SCRs, earlier studies such as the works of Alsakka and Gwilym (2010a, 2010b) focused on split-SCRs amongst the three leading CRAs as the lead and lag indicators on SCRs upgrades and downgrades. Chen et al. (2016) studied the effect of split-SCRs on rated countries' economic growth and reported that split-SCRs demonstrated competing effects. Chen et al. (2016) examined the spillover effect from rated countries that experienced SCRs upgrade or downgrade on other rated countries. The researchers reported that the upgrade and downgrade events would lead to downward revision on economic growth forecast on non-event rated countries. Specific to the cost of borrowing and the expected yield, earlier studies adopted the average approach to represent split-SCRs. The ordinal scaled SCRs from respective CRAs were combined as one, and the average value was used (Badaoui, Carthart, and El-Jahel 2013, Cantor and Packer 1996, Reusens and Croux 2017, Rowland 2004). These researchers tend to assume that the financial market treats the SCRs issued by the three CRAs equally.

The equality assumption may be far from the truth, especially in the context of debt pricing. The implication of split-SCRs on debt pricing has not been explicitly examined. This empirical paper is set to address this research gap. The empirical outcomes reveal that the SCRs issued by the three CRAs have different influences on debt pricing. The implication is that the financial market does not rely on SCRs from one specific CRA nor the SCRs issued by the three CRAs were given emphasis in debt pricing.

[1] https://www.sec.gov/files/2018-annual-report-on-nrsros.pdf

[2] https://www.moodys.com reported on August 21st 2020, http://www.capitaliq.com reported on July 2nd 2019, and https://www.fitchratings.com as at August 22nd 2020.

The organization of this paper is as follows. In Section 2, information on data and methodology are provided. The empirical results are discussed in Section 3, followed by the conclusion in Section 4.

2. Data & Methodology

In accordance with Hull and White (2000), SCRs as a key proxy for the credit risk component accounted for 56% of the variation in the spreads of sovereign credit default swaps (SCDSs), while the remaining proportion was accounted for by the non-credit risk component. The structural model of SCDSs advocated by Hull and White has been the reference model for many studies on the subject (Badaoui, Carthart, and El-Jahel 2013, Beber, Brandt, and Kavajecz 2009, Culp, Merwe, and Starkle 2016, Longstaff et al. 2011). Moreover, the effect of SCRs upgrade and downgrade on the spreads of SCDSs is also reasonably established (Afonso, Furceri, and Gomes 2012, Blau and Roseman 2014, Ismailescu and Phillips 2015). This means the SCDSs are well suited for studying the informational value of split-SCRs for debt pricing. The preferred SCDSs are of 5-year maturity as they have higher liquidity among this class of derivatives with other maturities.

The SCRs issued by Moody's, S&P, and Fitch are the key focus of the study. Only countries rated by all these three CRAs and the ratings within the investment-grade category (e.g., Aaa/AAA to Baa3/BBB-) are selected. The purpose of these selection criteria is to ensure the SCRs issued by the three CRAs are comparable on the same set of countries, and investment-grade rated countries have relatively the same level of access to funding. In addition, the selected countries must have data on SCDSs with 5-year maturity. The sample countries are listed in Table 1.

Table 1: List of Selected Countries

Australia	Finland	Lithuania	Slovenia
Austria	France	Malaysia	South Korea
Belgium	Germany	Mexico	Spain
Bulgaria	HK	Netherlands	Sweden
Chile	Ireland	Norway	Switzerland
China	Israel	New Zealand	Thailand
Czech	Italy	Poland	United Kingdoms
Denmark	Japan	Slovakia	United States

Table 2: SCRs Fine Ordinal Scale Convention

Moody's SCRs	**S&P SCRs**	**Fitch SCRs**	**Fine Ordinal Scale**
Aaa	AAA	AAA	10
Aa1	AA+	AA+	9
Aa2	AA	AA	8
Aa3	AA-	AA-	7
A1	A+	A+	6
A2	A	A	5
A3	A-	A-	4
Baa1	BBB+	BBB+	3
Baa2	BBB	BBB	2
Baa3	BBB-	BBB-	1

Note: SCR notches by the respective CRAs are sourced from Bloomberg. Since the sample only focused on investment-grade rated countries, the fine ordinal scales for speculative-grade rated countries are excluded.

