The Ghost of a Rating Downgrade: What Happens to Borrowing Costs When a Government Loses its Investment Grade Credit Rating? *

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1 Introduction

Global growth slowed following the global financial crisis of 2008, from an average 4.5% between 2000 and 2007 to 3.2% between 2008 and 2015.[1] Commodity exporters were hit by a second major shock when commodity prices dropped, led by a plummeting of the oil price in late 2014. Governments responded to low growth with countercyclical fiscal policy and in response, public finances deteriorated markedly. Public debt (in gross terms) rose from 78% of GDP in 2008 to 105% in 2015 in advanced economies, and, from 37% to 47% in emerging and developing countries. As solvency conditions softened, credit rating agencies reflected this in a wave of rating downgrades—not only of sovereigns but also private firms and state-owned enterprises. According to Fortune, by April 2016 only two U.S. companies were left with the top-notch AAA rating.[2] Many countries experienced similar fates—even U.S. sovereign debt was downgraded, to AA+, by Standard and Poors (S&P) in August 2011. Low growth means that countries continue to be haunted by potential rating downgrades.

This paper focuses on one specific rating decision, to sub-investment ('junk' or 'speculative' grade), and the effects on short-term government borrowing costs. Although borrowing costs are expected to increase in the event of a downgrade, empirical studies are largely lacking for the specific event

*The authors would like to thank Sergio Schmukler (World Bank), Sebastien Dessus (World Bank), Mampho Modise (South African National Treasury), and Siobhan Redford (South African Reserve Bank) for helpful suggestions.

[1] International Monetary Fund, World Economic Outlook, April 2016.

[2] http://fortune.com/2016/04/26/exxonmobil-sp-downgrade-aaa.

of a sovereign downgrade to sub-investment grade (sub-IG). It is uncertain whether markets expect and thus price-in the expectations of a downgrade to sub-IG, in which case there would be no significant impact on borrowing costs when the country is eventually downgraded, or whether the actual downgrade to sub-IG causes a significant change in the yield in that period. The behavior of yields during the period around the downgrade to sub-IG is thus not fully understood.

This study aims to fill that gap by analyzing a sample of 20 countries that have been rated by the three major credit rating agencies (Fitch, Moody's and S&P) between 1998 and 2015 and determining what effect a downgrade to sub-IG grade had on the short-term T-bill rate [3] in other countries that have already experienced such downgrades. The countries were selected based on data availability.

The analysis focuses on the effect rating downgrades have on T-bill rates only. While a sovereign downgrade is likely to feed through across the yield curve to longer maturity government bonds, and also affect the real economy, e.g. through effect on state-owned enterprises and private firms (especially banks), this is beyond the remit of this study. Although the paper makes an attempt to study differential effects of foreign-currency rating vs local currency rating changes, results for the local currency rating are inconclusive as they are limited by the sample size. A final shortcoming of the study is that it employs annual data, which is a high level of aggregation as financial markets change rapidly. Some nuance will undoubtedly be lost.

This paper is structured as follows. The next section will present an overview of the research design: section 2 provides a brief overview of the literature to help inform the analysis and choice of methodology. A more detailed description of the empirical methodology is provided in section 3 while data used in this study are described in section 4. Section 5 provides a short case study of the downgrade to sub-IG that occurred in Latvia in 2009. Section 6 will discuss the results of the analysis while the last section concludes.

2 Literature Review

The literature on rating downgrades in the private sector is well developed. Early studies focused on the effect rating decisions had on bond and equity returns. Drawing on this literature, Goh and Ederington (1993) zoomed in on the role of rating agencies in delivering new information to markets.

[3] 91 day T-bills were used unless unavailable.

They demonstrate that to the extent that credit ratings simply reflect firms' leverage (which relates to their solvency situation and is publicly known for listed companies) markets do not respond to rating decisions—if rating agencies, however, deliver unanticipated negative news about a firm's financial prospects risk premia increase accordingly. This is an important insight: to an extent, credit ratings reflect economic fundamentals, which markets can observe. However, ratings can also reveal new information that rating agencies gathered during the assessment period, and this is priced in accordingly. This paper thus aims to account for the extent to which credit ratings are anticipated by markets and to which extent they convey new information. Credit rating agencies often highlight that their ratings are mere 'opinion'. To an extent ratings are thus subjective. Yet as Goh and Ederington—as well as this paper—suggest that these opinions affect market perceptions and risk premia in turn.

The link between rating decisions and financial or economic outcomes is not straightforward, however. For example, a sovereign downgrade will immediately affect firms' credit ratings with residency in the country in question—firms generally cannot have a rating that is higher than the government's (Almeida et al., forthcoming). This can result in feedback effects where firm performance spills into the real economy and back into the fiscal accounts. Secondly, the effect of ratings on financial and economic variables is not necessarily linear. Hung et al. (2016) find that the effect of credit downgrades on firm leverage in the US is particularly pronounced for firms with investment-grade credit ratings.

