

Hami Saka

Istanbul University,
Department of Economics,
Istanbul
✉ hamisaka@gmail.com

Mehmet Orhan

Corresponding author
International Burch University,
Department of International Business,
Sarajevo
✉ mehmet.orhan@ibu.edu.ba

Are Sovereign Ratings by CRAs Consistent?

Summary: This study is an attempt to compare and contrast the credit ratings granted by prominent agencies, the so-called Big Three namely S&P, Moody's and Fitch, that dominate the market. The sovereign ratings are proven to motivate the CDS figures of countries empirically, and low ratings are known to increase the interest paid to liabilities by these countries. We employ the historical data over 1994-2014 on the sovereign ratings of 117 countries to test for whether the ratings assigned by CRAs are significantly different or not, with the help of paired t and ANOVA tests. Hypothesis test results reveal that such differences are significant for many countries and country groups, suggesting that the ratings by CRAs are not consistent with each other. This is true for BRIC, OECD, and emerging market countries. Extra ANOVA tests that we conducted support our findings.

Key words: Credit rating agencies, Sovereign ratings, Rating discrepancy, Global financial crisis, Paired t-test, ANOVA.

JEL: E44, F34, G01, G15, G24, H63.

Sovereign credit ratings announced for countries are default probability assessments evaluated by credit rating agencies. The ratings are based on a vast range of elements including main macroeconomic indicators and political stability indices of the country under focus. Since the ratings are crucial for a country's access to international finance and the interest paid therein, these assessments are highly critical for any country. Besides, many investors consider the rating of the country before they shape their portfolio, and high-rated countries attract more globally-flowing finance. That is why the role played by the credit rating agencies (CRAs) is sometimes more important than that of governments. A wide range of groups, including issuers, investors and regulators use the information provided by rating agencies in their decision-making. Low-rated countries are affected as they have less capital inflow and the debt they incur is more costly in terms of the interest paid. In this regard, rating is a crucial process and the rating agencies, especially the "Big Three" - namely Standard and Poor's (S&P), Moody's and Fitch, conduct vital procedures to assign ratings to countries. This fact renders the responsibilities of the credit rating agencies inevitable. The market dominated by the Big Three is almost oligopolistic: more than 80% is captured by Moody's and S&P while Fitch has a share of more than 13%, totaling about 93% of the business. Since the rating process is not transparent, there is ambiguity about how countries are granted their sovereign ratings.

In this paper, we compare the ratings of the CRAs statistically to investigate their similarity and diversity. We make use of the largest data set of sovereign ratings available and utilize the most reliable hypothesis test technique to check beyond any question whether the ratings granted by prominent CRA pairs have equal means. Furthermore, we extend this test to check if the ratings by all three have equal means, or not, by the analysis of variance (ANOVA). This second test requires extra effort to calculate the different rating means in case all population means are not the same. We gathered the ratings from S&P, Moody's and Fitch on 117 countries over 1994-2014 with emphasis on different country segments and time spans. This is the largest data set used in the literature to the best of our knowledge. Besides, we have not seen any study in the literature comparing and contrasting the sovereign ratings and we believe that our exploration will fill the gap. In Section 1 of the paper, related literature including sovereign ratings is reviewed. We report our findings on rating discrepancies in Section 2. Finally, Section 3 lists our concluding remarks.

1. Literature Survey

There is a vast number of studies on CRAs in the literature since the topic has been popular especially for the last two decades due to crises contributed by the CRAs. However, study on sovereign ratings is relatively limited. António Afonso, Pedro M. Gomes, and Abderrahim Taamouti (2014) underline that the role played by the credit rating agencies (CRAs) is often more important than that of governments. According to Rasha Al-Sakka and Owain ap Gwilym (2010) a wide range of groups, including issuers, investors and regulators ask for the information provided by rating agencies. Christina E. Bannier and Christian W. Hirsch (2010) concentrate on watchlists to suggest that the agencies' economic role appears to have been enhanced from a pure information certification function towards an active monitoring function. Angus Duff and Sandra Einig (2009) and Al-Sakka and Gwilym (2010) underline the domination of the market by the Big Three. Since the rating process is not transparent, there is a stream of research to explore both macroeconomic and political indicators to determine the ratings of countries. In this regard, Afonso, Gomes, and Philipp Rother (2007) attempt to reduce these indicators to GDP *per capita*, GDP growth, government debt, government effectiveness indicators, external debt, external reserves, and default history. In a similar study, Richard Cantor and Frank Packer (1996) concluded that the ratings can be explained by *per capita* income, GDP growth, inflation, external debt, level of economic development, and default history. On the other hand Al-Sakka and Gwilym (2009) stress outlook status, past rating changes, rating duration or existing rating as predictors of rating changes.

There is sufficient research in the literature to claim that ratings have profound and significant consequences on countries. Afonso, Davide Furceri, and Gomes (2012), for instance, state that downgrades in ratings of European Union (EU) countries reinforced upward movements in sovereign spreads. Similarly, Helmut Reisen and Julia Von Maltzan (1999), as well as Lars Norden and Martin Weber (2004), document that negative credit rating announcements have significant impacts on yields and CDS spreads. Afonso, Furceri, and Gomes (2012), define parametric volatilities using EGARCH specifications and make use of daily stock market and sover-

eign bond returns to conclude that upgrades do not have significant effects on volatility, but downgrades increase stock and bond market volatility. Furthermore, they state that policymakers look at rating agencies as a possible source contributing to the increase in financial markets volatility after the 2008-2009 financial and economic crisis in several EU countries. Volatility in such financial markets is addressed to trigger the amplification in output volatility. Iuliana Ismailescu and Hossein Kazemi (2010) demonstrate that positive announcements have a greater impact on CDS markets with data from 22 emerging markets. More specifically, Joshua Aizenman, Mahir Binici, and Michael Hutchison (2013) report for the EU countries that a credit rating upgrade decreases CDS spreads by about 45 basis points, on average.

Cantor and Packer (1996) and Amadou N. R. Sy (2004) demonstrate that the bond spread of countries rise in response to negative rating announcements. A one-notch upgrade is calculated to decrease the spread by 14%. Furthermore, sovereign ratings have spillover effects to other countries' bond markets (Afonso, Furceri, and Gomes 2012). In this regard, Graciela L. Kaminsky and Sergio L. Schmukler (2002) document that sovereign rating announcements lead to reactions in bonds and stock markets in emerging markets as well as neighboring countries. In a similar study, Amar Gande and David C. Parsley (2005) prove an asymmetric international spillover effect of a sovereign rating adjustment on the sovereign credit spreads of other countries. All in all, the ratings do not only influence the access of countries to international finance, but also affect the main macroeconomic indicators of the country. The criticisms pointed at the CRAs have become more intense since the global financial crisis. Many blame the CRAs as the main actor triggering the crisis, by granting the highest ratings to shady bonds.

