A Comparison of Country Performances with Sovereign Credit Ratings using the TOPSIS Model

Gökhan Demirtas[*] and Mahmut Masca[**]

Afyon Kocatepe University, Faculty of Economics and Administrative Sciences, Afyon karahisar, Turkey

Abstract: This study aims to rank 66 countries according to their macroeconomic and governance performance to compare that rating with the credit ratings for the countries. Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) model is based on Multi Criteria Decision Making approach was used to compare the credit ratings of 66 developed and developing countries assigned by (Standard and Poor's) S & P in July 2011 with the governance and macroeconomic data for the year 2010. The results show that the ranking according to credit ratings assigned by S&P in 2011 is open to complaints of developing countries when evaluated only according to macroeconomic performance. However, when the rankings consider governance variables, the results are very closely matched with the ranking according to the credit rating scores.

Keywords: Multi Criteria Decision Techniques, Credit Ratings, Governance

JEL Classification Number: C44, G24, G34

1. Introduction

Sovereign credit ratings represent the measurement of risk used to detect a country's willingness to pay and the solvency. Credit ratings provide an opportunity for governments to access the international bond market. In addition, they reduce uncertainty about the risk investors is exposed to while making arisk assessment. They also serve an important function regarding asymmetric information, one of the basic problems in financial markets.

Global financial markets are of great importance for developing countries because they have provided external funds since the beginning of the 1990s. Therefore, the portfolio preferences of institutional investors are important in determining the amount and composition of capital flows which will direct to those countries. Credit rating agencies (CRAs) such as Standard and Poor's (S & P) and Moody's Investors Service (Moody's) serve an important role between market participants and policy makers. Credit ratings issued by CRAs have an effect in determining which types of financial instruments will be held by institutional investors and what their cost will be (Krassl, 2005:356).

Policy makers and media paid great attention to sovereign credit ratings after the Asian crisis of 1997 and following the Russian crisis in 1998. During this period, the rating

---

[*] Email: demirtas@aku.edu.tr; [**]Email: mmasca@aku.edu.tr

agencies were heavily criticized due to their failures to predict the Asian crisis and downgrade the countries' credit rating during the financial turmoil. Although sovereign credit rating was not downgraded in 1996, Indonesia, Korea and Thailand were downgraded below investment-grade during the crises (Mora, 2006:2042).

A similar process was experienced during financial crisis in 2008. While CRAs tended to upgrade the credit ratings of European countries in the pre-crisis period, they started to downgrade the credit ratings of these countries during the crisis. Global financial markets were again influenced by the European sovereign debt crisis in 2010-2011.Thus, policymakers and regulators in developed economies have put the reform of the credit rating industry at the top of their agendas (Alsakkave, 2013).Because the crisis began in Greece in 2008 when it had Moody's (A1), the S & P (A +) and Fitch (A) credit ratings, many voices have criticized the CRAs. This kind of CRA action makes monetary and financial crises difficult to predict. In addition, downgrades during the crisis worsened the crisis in many countries. Sovereign credit ratings are not successful in predicting financial crises (Reinhart, 2002).The most concrete answer of CRAs to this criticism is that the sovereign credit ratings are not intended to predict future financial crises but assess the likelihood of sovereign default of a country.

There are five major institutions in the rating industry, namely Moody's, S&P, Fitch, Japan Credit Rating Agency (JCR) and Japan Rating & Investment Information (R & I). The credit rating industry has an oligopoly structure,80 per cent of which is dominated by Moody's and S & P. Fitch's market share is around 15 per cent (Duff and Einigen, 2007). S & P's actions are the least dependent to other agencies when their leading and lags compared to others. Moody's tends to be the first acting agency in case of upgrades. The Japanese agencies are influenced by the rating dynamics of S&P and Fitch, but not vice versa. Moody's can lag rating downgrades by JCR/R&I, but to a lesser extent than these Japanese agencies lag Moody's actions (Alsakk and Gwilym 2010).

Cantor and Packer (1996) examined the effect of rating announcements by S & P and Moody's on government bond yield spreads in their pioneering study. They found that the impact of changes in credit ratings on the yield differences in speculative-grade sovereigns is more powerful than in investment-grade sovereigns. The response to the downgrades from the financial markets of related countries is more significant (Hooper et. al., 2008). Positive ratings of events abroad have no discernable impact on sovereign spreads (Gandeve, 2005).