Moreover, discontinuities arise from the investment decisions of participants in financial markets, such as mutual fund managers. Raddatz et al. (2014) look at criteria that make certain instruments more likely to be included in international equity and bond market indexes (such as, for example the MSCI Emerging Market Index) which are increasingly being used as benchmarks by mutual funds—to enhance accountability of fund managers as well as management costs, increasing the extent to which investments track such indexes. The study shows that asset allocations shift considerably in response to financial instruments being included or excluded from such indexes. A downgrade to sub-IG is one such event where indexes may drop the associated financial instruments. In the case of bonds, this shifts demand away and therefore increases borrowing costs.

The incentives to maintain an investment-grade credit rating are therefore strong. At the economic level, avoiding a downgrade is important for growth. Chang et al. (2015) demonstrate that rating downgrades increase risk premia (and thus borrowing costs) for affected companies—with con-

tagion across the supply chain, affecting both suppliers and rivals. This affects leverage, i.e. firms' ability to borrow. Such contagion is not limited to firms. Almeida et al. (forthcoming) show that a sovereign downgrade spills into ratings in the private sector and thus into the real economy since sovereign and firm ratings are intertwined. This is another channel through which downgrades can thus result in lower firm leverage. Overall, rating downgrades are thus closely linked with real variables, such as investment and growth.

It is therefore not surprising that both firms and governments try to avoid rating downgrades. Graham and Harvey (2001) report that 57.1% of a sample of U.S. and Canadian Chief Financial Officers (CFO's) identified the credit rating as the second highest concern when issuing debt. Accordingly, Kisgen (2006) demonstrates that rating decisions affect firm leverage. Hanusch and Vaaler (2013, 2015) show something similar for governments. As voters are aware of the negative effects of rating downgrades on the economy, they punish governments at the polls in response to rating downgrades. This in turn provides incentives to governments to pursue less expansionary fiscal policy during election years.

This study builds on the insights from the literature. While a number of studies has explored the effect of a rating downgrade on companies, this study focuses on sovereign downgrades. Taking into account the discontinuities that exist in the effects of rating decisions, the paper focuses specifically on rating changes to sub-IG. To the knowledge of the authors it is the first study of its kind, presumably owing to the fact that there have been relatively few cases of sovereign downgrades to sub-IG, barring a limited number of cases during the Asian financial crisis of the 1990s. So samples have been limited (and the sample is still relatively small). As emerging market economies developed and financial markets deepened, sovereign credit ratings have been on a generally improving trend. This trend was reversed with the onset of the global financial crisis triggering another round of downgrades to sub-IG. The study also explicitly aims at taking into account the extent to which ratings are expected by markets and/or they convey new information.

3 Methodology

The research design is grounded in the fact that rating agencies do not fully reveal the criteria they apply in their rating decisions. So, to an extent at least, markets are left guessing how raters will assess a government's sol-

vency. Largely, of course, solvency is determined by economic fundamentals (economic growth, inflation, fiscal accounts, etc.) so credit ratings should generally reflect these. They are also variables observable by market participants. Thus, to a considerable extent, a credit rating should be expected by markets, based on economic fundamentals (Goh and Ederington, 1993). Yet it is well known that raters also apply a degree of discretion to their ratings which may not be expected by markets. The research design aims to tease out the expected and unexpected components of ratings to examine the effect on short-term borrowing costs.

The event of a down-grade to sub-IG is a special case along the rating scale as it fundamentally changes a country's risk profile and is likely to cause considerable shifts in investor exposure as the rating category changes to 'speculative'. This study teases out the differential effects of the downgrade to sub-IG of the first rating agency and a second rating agency respectively. A country's debt is only technically considered rated sub-IG when two raters downgrade it accordingly. However, the first such downgrade may have a signaling effect and the analysis below suggests that the first downgrade has the largest effect on T-bill rates—this is consistent with Raddatz et al. (2015) who focus on the first downgrade as markets anticipate a second downgrade to follow suit. The analysis is conducted both for local and foreign currency credit ratings. Although T-bills are issued in domestic currency, the analysis below does not find any effects of local currency rating downgrades to sub-IG on T-bill rates. The sample of countries experiencing such downgrades is low, however, so this result may merely be due to a lack of statistical power.