The SCRs from the selected countries are first converted into ordinal scale following the convention adopted in earlier studies (Afonso, Gomes, and Rother 2011, Bissondoyal-Bheenick 2005, Cantor and Packer 1996, Canuto, Santos, and Porto 2012, Hill, Brooks, and Faff 2010, Mellios and Paget-Blanc 2006, Reusens and Croux 2017). The scales are described in Table 2. The ordinal scaled SCRs are analysed individually by the CRAs that issued them, as well as in combination for each possible pair of CRAs and all the three CRAs using the average. The vectors of SCRs and combined SCRs are summarized in Table 3. The data points are gathered from Q1 2008 to Q2 2020. Table 4 contains the descriptive statistics of the sample.

Table 3: Vector of SCRs

Tagging	SCRs	Description
SCR1	Moody's SCRs	Alpha-numeric SCRs issued by Moody's in the form of fine ordinal scale
SCR2	S&P SCRs	Alpha-symbol SCRs issued by S&P in the form of fine ordinal scale
SCR3	Fitch SCRs	Alpha-symbol SCRs issued by Fitch in the form of fine ordinal scale
SCR4	Moody's and S&P SCRs	Average of fine ordinal scaled SCRs issued by Moody's and S&P
SCR5	Moody's and Fitch SCRs	Average of fine ordinal scaled SCRs issued by Moody's and Fitch
SCR6	S&P and Fitch SCRs	Average of fine ordinal scaled SCRs issued by S&P and Fitch
SCR7	Average SCRs	Average of fine ordinal scaled SCRs issued by Moody's, S&P and Fitch

Note: Refer to Table 2 on the convention regarding the SCRs ordinal scale transformation on both alpha-numeric and alpha-symbol SCRs.

Table 4: Descriptive Statistics

	SCDSs	Log SCDSs	SCR1	SCR2	SCR3	SCR4	SCR5	SCR6	SCR7
Mean	83.17	4.05	7.00	7.01	6.90	7.01	6.95	6.95	6.97
Median	57.85	4.06	7.00	8.00	7.00	7.50	7.50	7.50	7.67
Max.	753.95	6.63	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Min.	7.00	1.95	1.00	1.00	1.00	1.00	1.00	1.00	1.33
Std. Dev.	84.79	0.86	2.93	2.79	2.84	2.82	2.86	2.80	2.82
Skewness	3.07	0.08	-0.50	-0.50	-0.38	-0.47	-0.42	-0.43	-0.44
Kurtosis	16.88	2.66	1.90	1.98	1.81	1.86	1.79	1.87	1.82
Obs.	1572	1572	1572	1572	1572	1572	1572	1572	1572

Note: The observations are for the 32 countries listed in Table 1 spanning Q1 2008 to Q2 2020. The data are predominantly sourced from Bloomberg, and Thomson Reuters is used as the backup source. For the description of SCR1 to SCR7, refer to Table 3. Max=Maximum, Std. Dev = Standard deviation, Avg. SCRs = Average SCRs, and Obs. = Number of observations.

A dynamic model is adopted to examine if SCRs have any informational value in the pricing of SCDSs. The regression is expressed below:

$$logSCDSs_{it} = \mu + \beta_1 SCRs_{it} + \beta_2 logSCDSs_{i,t-1} + +v_{it} \tag{1}$$