Chen et. al. (2013) state that sovereign credit rating changes have an influence on the real private investment of related countries. Significant increases in private investment growth have occurred following upgrades in sovereign ratings. Developing countries object when the rating agencies downgrade their credit ratings, due to the aforementioned factors.

This study aims to rank the countries according to their macroeconomic and governance performance and to compare this rank with the credit ratings of the countries. For this purpose, the governance and total performance scores of countries have been calculated using the TOPSIS method. The study uses the credit ratings of 66 developed and developing countries assigned by S & P in July 2011, as well as the governance and macroeconomic data for the year 2010.

In the study, the credit ratings announced by S & P were taken into consideration because of its oligopolistic power in the rating industry. In addition, according to the results of a study conducted by Hill and Faffe (2010), the bond market gives a stronger reaction to changes in the credit ratingsby than the credit ratings by other rating agencies. Finally, there is empirical evidence that S & P tends to lead to other agencies in the changes of credit ratings.

2. Methodology

There are many Multi Criteria Decision Making (MCDM) methods to help select and rank conditions with multiple criteria. TOPSIS is a useful technique in solving the MCDM problems. It helps decision maker(s) (DMs) organize the problems to solve, and carry out analysis, comparisons and rankings of the alternatives.

The pioneering TOPSIS study was carried out by Hwang and Yoon (1981). Later, the technique was developed by Lai *et al* .(1994) and Yoon and Hwang (1995).TOPSIS is attractive in that limited subjective input needed from decision makers. The only subjective input needed is weights (Olson, 2004).

Shih et al. (2007) quotes that there are four advantages which make TOPSIS a major MCDM technique when compared with other related techniques such as analytical hierarchical process (AHP) and ELECTRE : (i) a sound logic that represents the rationale of human choice; (ii) a scalar value that accounts for both the best and worst alternatives simultaneously; (iii) a simple computation process that can be easily programmed into a spreadsheet; and (iv) the performance measures of all alternatives on attributes can be visualized on a polyhedron, at least for any two dimensions. TOPSIS was chosen for this study due to these advantages.

Feng and Wang (2001) express the idea of TOPSIS in a series of following steps:

Step 1: **Normalization of indicator values**

Normalization aims to obtain comparable scales. There are different ways of normalizing the indicator values. This paper uses vector normalization, which utilizes the ratio of the original value (xij) and the square-root of the sum of the original indicator values. The advantage of this method is that all indicators are measured in dimensionless units, thus

facilitating inter-indicator comparisons. This procedure is usually utilized in TOPSIS. The formula is:

$$r_{ij} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^{m} X_{ij}^2}}$$

where i is the country, j is the jth evaluation indicator, $\mathbf{r}ij$ is the indicator value after vector normalization for the ith county and jth evaluation indicator, $\mathbf{X}ij$ is the original value of indicators for the ith country and jth evaluation indicator and, m is the number of countries.

Step 2: Weighted Normalization of Values

In this step, normalized values are multiplied by weight of each indicator. The formula is:

$$v_{ij} = w_{ij} \cdot r_{ir}$$

where $\mathbf{w}_j$ is the weight of jth evaluation indicator, $\mathbf{r}ij$ is the indicator value after vector normalization for the ith county and jth evaluation indicator and $\mathbf{v}_{ij}$ is the indicator value after weighted normalization for the ith county and jth evaluation indicator.

Step 3: **To determine ideal (A^+) and worst (A^-) solution**

$$A^+ = \left\{ \left(\max_i v_{ij} \middle| j \in J \right), \left(\min_i v_{ij} \middle| j \in J' \right) i = 1,2,...,m \right\} = \left\{ A_1^+, A_2^+,...,A_j^+,..,A_k^+ \right\}$$

$$A^- = \left\{ \left(\min_i v_{ij} \middle| j \in J \right), \left(\max_i v_{ij} \middle| j \in J' \right) i = 1,2,...,m \right\} = \left\{ A_1^-, A_2^-,...,A_j^-,..,A_k^- \right\}$$

$J = \{ j = 1,2,..k | k$ belongs to benefit criteria$\}$, benefit criteria imply a larger indicator value and a higher performance score; $J' = \{ j = 1,2,..k | k$ belongs to cost criteria$\}$, cost criteria imply a smaller indicator value and a higher performance score.