3.1 Estimating credit ratings

We model each country's average credit rating as a function of economic fundamentals, namely GDP growth (annual percentage change), the budget balance (in percent of GDP—where a negative balance corresponds to a budget deficit), net government debt (in percent of GDP) and inflation (annual percentage change in consumer prices). The first lag of the dependent variable is included to account for dynamics in the series. The equation is given by

$$y_{it} = \boldsymbol{\alpha}' \mathbf{x}_{it} + \theta_i + \vartheta_t + \epsilon_{it}, \qquad (i = 1, ..., N; t = 1, ..., T) \tag{1}$$

where y_{it} is country i's average credit rating at time t, $\boldsymbol{\alpha}$ is a $(K+1) \times 1$ vector, and $\mathbf{x}_{it} = (1 \; x_{1,it} \; \cdots \; x_{K,it})'$, with $K = 5$—average rating lagged by one period, GDP growth, budget balance, net government debt, and

inflation. θ_i, ϑ_t, and ϵ_{it} capture country and time specific shocks and the overall error term respectively.

Given the number of time periods in this study, Generalized Methods of Moments (GMM) is the best estimator for this analysis (Judson and Owen, 1999). GMM is also common for a dynamic panel model with a relatively persistent dependent variable—specifically System-GMM (Arellano and Bond (1991), Arellano and Bover (1995), Blundell and Bond (1998) and Judson and Owen (1999)). Yet to compare estimates, as is also common in the literature, pooled and fixed effects Ordinary Least Squares results will also be reported.

From this analysis, predicted values are obtained to represent the expected rating while the corresponding residuals (i.e. the difference between the expected rating and the actual average rating) represent the unexpected rating. Values greater (lower) than zero on the unexpected rating mean that the average credit rating is above (below) market expectations. The analysis is conducted separately for both foreign currency and local currency long-term credit ratings. When estimating equation 1 for foreign currency ratings, the current account balance (in percent of GDP) is included, as one potential determinant that creates currency risk and may thus distinguish the foreign currency from the local currency-rating. As this variable is not significant, however, it is not included in the base specification.

3.2 Estimating the effect of credit rating downgrades to sub-IG on short term interest rates

To determine the effect of actual credit ratings on short-term government borrowing rates, the predicted values and residuals from equation 1 are used to estimate T-bill rates. In addition, two dummy variables are included to capture the event of a downgrade to sub-IG of a first rating agency (1st rater) and a second rating agency (2nd rater) respectively. Equation 2 is thus essentially a representation of T-bill rates as a function of expected ratings (underlying which are economic fundamentals) and unexpected ratings, as well as two downgrade dummies to capture non-linear effects of downgrades to sub-IG grade (as opposed to linear effects across the rating scale). A key control variable when analyzing T-bills is a country's policy rate (with a pairwise correlation coefficient of 0.7) which is thus included in all specifications. The equation is,

$$r_{it} = \boldsymbol{\beta}'\mathbf{z}_{it} + \delta_i + \omega_t + v_{it}, \qquad (i = 1, ..., N; t = 1, ..., T) \tag{2}$$

where r_{it} is country i's T-bill rate at time t, $\boldsymbol{\beta}$ is a $(M+1) \times 1$ vector, and $\mathbf{z}_{it} = (1 \; z_{1,it} \; \cdots \; z_{M,it})'$, with $M = 6$—lagged T-bill rate, expected rating, unexpected rating, indicator for downgrade by first agency, indicator for downgrade by second agency, and Central Bank policy rate. To distinguish the error terms from equation 1, δ_i, ω_t, and v_{it} represent country specific, time specific, and overall error terms, respectively, in equation 2.

A number of controls have been included for robustness. In the analysis below, several controls will be used to test the robustness of the relationship, including replacing the rating variables with the underlying economic fundamentals. Moreover, the central bank's main policy rate will also be included given that government bond yields—especially in the short end of the yield curve—closely follow policy rates. As for equation 1, the main employed estimator is System-GMM.

4 Data

The dependent variable in equation 1, the credit ratings on (i) long-term foreign currency-denominated and (ii) long-term local currency denominated government debt by the largest three rating agencies (S&P, Moody's, and Fitch), are retrieved from Bloomberg, and converted into numeric values between 19 and 0. Higher values represent better credit ratings: values from 10 to 19 represent investment grade ratings while 0 to 9 are sub-IG. The rating values for the three agencies are then averaged to create one variable for average foreign and local currency credit ratings each.[4] Figure 1 shows that in recent history there have been two episodes of sub-IG downgrades. The first was the Asian financial crisis of 1997, which mostly affected East Asian countries (Indonesia, the Republic of Korea, and Thailand), but also Colombia and the Slovak Republic. The second episode of major downgrade followed the global financial crisis and mostly affected European countries (Croatia, Bulgaria, Greece, Hungary, Iceland, Ireland, Latvia, Portugal, Russia and Slovenia), Latin American and Caribbean countries (Barbados, Brazil, Costa Rica, El Salvador, Uruguay) as well as Tunisia. Major rating shocks occurred in 2009, 2011, 2012, and most recently 2015, when the end of the commodity super-cycle hit commodity-exporters: Brazil, