Sovereign country rating, growth volatility and financial crisis

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Sovereign Country Rating, Growth Volatility and Financial Crisis

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Abstract:

Using monthly data from January 1996 up to May 2010 for a panel of 76 developed and emerging economies and adopting an instrumental variable estimation technique by correcting for both heterogeneity and endogeneity (correlation between the regressors and the idiosyncratic error) using the generalized two-stage least squares (G2SLS, EC2SLS) procedure method suggested by Balestra and Varadharajan-Krishnakumar (1987) and Baltagi (1995), this paper provides empirical evidence that an alternative channel via which growth volatility is reduced is through changes in sovereign country ratings. The paper also provides a new insight on the effect of global financial crisis (GFC) that it has contributed towards increased macroeconomic volatility by weakening this volatility reducing effect of sovereign country rating. Finally acknowledging the simultaneity between rating and volatility where output volatility may be a determining factor for sovereign country rating, the paper adopts a system approach and uses three stage least square (3SLS) estimator and finds that volatility reducing effect of country credit rating is robust. The channel via which sovereign rating changes affect growth volatility is through sovereign credit default swap (CDS) spread and its volatility.

Keywords: Growth volatility, sovereign country rating, global financial crisis, monetary policy, G2SLS, EC2SLS, 3SLS.

JEL Classification: C33, C36, E52.

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Introduction

Theories of business-cycle and long-run growth once were treated as unrelated areas in macroeconomics. However, over the last decade or so there has risen an agreement that business cycle volatility is somehow related to long-run economic growth. For instance, Kydland and Prescott (1982) show that fluctuations in output are generated by stochastic variations in technology, thus integrating growth and business-cycle theory. But they do not explicitly model how business cycle volatility affect growth. Economic growth and volatility of output growth may be linked, either positively or negatively. For instance, if investments are irreversible, then increased volatility can lead to lower investment (Bernanke, 1983 and Pindyck, 1991). On the other hand, if countries faced with a choice between high-variance, high-expected-return technology and low-variance, low-expected-return technology, opt to choose the former then high output volatility will associated with high growth (Black, 1987). Ramey and Ramey (1995) is the first and most influential paper to have empirically tested the link between output volatility and economic growth which found that countries which have a higher volatility of output also have a lower growth rate of output. This result remains unchanged even after controlling for other country-specific variables which are found to be robust in the literature like investment to GDP ratio.

Noting that high economic growth is what governments want to achieve, the fact that output volatility may induce lower growth is an important finding for policy makers because one of the objectives of macroeconomic policies should also be targeted to reduce growth volatility. As a result it has become crucial to understand what determines growth volatility.

Easterly, Islam and Stiglitz (2000) provides an insight into the empirical determinants of volatility. They have shown that the development domestic financial sector plays a crucial role in lowering output volatility and that this relationship is non-linear. Prasad et al (2004) have shown that increase in financial globalization measured interms of cross border capital inflow and capital account liberalisation has, on average reduced output and consumption volatility in industrial economies and "less financially integrated" developing economies.

Since sovereign credit ratings assigned by the credit rating agencies (CRAs) can affect the country's creditworthiness and thereby limit or enhance the access to global capital market, this paper proposes to test whether sovereign credit rating is another potential determinant of output volatility. In particular the paper tests the hypotheses whether credit rating and

changes to credit rating have any output volatility reducing effects. In addition to this the paper also tests whether the global financial crisis (GFC) has contributed to higher volatility by interacting with the rating-volatility relationship.

The remainder of this paper is organised as follows. Section 2 reviews the literature on sovereign ratings and in particular on the relevance of sovereign ratings for emerging economies. Section 3 presents the most important stylised facts of growth volatility and sovereign credit rating. Section 4 provides the empirical model and analyses the results. In particular, this section analyses the impact of credit ratings on a variety of volatility models where a counterfactual analysis is presented. Finally, section 5 provides concluding remarks and sketches the major policy implications that follow from this research.

1. Literature Review

It has been noted that "the recent financial market turbulence has brought credit rating agencies under fire" and academia as well as policy-makers argue for a reform of the business model of CRAs (Portes 2008). Rating agencies are faced with a serious conflict of interest, to the extent that their remuneration comes from rated issuers (Mathis, McAndrews and Rochet, 2008), both in the context of public of private borrowers. This is a crucial issue, given CRAs' considerable and increasing role on international capital markets. In this context, there is a large and useful literature studying the impact of ratings on market prices and bond spreads. Focusing on market prices, Kaminsky and Schmukler (2001) find that downgrades and upgrades have an impact on country risk and stock returns: these rating changes are transmitted across countries, with neighbour-country effects being more significant.