Although there is considerable research and literature on the inaccuracy of ratings, erroneous ratings are difficult to prove since the ratings are legally the opinions of the CRAs and are simply the likelihood of default, which is rare in sovereign history. Still, there are numerous papers published in distinguished journals such as Al-Sakka and Gwilym (2010), for instance, which analyze lead-lag relationships in sovereign ratings across five agencies, and report that upgrade as well as downgrade probabilities are much higher, and downgrades as well as upgrade probabilities are much lower for a sovereign issuer with a recent upgrade (downgrade) by another agency. Adam B. Ashcraft, Paul Goldsmith-Pinkham, and James I. Vickery (2010) state that mistakes by CRAs are often cited as one of the causes of the recent financial crisis. More than 80% of the subprime or Alt-A mortgage-backed-securities (MBS) were assigned the highest possible triple-A rating, but many such MBS have experienced large rating downgrades.

The other main criticism of the CRAs is about their failure in predicting the crisis. Sy (2004) documents that ratings do not predict currency crises and are instead downgraded *ex post*. A number of other papers conclude the same about the capability of CRAs in predicting the former upcoming crisis (Steven Radelet and Jeffrey Sachs 1998; Morris Goldstein, Kaminsky, and Carmen M. Reinhart 2000; Reinhart 2002). Various reasons are cited behind this failure, one of which is the difficulty CRAs face in getting timely information about the borrowing country. The second reason, according to Sy (2004) is a moral hazard and the third reason is that the CRA

has limited motivation to downgrade since "...they receive fees from the sovereign borrowers they rate and because such downgrades can precipitate a crisis". On the other hand, Frank Partnoy (2006) states that the ratings are subject to political pressure and mention that "...there is abundant anecdotal evidence of rating inaccuracy". Partnoy (2006) gives the example of the highest short-term rating granted to the Orange County only months before it filed for bankruptcy. Similarly, Lawrence J. White (2009) not only blames the CRAs in failing to anticipate the global financial crisis but claims they contributed to it by stating "...by means of the high ratings that they awarded to subprime mortgage backed bonds, the three major rating agencies, Moody's, Standard and Poor's and Fitch, played a central role in the current financial crisis". Pointed studies in the literature on the failure of the CRAs in predicting the global financial crisis can be read in Mehmet Orhan and Ramazan Alpay (2012).

Regarding the sovereign ratings in the ordinary framework of rating businesses, these ratings are designed to evaluate the sovereign risk. In comparison to sovereign risk, country risk is defined as the exposure to a loss in cross-border lending, caused by events in a particular country which are - at least to some extent - under the control of the government but definitely not under the control of a private enterprise or individual (Pancras J. Nagy 1984). Marwan Elkhoury (2008) mentions that all forms of cross-border lending in a country - whether to the government, a bank, a private enterprise or an individual - are included. That is why Elkhoury (2008) indicates that country risk is a broader concept than sovereign risk since the sovereign risk is attributed to the government of a sovereign nation though still the two risks are highly correlated.

In order to carry out the statistical analysis, the ratings expressed in letters have to be converted to real numbers. This is achieved by linear transformations using various scales in the literature. Rolando Avendaño, Norbert Gaillard, and Sebastián Nieto-Parra (2011), for instance used a scale of 1-21 in accordance with Moody's total number of letter grades. Similarly, Vanja Bozic and Cosimo Magazzino (2013) used the scale of 1-21 while Gaillard (2009) used a different scale for each agency. On the other hand, Bo Becker and Todd Milbourn (2011) used the scale of 1-28, and Kee-Hong Bae, Jun-Koo Kang, and Jin Wang (2013) classified the grades into 7 categories, and implemented a transformation in which the highest grade is 28 whereas Julia A. Bennell et al. (2006) assigned 16 to the highest rating. Ömer Veysel Çalışkan (2002) used a graded scale up to 100 in his study and Cecilia T. Valle and José Luis Martín Marín (2005) enumerated the letter grades from 1 to 8 with decimal points.

2. Rating Differences

One main motivation behind the paper is the investigation of whether the sovereign ratings assigned by prominent CRAs are significantly different or not. Since the Big Three are recognized worldwide by many countries and claim to assess the creditworthiness of each and every country under observation, ratings by them are expected to be similar. With this factor on the agenda, we employ one of the soundest and clearest statistical methods in our analysis, namely the paired *t*-test, to reveal the equality of ratings granted by different CRAs.

More technically, the paired t -test is an influential method to conclude whether populations from which the samples are drawn have significantly different means or not. The test is used for a wide list of disciplines ranging from management to psychology. The method can only be used when there are matched samples. For example, if the comparison is made for a certain time span, it is necessary for both CRAs to rate the country under focus. As for a comparison based on country, or country groups, both CRAs must have rated at the same time.

The null hypothesis of the test claims that the population means of the ratings by the CRAs, say CRA_1 and CRA_2 are the same, or equivalently their difference is equal to 0, that is:

$$H_0: (\mu_{CRA_1} - \mu_{CRA_2}) = 0 \Leftrightarrow \mu_d = 0,$$

$$H_a: (\mu_{CRA_1} - \mu_{CRA_2}) \neq 0 \Leftrightarrow \mu_d \neq 0.$$

In other words, H_0 can be stated that there is no significant difference between the means of two populations which are the “long-term sovereign ratings” of the two CRAs in the study.

The test statistic is:

$$t = \frac{\bar{d} - 0}{s_d / \sqrt{n_d}}, \quad (1)$$

where:

- \bar{d} - sample mean of difference;
- s_d - standard deviation of differences;
- n_d - number of pairs (sample size).

Rejection of H_0 means that the difference between the means of CRA_1 and CRA_2 ratings is significant. It then enables us to reach the conclusion that these two CRAs do not agree with each other.

Regarding the transformation of ratings to numerical values, as it is evident from the references cited in the literature survey section, even though the linear transformations differ in many of the studies, there is an analogy between the definitions of the letter grades. In this paper we follow the linear transformations used in Afonso, Gomes, and Rother (2007) and Aizenman, Binici, and Hutchison (2013). We have prepared Table 1 to display the list of ratings with the integers we assign to them.

We first conduct the test for emerging market countries the list of which is taken from the official web site of the Morgan Stanley Capital International (MSCI)¹. This index contains Brazil, Chile, China, Colombia, Czech Republic, Egypt, Greece, Hungary, India, Indonesia, South Korea, Malaysia, Mexico, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, and Turkey. We report the results of the tests in Table 2. The first row results of the table compare the ratings of S&P and Fitch. The test statistic of -13.99 rejects the null hypothesis of equal population

¹ **Morgan Stanley Capital International (MSCI)**. 2014. The MSCI Global Investable Market Indexes (GIMI) Methodology. <https://www.msci.com/market-cap-weighted-indexes> (accessed March 19, 2014).

means at a highly significant level. The same conclusion is drawn in tests for the S&P-Moody's and Fitch-Moody's pairs. That is, according to the test results reported in Table 2, there is a noteworthy discrepancy between ratings by the Big Three. This discrepancy means, there is incoherence in the ratings assigned to emerging market countries by these CRAs. Nonetheless, the emerging markets are in need of global financial capital since their savings are often not sufficient for their desired level of investment. They will definitely prefer the CRA with the highest average ratings.