Step 4: **To calculate the separation measure**

$$S_i^+ = \sqrt{\sum_{j=1}^{k} \left(v_{ij} - A_j^+ \right)^2} \text{ and } S_i^- = \sqrt{\sum_{j=1}^{k} \left(v_{ij} - A_j^- \right)^2}$$

The separation of each country from the ideal one $\left(S_i^+ \right)$ and the worst one $\left(S_i^- \right)$ is then respectively given by:

$$C_i^* = \frac{S_i^-}{S_i^+ + S_i^-} \quad 0 < C_i^* < 1$$

Step 5: To calculate the relative closeness to the ideal solution (C_i^*).

Step 6: To rank the preference order according to the descending order of (C_i^*).

3. Data

This study investigates 66 industrialized or developing countries. Credit ratings are as of July 2011. Data related to macroeconomic variables and governance variables are as of the end of 2010. The weights of the variables have been presented in the Table 1.

Table 1: Weights of the Variables

Definitions	Variables	Macroeconomic Performance	Governance Performance	Total Performance
Income Levels	GDP per capita (current US$)	0.1		0.05
Economic Growth Prospects	GDP per capita growth (annual %)	0.1		0.05
	Unemployment, total (% of total labor force)	0.1		0.05
Monetary Policy's Credibility	Inflation, consumer prices (annual %)	0.1		0.05
External Liquidity	Total reserves (includes gold, % of GDP)	0.1		0.05
Trend and funding composition of the balance of payment	Current account balance (% of GDP)	0.1		0.05
	Terms of trade index (2000 = 100)	0.1		0.05
	Foreign direct investment, net inflows (% of GDP)	0.1		0.05
Fiscal Performance and Flexibility	Cash surplus/deficit (% of GDP)	0.1		0.05
Debt burden	Interest payments (% of revenue)	0.1		0.05
Governance Indicators	Voice and Accountability		0.16667	0.08333
	Political Stability and Absence of Violence/Terrorism		0.16667	0.08333
	Government Effectiveness		0.16667	0.08333
	Regulatory Quality		0.16667	0.08333
	Rule of Law		0.16667	0.08333
	Control of Corruption		0.16667	0.08333

The Sovereign Government Rating Methodology and Assumptions report published by S & P is taken into consideration in determining which variables will be used in the calculations of performance. S & P places the most emphasis on the Institutional and Governance Effectiveness Scores of countries. The mentioned publication includes the following statement:

> "The Institutional and Governance Effectiveness Scores assess how a government's institutions and policy making affect a sovereign's credit fundamentals by delivering sustainable public finances, promoting balanced economic growth, and responding to economic or political shocks."

In the study, six different variables showing the governance performance of the countries in 2010 were taken from The Worldwide Governance Indicators databaseprepared by the World Bank. These variables are Voice and Accountability, Political Stability, Government Effectiveness, Regulatory Quality, Rule of Law, Control of Corruption. Using the TOPSIS method and by giving equal weight to these variables, "governance performance" variable was created.

Ten different variables from the aforementioned publication were determined as macroeconomic performance indicators. The macro-economic performance scores of the countries were calculated by giving equal weight to these variables,. The data on these variables are for the year 2010 and were taken from World Development Indicators database prepared by the World Bank.

Finally, a score named "total performance" in which macroeconomic variables and governance variables are weighted equally at 50% was obtained. Later, the ranking obtained from this score and the ranking obtained from the credit ratings were compared. The results can be seen in Table 2. According to Table 2, the countries whose macroeconomic performances are similar with their credit ratings are Singapore, Hong Kong, Norway and Sweden. The developed countries (Finland, Denmark, Netherlands, Germany, New Zealand, Australia, Canada, Austria, Japan, France, United Kingdom, Iceland, Ireland, United States, Portugal, Spain, and Italy) have a higher credit rating when researchers only considers just their macroeconomic performance. However, there are two developed countries (Belgium, Republic of Korea.) which have a lower credit rating than their macroeconomic performance.