The study of sovereign risk assessment has focused on comparing ratings to market spreads. For the period 1987-1994, Cantor and Packer (1996) find a greater impact on spreads from a rating change in the case of Moody's or if it is related to speculative-grade countries. Reisen and Von Maltzan (1999) show that rating has asymmetric effects as in the period 1989-1997, Fitch, Moody's and S&P's downgrades have a significant impact on spreads, contrary to upgrades, which were anticipated by the market. For them, sovereign ratings have the potential to moderate euphoria among investors on emerging markets but rating agencies failed to exploit that potential in the 1990s. Sy (2001) highlights the strong negative

relationship between ratings and EMBI+ spreads declines during periods of high risk aversion (e.g., 1997-1998). Mora (2006) examines Moody's and S&P's ratings and concludes that the procyclicality of ratings is not ascertained when considering the post Asian crisis years. Analyzing sovereign ratings issued by the three agencies for 1993-2007, Gaillard (2009) finds that the procyclicality of ratings was much sharper during periods of high risk aversion (1997-1998 in particular) than periods of low risk aversion (2005-2007). He also highlights the greater stability of Moody's ratings. In a different way, Cavallo et al (2008) develop a simple Hausman specification test and find that there is some informational content in sovereign ratings that is not completely captured by market spreads. Additional tests reinforce their conclusion that ratings matter. Lastly, going beyond the traditional "ratings vs. spreads" view, Roubini and Manasse (2005) present an original sovereign risk assessment methodology by using a binary recursive tree. This enables them to better discuss appropriate policy options to prevent crises.

2. Sovereign credit rating, macroeconomic volatility and the stylized facts

It can be seen from the reviews of the papers in section 3 that the focus of these has been analysing the effect of ratings on financial variables and not on the macroeconomic variables. Sovereign credit rating can have effects on macroeconomic volatility because higher credit rating improves a country's creditworthiness which lowers the cost of borrowing from the international market. This allows countries to borrow in bad times and thereby smooth consumption and reduce growth volatility. Sovereign credit rating can also serve as signal for the overall macroeconomic discipline of the economy, for instances a country with excessive deficit will be assigned a lower rating and vice versa. A high credit rating can signal of a disciplined macroeconomy boosting both domestic and foreign investors' confidence and thereby reducing investment volatility.

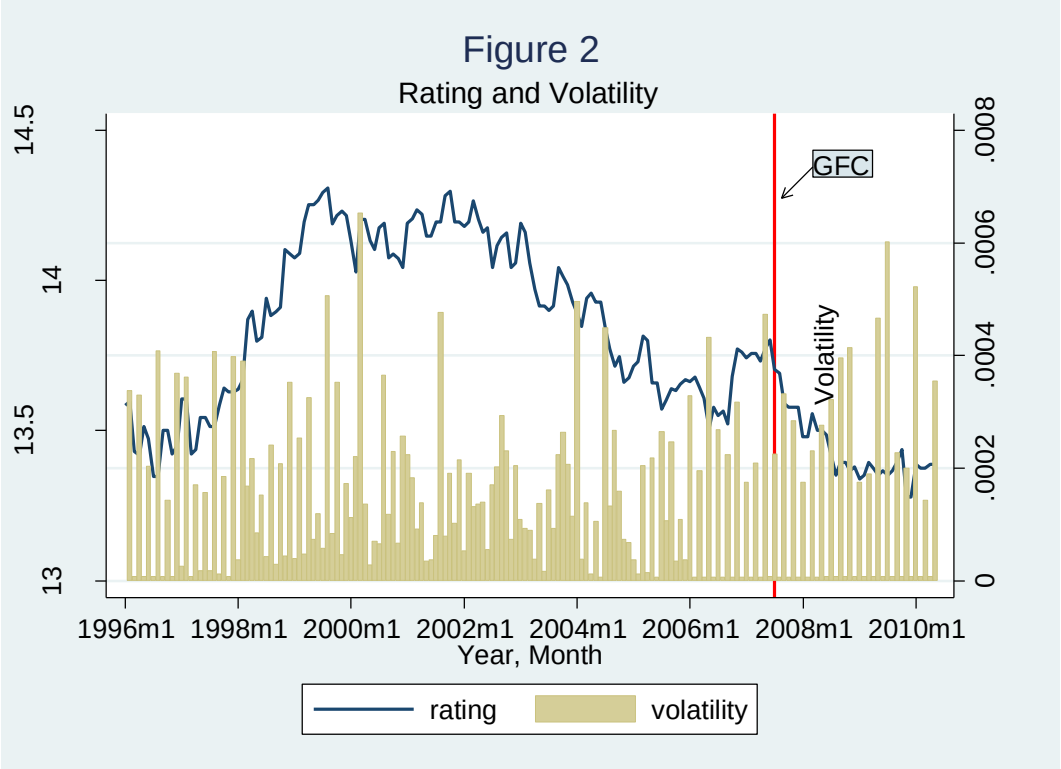
The paper uses monthly data on sovereign credit rating provided by Standard and Poor for the period of January 1996 to May 2010 in 76 developed and emerging economies. In Figure 1 the graphs of rating, changes in rating and growth volatility are combined together. The data are average values for all the countries in the sample. The first panel in Figure 1 shows the dynamics of credit ratings from 1996 to 2010. The red line indicates the time since when the global financial crisis (GFC) sets in. It can be seen that average monthly ratings have gone up