Table 1 Scale of Credit Ratings and Their Numerical Transformation

S&P	Fitch	Moody's	Numeric scale	Characterization	
AAA	AAA	Aaa	25	Highest quality	Investment grade
AA+	AA+	Aa1	24	High quality	
AA	AA	Aa2	23		
AA-	AA-	Aa3	22		
A+	A+	A1	21	Strong payment capacity	
A	A	A2	20		
A-	A-	A3	19		
BBB+	BBB+	Baa1	18		
BBB	BBB	Baa2	17	Adequate payment capacity	
BBB-	BBB-	Baa3	16		
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BB+	BB+	Ba1	15	Likely to fulfill obligations, ongoing uncertainty	Speculative grade
BB	BB	Ba2	14		
BB-	BB-	Ba3	13		
B+	B+	B1	12	High credit risk	
B	B	B2	11		
B-	B-	B3	10		
CCC+	CCC+	Caa1	9	Very high credit risk	
CCC	CCC	Caa2	8		
CCC-	CCC-	Caa3	7		
CC	CC	Ca	6	Near default with possibility of recovery	
-	C	-	5		
R	RD	-	4	Default	
SD	DDD	C	3		
D	DD	-	2		
-	D	-	1		

Source: Numerical scale based on previous linear transformations, see Afonso, Gomes, and Rother (2007) and Aizenman, Binici, and Hutchison (2013).

Table 2 Emerging Markets Ratings

	$\mu_{S\&P}$	μ_{FT}	μ_{MD}	\bar{d}	t -test	df	p -val
S&P - Fitch	16.41	16.59		-0.18	-13.99	5087	0.00
S&P - Moody's	16.57		16.77	-0.20	-12.29	5349	0.00
Fitch - Mood's		16.55	16.63	-0.08	-4.99	4884	0.00

Source: Authors' calculation.

On the other hand, the average rating reported in Table 2 is slightly less than 17 which means countries taking part in emerging markets are positioned just above the investment grade.

In addition to the paired *t*-test, one can check for a similar hypothesis in the ANOVA framework enabling us to claim whether the ratings by all three CRAs are simultaneously the same, or not. In other words, rejection of the null hypothesis leaves us with limited information about the unequal CRA ratings. This time, the null hypothesis claims that the population means of the ratings by all CRAs are the same. That is, $H_0: \mu_{CRA_1} = \mu_{CRA_2} = \mu_{CRA_3}$. We employ the ANOVA method over the BRIC countries (namely, Brazil, Russia, India and China). Table 3 reports the conclusions of the test where the null hypothesis claiming the equality of all ratings is rejected very significantly for long-term sovereign ratings. On the other hand, the CRA awarding the highest average rating to the BRIC countries is Moody's, and S&P has the lowest average. The average of the ratings that the BRIC countries received over 1994-2014 is at the intersection of speculative and investment grades.

Table 3 ANOVA for BRIC Countries

		Descriptive stat.		ANOVA	
		N	Mean	F-statistics	Sig.
BRIC long-term sovereign ratings	S&P	1082	15.47	8.89	0.00
	Fitch	947	15.90		
	Moody's	1016	16.05		
	Total	3045	15.80		
Before global financial crisis (June 2007-June 2008)	S&P	1811	17.50	11.28	0.00
	Fitch	1634	17.84		
	Moody's	1566	18.34		
	Total	5011	17.87		
During global financial crisis (July 2008-July 2009)	S&P	1773	17.25	14.95	0.00
	Fitch	1555	17.67		
	Moody's	1488	18.25		
	Total	4816	17.69		

Source: Authors' calculation.

A key litmus test to CRAs in their consistency of ratings is over periods of crisis. With this in mind, Table 3 also summarizes the ANOVA outcomes around the global financial crisis. Test results reveal differences among the ratings not only during but also after the crisis. Before the crisis hit (June 2007-June 2008) S&P, Fitch and Moody's averages were 17.50, 17.84 and 18.34, respectively. However, after the crisis, averages decreased and became 17.25, 17.67 and 18.25. The most optimistic CRA among the three is Moody's with the highest average ratings for both periods.

We conducted a similar analysis with the OECD (Organization for Economic Co-operation and Development founded in 1961) countries to investigate the ratings for well-established economies. As known, the OECD includes 34 high-income countries.

Table 4 displays the ANOVA test results on the long-term sovereign ratings of OECD countries. As the p -values suggest, the ratings of at least two of the three CRAs are significantly different over June 2005-June 2006. In addition, S&P and Fitch assign close ratings while Moody's ratings are remarkably higher.

Table 4 ANOVA for OECD Countries

		Descriptive stat.		ANOVA	
		<i>N</i>	Mean	<i>F</i> -statistics	Sig.
OECD long-term sovereign ratings (June 2005-June 2006)	S&P	442	22.41	8.89	0.00
	Fitch	442	22.44		
	Moody's	442	22.86		
	Total	1326	22.57		
OECD long-term sovereign ratings (August 2008-August 2009)	S&P	578	22.35	14.95	0.00
	Fitch	578	22.44		
	Moody's	578	22.81		
	Total	1734	22.54		

Source: Authors' calculation.

As for the post crisis period, the rating averages of the OECD countries by all CRAs are over 22 which falls into the high investment category. This time the null hypothesis claiming the equality of the ratings is rejected more significantly, at an exact significance level of 2.2%.

Although we gathered an impression of the rating discrepancies from hypothesis tests on emerging market and OECD economies, a complete picture definitely yields a better understanding. To this end, we conducted the paired t -test for all countries over the longest possible duration with ratings from three pairs of CRAs. At this point, any country is included in the data set since it began getting credit ratings. The comparisons were among the CRAs which had rated the same country at the same period.

We have prepared two tables: countries with, and without significantly different ratings. The long list of countries displayed in Table 5 indicates that countries received significantly different ratings from S&P and Fitch. Table 5 includes countries with high and low ratings ranging from an average rating of a little more than 9 (for Benin) to almost 25 (for the UK). The p -values are 0.00 for almost all countries. S&P and Fitch assigned significantly different ratings to 81 countries according to Table 5. Noting that negative d -bars are slightly more than positive ones, Fitch granted higher ratings than S&P, on average.

Another point deserving attention according to Table 5, is that the results of these two CRAs suggest that there are larger differences in ratings to countries experiencing economic crisis or instability. For example, the difference between the averages of the ratings which S&P and Fitch assigned to Argentina is 2.48. Considering the fact that the ratings given over 20 years are averaged, this remarkable difference shows that there is considerable incoherence between S&P and Fitch on Argentina.

This incoherence becomes more striking when updates of ratings are considered. For instance, while S&P raised Argentina's rating from SD to B- in June 2005, Fitch raised the rating from DDD to B about 5 years later (in June 2010). Therefore, that the economy of a country which is in crises going through a delicate period, is rated differently by these two agencies, and that this difference lasts for many years is both to the detriment of the country and to the credibility of the two CRAs as well.