Additionally, most developing countries located in Europe (Czech Republic, Slovenia, Cyprus, Poland, Lithuania, Slovak Republic, Hungary, Romania) have higher credit ratings than their macroeconomic performance. The exceptions to these countries are Estonia, Malta, Latvia, and Bulgaria. The developing countries located in other regions of the world (Chile, Uruguay, Malaysia, Costa Rica, Israel, Azerbaijan, South Africa, Peru,

Kazakhstan, Thailand Jordan, Paraguay, Tunisia, Indonesia, Dominican Republic, Russia, Bosnia and Herz., Philippines, Honduras, Guatemala and Belarus) generally have lower credit ratings than their macroeconomic performance.

Table 2: Empirical Results

Country	Macroeconomic Performance		Governance Performance		Total Performance		S&P Sovereign CreditRatings	
	Score	Rank	Score	Rank	Score	Rank	Ratings	Rank
Singapore	0.8279	1	0.7765	18^-	0.8027	1	AAA	1-14
Hong Kong	0.7301	2	0.8105	13	0.7603	2	AAA	1-14
Norway	0.6003	3	0.9243	5	0.6959	3	AAA	1-14
Sweden	0.5246	8	0.9358	4	0.6592	4	AAA	1-14
Finland	0.4992	17^-	0.9702	1	0.6522	5	AAA	1-14
Denmark	0.4882	20^-	0.9397	2	0.6408	6	AAA	1-14
Belgium	0.5343	5^+	0.8059	14^+	0.6341	7^+	AA+	15-16
Netherlands	0.4889	19^-	0.8944	6	0.6285	8	AAA	1-14
Germany	0.4992	16^-	0.8373	11	0.6208	9	AAA	1-14
New Zealand	0.4495	32^-	0.9384	3^+	0.6146	10^+	AA+	15-16
Chile	0.5171	11^+	0.7743	19^+	0.6113	11^+	A+	20-22
Australia	0.4648	26^-	0.8839	8	0.6111	12	AAA	1-14
Canada	0.4589	27^-	0.8888	7	0.6094	13	AAA	1-14
Austria	0.4539	31^-	0.8757	9	0.6014	14	AAA	1-14
Estonia	0.5213	10^+	0.7174	23	0.5972	15^+	A	23-27
Malta	0.4805	21^+	0.7691	20^+	0.5915	16^+	A	23-27
Japan	0.4675	25^-	0.7820	17^+	0.5883	17^+	AA-	19
France	0.4410	40^-	0.7872	16^-	0.5722	18^-	AAA	1-14
United Kingdom	0.4128	56^-	0.7980	15^-	0.5655	19^-	AAA	1-14
Iceland	0.3876	64^-	0.8308	12^+	0.5628	20^+	BBB-	38-47
Rep. of Korea.	0.5129	12^+	0.6337	31^-	0.5606	21^+	A	23-27
Uruguay	0.4905	18^+	0.6612	27^+	0.5601	22^+	BB	52-58
Ireland	0.4035	60^-	0.8426	10^+	0.5563	23^+	BBB+	31-33
United States	0.4121	57^-	0.7669	21^-	0.5529	24^-	AAA	1-14
Czech Republic	0.4577	28^-	0.6781	26	0.5487	25	A	23-27
Slovenia	0.4436	37^-	0.6910	25^-	0.5411	26^-	AA	17-18
Cyprus	0.4060	59^-	0.7334	22^+	0.5294	27^+	A-	28-30
Poland	0.4345	45^-	0.6528	28	0.5272	28	A-	28-30
Lithuania	0.4375	43^-	0.6317	32	0.5189	29^+	BBB	34-37
Malaysia	0.5257	7^+	0.5056	39^-	0.5171	30	A-	28-30
Slovak Republic	0.4267	50^-	0.6435	29^-	0.5171	31^-	A+	20-22