through late 90s and early 00s and have remained more or less constant from the early months of 2000 until 2003. There seems to be gradual but fluctuating decline of ratings from late 2003 until 2006 when it starts rising again but only upto 2007 when GFC sets in coupled with a thorough decline in average ratings.

The second panel in Figure 1 shows the average changes in rating for the sample period. It can be seen that in the period prior to 2004, the frequency of positive changes in rating has been high compared with period from 2004 to 2010. In the latter period the frequency of negative changes in rating is higher.

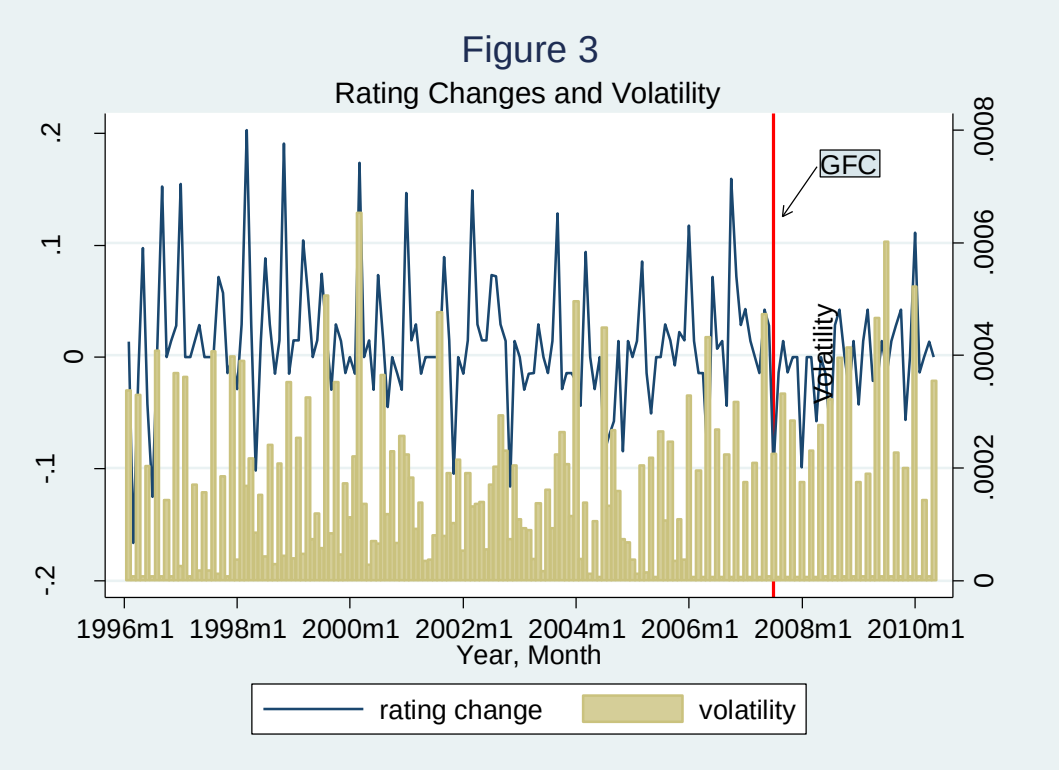
The third panel of Figure 1 shows the dynamics of growth volatility for the same time period. Here there seems to three distinct phases. The early months of 1996 to 2000 is a period of high volatility followed a by relatively tranquil period from 2001 to 2004 where growth volatility has been rather less. From 2005 onward another high volatility period sets in continuing through the GFC with increasing in later period of 2010.

