The relation between sovereign credit rating revisions and economic growth ☆

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A R T I C L E   I N F O

A B S T R A C T

A country's economic growth exhibits a significant response to sovereign rating changes: a one-notch upgrade (downgrade) causes an increase (decline) of about 0.6% (0.3%) in re-rated countries' five-year average annual growth rates. The results hold after accounting for other determinants of economic growth and potential endogeneity problems, and are robust to the use of quarterly data. Changes in country rating affect economic growth via the interest-rate and capital-flow channels: narrower sovereign bond yield spreads and increased capital inflows are associated with upgrades, which stimulate re-rated countries' economic performance, and the converse holds for downgrades.

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1. Introduction

Sovereign credit rating agencies use a combination of economic, social, and political factors to assess a rated country's capacity and willingness to honor its current and future debt obligations in full and on time. Reinhart (2002) indicates that sovereign credit ratings are useful in predicting sovereign distress. When a sovereign defaults, it may incur reputation costs, lose assets abroad, worsen its access to international capital markets, and impede international trade (Bulow and Rogoff, 1989; Duffie et al., 2003). Recent

sovereign rating downgrades of several European countries by the major credit rating agencies show how important it is to examine the effects of revisions in sovereign credit ratings.

Negative sovereign rating changes typically lead to significant increases in sovereign bond yields (Cantor and Packer, 1996). Sovereign bonds represent "benchmark securities". That is, sovereign bond yields serve as the benchmark for interest rates in borrowing countries (Gande and Parsley, 2005; Dittmar and Yuan, 2008). Changes in sovereign credit risk may also trigger re-weighting of global debt portfolios, which would affect the cost and the flow of capital across countries (Longstaff et al., 2011). Institutional investors such as pension funds and money market funds are prohibited from buying non-investment-grade securities (Becker and Milbourn, 2011). Stock markets can be adversely affected by negative revisions in sovereign ratings (Kaminsky and Schmukler, 2002; Brooks et al., 2004). Positive sovereign rating announcements are associated with an immediate reduction in sovereign credit default swap spreads (Ismailescu and Kazemi, 2010). Sovereign rating downgrades result in an increase in stock and bond market volatilities (Afonso et al., 2014). Negative sovereign rating events lead to significant spillover effects on yield spreads of sovereign bonds (Gande and Parsley, 2005; Afonso

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et al., 2012; Beetsma et al., 2013) and on stock market returns (Ferreira and Gama, 2007).[1]

While a variety of studies on the effects of revisions in sovereign credit ratings are insightful, they do not consider explicitly how rating changes affect re-rated countries' economic growth, perhaps the most important aspect of national economic performance (Quinn and Toyoda, 2008). Sovereign rating revisions could affect the re-rated country's economic growth through the interest-rate and capital-flow channels. Negative revisions of sovereign credit ratings tend to increase relative debt burdens, so a re-rated country and its businesses will find it harder to raise funds in international capital markets. Unregulated capital outflow following negative rating changes could also increase the cost of capital and restrict credit, which in turn dampens real economic activity, leading eventually to slow growth or recession. Positive sovereign rating revisions would have just the opposite effect.

The hypothesis of changes in capital flows associated with sovereign rating changes can be explained by a flight-to-quality argument. That is, investors will shift capital away from riskier investments to the safest possible investment vehicles in the face of uncertainty in international financial markets (Bernanke et al., 1996; Hartmann et al., 2004; Pavlova and Rigobon, 2008). Caballero and Krishnamurthy (2008) argue that severe flight-to-quality episodes involve uncertainty about the entire environment, not just risk about asset payoffs. Reinhart and Rogoff (2004) assert that credit markets and political risk are the main reasons that explain the patterns of international capital flows. Arteta and Hale (2008) find a large and significant decline in foreign credit to domestic private firms in emerging markets during sovereign debt crisis periods.

Capital flows are significant because they influence the interest rate at which a country can borrow in international financial markets (Henry, 2000, 2003; Sandleris, 2008; Broner et al., 2010). The level of interest rates will affect investment and thus economic performance. A number of authors provide evidence on how capital flows and interest rates contribute to the promotion of investment and output growth. Bekaert and Harvey (1998, 2000) suggest that increases in private equity flows are associated with a lower cost of capital and positive macroeconomic performance in emerging markets. Levine and Renelt (1992) show robust relations among economic growth, foreign direct investment (FDI), and human capital. Borensztein et al. (1998) suggest that FDI plays an important role in the process of technology diffusion, contributing more to economic growth in developing countries than domestic investment. Alfaro et al. (2004) find that countries with more developed financial systems can gain significant economic growth advantages from FDI. Lane and Milesi-Ferretti (2001) show that the growth of gross stocks of equity and FDI is related to gross domestic product (GDP) in both industrialized and developing countries. Neumeyer and Perri (2005), Aguiar and Gopinath (2007), and Arellano (2008) document co-movement among interest rates, capital flows, and economic growth in emerging economies.

To sum this up, when a sovereign rating drops (i.e., country risk is higher), investors might shift investment from high-risk countries with political disorder, financial turmoil, or volatile economic conditions to less risky markets in other countries. One would expect negative sovereign rating revisions to be associated with increased interest rates and net capital outflows. Credit restriction would inhibit activity in the real economy, and ultimately may lead to a reduction in subsequent economic output. The converse holds for positive sovereign rating revisions.

We examine changes in Standard & Poor's (S&P) long-term foreign currency sovereign credit ratings for 103 countries during 1982–2012. The growth rate of real per capita GDP exhibits a significant response to sovereign credit rating changes. A one-notch rating upgrade results in an increase of about 0.6%, and a one-notch rating downgrade results in a decline of about 0.3%, in the subsequent five-year average annual growth rates of re-rated countries. The effects of sovereign rating revisions on economic growth are stronger when an upgraded country has a higher level of economic openness, when a downgraded country has greater external debt or external deficit, or when a re-rated country's rating is close to the investment-grade threshold. Our findings hold after accounting for other determinants of economic growth, financial liberalization, financial crises, economic development status, debt level, investor protection, quality of institution, future growth expectations, and potential endogeneity problems. We mitigate the endogeneity concerns using a system generalized method of moments (system GMM) approach and a difference-in-differences framework. Using quarterly data to better disentangle changes in economic growth immediately before and after rating revisions does not change our results.