Table 2 continued

Portugal	0.3975	61⁻	0.6955	24⁺	0.5154	32⁺	BBB-	38-47
Latvia	0.4448	36⁺	0.6067	34⁺	0.5123	33⁺	BB+	48-51
Spain	0.4209	53⁻	0.6400	30⁻	0.5107	34⁻	AA	17-18
Costa Rica	0.4381	42⁺	0.6042	35⁺	0.5082	35⁺	BB	52-58
Israel	0.4804	22⁺	0.5289	38⁻	0.5033	36⁻	A	23-27
Italy	0.4332	48⁻	0.5753	36⁻	0.4932	37⁻	A+	20-22
Hungary	0.3960	62⁻	0.6283	33⁺	0.4893	38	BBB-	38-47
Croatia	0.4408	41	0.5410	37⁺	0.4826	39	BBB-	38-47
Bulgaria	0.4692	24⁺	0.4918	40⁻	0.4788	40⁻	BBB	34-37
Brazil	0.4492	33	0.4539	43	0.4512	41	BBB-	38-47
Azerbaijan	0.5854	4⁺	0.2277	64⁻	0.4474	42⁺	BB+	48-51
South Africa	0.4098	58⁺	0.4906	41⁺	0.4432	43⁺	BBB+	31-33
Romania	0.4178	54⁻	0.4710	42⁺	0.4406	44⁺	BB+	48-51
Peru	0.5094	14⁺	0.3351	48⁻	0.4394	45	BBB-	38-47
Kazakhstan	0.5213	9⁺	0.3253	52⁻	0.4377	46⁻	BBB	34-37
Thailand	0.5300	6⁺	0.2908	56⁻	0.4337	47⁻	BBB+	31-33
Jordan	0.4337	47⁺	0.3787	45⁺	0.4113	48⁺	BB	52-58
Paraguay	0.5124	13⁺	0.2443	62	0.4103	49⁺`	B+	59-63
Tunisia	0.4449	35⁺	0.3581	47	0.4091	50⁻	BBB-	38-47
Morocco	0.4577	29	0.3255	51⁻	0.4075	51⁻	BBB-	38-47
Turkey	0.4158	55	0.3777	46⁺	0.4004	52	BB	52-58
Indonesia	0.4700	23⁺	0.2722	58⁻	0.3927	53⁻	BB+	48-51
India	0.4278	49⁻	0.3261	50⁻	0.3860	54⁻	BBB-	38-47
Dominican Rep.	0.4244	51⁺	0.3305	49⁺	0.3852	55⁺	B+	59-63
Russia	0.5017	15⁺	0.1908	66⁻	0.3847	56⁻	BBB	34-37
Ukraine	0.4425	38⁻	0.3060	53⁻	0.3837	57⁻	B+	59-63
Bosnia and Herz.	0.4344	46⁺	0.2968	54⁺	0.3825	58⁺	B+	59-63
Philippines	0.4562	30⁺	0.2536	59⁻	0.3714	59⁻	BB	52-58
Honduras	0.4463	34⁺	0.2497	60⁺	0.3712	60⁺	B	64-65
Colombia	0.4211	52⁻	0.2923	55⁻	0.3678	61⁻	BBB-	38-47
Guatemala	0.4363	44⁺	0.2462	61⁻	0.3627	62⁻	BB	52-58
Jamaica	0.3335	66	0.4002	44⁺	0.3624	63⁺	B-	66
Belarus	0.4414	39⁺	0.2142	65	0.3549	64	B	64-65
Sri Lanka	0.3861	65⁻	0.2783	57⁺	0.3448	65⁻	B+	59-63
Egypt, Arab Rep.	0.3900	63⁻	0.2339	63⁻	0.3287	66⁻	BB	52-58

Note: + sign next to the numbers shows that the country has a better economic performance than its credit rating score. ⁻sign next to the numbers shows that the country has a worse economic performance than its credit rating score.

While Azerbaijan, Kazakhstan and Thailand have very high macroeconomic performance, their credit ratings are relatively low. Croatia, Brazil, Morocco, Turkey and Jamaica's macroeconomic performances are similar to their credit ratings. The governance performance score which is calculated taking only institutional structure and political risk into account is more accordant with the ranking of the credit ratings of the countries.