Given the pattern in these data there may be a possible link between rating and volatility. Before investigating it using an econometric model, it will be useful to combine the rating and its changes with volatility together in separate graphs. This is done in Figure 2 and 3 respectively. In Figure 2, sovereign credit rating and growth volatility are combined to see if there is any link between these two. It can be seen at the later part of the data credit rating is gradually falling while growth volatility is going up.



A similar analysis between volatility and changes in rating also shows a possible link between volatility and credit rating which can be seen from Figure 3 where growth volatility and changes in ratings graphs are combined. High positive changes in rating and low negative changes in rating are associated with higher growth volatility. From 1996:01 to 2000:01 – a period of high growth volatility – the frequency of large positive changes in rating is

prominent. Similarly, from 2005:01 to 2010:05 – another period of high growth volatility – the frequency of negative although low, changes in rating is more prominent.



Based on the analysis of the data provided in these data, it is possible to conclude that sovereign credit rating and growth volatility could be related as argued in the beginning of this section. The next section will present results based on a formal econometric model to see if there is any link between credit rating and growth volatility and if this relationship is robust.

3. Econometric Model and Analysis of Results

In order to facilitate understanding the link between rating and volatility, this section will undertake an empirical analysis of the key variables. The specification that will be estimated is as follows:

$$VOL_{it} = \beta_0 + \beta_1 RATING_{it} + \beta_2 DRATING_{it} + \beta_3 GFC_i + \beta_4 (GFC \times DRATING)_{it} + \beta_6 X_{it} + u_{it} \quad (1)$$

Where VOL_{it} is volatility of growth of per capita real GDP, $RATING_{it}$ is sovereign credit rating, $DRATING_{it}$ is changes in sovereign credit rating, GFC (global financial crisis) is an

indicator variable taking the value equal to 1 if the month is equal to July, 2007 to May 2010, and zero otherwise., X_{it} is a matrix of control variable which include price of oil (*OIL*) and number of stocks traded (*STOCK*) and u_{it} is the error term.

Expected signs of the estimated coefficients are as follows. Since credit rating and changes in credit rating are expected to reduce growth volatility, the expected signs of β_1 and β_2 are negative. The global financial crisis has created greater uncertainty and financial instability as a result the expected sign of β_3 is positive. The expected sign of β_4 which is the coefficient of the interacting term is a priori ambiguous. A positive coefficient will imply GFC has strengthened the rating – volatility relationship, and a negative coefficient will imply that it has weakened it. With regard to the control variables, it is expected that a higher oil price and increase in the number of stocks traded will increase growth volatility and hence the signs of their estimated coefficients would be positive.

The results of the estimation of equation (1) using a fixed effect estimator are presented in Table 1. At first the equation is estimated without interaction term and controlling for other variables, and then the controls are added. The estimated results without and with the control variables are in columns (1) and (2) respectively. It can be seen in column (1) that the sign of RATING is negative and significant. It can also be seen that coefficient of DRATING is also negative and significant at 1 percent. Both of these estimations show that credit rating is somehow negatively associated with growth volatility. The estimated coefficient of the variable GFC is positive as expected, but it is not significant. The robustness of these results depend on the addition of the interaction term and the control variables to the regression equation. This is done in column (2). It can be seen that the estimated coefficient of RATING is negative and remain same as before and also significant at 1 percent while there is only a very marginal increase of the magnitude in the estimated coefficient of DRATING but it is still negative and significant at 1 percent. As a result based on the current model, it can be concluded that credit rating has lead to reduction in growth volatility in this sample. The coefficient of GFC is almost similar to its previous value and it is still positive but insignificant. This does not give not sufficient ground to conclude that GFC had added to growth volatility. However, interesting result arises in estimation of the coefficient of interaction term which turns out to be negative although not significant at the conventional level (p-value = 0.101).

Table 1

Dependent variable: Volatility of per capita GDP growth
(Fixed Effect Estimator)

Regressor	(1)	(2)
RATING	-0.000012 (-3.60)***	-0.000012 (-3.14)***
DRATING	-0.000138 (-4.36)***	-0.000105 (-2.80)***
GFC	0.000015 (0.70)	0.000013 (0.59)
*GFC*DRATING*		-0.000116 (-1.64)
OIL		$2.51e^{-06}$ (2.44)**
STOCK		$-1.13e^{-16}$ (-0.68)
CONS	0.000311 (6.74)***	0.000296 (6.29)***
F-Statistics and Summary Statistics		
F-statistic testing coefficients on DRATING (P-value)		0.71 (0.398)
R^2 (within)	0.0035	0.0042
F-statistic (overall) (P-value)	11.59 (0.000)	6.95 (0.000)
No. of observation/countries	10061/76	9952/76

The test of the joint significance of the DRATING variable turns out to be insignificant. Hence no conclusion can be made whether GFC has contributed to growth volatility by interacting with credit ratings. Among the control variables it is found oil price is also contributor to growth volatility because of the estimated coefficient of the OIL variable which positive and significant. The same cannot be concluded for the other control variable, because STOCK is insignificant.

The results in Table 1 which are analysed above will have to be taken with some degree of caution. The estimated coefficient may be biased because the variable RATING could be endogenous and be correlated with the error term. Moreover, because the 76 countries in sample are chosen from different regions across the world, there is possibility that the variance of the error term exhibits some form of heteroscedasticity. These two problems need to be addressed in order to have some meaningful results. Therefore to account for

endogeneity the equation (1) is estimated using an instrumental variable (IV) estimator using the following framework:

$$VOL_{it} = \beta_0 + \beta_1 RATING_{it} + \beta_2 DRATING_{it} + \beta_3 GFC_i + \beta_4 (GFC \times DRATING)_{it} + \beta_6 X_{it} + u_{it} \quad (2)$$

$$RATING_{it} = \gamma_1 IV_{it} + v_{it} \quad (2.1)$$

$$E(RATING_{it} * u_{it}) \neq 0 \text{ but } E(IV_{it} * v_{it}) = 0 \quad (2.2)$$

The results of the instrumental variables estimation of equation (2) are presented in Table (2). The first column presents the fixed effect-IV results correcting for endogeneity but assuming standard property of the error term. The variable RATING instrumented with economic risk, political risk and financial risk as measured in the international country risk guide (ICRG). The results are not too different from those found in the simple FE estimation in Table 1. Both the coefficients RATING and DRATING are negative and significant, implying that the volatility reducing effect of credit rating is robust. The coefficient of the GFC but insignificant as before and the estimated coefficient of the interaction between GFC and DRATING is negative but not significant at the conventional level. However, it can be noted that the test of the joint hypothesis the DRATING variable is clearly rejected. Hence it can be concluded that GFC does contribute to growth volatility by somehow interacting with the DRATING variable. The significance and signs of the estimated coefficients on the control variables OIL and STOCK are remains unchanged.

The estimation of the model with controlling for country specific heterogeneity implies that that there is no time effect. It is possible that some countries in the sample have fixed country effects while others have fixed time effects. This requires the use of the random effect estimator. In presence of endogeneity the method of estimation is the generalized two-stage least squares (G2SLS) procedure method suggested by Balestra and Varadharajan-Krishnakumar (1987). When the heteroscedasticity of the error term is corrected for within this framework the method of estimation is the error corrected generalized two-stage least squares (EC2SLS) suggested by Baltagi (1995). Columns (2) and (3) of Table presents the generalised 2SLS estimations. In column (2) the results of G2SLS estimation are presented. Note that there results almost very similar to those in column (1). RATING and DRATING have negative and significant coefficient as before, and for the first time the estimated

coefficient on the interaction term (GFC*DRATING) is significant at 10 percent level and the joint test on the coefficients on both DRATING is comfortably rejected. As a results it is now possible to conclude that GFC affects growth volatility by interacting with rating changes.

Table 2

Dependent variable: Volatility of per capita GDP growth
(Instrumental Variable Estimator)
Endogenous variable: RATING

Regressor	(1) FE-IV	(2) RE-G2SLS	(2) RE-EC2SLS
RATING	-0.000013 (-3.13)***	-0.000011 (-3.97)***	-0.000012 (-3.79)***
DRATING	-0.000106 (-2.81)***	-0.000104 (-2.76)***	-0.000103 (-2.74)***
GFC	0.000014 (0.64)	0.000010 (0.46)	8.95e-06 (0.41)
*GFC*DRATING*	-0.000114 (-1.61)	-0.000116 (1.65)*	-0.000117 (-1.65)*
OIL	2.60e-06 (2.51)**	1.03e-06 (2.57)**	2.65e-06 (2.57)**
STOCK	-1.44e-16 (-0.84)	-5.40e-17 (-0.36)	-3.18e-17 (-0.21)
CONS	0.000329 (5.74)***	0.000299 (7.59)***	0.000314 (6.97)***
χ^2-Statistics and Summary Statistics			
χ^2-statistic testing coefficients on DRATING (P-value)	13.50 (0.000)	13.65 (0.000)	13.51 (0.000)
R^2 (within)	0.0044	0.0044	0.0044
Wald – χ^2 (P-value)	300.00 (0.000)	45.68 (0.000)	44.41 (0.000)
No. of observation/countries	9809/76	9809/76	9809/76