We use a three-stage least squares procedure to examine the transmission channels. We find changes in country rating will affect output growth through two channels: interest rate and capital flows. That is, rating upgrades result in reduced interest rates and increased capital inflows that stimulate economic growth. Rating downgrades, on the other hand, lead to increased interest rates and capital outflows, which in turn generate poor economic performance.

We also perform several robustness checks of the effects of sovereign credit rating revisions on the re-rated country's economic growth rates. We take into account the potential effects of different rating agencies (Moody's and Fitch), non-overlapping data, and alternative economic growth measures. Our conclusions remain unchanged. Thus, we find robust evidence that revisions in sovereign credit ratings do affect the economic growth prospects of re-rated countries.

The paper is organized as follows. Section 2 describes the sample selection process and empirical models. Section 3 presents the empirical results. Section 4 explores the transmission channels. Section 5 discusses robustness checks. Section 6 summarizes our findings.

2. Data and methodology

2.1. Sample

We collect S&P sovereign credit ratings for long-term foreign currency-denominated debt from the S&P website (http://www.s-tandardandpoors.com). S&P is more active in making rating changes among rating agencies, hence providing a larger data set. S&P rating changes are less anticipated by market investors, precede the rating revisions of other rating agencies (Reisen and von Maltzan, 1999; Gande and Parsley, 2005; Ismailescu and Kazemi, 2010), and demonstrate the least dependence on other rating agencies (Alsakka and ap Gwilym, 2010).

Our sample consists of upgrades and downgrades in S&P sovereign ratings covering the period 1982–2012.[2] Our analysis also incorporates changes in the credit outlook of a country that are released by S&P, because they add information regarding a sovereign's credit health (e.g., Ismailescu and Kazemi, 2010). Using a method similar to that in Gande and Parsley (2005), we construct a "comprehensive credit rating" measure. The numerical codings

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for letter ratings and credit outlook are presented in Appendix A1.[3] The comprehensive credit rating measure is the sum of the numerical value for the letter rating and the numerical value for the credit outlook. Positive and negative rating events are events with positive and negative changes in comprehensive credit ratings, respectively. Our final sample consists of 271 positive rating events and 192 negative rating events for 103 countries.

2.2. Empirical model

The link between sovereign rating revisions and economic growth may suffer from endogeneity problems. One form of endogeneity is that economic growth may have a reverse causal effect on country credit ratings; that is, changes in economic growth may cause rating agencies to consider a revision of the current rating. Cantor and Packer (1996) and Mellios and Paget-Blanc (2006) find that GDP per capita plays an important role in determining a country's credit rating. Another source of endogeneity is the possibility that both economic growth and country credit ratings are determined by an omitted factor. For example, positive sovereign rating revisions could have a positive impact on output growth because of the contemporaneous implementation of other economic reforms or market expectations for future growth opportunities. In these circumstances, there would be a correlation between rating change variables and the error term, resulting in biased estimated coefficients. To account for possible endogeneity effects, we employ two different approaches: (1) a system generalized method of moments (system GMM) (Arellano and Bover, 1995; Blundell and Bond, 1998) and (2) a difference-in-differences framework.

2.2.1. System GMM

We use a dynamic panel data approach, system GMM, which helps to mitigate the bias induced by omitted variables and any inconsistency caused by endogeneity (Quinn and Toyoda, 2008; Rancière et al., 2008). The baseline regression model is:

$$AvgGrowth_{i,t,t+4} = \beta_0 y_{i,t-1} + \beta_1 RatChgUp_{i,t} + \beta_2 RatChgDown_{i,t} + \gamma' \boldsymbol{X}_{i,t} + \eta_t + \varepsilon_{i,t}, \tag{1}$$

$AvgGrowth_{i,t,t+4}$ is the average growth rate, defined as the mean of the real per capita GDP growth rate for country i calculated over a five-year period from year t to year $t + 4$.[4] Data on economic growth are obtained from the World Bank's World Development Indicators (WDI). We use overlapping growth spells to maximize the time-series content in our regression (as in Bekaert et al., 2001, 2005; Checherita-Westphal and Rother, 2012; Panizza and Presbitero, 2014). $y_{i,t-1}$ denotes the logarithm of per capita real GDP for country i in year $t − 1$.[5] $RatChgUp$ is the change in comprehensive credit rating in the year of the positive rating event, and zero otherwise. $RatChgDown$ is the absolute change in comprehensive credit rating in the year of the negative rating event, and zero otherwise. $\boldsymbol{X}$ represents a set of control variables suggested in the

literature that could affect economic growth (e.g., Sala-i-Martin et al., 2004; Bekaert et al., 2005; Arellano, 2008; Quinn and Toyoda, 2008; Reinhart and Rogoff, 2010). Appendix A2 describes the control variables and their data sources. η_t denotes year-specific dummy variables to control for cross-country correlations in the error terms that may be induced by common worldwide shocks. ε is a random error term. We use Eq. (1) to construct a system of two equations in both levels and first differences.

We follow prior studies and use the indicator of a country's default history, Sub-Saharan Africa dummy, Latin America dummy, and East Asia dummy as instruments (Barro, 1991, 1997, 2001, 2003; Levine and Renelt, 1992; Cantor and Packer, 1996; Sala-i-Martin, 1997; Sala-i-Martin et al., 2004).[6] We use robust standard errors adjusted for panel-specific autocorrelation and heteroskedasticity, Hansen's (1982) J-statistic to test over-identifying restrictions, and the Arellano and Bond (1991) test to detect for residual autocorrelation.