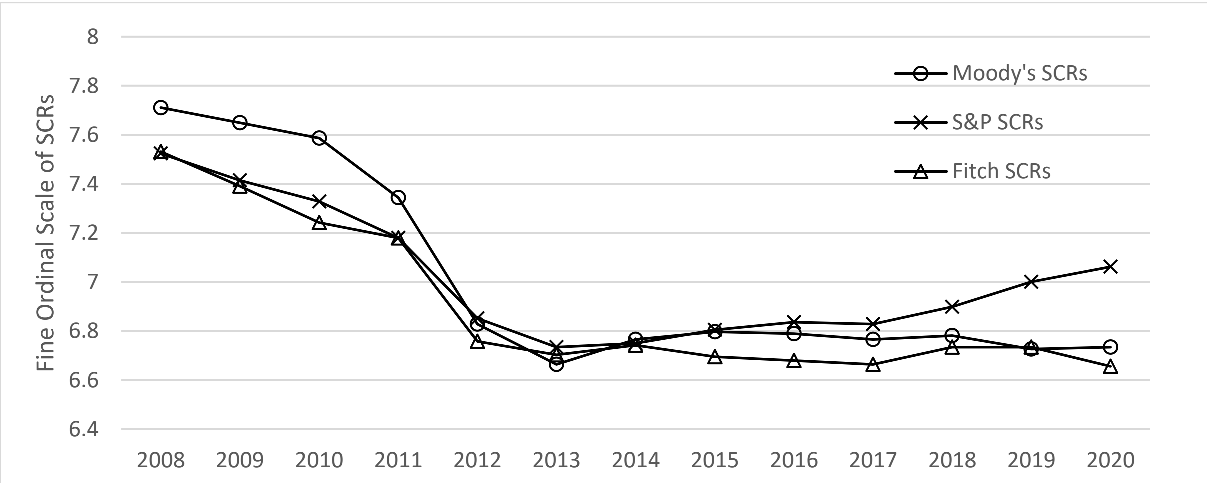
where $SCDSs_{it}$ is the sovereign credit default swap rate of country i at time t expressed in a log to reduce potential heteroscedasticity, SCR_{it} is the SCRs of country i at time t as defined in Table 3, and v_{it} denotes the composite error term. The dynamic model has the advantage of including the lagged term $SCDSs_{i,t-1}$, which is commonly used as a proxy of non-credit risk component (Aizenman, Chinn, and Hutchison 2009, Aizenman, Hutchison, and Jinjarak 2013, Dieckman and Plank 2012, Eyssell, Fung, and Zhang 2013, Longstaff et al. 2011).

The generalized methods of moment (GMM) based on the forward orthogonal deviation (FOD) transformation of Arellano and Bover (1995) is adopted to estimate equation (1) to address the heterogeneous individual effects of sample countries and any possible endogeneity issue in equation (1). The FOD-GMM estimators have desirable statistical properties especially if the sample is unbalanced (Arellano and Bover 1995, Hayakawa 2009, Hsiao and Zhou 2017), and is particularly suitable for the sample in this study that has some missing observations.

3. Empirical Findings

Equation (1) is estimated using FOD-GMM for the full dataset with observations from Q1 2008 to Q2 2020. Further, a sub-sample analysis is conducted, where sub-period 1 spans from Q1 2008 to Q4 2011, and sub-period 2 includes observations from Q1 2012 to Q2 2020. The rationale of splitting the full dataset into two sub-periods with the cut-off point of 2012 is motivated by the divergence and convergence of the mean SCRs for the 32 countries amongst the three CRAs as depicted in Figure 1. The means SRCs displayed divergence among the three CRAs before 2012, and the gap narrowed after that before increasing again in recent years.

Figure 1: Mean SCRs by CRAs



Note: The mean SCR notch computed for each of the CRAs is the mean of the SCR ordinal scales for the 32 selected countries listed in Table 1. The SCRs are defined according to a fine ordinal scale following the common convention (see Table 2).

The empirical results for the full sample (Table 5) show that the SCRs issued by all three CRAs are irrelevant in explaining SCDSs. Although the estimated coefficients of SCR1 to SCR3 in Panels A, B and C are all significant at a 1% level, the positive sign has rendered the SCRs irrelevant for SCDSs pricing. With an increase in SCRs that signifies creditworthiness improvement, the SCDSs are expected to decrease because of a lower credit default risk premium. Therefore, a negative sign is expected on the estimated coefficient of SCRs. The estimates from Panel D to G for SCR4 to SCR7 also show the same outcome on paired SCRs being rendered irrelevant. A noteworthy finding is that the lag term of SCDSs, the proxy for non-credit risks, remains significant consistently.