In column (2) the variance of the error term is assumed to be homoscedastic. This assumption is relaxed, and column (3) provides the estimation of equation (2) using EC2SLS estimator where the variance of the error term is allowed to vary across countries. It can be seen that correcting for both endogeneity and heteroscedasticity, the link between rating and volatility is still negative – the estimated coefficients on RATING and DRATING are negative and significant. Also the estimated coefficient of the interaction term is also significant. Therefore it can be concluded that the volatility reducing effects of sovereign credit rating is robust to

alternative estimators and also that the global financial crisis has contributed to the volatility of growth of output by weakening this relationship.

In estimating equations (1) and (2), the depended variable was volatility of per capita GDP growth which is calculated as the squared deviation of actual growth from the mean. This is a overall measure of output variability. Perhaps even more important are the economic downturns that occur periodically and have long characterised market economies. To analyse the link between rating and economic downturn, a probit analysis is performed on the same data. The estimated model is slightly different from the previous ones which is as follows:

$$DOWN_{it} = \beta_0 + \beta_1 RATING_{it} + \beta_2 DRATING_{it} + \beta_3 GFC_i + \beta_4 (GFC \times DRATING)_{it} + \beta_6 X_{it} + u_{it} \quad (3)$$

The right hand side variables are same as before but the depended variable DOWN has been transformed into a binary one where it takes a value equal to 1 when per capita GDP growth is negative or 0 when growth is positive. This allows to analyse if credit ratings has any implication negative growth only. The probit results are summarised in Table (3), where column (1) represents the population-averaged probit estimation of equation (3) and column (2) represents the random effect estimations. The results are not promising compared to has been found so far. However, it can be seen that in both estimations the coefficient on RATING is found to be negative and significant at 10 percent. So there is some evidence, albeit very weak, that credit rating can also lead to reduction in economic downturn.

Table 3 Dependent variable: Binary variable when per capita GDP growth is negative, dependent variable = 1; otherwise 0) (PROBIT Estimator)		
Regressor	(1) Population-Averaged	(2) RE
RATING	-0.0145 (-1.79)*	-0.0144 (-1.70)*
DRATING	-0.1012 (-1.42)	-0.1013 (-1.33)
GFC	-0.1190 (-1.22)	-0.1205 (-1.22)
*GFC*DRATING*	0.0163 (0.09)	0.0162 (0.09)
OIL	0.0039 (0.89)	0.0037 (0.84)
STOCK	3.05e-13 (0.60)	3.17e-13 (0.60)
CONS	-2.1560 (-19.19)***	-2.1823 (-17.41)***
Summary Statistics		
Log likelihood		-551.7714
No. of observation/countries	10609/76	10609/76

The final model presented in this paper to analyse the rating – volatility link is based on the observation that there could be simultaneity between them—just as rating can affect volatility; it can also get affected by volatility. A simultaneous relationship between credit rating and volatility requires an appropriate model and estimator to be used which accounts for this joint determination of both rating and volatility by modelling them simultaneously. With these objectives the following model is estimated:

$$VOL_{it} = \beta_0 + \beta_1 RATING_{it} + \beta_2 DRATING_{it} + \beta_3 GFC_i + \beta_4 (GFC \times DRATING)_{it} + \beta_6 X_{it} + u_{it} \quad (4.1)$$

$$RATING_{it} = \delta_0 + \delta_1 VOL_{it} + \delta_2 MONEY + \delta_3 INF + \delta_4 COMPRISK + \delta_5 LGDP + \delta_6 GROWTH + \delta_7 VINF + \varepsilon_{it} \quad (4.2)$$