2.2.2. Difference-in-differences framework

We use a difference-in-differences approach to address potential endogeneity problems (Roberts and Whited, 2011). The matching-country-adjusted economic growth rate is the difference between the economic growth rate of the re-rated country and the average economic growth rate of its matching countries. Matching countries must not have had a sovereign rating revision in the five years before or after the year of the re-rated country's sovereign rating change. They also must not be within the same trade bloc (the Northern American Free Trade Agreement (NAFTA), the Mercado Comun del Sur (Mercosur), the European Union (EU), or the Association of South East Asia Nations (ASEAN)) as the re-rated country to avoid the potential effects of regional common shocks. They must be within the same political risk quintile and growth opportunities tercile as the re-rated country. Measures of political risk and growth opportunities are defined in Appendix A2.

3. Real economy response around sovereign credit rating revisions

3.1. Preliminary analysis

Table 1 presents the mean and median annual growth rates of real per capita GDP in pre- and post-rating-change periods. The number of observations varies because of data availability. Panel A presents the results for the full sample. The first three columns show the results of positive rating events. We find significant increases in real GDP growth rates after a positive revision in sovereign credit ratings. The average annual GDP growth rate is 3.2% in the three-year pre-rating-change period and 4.2% in the three-year post-rating-change period. The mean difference in annual GDP growth rates between the two periods is 1.0%, statistically significant at the 1% level according to a t-test. Equal median GDP growth rates can also be rejected at the 1% level using a Wilcoxon rank-sum test. Results are similar for five-year pre- and post-rating-change periods. The last three columns show that for the sample of negative rating events, the average annual GDP growth rate is 1.5% in the three-year pre-rating-change period and 0.6% in the three-year post-rating-change period. The mean difference in the annual GDP growth rates is –0.9%, statistically significant at the 1% level. Results are similar for median differences and for five-year pre- and post-rating-change periods. Thus,

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[3] Gande and Parsley (2005) count the positive and negative outlook the same as one notch. It makes more sense, however, to have the positive and negative outlook count as 0.5 notches and the positive and negative watch 0.25. We are grateful to a referee for this suggestion.

[4] International rating agencies revised the sovereign credit ratings of several Eurozone countries and the United States during the 2010–2011 period. To capture these important rating revision events, we also compute AvgGrowth for years 2009, 2010, 2011, and 2012 even though not calculated over the whole five-year interval. The results are similar if our sample period ends in 2008.

[5] We follow Bekaert et al. (2011) and Panizza and Presbitero (2014) and include the logarithm of initial per capita real GDP, $y_{i,t-1}$, as a regressor. Notice that $y_{i,t-1}$ is not overlapped with the dependent variable.

[6] The indicator of default history is a binary variable that equals one if a country has ever defaulted on foreign currency debt, and zero otherwise. Data are obtained from the S&P website.

Table 1
Preliminary evidence.

	Positive rating events			Negative rating events		
Panel A: full sample						
	3-year pre-rating-change period	3-year post-rating-change period	Difference	3-year pre-rating-change period	3-year post-rating-change period	Difference
Mean	0.032	0.042	0.010[***]	0.015	0.006	−0.009[***]
Median	0.030	0.041	0.011[***]	0.012	0.006	−0.006[**]
Number of events	268	270		192	192	
	5-year pre-rating-change period	5-year post-rating-change period	Difference	5-year pre-rating-change period	5-year post-rating-change period	Difference
Mean	0.031	0.038	0.007[***]	0.021	0.010	−0.011[***]
Median	0.030	0.037	0.007[***]	0.016	0.009	−0.007[***]
Number of events	268	271		192	192	
Panel B: Subsample entailing a rating revision of larger than one notch						
	3-year pre-rating-change period	3-year post-rating-change period	Difference	3-year pre-rating-change period	3-year post-rating-change period	Difference
Mean	0.021	0.042	0.021[***]	0.015	0.001	−0.014[***]
Median	0.023	0.042	0.019[***]	0.007	0.004	−0.003[***]
Number of events	77	78		122	122	
	5-year pre-rating-change period	5-year post-rating-change period	Difference	5-year pre-rating-change period	5-year post-rating-change period	Difference
Mean	0.019	0.038	0.019[***]	0.022	0.007	−0.015[***]
Median	0.017	0.040	0.023[***]	0.015	0.006	−0.009[***]
Number of events	77	78		122	122	

The table presents three- and five-year average annual growth rates of real per capita GDP before and after sovereign rating changes. Panels A and B show the results for the full sample and for the subsample entailing a sovereign rating revision of larger than one notch, respectively. Differences in mean and median are assessed using a *t*-test and a Wilcoxon rank-sum test. The number of observations varies because of data availability.
[***] Represents 1% significance level.
[**] Represent 5% significance level.

negative sovereign rating changes are associated with significant declines in real GDP growth rates.[7]

Panel B of Table 1 presents the results for the subsample entailing a sovereign rating revision of larger than one notch. We find similar results: Positive (negative) sovereign rating revisions are associated with significant increases (declines) in economic growth. The absolute magnitudes of the changes in economic growth rates associated with positive and negative sovereign rating revisions are generally greater for this subsample than for the full sample.

3.2. System GMM and difference-in-differences results

Table 2 presents the estimation results of system GMM regressions. The number of observations varies across regressions because of data availability. Columns (1) through (7) show that the coefficients on *RatChgUp* are positive and the coefficients on *RatChgDown* are negative, in all cases statistically significant at the 5% level or better. The average coefficients on *RatChgUp* and *RatChgDown* are 0.6% and −0.3% in Column (3), respectively. The evidence indicates that a one-notch rating upgrade (downgrade) leads to an increase (decline) of 0.6% (0.3%) in the subsequent five-year average annual growth rates of the re-rated countries. By comparing the size of the coefficient on *RatChgUp* in Column (3) with the mean difference in GDP growth rates before and after the positive rating change (as shown in Panel A of Table 1), we can

argue that the casual effect of the upgrade is 86% (= 0.6/0.7) of the total difference. Similarly, the casual effect of the downgrade is 27% (= 0.3/1.1) of the total difference.