Table 5: FOD-GMM Estimates – Full Sample (Q1 2008 to Q2 2020)

	Panel A	Panel B	Panel C	Panel D	Panel E	Panel F	Panel G
Dependent Variable:	$log(SCDSs_t)$						
Instrumental Variable:	$log(SCDSs_{t-2})$						
$log(SCDSs_{t-1})$	0.849***	0.856***	0.849***	0.852***	0.848***	0.853***	0.851***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
SCR1	0.063***						
	(0.002)						
SCR2		0.057***					
		(0.004)					
SCR3			0.068***				
			(0.004)				
SCR4				0.068***			
				(0.003)			
SCR5					0.070***		
					(0.003)		
SCR6						0.068***	
						(0.004)	
SCR7							0.071***
							(0.003)
SSR	145.220	144.510	144.715	144.924	145.071	144.652	144.902
Instrument Rank	32	32	32	32	32	33	32
J-Stat	31.967	31.833	31.913	31.980	31.953	43.970	31.961
J-Stat (p-value)	0.369	0.375	0.372	0.368	0.370	0.061	0.369

Note: SSR = sum squared residuals and J-Stat = J statistic. The J-Stat and its p-value are to determine the status of identification in accordance with Sargan statistics. For SCR1 to SCR7 description, refer to Table 3. Figures in parentheses are standard errors. ***, **, * indicate significance at 1 percent, 5 percent and 10 percent level, respectively.

Interesting results were found when the full sample is split into two sub-periods. The estimates for sub-period 1 are reported in Table 6. The results show that the SCRs issued by all three CRAs and all paired SCRs are significant at 1% and the coefficients have the expected negative sign. The empirical results highlighted that the SCRs issued by Fitch (SCR3) had the highest influence on the spreads at -34.2%, and the SCRs issued by S&P (SCR2) had the least influence amongst the three CRAs. The pair of SCRs issued by Moody's and Fitch (SCR5) had the highest influence on spreads at -38.6% compared to the averages of other paired SCRs and the average of all three SCRs.

The estimates from sub-period 2 are compiled in Table 7. The estimates show that the SCRs by CRAs and all paired SCRs are significant at 1% level but the coefficients do not have the expected sign.

These results suggest that while the SCRs had been relevant for SCDSs pricing in sub-period 1, they were disregarded on SCDSs price discovery since 2012. A possible reason that rendered the SCRs issued by all three CRAs irrelevant from 2012 onwards could be deduced from Figure 2. The mean SCDSs of the 32 countries had reached the peak in 2011 at 160 basis points (bps) from 80 bps in 2008 to account for the additional default risk as indicated by the drop in the mean SCRs by the respective CRAs from 2008 to 2012. From 2012 onwards, the mean spreads were contracting from 160 bps in 2011 to 38.3 bps in 2019 while the risk of default increased in 2012 compared to 2011 and hovered around the same level after that, despite a larger split in SCRs in recent years.

Table 6: FOD-GMM Estimates – Sub-Period 1 (Q1 2008 to Q4 2011)

	Panel A	Panel B	Panel C	Panel D	Panel E	Panel F	Panel G
Dependent Variable:	$log(SCDSs_t)$						
Instrumental Variable:	$log(SCDSs_{t-2})$						
$log(SCDSs_{t-1})$	0.549***	0.581***	0.558***	0.556***	0.538***	0.563***	0.548***
	(0.002)	(0.001)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)
SCR1	-0.254***						
	(0.016)						
SCR2		-0.139***					
		(0.009)					
SCR3			-0.342***				
			(0.026)				
SCR4				-0.256***			
				(0.014)			
SCR5					-0.386***		
					(0.031)		
SCR6						-0.281***	
						(0.017)	
SCR7							-0.337***
							(0.022)
SSR	80.058	72.196	81.831	76.667	88.1	76.667	81.228
Instrument Rank	32	32	32	32	32	32	32
J-Stat	31.946	31.95	31.869	31.895	31.924	31.886	31.864
J-Stat (p-value)	0.37	0.37	0.374	0.372	0.371	0.373	0.374

Note: SSR = sum squared residuals and J-Stat = J statistic. The J-Stat and its p-value are to determine the status of identification in accordance with Sargan statistics. For SCR1 to SCR7 description, refer to Table 3. Figures in parentheses are standard errors. ***, **, * indicate significance at 1 percent, 5 percent and 10 percent level, respectively.