The variables in equation (4.1) are same as before and some of the variables in equation (4.2) are new and they have been as determinants of sovereign credit ratings. MONEY is monetary policy stand, INF is rate of inflations, COMPRISK is composite risk as measured in ICRG, LGDP stands for log of GDP, GROWTH is for per capita GDP growth, and VINF is volatility of inflation. Equations (4.1) and (4.2) are jointly estimated as a system using the three stage least square estimator and the results are presented in Table 4. Column (1) presents the estimated coefficients of the volatility equation. It can be seen that the signs of the estimated coefficients and their significance are very similar to those in Table 3. In particular, the estimated coefficient of RATING and DRATIING are negative and significant as they have been before conforming the notion that credit rating contributes to lower growth volatility. What is also seen from column is that the estimated coefficient on the interaction term (GFC*DRATING) is negative and significant. The joint test on the coefficients of DRATING clearly rejects the null. This leads to the conclusion that whilst the direct effect of GFC on growth volatility has been insignificant, the indirect of GFC has been its contribution towards it by weakening the volatility reducing effect of credit rating. Among the control variable, oil prices have consistently contributed towards increased volatility of output by having a positive and significant coefficients in all specifications.

In column (2) the estimated coefficients of the RATING equation is presented. It can be seen that volatility itself is a major determinant of credit rating because the estimated sign of VOL is negative and significant. This implies volatility will lead to reduced ratings. With regard to policy the variables MONEY, INF and VINF seem to be important as these can instruments for conducting monetary policy. The variable MONEY which is an indicator variable set equal to one if the short-term interest rate was increased (until the next interest rate cut), zero otherwise represents the monetary policy stance of the authority. With a positive and significant estimated coefficient on this variable it can be concluded that a increase in short term rate before it is reduced next can increase credit rating because it shows the commitment of the monetary authority to discipline the economy. On the contrary high inflation and inflation volatility can lead to lower credit rating as can be seen from the estimated coefficients on INF and VINF are negative and significant at 1 percent. High inflation and volatility of inflation represents an unstable macroeconomic environment which leads to decrease in sovereign.

Table 4

Dependent variables: Volatility of per capita GDP growth, Rating
(Three stage least square (3SLS) estimator)
Endogenous Variables: Volatility of per capita GDP growth, Rating

Regressor	(1) VOLATILITY	(2) RATING
RATING	-0.000015 (-6.47)***	
DRATING	-0.000105 (-2.65)***	
GFC	9.50e-06 (0.41)	
*GFC*DRATING*	-0.000126 (-1.69)*	
OIL	2.76e-06 (2.46)**	
STOCK	2.10e-17 (0.884)	
VOLATILITY		-11.6914 (-4.02)***
MONETARY POLICY STANCE		0.36735 (8.02)***
INFLATION		-0.22152 (-6.59)***
COMPRISK		0.33421 (73.37)***
LOG(GDP)		1.43645 (51.11)***
GDP GROWTH		0.05054 (0.02)
INFLATION VOLATILITY		-0.17487 (-7.47)***
CONS	0.000356 (10.82)***	-20.8765 (82.71)***
χ^2-Statistics and Summary Statistics		
χ^2-statistic testing coefficients on DRATING (P-value)	9.16 (0.002)	
R^2	0.0075	0.8269
RMSE	0.0009	2.0859
χ^2-statistic (overall) (P-value)	71.38 (0.000)	42420.35 (0.000)
No. of observation/countries	8873/76	8873/76

4. Sovereign Credit Rating and Growth Volatility: The Missing Link

In the preceding sections an attempt has been made to empirically establish a link between credit rating and growth volatility. The evidence confirms that such a relation exists and that it is robust. In this last we make an attempt to explain why credit rating decreases volatility of output. The mechanism by which the effect of credit ratings fall on to the real sector of the economy can be attributed on its impact on the sovereign credit default swap (CDS) spread. That is sovereign credit rating changes cause higher volatility in the sovereign CDS spreads exacerbating the uncertainty of the market's perception on whether a sovereign is going to default which has real economic consequences and thus can affect output volatility.

Table 5
Rating Changes and Sovereign CDS spread and volatility

Variables	Dependent Variables			
	CDS Spread		CDS Volatility	
RATINGS	-0.00329 (-3.23)***	-0.00323 (-3.27)***	-0.00053 (-2.82)***	-0.00054 (-2.80)***
DRATING	-0.01219 (-2.13)**		-0.00383 (-2.08)**	
POSITIVE DRATING		-0.00275 (-0.62)		-0.00228 (-0.68)
NEGATIVE DRATING		0.05657 (2.86)***		0.01181 (2.41)**
OIL	-0.00033 (-2.63)***	-0.00032 (-2.60)***	-0.00015 (-7.90)***	-0.00015 (-7.85)***
GROWTH	-0.22144 (-3.55)***	-0.21677 (-3.45)***	-0.08027 (-2.22)**	-0.07826 (-2.17)**
INFLATION	0.05427 (2.17)**	0.52667 (2.10)**	0.02765 (15.73)***	0.02744 (15.55)
CONS	0.05808 (4.00)***	0.05659 (4.05)***	0.00741 (2.38)**	0.00731 (2.34)**
NO. OF OBS/GROUPS	4530/70	4530/70	4530/70	4530/70
WALD χ^2-statistic	19.73 (0.001)	8.99 (0.109)	29.52 (0.000)	12.55 (0.050)
WITHN R^2	0.266	0.105	0.276	0.106