According to the flight-to-quality argument, the causal effect of sovereign rating revisions works through the effect of international credit markets. If this is the channel, the effects should be stronger for open countries more reliant in international markets. We use the ratio of the sum of imports plus exports to GDP as a proxy for the degree of a country's openness. We divide the sample countries into deciles according to the degree of openness, and define high-openness countries (*H_OPENNESS*) as those in the top three deciles. High-external-debt countries (*H_ExtnlDebt*) and high-external-deficit countries (*H_ExtnlDeficit*) are similarly defined for countries with a high ratio of external debt to GDP and a high ratio of trade deficit to GDP, respectively. We then interact these variables with *RatChgUp* and *RatChgDown* in Columns (5) through (7), respectively. We expect countries with a higher level of openness, external debt, or external deficit to be more sensitive to upgrades and downgrades.

Column (5) shows that the coefficient on *RatChgUp × H_OPENNESS* is significantly positive at the 5% level, while the coefficient on *RatChgDown × H_OPENNESS* is statistically insignificant. The result is consistent with our expectation that the effect of a positive rating revision on economic growth rates is significantly stronger for a country with a higher level of economic openness. Columns (6) and (7) show that the coefficients on *RatChgDown × H_ExtnlDebt* and *RatChgDown × H_ExtnlDeficit* are significantly negative at the 5% level or better, while the coefficients on *RatChgUp × H_ExtnlDebt* and *RatChgUp × H_ExtnlDeficit* are statistically insignificant. The evidence indicates that a country with more external debt or external deficit will suffer a greater decline in output growth rates when its sovereign rating is downgraded.

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[7] We also check for the effects of sovereign rating revisions on stock markets. Data on stock index returns for re-rated countries are obtained from Datastream. Online Appendix Table A2 shows the asymmetric effects of rating revisions on stock markets: Upgrades have no significant effects on stock returns, but downgrades prompts a significant decline in stock returns, consistent with prior evidence (e.g., Brooks et al., 2004). The results hold for both annual and quarterly stock returns.

Table 2
Relation between sovereign rating revisions and economic growth: system GMM estimation.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
RatChgUp	0.010***	0.007***	0.006***	0.005***	0.006***	0.007***	0.006***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
RatChgDown	−0.005***	−0.004**	−0.003***	−0.003***	−0.003**	−0.002**	0.004**
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
LIBER			0.009***	0.008**	0.010***	0.011***	0.011***
			(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
CRISIS			−0.010***	−0.006***	−0.012***	−0.013***	−0.013***
			(0.003)	(0.002)	(0.003)	(0.003)	(0.003)
DEVELOP			−0.011**	−0.028***	−0.009**	−0.010**	−0.010**
			(0.005)	(0.005)	(0.004)	(0.004)	(0.004)
EmgExtnlDebt			−0.017***	−0.023***	−0.007**	−0.009*	−0.011**
			(0.006)	(0.007)	(0.004)	(0.005)	(0.005)
Duration			−0.013***	−0.012**	−0.009***	−0.012***	−0.012***
			(0.004)	(0.006)	(0.003)	(0.004)	(0.004)
Anti-self-dealing			−0.003	0.010	−0.005	−0.007	−0.008
			(0.009)	(0.009)	(0.006)	(0.007)	(0.007)
GO				0.019***			
				(0.007)			
RatChgUp × H_OPENNESS					0.011**		
					(0.005)		
RatChgDown × H_OPENNESS					−0.007		
					(0.005)		
RatChgUp × H_ExtnlDebt						−0.004	
						(0.004)	
RatChgDown × H_ExtnlDebt						−0.006**	
						(0.003)	
RatChgUp × H_ExtnlDeficit							0.003
							(0.003)
RatChgDown × H_ExtnlDeficit							−0.010***
							(0.003)
PCGDP80	−0.011***	−0.010***	−0.013***	−0.010***	−0.013***	−0.014***	−0.014***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)
SCH80	0.003**	0.004**	0.001	−0.001	0.001	0.001	0.001
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
LIFE80	0.039**	0.025	0.017	0.075**	0.009	0.019	0.020
	(0.018)	(0.020)	(0.026)	(0.033)	(0.024)	(0.027)	(0.028)
FERTILITY	−0.364***	−0.311**	−0.919***	−1.123***	−0.890***	−0.867***	−0.853***
	(0.130)	(0.159)	(0.175)	(0.194)	(0.168)	(0.205)	(0.205)
INV	0.053***	0.032	−0.007	−0.031	−0.010	−0.015	−0.017
	(0.020)	(0.040)	(0.022)	(0.023)	(0.021)	(0.020)	(0.021)
GOV	−0.019	0.021	−0.061**	−0.120***	−0.064**	−0.050*	−0.052*
	(0.022)	(0.033)	(0.026)	(0.031)	(0.026)	(0.029)	(0.028)
OPENNESS	0.001	0.003	−0.003	−0.006	−0.001	0.016	0.015
	(0.001)	(0.003)	(0.003)	(0.004)	(0.002)	(0.017)	(0.017)
INF	−0.0001**	−0.0004***	−0.0002*	−0.001	0.00002	0.00002	0.00003
	(0.0001)	(0.0001)	(0.0001)	(0.001)	(0.00005)	(0.00005)	(0.00005)
PR	0.00005	−0.0003	0.0001	−0.0001	0.0001	0.0001	0.0001
	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0001)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies × Regional dummies	No	Yes	Yes	Yes	Yes	Yes	Yes
Specification tests							
Hansen test	[0.883]	[0.977]	[1.000]	[1.000]	[0.991]	[0.962]	[0.845]
Arellano–Bond test (AR2)	[0.133]	[0.771]	[0.962]	[0.205]	[0.433]	[0.971]	[0.488]
Observations	2,748	2,748	1,673	849	1,673	1,673	1,673