Further investigation reveals that the pricing of SCDCs did not always observe the ranking of default risk conveyed by the SCRs. The anomalies are depicted in Figure 3 that shows the mean SCDSs by the different notches of SCRs. In some instances, the countries with ratings of A2/A had higher mean SCDSs than the countries rated with lower credit quality (i.e., A3/A-, Baa1/BBB+, etc.). This contradicted the risk pricing convention and the problem is more serious in the second sub-period. This is shown in Figure 4, where the information conveyed by SCRs for pricing of SCDSs became weaker in sub-period 2 compared to sub-period 1. Although the risk ranking discipline in SCDSs pricing appeared to regain traction from 2017, it was not sufficient to overturn the irrelevance of SCRs for SCDSs pricing in the second sub-period.

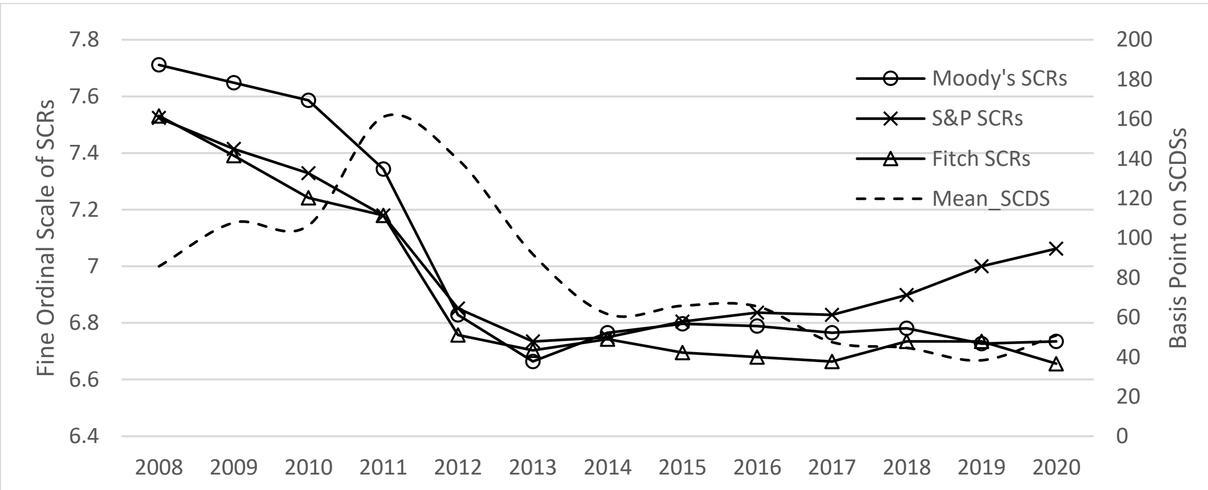
The empirical findings from Lim and Kwek (2021) reported that SCRs may not be relevant in the pricing of sovereign bond yields, the reference entity of SCDSs. The most likely factors leading to SCRs being disregarded in the pricing of SCDSs would be the zero bound policy rate (ZBPR) and quantitative easing programme (QEP). These were policies actively pursued by some developed countries and had large global impacts. When the cost of borrowing is offered at a cheap rate due to ZBPR, and the world financial markets have abundant liquidity injected through QEP, additional capacity for new debts became easily available and matured debts could be refinanced with little or no constraint. The joint effect of ZBPR and QEP is also reported by Kinateder and Wagner (2017) and Malliaropulos and Migiakis (2018). Under such a credit conducive environment, the probability of default for SCDSs diminishes. This causes the creditworthiness conveyed by SCRs to become negligible.