Table 5 Countries with Significantly Different Ratings from S&P and Fitch

Countries	$\mu_{S\&P}$	μ_{FT}	\bar{d}	<i>t</i> -test	df	<i>p</i> -val	Countries	$\mu_{S\&P}$	μ_{FT}	\bar{d}	<i>t</i> -test	df	<i>p</i> -val
Angola	12.40	12.73	-0.33	-4.98	51	0.00	Korea	19.03	19.77	-0.73	-21.88	251	0.00
Argentina	10.08	7.60	2.48	11.44	239	0.00	Kuwait	21.27	21.79	-0.52	-16.03	234	0.00
Australia	24.45	23.75	0.70	24.34	249	0.00	Lebanon	11.01	11.10	-0.09	-3.17	242	0.00
Austria	24.89	25.00	-0.11	-5.79	273	0.00	Libya	18.78	17.81	0.96	26.00	26	0.00
Azerbaijan	15.42	15.70	-0.28	-5.38	73	0.00	Lithuania	17.46	17.16	0.30	7.25	238	0.00
Bahrain	18.94	18.76	0.18	4.13	162	0.00	Macedonia	14.36	14.94	-0.58	-8.91	119	0.00
Belgium	23.88	23.34	0.55	11.36	273	0.00	Malaysia	18.33	17.94	0.39	9.71	220	0.00
Benin	11.24	11.00	0.24	5.71	103	0.00	Malta	19.99	20.36	-0.38	-6.18	250	0.00
Bermuda	22.95	23.35	-0.41	-11.49	250	0.00	Mongolia	12.56	11.77	0.78	8.93	123	0.00
Bulgaria	15.33	15.06	0.27	6.02	215	0.00	Morocco	15.55	16.00	-0.46	-9.04	98	0.00
Cameroon	10.56	10.89	-0.33	-5.56	144	0.00	Mozambique	11.60	11.00	0.60	13.21	118	0.00
Canada	24.50	24.16	0.34	11.84	273	0.00	New Zealand	23.80	23.69	0.11	4.48	166	0.00
Chile	19.96	19.59	0.36	11.99	270	0.00	Nigeria	12.60	13.00	-0.40	-8.83	116	0.00
China	19.28	19.91	-0.63	-8.90	231	0.00	Panama	14.94	15.42	-0.48	-14.04	218	0.00
Colombia	15.10	15.47	-0.37	-11.34	273	0.00	Papua New G.	11.61	11.70	-0.08	-3.15	213	0.00
Costa Rica	14.00	14.18	-0.18	-7.07	224	0.00	Philippines	13.99	14.50	-0.51	-14.64	204	0.00
Croatia	16.29	15.86	0.43	11.67	244	0.00	Poland	17.88	18.17	-0.29	-8.53	259	0.00
Cyprus	18.58	19.86	-1.27	-15.11	167	0.00	Portugal	21.01	21.62	-0.60	-12.50	273	0.00
Czech R.	19.77	19.48	0.29	4.78	261	0.00	Romania	13.66	14.08	-0.42	-11.01	254	0.00
Denmark	24.68	24.53	0.15	6.83	273	0.00	Russia	13.91	14.88	-0.97	-8.39	247	0.00
Ecuador	9.17	8.83	0.34	3.63	157	0.00	Saudi Arabia	21.60	21.45	0.15	4.84	131	0.00
Egypt	14.64	14.84	-0.20	-5.88	236	0.00	Serbia	13.15	12.99	0.16	4.37	125	0.00
El Salvador	14.40	14.61	-0.21	-8.19	248	0.00	Singapore	25.00	24.70	0.30	9.52	215	0.00
Estonia	19.58	19.13	0.45	10.95	231	0.00	Slovakia	18.19	18.30	-0.11	-3.42	249	0.00
Finland	24.25	24.62	-0.37	-10.01	273	0.00	Slovenia	21.23	20.89	0.34	11.39	252	0.00
France	24.88	24.97	-0.10	-5.35	273	0.00	South Africa	16.63	16.40	0.23	7.49	271	0.00
Georgia	11.97	12.50	-0.53	-9.97	95	0.00	Spain	23.15	23.38	-0.22	-6.83	273	0.00
Ghana	11.67	11.86	-0.19	-3.78	143	0.00	Sri Lanka	11.77	12.60	-0.82	-23.47	118	0.00
Greece	16.93	17.26	-0.33	-5.41	258	0.00	Suriname	11.66	11.41	0.25	3.50	137	0.00
Guatemala	13.96	15.00	-1.04	-55.53	116	0.00	Sweden	24.52	23.92	0.60	12.28	273	0.00
Hong Kong	21.93	22.21	-0.29	-5.51	273	0.00	Taiwan	22.09	21.00	1.09	50.39	171	0.00
Hungary	17.14	17.42	-0.28	-8.92	253	0.00	Thailand	17.26	16.88	0.37	11.34	224	0.00
Iceland	19.19	19.45	-0.26	-4.85	197	0.00	Tunisia	16.40	16.51	-0.11	-2.44	238	0.02
India	15.18	15.45	-0.27	-8.60	196	0.00	Turkey	12.31	12.86	-0.55	-12.57	273	0.00

Indonesia	11.64	12.81	-1.17	-11.41	238	0.00	United King.	25.00	24.97	0.03	3.05	273	0.00
Ireland	23.13	23.44	-0.32	-7.94	271	0.00	United States	24.87	25.00	-0.13	-6.32	273	0.00
Israel	19.58	19.33	0.26	9.39	258	0.00	Uruguay	13.79	13.92	-0.13	-4.29	268	0.00
Jamaica	10.14	10.48	-0.34	-2.81	110	0.01	Venezuela	11.72	12.24	-0.52	-6.71	235	0.00
Japan	23.30	23.41	-0.11	-2.62	273	0.01	Vietnam	13.45	12.78	0.66	14.48	145	0.00
Kazakhstan	15.17	15.35	-0.18	-4.05	246	0.00	Zambia	12.00	11.90	0.10	2.08	40	0.04
Kenya	11.54	12.00	-0.46	-8.67	88	0.00							

Source: Authors' calculation.

It is not only Argentina that is being rated differently by S&P and Fitch. The discrepancies among ratings' averages for countries like Turkey, Russia, Cyprus, Taiwan, South Korea and Libya are also high. What these countries have in common is that they were in crisis or are still in economic and/or political instability.

Table 6 Countries Whose Ratings Assigned by S&P and Fitch Are Not Significantly Different

Countries	$\mu_{S\&P}$	μ_{FT}	\bar{d}	<i>t</i> -test	df	<i>p</i> -val
Bolivia	10.84	10.89	-0.05	-1.30	140	0.20
Brazil	13.76	13.72	0.04	1.01	269	0.31
Cape Verde	11.97	12.00	-0.03	-1.42	73	0.16
Dominican R.	10.68	10.59	0.09	0.71	148	0.48
Italy	21.75	21.85	-0.10	-1.82	273	0.07
Latvia	17.05	17.11	-0.06	-1.79	223	0.08
Mexico	16.02	16.00	0.02	1.23	261	0.22
Netherlands	24.99	25.00	-0.01	-1.74	273	0.08
Peru	14.87	14.90	-0.03	-1.14	201	0.26
Ukraine	11.60	11.68	-0.08	-1.31	170	0.19
Bolivia	10.84	10.89	-0.05	-1.30	140	0.20

Source: Authors' calculation.