In Table 5 we report generalised least square (GLS) estimates on the effects of credit ratings changes on both CDS spread and CDS spread volatility. Our variable of interest is DRATING. We also create a new variable POSITIVE DRATING which is an indicator variables taking value equal to 1 when DRATING is positive. Similarly for NEGATIVE DRATING but when change in rating is negative. We also use oil price (OIL), GDP growth per capita and inflation rate as control variables. The findings show that credit rating changes have a negative impact on CDS spread and on its volatility. This can be seen from the coefficient on DRATING which is negative and significant. However what is interesting is to note that this effect is asymmetric. The effect of positive change in ratings is negative but insignificant. But the effect of negative changes in ratings is positive and significant, that is only negative changes in rating increases both CDS spread and its volatility. However, since on the aggregate DRATING lowers CDS spread and CDS spread volatility, sovereign credit rating changes can help reduce uncertainty in the overall macroeconomy and thus cause to lower output volatility.

5. Conclusion

The empirical fact that output volatility may induce lower growth (Ramey and Ramey, 1995) is an important finding for policy makers because reducing growth volatility can be a key target via which one of the main objectives of macroeconomic policies – higher economic growth – can be achieved. As a result it has become crucial to understand what determines growth volatility. Using monthly data from January 1996 up to May 2010 for a panel of 76 developed and emerging economies and adopting an instrumental variable estimation technique by correcting for both heterogeneity and endogeneity (correlation between the regressors and the idiosyncratic error) using the generalized two-stage least squares (G2SLS, EC2SLS) procedure method suggested by Balestra and Varadharajan-Krishnakumar (1987) and Baltagi (1995), this paper provides empirical evidence that an alternative channel via which growth volatility is reduced is through increases in sovereign country ratings. The paper also provides a new insight on the effect of global financial crisis (GFC) that it has contributed towards increased macroeconomic volatility by weakening this volatility reducing effect of sovereign country rating. Acknowledging the simultaneity between rating and volatility where output volatility may be a determining factor for sovereign country rating, the paper adopts a system approach and uses three stage least square (3SLS) estimator and finds that volatility reducing effect of country credit rating is

robust. The 3SLS estimates also show that monetary policy stance, inflation and inflation volatility are major determinants of sovereign rating. As a result, monetary policy can be effectively used to increase sovereign credit rating and achieve lower output volatility. As a final note, it must stressed that the objective of this paper is to put forward a case that there is possible link between growth volatility and sovereign credit rating using simple econometric model. It has been shown in the paper that the link between sovereign ratings changes and growth volatility is through CDS spread. Changes in sovereign credit ratings lowers CDS spread and CDS spread volatility, and therefore reduce uncertainty in the overall macroeconomy which leads to lower output volatility.

Data Appendix

Variable	Data Definition	Sources
VOL	Volatility of per capita GDP growth measured as squared deviation of per capita GDP growth from its mean.	Calculated by author. Per capita GDP growth data from World development indicators (2010).
RATING	Sovereign credit ratings provided by Standard and Poors. The ratings have been converted to a linear time series following Gande and Parsley (2005).	Standard and Poors.
CDS	Sovereign credit default swap spread.	Bloomberg.
DRATING	First difference on RATING	Author.
GFC	Binary variable =1 if time equals 2010:07 to 2010:05. It represents Global Financial Crisis months.	Author.
OIL	World oil price	Datastream.
STOCK	Total value of shares traded during the period (current US$)	World development indicators (2010).
MONEY	An indicator variable set equal to one if the short-term interest rate was increased (until the next interest rate cut), zero otherwise.	World development indicators (2010).
INF	Inflation rate.	World development indicators (2010).
VINF	Volatility of inflation rate measured as deviation of actual inflation from its mean.	Calculated by author.
LY	Log of Gross domestic product-value of goods produced per person in the country.	World development indicators (2010).
GROWTH	Real GDP per capita growth rate.	World development indicators (2010).

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