The dependent variable is the overlapping five-year average growth rate of real per capita GDP. Regressions are estimated using a system generalized method of moments (system GMM). Instruments are the indicator of a country's default history, Sub-Saharan Africa dummy, Latin America dummy, and East Asia dummy. All regressions include a constant term (unreported). *RatChgUp* is the change in comprehensive credit rating in the year of the positive rating event, and zero otherwise. *RatChgDown* is the absolute change in comprehensive credit rating in the year of the negative rating event, and zero otherwise. *LIBER* is a binary variable that equals one in the year that a country liberalizes its stock market, and zero otherwise. *CRISIS* is a binary variable that equals one in the year that a country experiences a banking or currency crisis, and zero otherwise. *DEVELOP* is a binary variable that equals one if a country is classified as a developed economy, and zero otherwise. *EmgExtnlDebt* is a binary variable with a value of one if the sample country belongs to developing economies and its external debt level as a percentage of GDP is above 60%, and zero otherwise. We measure institutional quality using the total estimated duration (*Duration*) in calendar days of the legal procedure to evict a tenant for non-payment of rent or to collect a bounced check. The *Anti-self-dealing* index measures, at the country level, minority shareholder protection against controlling shareholders' actions that would hurt shareholder value. *GO* is *GEGO* less a 60-month moving average, where *GEGO* is a global measure of country-specific growth opportunities in excess of world growth opportunities. *H_OPENNESS* is a binary variable that equals one if a country is a high-openness country, and zero otherwise. *H_ExtnlDebt* is a binary variable that equals one if a country is a high-external-debt country, and zero otherwise. *H_ExtnlDeficit* is a binary variable that equals one if a country is a high-external-deficit country, and zero otherwise. *PCGDP80* is the logarithm of a country's real GDP per capita in 1980. *SCH80* is the average years of secondary schooling attained in 1980. *LIFE80* is the logarithm of life expectancy in 1980. *FERTILITY* is the total fertility rate (births per woman) in 1980. *INV* is the domestic investment level as a percentage of GDP. *GOV* is the government consumption level as a percentage of GDP. *OPENNESS* is the sum of imports plus exports as a percentage of GDP. *INF* is the percentage change in the consumer price index. *PR* is a political risk rating indicator. *Regional dummies* are based on World Bank regional classifications. Robust standard errors adjusted for panel-specific autocorrelation and heteroskedasticity are reported in parentheses. *p*-values for specification tests are reported in brackets. The number of observations varies because of data availability.

*** Represents 1% significance level.
** Represents 5% significance level.
* Represents 10% significance level.

Table 3
Difference-in-differences tests.

Panel A: changes in matching-country-adjusted economic growth around sovereign rating revisions
A.1. Positive rating events

	3-year pre-rating-change period	3-year post-rating-change period	Difference	5-year pre-rating-change period	5-year post-rating-change period	Difference
Mean	0.017	0.030	0.013**	0.011	0.027	0.016***
Median	0.018	0.025	0.007**	0.011	0.019	0.008***
Number of events	99	118		99	118	

A.2. Negative rating events

	3-year pre-rating-change period	3-year post-rating-change period	Difference	5-year pre-rating-change period	5-year post-rating-change period	Difference
Mean	−0.007	−0.028	−0.021**	−0.004	−0.019	−0.015**
Median	−0.013	−0.030	−0.017***	−0.009	−0.024	−0.015***
Number of events	78	53		83	58	

Panel B: relation between sovereign rating revisions and matching-country-adjusted economic growth

RatChgUp	RatChgDown	LIBER	CRISIS	DEVELOP	EmgExtnl-Debt	Duration	Anti-self-dealing	GO	PCGDP80	SCH80	LIFE80
0.006***	−0.004**	0.007*	−0.007**	−0.024***	−0.016***	−0.015***	0.008	0.013**	−0.012***	0.00003	0.095**
(0.002)	(0.002)	(0.004)	(0.003)	(0.005)	(0.006)	(0.005)	(0.011)	(0.005)	(0.003)	(0.002)	(0.040)

FERTILITY	INV	GOV	OPENNESS	INF	PR	Year dummies	Year dummies × Regional dummies	Specification tests Hansen test	Arellano–Bond test (AR2)	Obs.
−0.963***	−0.049**	−0.102***	−0.003	−0.0005	0.0001	Yes	Yes	[1.000]	[0.984]	849
(0.222)	(0.023)	(0.031)	(0.003)	(0.001)	(0.0002)					

Panel A presents three- and five-year average matching-country-adjusted annual growth rates of real per capita GDP before and after sovereign rating changes. The matching-country-adjusted economic growth rate is the difference between the economic growth rate of the re-rated country and the average economic growth rate of its matching countries. Matching countries are identified according to the procedure described in Section 2.2.2. Differences in mean and median are assessed using a *t*-test and a Wilcoxon rank-sum test. The number of observations varies because of data availability. In Panel B, the dependent variable is the overlapping five-year average matching-country-adjusted growth rate of real per capita GDP. Regressions are estimated using a system generalized method of moments (system GMM). All regressions include a constant term (unreported). *RatChgUp* is the change in comprehensive credit rating in the year of the positive rating event, and zero otherwise. *RatChgDown* is the absolute change in comprehensive credit rating in the year of the negative rating event, and zero otherwise. All other variables are as defined in Table 2. Robust standard errors adjusted for panel-specific autocorrelation and heteroskedasticity are reported in parentheses. *p*-values for specification tests are reported in brackets.

*** Represents 1% significance level.
** Represents 5% significance level.
* Represents 10% significance level.

Several control variables in Table 2 are consistently significant and their results are consistent with previous evidence. The coefficients on *LIBER* and *GO* are significantly positive, while the coefficients on *CRISIS*, *DEVELOP*, *EmgExtnlDebt*, *Duration*, *PCGDP80*, and *FERTILITY* are significantly negative. That is, economic growth rates tend to be higher for countries with stock market liberalization, higher growth opportunities, higher institutional quality, lower initial GDP levels, and lower initial fertility rates. On the other hand, economic growth tends to be lower for countries that experiences a banking or currency crisis, for developed counties, and for developing countries with a high external debt level.

Table 2 also shows that the diagnostic statistics support our chosen specification. The Hansen test of over-identifying restrictions shows no evidence that the instruments are invalid, and the serial-correlation tests indicate no traces of higher-order autocorrelation.