Table 7: FOD-GMM Estimates – Sub-Period 2 (Q1 2012 to Q2 2020)

	Panel A	**Panel B**	**Panel C**	**Panel D**	**Panel E**	**Panel G**
Dependent Variable:		*log*(*SCDSs$_t$*)				
Instrumental Variable:		*log*(*SCDSs$_{t\text{-}2}$*)				
log(*SCDSs$_{t\text{-}1}$*)	0.854***	0.857***	0.854***	0.855***	0.853***	0.855***
	(0.000)	(0.004)	(0.003)	(0.002)	(0.001)	(0.002)
SCR1	0.028***					
	(0.002)					
SCR2		0.013***				
		(0.005)				
SCR3			0.027***			
			(0.003)			
SCR4				0.023***		
				(0.004)		
SCR5					0.031***	
					(0.002)	
SCR7						0.026***
						(0.003)
SSR	55.292	55.447	55.416	55.385	55.340	55.386
Instrument Rank	32	32	32	32	33	32
J-Stat	31.955	31.558	31.808	31.930	33.407	31.940
J-Stat (p-value)	0.370	0.388	0.377	0.371	0.351	0.370

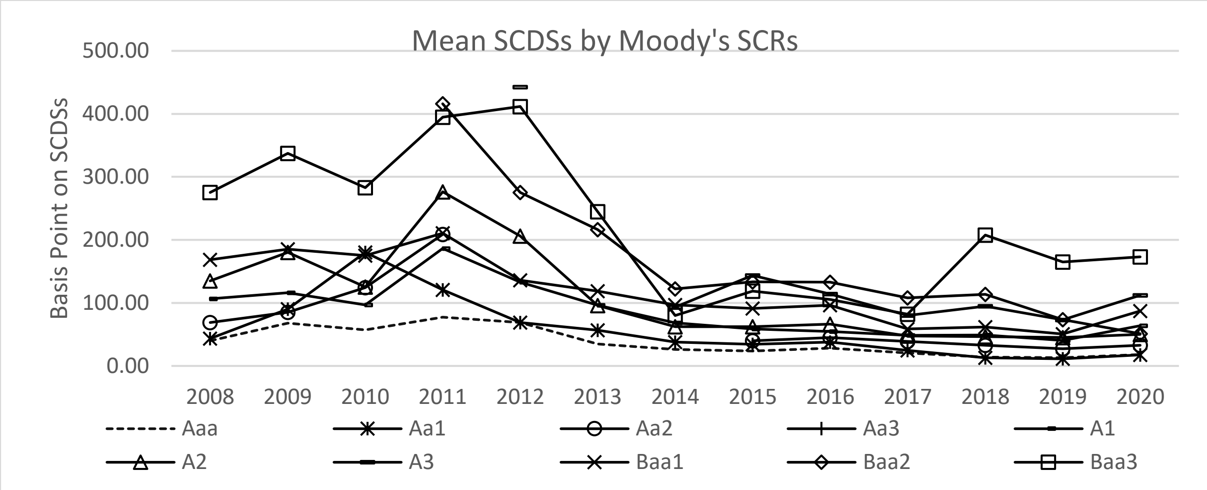
Note: Total number of observations is 1088. SSR = sum squared residuals and J-Stat = J statistic. The J-Stat and its p-value are to determine the status of identification in accordance with Sargan statistics. For SCR1 to SCR7 description, refer to Table 3. Figures in parentheses are standard errors. ***, **, * indicate significance at 1 percent, 5 percent and 10 percent level, respectively. The regression could not be estimated for the pairing of S&P's SCRs and Fitch's SCRs (SCR6) which led to singularity.

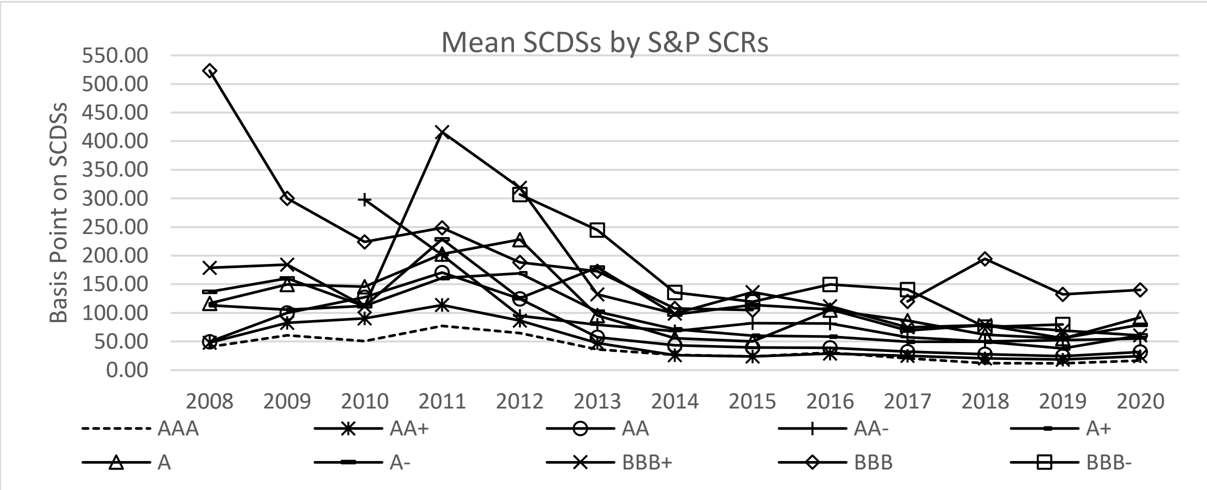
Figure 2: Mean SCRs by CRAs Versus Mean SCDSs