In addition to Table 5, we have prepared Table 6 to include countries for which the rating difference is not significant. Note that this table is much shorter than Table 5.

When the countries with similar ratings in Table 6 are examined, S&P and Fitch are noticed to be coherent in rating all developed, developing and underdeveloped countries like Brazil and Bolivia.

Countries rated differently by S&P and Moody's as well as test statistics of the ratings are listed in Table 7. According to these results, the ratings S&P and Moody's assigned to 78 countries do not coincide with each other.

When \bar{d} values in Tables 5 and 7 are contrasted, it is seen that the difference between S&P and Moody's is not as great as the one between S&P and Fitch. For example, S&P and Fitch are not coherent in the ratings given to Argentina, while S&P and Moody's are. Besides, most \bar{d} values are less than or equal to 1.

Table 7 Countries with Significantly Different Ratings from S&P and Moody's

Countries	$\mu_{S\&P}$	μ_{MD}	\bar{d}	<i>t</i> -test	df	<i>p</i> -val	Countries	$\mu_{S\&P}$	μ_{MD}	\bar{d}	<i>t</i> -test	df	<i>p</i> -val
Angola	12.40	12.71	-0.31	-4.76	51	0.00	Israel	19.59	20.07	-0.48	-15.42	257	0.00
Australia	24.45	24.27	0.18	6.70	249	0.00	Jamaica	10.67	11.41	-0.74	-9.14	200	0.00
Austria	24.89	25.00	-0.11	-5.78	281	0.00	Japan	23.34	24.13	-0.79	-10.21	281	0.00
Azerbaijan	15.42	15.32	0.09	2.76	73	0.01	Kazakhstan	15.17	15.35	-0.18	-3.63	245	0.00
Bahamas	18.35	18.90	-0.54	-9.18	143	0.00	Kuwait	21.27	20.73	0.54	6.76	234	0.00
Bahrain	18.94	18.45	0.50	4.96	162	0.00	Latvia	17.03	18.03	-1.01	-14.54	193	0.00
Barbados	17.76	16.66	1.10	17.93	192	0.00	Lebanon	11.01	11.24	-0.23	-4.40	242	0.00
Belgium	23.89	23.78	0.11	5.58	281	0.00	Malaysia	18.79	18.69	0.11	4.58	281	0.00
Bermuda	22.91	23.76	-0.85	-38.63	261	0.00	Malta	20.00	19.62	0.38	6.86	279	0.00
Bolivia	11.36	11.21	0.16	4.31	223	0.00	Mexico	15.92	16.48	-0.56	-16.49	281	0.00
Bosnia H.	11.57	10.68	0.89	24.54	73	0.00	Mongolia	12.60	12.00	0.60	9.02	120	0.00
Botswana	19.70	20.00	-0.30	-8.67	176	0.00	Montenegro	14.11	13.20	0.91	12.89	84	0.00
Brazil	13.76	13.36	0.40	8.52	269	0.00	Morocco	14.86	15.00	-0.14	-2.43	204	0.02
Bulgaria	15.33	14.50	0.83	20.67	215	0.00	New Zealand	23.75	24.25	-0.50	-8.78	281	0.00
Cambodia	11.53	11.00	0.53	10.47	97	0.00	Norway	25.00	24.84	0.16	7.40	281	0.00
Canada	24.48	24.35	0.13	3.74	281	0.00	Panama	14.95	15.28	-0.33	-10.09	244	0.00
Chile	20.28	19.65	0.63	11.71	207	0.00	Papua New G.	11.61	12.00	-0.39	-11.62	213	0.00
China	18.90	20.02	-1.12	-20.77	281	0.00	Peru	14.86	14.24	0.62	15.11	204	0.00
Colombia	15.13	14.90	0.23	8.90	281	0.00	Philippines	14.06	13.80	0.26	6.67	281	0.00
Costa Rica	14.00	15.20	-1.20	-46.31	237	0.00	Poland	17.82	18.73	-0.91	-18.37	263	0.00
Croatia	16.29	15.95	0.34	10.45	244	0.00	Portugal	21.04	21.26	-0.22	-3.43	281	0.00
Denmark	24.74	24.82	-0.08	-4.53	249	0.00	Russia	13.91	15.18	-1.27	-9.15	246	0.00
Dominican R.	11.16	11.61	-0.46	-4.24	204	0.00	Saudi Arabia	21.41	20.15	1.26	10.55	149	0.00
Ecuador	9.16	8.18	0.98	9.94	191	0.00	Singapore	24.95	24.48	0.47	13.26	281	0.00
Egypt	14.19	14.04	0.15	5.01	177	0.00	Slovakia	18.44	18.80	-0.36	-7.94	224	0.00
El Salvador	14.42	15.51	-1.09	-35.99	237	0.00	Slovenia	21.23	20.75	0.49	7.22	252	0.00
Estonia	19.79	20.31	-0.52	-6.90	204	0.00	South Africa	16.63	17.28	-0.65	-18.85	271	0.00
Fiji Islands	10.87	12.77	-1.90	-24.43	110	0.00	Suriname	11.61	12.14	-0.53	-6.29	141	0.00
Finland	24.19	24.67	-0.48	-12.60	281	0.00	Sweden	24.50	24.15	0.35	6.95	281	0.00
France	24.88	24.44	0.44	14.35	281	0.00	Taiwan	22.80	22.00	0.80	14.26	279	0.00
Georgia	12.65	13.00	-0.35	-4.17	45	0.00	Thailand	17.70	17.54	0.16	3.65	281	0.00
Greece	16.97	17.43	-0.46	-3.37	246	0.00	Turkey	12.35	12.92	-0.57	-11.55	281	0.00
Guatemala	13.77	14.29	-0.52	-13.77	173	0.00	Ukraine	11.60	11.31	0.29	3.55	170	0.00
Hong Kong	21.87	20.93	0.94	22.68	281	0.00	United King.	25.00	24.96	0.04	3.53	281	0.00
Hungary	17.38	18.61	-1.23	-18.16	211	0.00	United States	24.88	25.00	-0.12	-6.31	281	0.00
Iceland	19.63	21.11	-1.47	-15.46	281	0.00	Uruguay	13.84	13.75	0.09	2.12	280	0.03
India	15.13	15.45	-0.32	-7.72	204	0.00	Venezuela	11.74	11.48	0.26	2.61	281	0.01
Indonesia	12.37	12.82	-0.45	-4.40	279	0.00	Vietnam	13.57	12.58	0.99	23.46	113	0.00

Source: Authors' calculation.

Countries rated by S&P and Moody's experiencing crisis are more distinctly incoherent with each other than others over 1994-2014.