We also consider the effects of sovereign rating changes for countries that are near the investment-grade threshold prior to the revision, because this kind of rating change may produce stronger effects (Holthausen and Leftwich, 1986). We add two interaction terms in the system GMM regression, *RatChgUp × NearThreshold_UG* and *RatChgDown × NearThreshold_DG*, where *NearThreshold_UG* (*NearThreshold_DG*) takes a value of one if the S&P sovereign credit rating is BB+ or BB (BBB− or BBB), and the subsequent rating revision is upgrade (downgrade), and zero otherwise. The results show that the coefficient on *RatChgUp × NearThreshold_UG* is positive and statistically significant at the 10% level or better and that the coefficient on *RatChgDown × NearThreshold_DG* is negative and statistically significant at the 10% level.[8] Thus, sovereign rating revisions result in stronger impacts on a re-rated country's economic growth rate when its rating is close to the investment-grade threshold.

Panel A of Table 3 shows that matching-country-adjusted GDP growth rates of re-rated countries increase significantly after the positive rating events and decrease significantly after the negative rating events. Panel B of Table 3 presents the system GMM estimation results using the matching-country-adjusted economic growth rate as the dependent variable. The coefficient on *RatChgUp* is significantly positive, and the coefficient on *RatChgDown* is significantly negative. The evidence again indicates a significant association between sovereign rating revisions and the economic growth of re-rated countries.[9]

We further model the relation between sovereign rating changes and matching-country-adjusted economic growth as a bivariate system of equations. Specifically, we use Granger causality tests to examine the dynamic relation between sovereign rating revisions and matching-country-adjusted output growth rates for positive and negative rating events. The regressions are:

$$Growth_{i,t} = \alpha_1 + \sum_{j=1}^{N} \beta_j RatChg_{i,t-j} + \sum_{j=1}^{N} \gamma_j Growth_{i,t-j} + \varepsilon_{1,i,t}, \quad (2)$$

$$RatChg_{i,t} = \alpha_2 + \sum_{j=1}^{N} \theta_j Growth_{i,t-j} + \sum_{j=1}^{N} \delta_j RatChg_{i,t-j} + \varepsilon_{2,i,t}, \quad (3)$$

where *Growth* is the one-year matching-country-adjusted growth rate of real per capita GDP of the re-rated country and *RatChg* denotes *RatChgUp* or *RatChgDown*. Table 4 shows that for all matching-country-adjusted economic growth rates, the lagged *RatChg* terms in Eq. (2) are statistically significantly different from zero at the 1% level for all lags. The lagged *Growth* terms in Eq. (3)

Table 4
Granger causality tests.

Lag	Relation	*F*-value	*P*-value
N = 1	RatChgUp → Growth	5.393***	0.020
	Growth → RatChgUp	0.025	0.875
	RatChgDown → Growth	21.066***	0.000
	Growth → RatChgDown	1.431	0.232
N = 2	RatChgUp → Growth	6.912***	0.001
	Growth → RatChgUp	1.823	0.162
	RatChgDown → Growth	19.303***	0.000
	Growth → RatChgDown	0.938	0.392
N = 3	RatChgUp → Growth	5.714***	0.001
	Growth → RatChgUp	1.318	0.267
	RatChgDown → Growth	15.099***	0.000
	Growth → RatChgDown	0.696	0.554
N = 4	RatChgUp → Growth	4.310***	0.002
	Growth → RatChgUp	1.255	0.286
	RatChgDown → Growth	11.421***	0.000
	Growth → RatChgDown	0.347	0.846
N = 5	RatChgUp → Growth	5.438***	0.000
	Growth → RatChgUp	1.528	0.179
	RatChgDown → Growth	10.307***	0.000
	Growth → RatChgDown	0.562	0.729

Pairwise Granger causality models are estimated to test the causality relation between changes in comprehensive credit ratings and matching-country-adjusted economic growth for positive and negative rating events. *Growth* is the one-year matching-country-adjusted economic growth rate, measured as the difference between the economic growth rate of the re-rated country and the average economic growth rate of matching countries. Matching countries are identified according to the procedure described in Section 2.2.2. *RatChgUp* is the changes in comprehensive credit ratings for positive rating events in the year of the rating revision, and zero otherwise. *RatChgDown* is the absolute change in comprehensive credit rating in the year of the negative rating event, and zero otherwise. *RatChgUp → Growth* denotes the null hypothesis that *Growth* is not caused by *RatChgUp*, and so on.
*** Represents a 1% significance level.

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are not statistically significantly different from zero for all lags. The results indicate a strong causal effect of sovereign rating revisions on economic growth of re-rated countries, and we find no evidence of a reverse causal effect.

3.3. Quarterly data

Sovereign rating revisions are infrequent episodes that can occur in any given month of the year. Quarterly data permit us to better disentangle changes in economic growth immediately before and after a rating revision. We hence collect seasonally adjusted data for quarterly real GDP and re-examine the relation between sovereign rating revisions and output growth. The quarterly data are obtained from Datastream, which covers only 37 sample countries.

Table 5 presents system GMM estimation results where the dependent variable is the overlapping 20-quarter average growth rate of real per capita GDP. Sovereign rating revisions remain significantly related to economic growth: Changes in comprehensive credit ratings have significantly positive effects on output growth for positive rating events and significantly negative effects on output growth for negative rating events. The results hold for both unadjusted and matching-country-adjusted economic growth rates of re-rated countries.

4. Transmission channels

Sovereign rating revisions typically lead to significant changes in sovereign bond yields (Cantor and Packer, 1996) and interest rates (Cantor and Packer, 1996; Dittmar and Yuan, 2008). Changes in interest rates will cause international capital flows (e.g., Henry, 2000, 2003). Several authors have provided evidence on how

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[8] See Online Appendix Table A3.
[9] Online Appendix Table A4 shows similar results if we identify matching countries based on different sets of variables.

Table 5
Relation between sovereign rating revisions and economic growth: quarterly data.