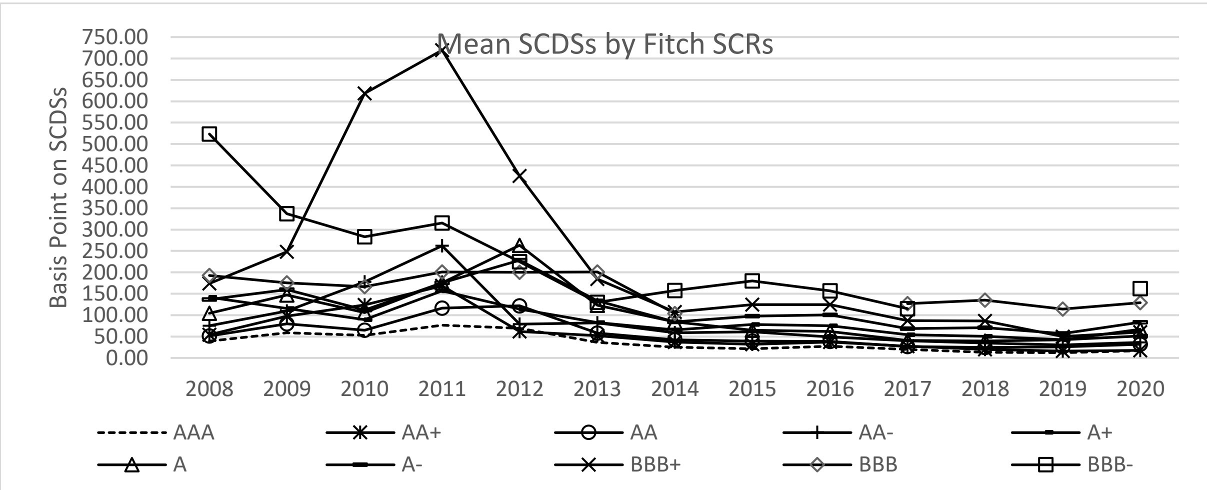


Note: The mean SCR notch is the mean computed from the SCRs of the 32 selected countries listed in Table 1 for each of the CRAs. The SCRs are defined according to a fine ordinal scale following the common convention (see Table 2). The mean SCDSs is the mean computed from the SCDSs of the 32 selected countries.