Table 8 Countries Whose Ratings Assigned by S&P and Moody's Are Not Significantly Different

Countries	$\mu_{S\&P}$	μ_{MD}	\bar{d}	<i>t</i> -test	df	<i>p</i> -val
Argentina	10.52	10.49	0.04	0.26	281	0.80
Belarus	11.20	11.18	0.02	1.42	93	0.16
Belize	10.25	10.26	-0.01	-0.09	190	0.93
Cyprus	19.16	19.14	0.01	0.19	229	0.85
Czech R.	19.62	19.59	0.03	0.37	281	0.72
Ireland	23.09	23.04	0.05	0.61	281	0.54
Italy	21.78	21.87	-0.09	-1.05	281	0.29
Korea	18.94	18.92	0.03	0.72	225	0.47
Lithuania	17.46	17.47	-0.01	-0.12	238	0.90
Netherlands	24.99	25.00	-0.01	-1.74	281	0.08
Pakistan	10.34	10.32	0.02	0.19	270	0.85
Paraguay	10.64	10.49	0.15	1.13	221	0.26
Qatar	20.95	20.85	0.10	1.48	201	0.14
Romania	13.70	13.77	-0.07	-1.29	238	0.20
Spain	23.15	23.23	-0.08	-1.75	281	0.08
Tunisia	16.47	16.49	-0.02	-0.35	186	0.72

Source: Authors' calculation.

The 16 countries in which S&P and Moody's are coherent with each other are listed in Table 8. These countries include Italy and the Netherlands which were involved in the former comparison as well. Indeed, the ratings for many of the developed countries are triple A, regardless of the CRA. In addition to these, S&P and Moody's are also coherent in the example of Argentina. S&P gives higher ratings than Fitch as was stated in the former example. The situations in which the CRAs rate identically or give different ratings, change from CRA to CRA and from country to country, as well.

Test results between Fitch and Moody's are documented in Tables 9 and 10. According to Table 9, a significant difference between these two CRAs is found in 77 countries. The \bar{d} values representing this difference in countries such as Argentina, Costa Rica, Cyprus and New Zealand are more than 1 and these differences are critical for the long duration of 1994-2014. The difference among the ratings of 22 countries is not found to be significant. Table 10 lists nine countries for which the null hypothesis of equal ratings by Fitch and Moody's is not rejected. Hami Saka (2014) includes a more detailed analysis and comments on similar test results.

Table 9 Countries with Significantly Different Ratings from Fitch and Moody's

Countries	μ_{FT}	μ_{MD}	\bar{a}	t -tets	df	p -val	Countries	μ_{FT}	μ_{MD}	\bar{a}	t -test	df	p -val
Argentina	7.60	10.22	-2.62	-11.55	239	0.00	Kuwait	21.64	20.50	1.14	15.70	256	0.00
Australia	23.73	24.24	-0.51	-15.38	256	0.00	Latvia	17.13	18.03	-0.90	-13.75	193	0.00
Azerbaijan	15.40	15.22	0.18	3.50	108	0.00	Lebanon	11.10	11.24	-0.14	-2.25	242	0.03
Bahrain	18.30	17.84	0.47	6.28	197	0.00	Lithuania	17.11	17.38	-0.28	-5.60	244	0.00
Belgium	23.34	23.77	-0.44	-7.81	273	0.00	Malaysia	17.94	18.18	-0.24	-5.76	220	0.00
Bermuda	23.35	23.80	-0.46	-9.36	255	0.00	Malta	20.36	19.58	0.79	20.68	250	0.00
Brazil	13.72	13.36	0.36	11.49	269	0.00	Mexico	16.00	16.67	-0.67	-18.82	261	0.00
Bulgaria	14.93	14.35	0.58	10.17	225	0.00	Mongolia	11.77	12.00	-0.23	-6.01	120	0.00
Canada	24.16	24.34	-0.18	-7.71	273	0.00	New Zealand	23.69	24.90	-1.22	-30.43	166	0.00
Chile	19.82	19.65	0.16	2.22	207	0.03	Norway	25.00	24.88	0.12	5.91	266	0.00
China	19.91	20.24	-0.33	-10.71	231	0.00	Panama	15.42	15.31	0.11	5.06	218	0.00
Colombia	15.47	14.90	0.57	14.64	273	0.00	Papua New G.	11.70	12.00	-0.30	-9.64	213	0.00
Costa Rica	14.18	15.21	-1.03	-95.38	224	0.00	Peru	14.90	14.26	0.64	13.96	201	0.00
Croatia	15.86	15.95	-0.09	-3.89	244	0.00	Philippines	14.50	13.64	0.86	11.98	204	0.00
Cyprus	19.86	18.83	1.03	9.98	167	0.00	Poland	18.17	18.77	-0.60	-8.65	259	0.00
Czech R.	19.48	19.81	-0.33	-5.84	261	0.00	Portugal	21.62	21.27	0.35	7.59	273	0.00
Denmark	24.58	24.82	-0.24	-8.77	249	0.00	Romania	14.15	13.77	0.38	6.81	238	0.00
Dominican R.	10.59	11.11	-0.52	-5.77	148	0.00	Russia	14.88	15.18	-0.30	-4.45	246	0.00
Ecuador	8.83	8.22	0.61	6.08	157	0.00	Saudi Arabia	21.45	20.71	0.74	7.42	131	0.00
Egypt	14.46	14.04	0.42	8.61	177	0.00	Singapore	24.70	24.76	-0.06	-3.56	215	0.00
El Salvador	14.64	15.51	-0.87	-22.68	237	0.00	Slovakia	18.56	18.80	-0.24	-4.27	224	0.00
Estonia	19.41	20.31	-0.90	-12.39	204	0.00	Slovenia	20.89	20.75	0.15	2.67	252	0.01
Finland	24.62	24.72	-0.10	-5.46	273	0.00	South Africa	16.40	17.28	-0.88	-17.65	271	0.00
France	24.97	24.42	0.55	18.31	273	0.00	Spain	23.38	23.23	0.14	3.90	273	0.00
Georgia	12.67	13.00	-0.33	-4.67	45	0.00	Sri Lanka	12.77	12.00	0.77	12.27	46	0.00
Guatemala	15.00	14.44	0.56	12.25	116	0.00	Suriname	11.41	12.14	-0.73	-18.66	137	0.00
Hong Kong	22.21	20.99	1.23	17.83	273	0.00	Sweden	23.92	24.19	-0.27	-9.96	273	0.00
Hungary	17.58	18.61	-1.04	-14.36	211	0.00	Thailand	16.88	17.15	-0.26	-6.69	224	0.00
Iceland	19.45	21.10	-1.65	-14.33	197	0.00	Tunisia	16.61	16.46	0.16	5.19	188	0.00
Indonesia	12.81	12.28	0.53	13.11	238	0.00	Ukraine	11.60	11.21	0.40	7.88	178	0.00
Ireland	23.44	23.07	0.37	5.12	271	0.00	Uruguay	13.92	13.70	0.23	3.87	268	0.00
Israel	19.33	20.07	-0.74	-26.80	257	0.00	Venezuela	12.24	10.98	1.26	24.30	235	0.00
Japan	23.41	24.11	-0.70	-12.63	273	0.00	Vietnam	12.69	12.75	-0.06	-2.51	102	0.01
Korea	19.77	18.92	0.85	18.87	225	0.00							