Variable	Unadjusted economic growth	Matching-country-adjusted economic growth
RatChgUp	0.006***	0.006**
	(0.002)	(0.002)
RatChgDown	−0.004***	−0.005*
	(0.001)	(0.003)
LIBER	0.010	0.004
	(0.013)	(0.017)
CRISIS	−0.010**	−0.008**
	(0.004)	(0.004)
DEVELOP	−0.027***	−0.028***
	(0.007)	(0.011)
EmgExtnlDebt	−0.013	−0.019
	(0.014)	(0.015)
Duration	−0.004	−0.005
	(0.007)	(0.008)
Anti-self-dealing	0.002	−0.009
	(0.011)	(0.015)
GO	0.020***	0.013*
	(0.006)	(0.007)
PCGDP80	−0.011***	−0.010**
	(0.004)	(0.005)
SCH80	0.001	0.003
	(0.002)	(0.003)
LIFE80	0.029	0.025
	(0.049)	(0.068)
FERTILITY	−1.126***	−0.904*
	(0.398)	(0.547)
INV	−0.060	−0.044
	(0.042)	(0.047)
GOV	−0.129***	−0.128**
	(0.039)	(0.051)
OPENNESS	0.000001	0.0001
	(0.00003)	(0.00005)
INF	0.00005	0.003
	(0.005)	(0.009)
PR	−0.0001	0.0001
	(0.0003)	(0.0004)
Seasonal dummies	Yes	Yes
Year dummies	Yes	Yes
Year dummies × Regional dummies	Yes	Yes
Specification tests		
Hansen test	[0.432]	[0.962]
Arellano-Bond test (AR2)	[0.290]	[0.531]
Observations	2,310	2,310

The dependent variable is the overlapping 20-quarter average growth rate of seasonally adjusted real per capita GDP. ... *** Represents 1% significance level. ** Represents 5% significance level. * Represents 10% significance level.

$$AvgGrowth_{i,t,t+4} = \alpha_1 + \beta_1 CapFlow_{i,t} + \beta_2 CapFlow_{i,t-1} + \varepsilon_{1,i,t}, \quad (4)$$

$$CapFlow_{i,t} = \alpha_2 + \gamma_1 Spread_{i,t} + \gamma_2 Spread_{i,t-1} + \varepsilon_{2,i,t}, \quad (5)$$

$$Spread_{i,t} = \alpha_3 + \lambda_1 RatChgUp_{i,t} + \lambda_2 RatChgUp_{i,t-1} + \lambda_3 RatChgDown_{i,t} + \lambda_4 RatChgDown_{i,t-1} + \varepsilon_{3,i,t}, \quad (6)$$

5. Robustness checks

5.1. Different rating agencies

Table 6
Relations among sovereign rating revisions, interest rates, capital flows, and economic growth.

Variable	Economic growth	Capital inflows	Bond yield spreads
Panel A: unadjusted economic growth			
$CapFlow_t$	0.532***		
	(0.112)		
$CapFlow_{t-1}$	0.027		
	(0.049)		
$Spread_t$		−0.215**	
		(0.108)	
$Spread_{t-1}$		−0.147***	
		(0.037)	
$RatChgUp_t$			0.005
			(0.005)
$RatChgUp_{t-1}$			−0.010**
			(0.005)
$RatChgDown_t$			0.014***
			(0.004)
$RatChgDown_{t-1}$			0.010**
			(0.005)
Adjusted R^2	0.033	0.025	0.054
F-value	5.110***	4.010**	4.430***
Panel B: matching-country-adjusted economic growth			
$CapFlow_t$	0.797***		
	(0.191)		
$CapFlow_{t-1}$	−0.094		
	(0.087)		
$Spread_t$		−0.213**	
		(0.090)	
$Spread_{t-1}$		−0.078**	
		(0.036)	
$RatChgUp_t$			0.006
			(0.006)
$RatChgUp_{t-1}$			−0.015**
			(0.006)
$RatChgDown_t$			0.015**
			(0.006)
$RatChgDown_{t-1}$			0.002
			(0.014)
Adjusted R^2	0.041	0.029	0.024
F-value	3.870**	3.120**	3.190**

A simultaneous equations model is estimated using three-stage least squares (3SLS) regressions to address the relation among sovereign rating revisions, sovereign bond yield spreads, capital inflows, and economic growth. The dependent variables are economic growth, capital inflows, and sovereign bond yield spreads, where economic growth is measured by the overlapping five-year average growth rate of real per capita GDP in Panel A and the overlapping five-year average matching-country-adjusted growth rate of real per capita GDP in Panel B. The instrumental variables include *PCGDP80, SCH80, LIFE80, FERTILITY*, lagged *INV*, lagged *GOV*, lagged *OPENNESS*, lagged *INF*, lagged *PR, GO*, and the indicator of a country's default history. Variables are defined as in Tables 2. All regressions include a constant term (unreported). $RatChgUp_t$ and $RatChgUp_{t-1}$ are the changes in comprehensive credit ratings for positive rating events in years t and $t-1$. $RatChgDown_t$ and $RatChgDown_{t-1}$ are the absolute changes in comprehensive credit ratings for negative rating events in years t and $t-1$. $CapFlow_t$ and $CapFlow_{t-1}$ are the country's total capital inflows as a percentage of GDP in year t and $t-1$. The capital inflows include foreign direct investment, portfolio equity investment, and debt inflows. $Spread_t$ and $Spread_{t-1}$ are the country's aggregate cost of debt in years t and $t-1$ (measured by the ratio of the yield on sovereign bonds to the yield on U.S. Treasury bonds of comparable maturity, minus one). Standard errors are reported in parentheses.
*** Represents 1% significance level.
** Represents 5% significance level.

in sovereign ratings information provided by different rating agencies (Cantor and Packer, 1996; Gande and Parsley, 2005). For both Moody's and Fitch rating revisions obtained from their websites, we find the coefficients on *RatChgUp* and *RatChgDown* remain significantly positive and negative, respectively. As in the case of the S&P sovereign rating revisions, Moody's and Fitch revisions are also associated with significant changes in economic growth. We also merge sovereign rating revision data from S&P, Moody's, and Fitch, and consider only the earliest

revision by any of the three credit rating agencies if there are multiple revisions. The results do not change our conclusion.[12]

5.2. Non-overlapping data and alternative economic growth measures

Our regression analyses have been based on the five-year average growth rate of real per capita GDP. The results could be biased if there is more than one rating revision for the same country in the period from five years before to five years after sovereign rating changes (years −5 to +5), where year 0 denotes the year of the credit rating change. When we re-estimate the regressions using only non-overlapping observations (i.e., only one rating change occurs in the country within the (−5, +5) window), the conclusion remains unchanged.