Figure 3: Mean SCDSs by SCRs of respective CRAs

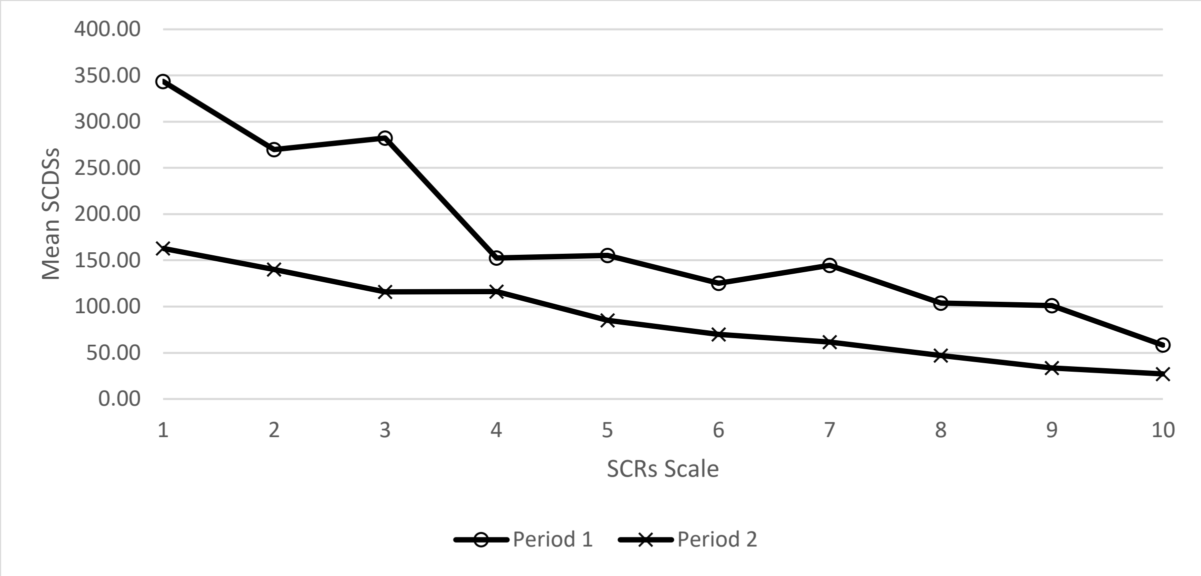






Note: The mean SCDSs is the mean computed from the SCDSs of the countries listed in Table 1 by their SCRs issued by the individual CRAs. The SCRs are defined according to a fine ordinal scale following the common convention (see Table 2).

Figure 4 Mean SCDSs by SCRs scale



Note: The mean SCDSs is the mean computed from the SCDSs of the countries listed in Table 1 by their SCRs notches defined according to a fine ordinal scale following the common convention (see Table 2).

4. Conclusion

This paper aims to examine the influence of SCRs issued by three CRAs on the pricing of SCDSs. The empirical estimates provide interesting revelations that challenge the common assumption that the financial market weighs the SCRs issued by these CRAs equally. When split-SCRs were more apparent amongst the three leading CRAs as is the case for the period 2008-2011, the SCRs were significant in explaining the SCDSs. However, the SCRs were insignificant when the opinions on creditworthiness amongst the three CRAs converged in the period 2012-2020.

When SCRs were significant in explaining the SCDSs, the SCRs issued by Fitch has the highest influence on the spreads as compared to the SCRs issued by Moody's and S&P. Although the argument could lean on the Fitch's SCRs were less generous as compared to the Moody's SCRs as suggested by Alsakka and Gwilym (2010), the S&P's SCRs were threading closely with the Fitch's SCRs and yet had the least influence on SCDSs pricing. Moreover, the estimates revealed that the pairing of SCRs issued by Moody's and Fitch had the highest influence. The other pairs of SCRs, including the average of SCRs from all three CRAs, weaken the SCRs' influence in explaining the spreads. Split-SCRs, thus, have an influence on the pricing of SCDSs.

In conclusion, when SCRs were significant in explaining the SCDSs and the divergence of creditworthiness opinions amongst the three CRAs was more apparent, debt pricing relied less on the SCRs issued by specific CRA nor all three CRAs, but the pairing of SCRs issued by Moody's and Fitch had the largest influence. This means the equality assumption on SCRs issued amongst the three leading CRAs is challenged and the selection of SCRs by CRAs matters in empirical studies.

It is also essential to qualify that the insignificance of SCRs for debt pricing since 2012 irrespective of the CRAs that issued them is not because of the convergence of creditworthiness opinions amongst the CRAs. On the contrary, the convergence of SCR notches amongst the three CRAs supposedly reduces the confusion and strengthens the informational value of SCRs on SCDSs price discovery. The downward trajectory of SCDSs since 2012 could only be motivated by non-credit risks, and this is supported by the significance of the proxy of the non-credit risk component in the analysis. Further investigation on the influence of non-credit risk factors for debt pricing is necessary for future research. One example is the zero bound policy rate and quantitative easy programmes adopted by a few developed countries. Such a policy stance has increased the availability of funding across the globe at lower costs and diminishes the relevance of creditworthiness for debt pricing.

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