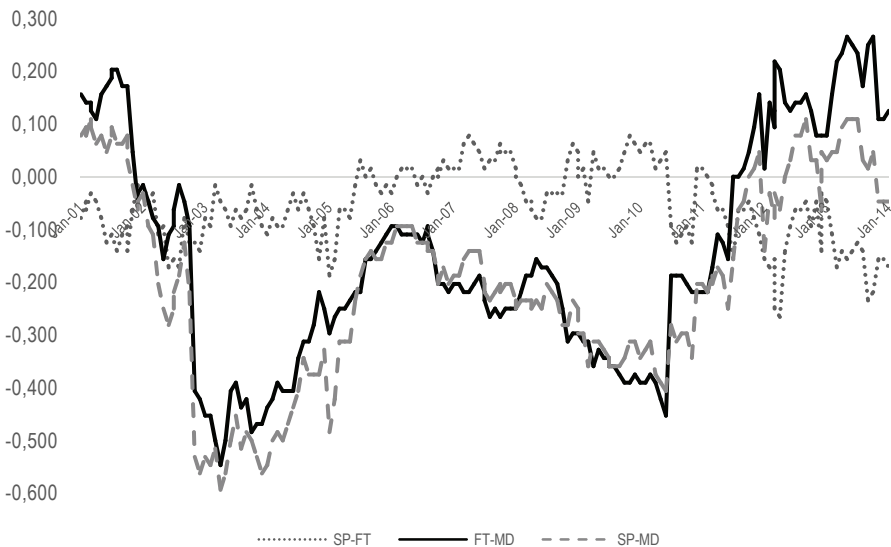
Source: Authors' calculation.

Table 10 Countries Whose Ratings Given by Fitch and Moody's Are Not Significantly Different

Countries	μ_{FT}	μ_{MD}	\bar{d}	t -test	df	p -val
Angola	12.73	12.71	0.02	1.00	51	0.32
Bolivia	10.89	10.91	-0.02	-1.14	140	0.26
Greece	17.32	17.43	-0.11	-0.81	246	0.42
India	15.45	15.51	-0.06	-1.53	196	0.13
Italy	21.85	21.90	-0.05	-0.98	273	0.33
Jamaica	10.48	10.49	-0.01	-0.13	110	0.89
Kazakhstan	15.36	15.35	0.00	0.08	245	0.93
Turkey	12.86	12.88	-0.02	-0.30	273	0.76
United King.	24.97	24.96	0.01	1.74	273	0.08

Source: Authors' calculation.

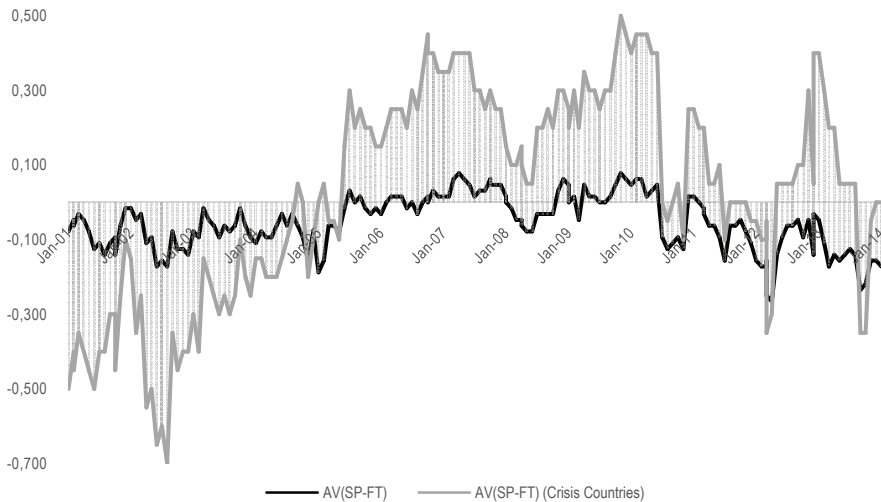
If the CRAs assign exactly the same ratings to countries, the d -bar of the test statistic would be 0. When the difference gets larger d -bar deviates from 0 more. In Figure 1 we plot the behavior of the d -bar over the whole range of time spans for 64 countries over 2000-2014. The SP-FT line representing the d -bar of S&P and Fitch displays more stable behavior closer to 0 than others with lower deviations. On the other hand, S&P-Moody's and Moody's-Fitch d -bar lines behave similarly; the difference gets larger in late 2003, early 2004 and late 2010.



Source: Authors' own elaboration based on the credit ratings by S&P, Fitch and Moody's.

Figure 1 The Behaviours of d -bar for CRA Pairs

We present the behavior of the d -bar by S&P and Fitch for the same 64 countries (black line) as well as 20 countries (gray line) experiencing stressful times, in Figure 2 to illustrate the difference in the behaviors of them. These countries are Argentina, Brazil, Bulgaria, Chile, China, Greece, Hong Kong, Iceland, Indonesia, Ireland, Korea, Lebanon, Malaysia, Mexico, Romania, Russia, Singapore, Thailand, Turkey, and Uruguay. Figure 2 explicitly shows that the rating difference gets larger for countries under stress especially around mid-2002, early 2010 and early 2013.



Source: Authors' own elaboration based on the credit ratings by S&P and Fitch.

Figure 2 The Behaviours of d -bar for 64 Countries and 20 Countries Experiencing Hard Times

The CRAs are particularly criticized for abruptly changing countries' ratings at times of crisis. As an example of such a crisis, the 1997-1998 period is critical since it belongs to the break out of the East Asian Crisis in Thailand. After this crisis, the CRAs were exposed to severe criticisms and accused of not foreseeing it (Goldstein, Kaminsky, and Reinhart 2000; Sy 2004; John Kiff, Sylwia Barbara Nowak, and Liliana Schumacher 2012). The CRAs had downgraded Indonesia by 8, 6, and 6 notches, respectively at the end of the crisis whilst it was rated at investible levels a priori (S&P: BBB, Fitch: BBB- and Moody's: Baa3). The case of South Korea is even worse: S&P increased the rating by 3 notches, which it then decreased by 10 notches. Similarly, a 5-notch upgrade followed Fitch's 12-notch downgrade. Considering that all these changes were made in a period of less than 2 years and that the changes were made with the ratings announced as "long-term", it can be clearly seen that the CRAs had failed in foreseeing the crisis. In addition, Malaysia, Pakistan, Russia and Thailand were countries whose ratings were reduced by high-notch differences.