Total performance variables which contain both macroeconomic variables and governance performance give the most compliant results with credit ratings. According to these results, 11 countries with a rating of AAA within the first 14 in the ranking have the highest total performance. Three countries with AAA grade (France, United Kingdom, and United States) have low performance. Additionally, Spain and Italy have a higher credit rating than their economic performance. Some developed countries (Belgium, New Zealand, Japan, Iceland, Republic of Korea, Ireland, and Portugal)have lower credit ratings than their economic performance. While Chile and Uruguay have very high performance, they have low credit ratings. Furthermore, Costa Rica and Latvia are developing countries with lower credit ratings than their performances. Russia, South Africa and Colombia have high credit ratings though they have poor economic performance.

4. Conclusion

When evaluated only according to macroeconomic performance, the rankings according to credit ratings assigned by S & P in 2011are open to the appeals of developing countries. A large number of developing countries located outside Europe have a lower credit rating than their macroeconomic performance. Developed countries and a large majority of developing countries located in Europe have a higher credit rating than their macroeconomic performance. Therefore, the governance performances of countries are calculated in the application part. The credit rating scores of these countries are more accordant with the governance performance than their macroeconomic performance.

Therefore, a ranking of countries has been made according to the total performance indicator in which both macroeconomic and governance performances have equal weight. This ranking has given the most compliant results with the ranking according to the credit rating scores. The inconsistencies between total performance scores and the credit ratings of the countries are not very high when few exceptions are ignored. This result shows that credit rating agencies consider the Institutional and Governance Factors. In brief, it is temporary situation that developing countries get higher credit ratings just improving macroeconomic indicators unless improving Institutional and Governance Factors.

References

Alsakka, R. and Gwilym, O., 2010, Leads and lags in sovereign credit ratings, Journal of Banking & Finance, 34: 2614-2626.

Alsakka, R. and Gwilym, O.. 2013, Rating agencies' signals during the European sovereign debt crisis: Market impact and spillovers, Journal of Behavior & Organization, 85: 144-162.

Cantor, R. and Packer, F., 1996, Determinants and Impact of Sovereign Credit Ratings, FRBNY Economic Policy Review, 2(2):37-54.

Chen, S.-S., Chen, H.-Y.; Chang,C.-C. and Yang, S.-L., 2013, How do sovereign credit rating changes affect private investment? Journal of Banking& Finance, 37: 4820–4833.

Duff, A. and Einig, S., 2007, Credit Rating Agencies: Meeting the Needs of the Market, The Institute of Chartered Accountants of Scotland.

Feng, C.-M. and R.-T. Wang, 2001, Considering the financial ratios on the performance evaluation of highway bus industry", Transport Reviews, 21 (4), 449–467.

Gande, A. and Parsley, D. C., 2005, News spillovers in the sovereign debt market, Journal of Financial Economics, 75: 691-734.

Hill, P. and Faff, R., 2010, The Market Impact of Relative Agency Activity in the Sovereign Ratings Market, Journal of Business Finance & Accounting, 37(9-10): 1309-1347.

Hooper, V., Hume, T., and Kim, S.-J., 2008, Sovereign rating changes—Do they provide new information for stock markets? Economic Systems, 32:142–166.

Hwang, C.L. and K. Yoon, 1981, Multiple Attribute Decision Making: Methods and Applications, Springer-Verlag, New York.

Kraussl, R., 2005,. Do credit rating agencies add to the Dynamics of emerging market crises, Journal of Financial Stability, 1, 355-385.

Lai, Y.-J., T.-Y.Liu and C.-L. Hwang, 1994, TOPSIS for MODM, European Journal of Operational Research 76 (3), 486–500.

Mora, N., 2006, Sovereign credit ratings: Guilty beyond reasonable doubt?, Journal of Banking& Finance, 30(2006): 2041-2062.

Olson, D.L., 2004, Comparison of Weights in TOPSIS Models, Mathematical and Computer Modelling, 40, 7–8, 721–727

Reinhart, C. M., 2002, Default, Currency Crises and Sovereign Credit Ratings, NBER Working Paper 8738.

Shih, Hsu-Shih, Huan-Jyh Shyur, E. Stanley Lee, 2007, An extension of TOPSIS for group decision making, Mathematical and Computer Modelling, 45, 801–813.

Yoon, K. and C.L. Hwang, 1995, Multiple Attribute Decision Making: An Introduction, Sage, Thousand Oaks, CA.