We also follow Quinn and Toyoda (2008) and use two alternative measures of economic growth: purchasing power parity (PPP)-adjusted economic growth and unexpected economic growth.[13] Assuming that investors use current economic growth to forecast future output performance, we define unexpected economic growth as the current overlapping five-year average growth rate of real per capita GDP minus the last five-year average growth rate of real per capita GDP. Results using these alternative variables are similar.[14]

6. Summary

Sovereign credit ratings are intended to reflect a nation's willingness and ability to service its financial obligations. The research on sovereign credit rating changes has focused on their effects on financial markets rather than on their impact on real economic activity. To fill this gap, we explore the relation between sovereign rating revisions and changes in the economic growth rates of the re-rated country.

Sovereign rating revisions may trigger a flight-to-quality, resulting in shifts of capital flows. According to this viewpoint, sovereign credit rating changes are important because they affect the cost of capital and the availability of credit, which in turn influence economic activity in the real sector and lead to changes in a country's economic performance. This argument suggests that changes in output growth may occur following sovereign rating revisions. Examination of a sample of Standard & Poor's sovereign rating changes for 103 countries over the 31-year period 1982–2012 indicates the growth rate of real per capita gross domestic product responds substantially to changes in sovereign rating revisions via the interest-rate and capital-flow channels. That is, narrower sovereign bond yield spreads and increased capital inflows are associated with positive rating revisions, which stimulate re-rated countries' economic performance, and negative rating revisions are associated with widening sovereign bond yield spreads, greater capital outflows, and poor output growth. These results hold after accounting for other determinants of economic growth, financial liberalization, financial crises, economic development status, debt level, investor protection, quality of institution, future growth expectations, and endogeneity. They are also robust to the use of quarterly GDP data and hold after accounting for rating-specific characteristics and alternative economic growth measures. All the results indicate that sovereign rating changes do affect re-rated countries' economic growth prospects.

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[12] The results for different rating agencies are shown in Online Appendix Table A5.
[13] Data on PPP-adjusted economic growth rates are obtained from WDI.
[14] The results using non-overlapping data and alternative economic growth measures are given in Online Appendix Table A6.

Appendix A1
Numerical scale of sovereign credit ratings.

Investment grade		Speculative grade		Credit outlook	
Rating	Score	Rating	Score	Rating	Score
AAA	21	BB+	11	Positive	+0.5
AA+	20	BB	10	Watch positive	+0.25
AA	19	BB−	9	Stable	0
AA−	18	B+	8	Watch negative	−0.25
A+	17	B	7	Negative	−0.5
A	16	B−	6		
A−	15	CCC+	5		
BBB+	14	CCC	4		
BBB	13	CCC−	3		
BBB−	12	CC	2		
		C	1		
		SD, D	0		

Appendix A2
Description of control variables and their data sources.

Variable	Description	Source
Anti-self-dealing	An index that measures, at the country level, minority shareholder protection against controlling shareholders' actions that would hurt shareholder value	Djankov et al. (2008)
CRISIS	Binary variable that equals one in the year that a country experiences a banking or currency crisis, and zero otherwise	Reinhart and Rogoff (2011)
DEVELOP	Binary variable that equals one if a country is classified as a developed economy, and zero otherwise	S&P/IFCG Emerging Market Indexes of Standard & Poor's
Duration	Total estimated in calendar days of the legal procedure to evict a tenant for non-payment of rent or to collect a bounced check, which equals the entire time for completion of service of process, length of trial, and period of enforcement	Djankov et al. (2003)
EmgExtnlDebt	Binary variable that equals one if the sample country is a developing economy and its external debt level as a percentage of GDP is above 60%, and zero otherwise	WDI and Reinhart and Rogoff (2011)
FERTILITY	Total fertility rate (births per woman) in 1980	WDI
GO	A global measure of country-specific growth opportunities in excess of world growth opportunities, defined as the log of a vector of global industry price-earnings (PE) ratios times a vector of country-specific industry weights divided by the overall world market PE ratio. This variable is measured relative to its past five-year moving average	Bekaert et al. (2005) and Datastream
GOV	Government consumption level as a percentage of GDP	WDI
H_ExtnlDebt	Binary variable that equals one if a country is a high-external-debt country and zero otherwise, where a high-external-debt country is in the top three deciles of external debt/GDP	WDI and Reinhart and Rogoff (2011)
H_ExtnlDeficit	Binary variable that equals one if a country is a high-external-deficit country and zero otherwise, where a high-external-deficit country is in the top three deciles of trade deficit/GDP	WDI
H_OPENNESS	Binary variable that equals one if a country is a high-openness country and zero otherwise, where a high-openness country belongs to the top three deciles of OPENNESS	WDI
INF	Percentage change in the consumer price index	WDI
INV	Domestic investment level as a percentage of GDP	WDI
LIBER	Binary variable that equals one in the year that a country liberalizes its stock market, and zero otherwise. The liberalization dates include the official liberalization date, the first American Depository Receipt issuance date, and the first country fund date	Bekaert and Harvey (2000), Henry (2000), and Bekaert et al. (2005)
LIFE80	Logarithm of life expectancy in 1980	WDI
OPENNESS	Sum of imports plus exports as a percentage of GDP	WDI
PCGDP80	Logarithm of real GDP per capita in 1980	WDI
PR	A political risk rating indicator, which is a combination of 12 sub-components and ranges between 0 (high risk) and 100 (low risk)	International Country Risk Guide (ICRG)
Regional dummies	Regions according to World Bank regional classifications	World Bank
SCH80	Average years of secondary schooling attained in 1980	Barro and Lee (2013)

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.jbankfin.2015.10.012.

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