Failures in the ratings the CRAs assigned to countries are not limited to the East Asian Crisis. The global financial crisis has similar cases and it is claimed that the CRAs were a main factor causing it (see for instance Marco Pagano and Paolo Volpin 2010; Miloš Božović, Branko Urošević, and Boško Živković 2011; Bruce G. Carruthers 2013). A good reason for the collapse of the AAA ratings maybe the conflict of interest suggested by Patrick Bolton, Xavier Freixas, and Joel Shapiro (2012). For instance, Fitch assigning RD to Argentina at the beginning of 2008 upgrading the rating by 7 notches in the aforesaid period. Similarly, Greece received BB+, BBB- and Ba1 from S&P, Fitch, and Moody's at the end of 2010 while these ratings were A, A and A1 at the beginning of that year which indicates 5, 4, and 6-notch differences. Rating downgrades that started with the crisis were extensive within a few months and changed the position of some countries from investment to speculative level. Indeed, the CRAs are supposed to assess the rating before the event and warn accordingly, not decrement the rating when the process of economic downfall starts.

Although we have conducted and reported tests for different country groups and periods, we have not answered the question concerning the test including all countries over the widest duration possible. Table 11 answers this question. A general rating repository belonging to the three rating agencies has been prepared, using all data over 1994-2014. Table 11 indicates that the results are parallel to previous tests in that the mean ratings for all pairs of CRAs are significantly different. This result is expected since the majority of the countries had different population means from the CRA pairs.

Table 11 Test Results of All Data between the Years 1994-2014

	$\mu_{S\&P}$	μ_{FT}	μ_{MD}	\bar{d}	<i>t</i> -test	df	<i>p</i> -val
S&P and Fitch	18.16	18.20		-0.04	-6.88	20306	0.00
S&P and Moody's	18.16		18.25	-0.08	-11.21	21859	0.00
Fitch and Moody's		18.66	18.72	-0.06	-7.66	18458	0.00

Source: Authors' calculation.

We repeated the same test with Wilcoxon's method and report the results in Table 12 where one can observe how many times S&P, Fitch and Moody's assigned the same and different ratings. On the average S&P and Fitch achieve a 61% coherency rate (the ratio of the same ratings to all) by assigning different ratings in 7852 out of 20307 cases. S&P and Moody's assigned different ratings in 11067 of 21860 cases rendering the coherency rate to 49%. Fitch and Moody's give different ratings in 8607 of 18459 cases and get a 59% coherency rate. The number of times that these three CRAs assigned different ratings to countries, is remarkable. The three rows are stating the same test results for different pairs of CRAs. Note that the *p*-value, namely the exact level of significance, is 0.00 for all three tests indicating that the equality of the ratings is rejected at a highly significant level. This finding is extremely important in that the largest data available lead to significant difference in the ratings of the Big Three.

Table 12 Test Results of Wilcoxon Signed Rank for All Sovereign Rating Data between the Years 1994-2014

		<i>N</i>	Mean rank	<i>Z</i>	<i>p-val</i>
Fitch sovereign ratings, Jan 2007, all countries - S&P sovereign ratings, Jan 2007, all countries	Neg. ranks	3443	3951.54	-9.92	0.00
	Pos. ranks	4409	3906.94		
	Ties	12455			
	Total	20307			
Moody's sovereign ratings, Jan 2007, all countries - S&P sovereign ratings, Jan 2007, all countries	Neg. ranks	5165	5342.78	-9.56	0.00
	Pos. ranks	5902	5701.34		
	Ties	10793			
	Total	21860			
Moody's sovereign ratings, Jan 2007, all countries - Fitch sovereign ratings, Jan 2007, all countries	Neg. ranks	3960	4356.95	-5.86	0.00
	Pos. ranks	4647	4258.87		
	Ties	9852			
	Total	18459			

Source: Authors' calculation.

Indeed, it is interesting to note that the CRAs differentiate in their ratings, yet it maybe more interesting to explore when, why and how they differentiate. It would be naive to think that a CRA has a perfect model to predict default risk. CRAs determine their ratings as a result of different data sets input to different methods by different personnel. The CRAs list numerous economic, social, and political factors that underline their sovereign credit ratings in their statement on rating criteria.

Further research is required to identify the main reasons behind the differences in ratings. Diversities ranging from data sets to methodologies and from even basic definitions to weights assigned to variables may lead to such differences. As a first step in this exploration one can perform a rigorous analysis of the factors leading to differences. That is, one can regress the difference in ratings based on the characteristics of the sovereign, time period, and possible other variables that may influence the ratings including whether the ratings are unsolicited or not. Furthermore, one can study the degree of difference between ratings as well as how often and for which countries there is more disagreement.

The first main point of conflict among the CRAs is the set of variables they emphasize. As Al-Sakka and Gwilym (2010) indicate the Big Three use default history, exports-to-GDP and reserves-to-imports as important drivers of downgrading. However, there are variables that are not common to all three. Reserves-to-foreign debt and GDP growth are key aspects for the downgrading and upgrading decisions by Moody's. Similarly, external balance, fiscal balance and reserves-to-foreign debt are more relevant to the rating change process for S&P. Finally, external debt, fiscal balance, exports-to-GDP, debt service-to-exports and reserves-to-imports are taken into account more in the rating decisions by Fitch. In a lead-lag analysis, S&P has been identified as the first to change the ratings they have granted. On the other hand, Moody's is the most hesitant of the three. That is why the ratings by S&P and

Moody's may differ due to Moody's taking more time to make the assessment. One other technical point to address the rating differences is that Moody's does not rate defaults.

Besides, it is not easy to index some variables, especially the ones on social and political factors, to real numbers. For instance, it is really hard to quantify political risk which is a key factor in sovereign ratings. Although there are objective indicators of political risk, working out a unique figure from these indicators to model risk is quite complicated and subjective. In addition, political instability is a complex and sophisticated concept that cannot be measured with a single variable. Some crucial political indicators are not accessible for many developing and underdeveloped countries. One other point to note is the weight assigned to factors. Even if the CRAs make use of exactly the same variables, their ratings can be different due to the weights assigned to these factors.

3. Concluding Remarks

We hypothesized the equality of population means belonging to the sovereign ratings by prominent CRAs and tested these with well-established statistical techniques. Our results revealed that ratings by S&P and Fitch are significantly different for 81 countries but the test does fail to reject the equality of the ratings for 11 countries. Similarly, ratings by S&P and Moody's are significantly different for 78 countries but the difference is not rejected for 16 sovereign ratings. As for the ratings by Fitch and Moody's, 77 countries have significantly different ratings while for 9 countries significant difference is not documented.

The difference in ratings for emerging market countries is documented as well. We have executed the tests by the paired *t*-test framework and the other techniques we employed for cross checking, namely the Wilcoxon and ANOVA, have supported our findings.

Test for OECD countries reveals similar results whereas for BRIC countries the ratings are demonstrated to be significantly different for all cases but one. Ratings to countries under stressful times by CRAs are more different as are the ratings granted to emerging markets of BRIC countries.

Concerning future research, one maybe interested in the reasons for such differences of rating means. Although we are not concerned with the objectivity of the CRAs in the business of rating there are studies exploring the subjectivity of a particular CRA. John M. Griffin and Dragon Yongjun Tang (2012) state that they documented a top CRA making positive adjustments beyond its main model that amounted to increasingly larger AAA's in collateralized debt obligations (CDOs). Another line of research should be directed towards further studies to explore subjectivity in sovereign ratings. Such studies may lead to rating-agency reform, as suggested by Anthony Phillip O'Hara (2011).

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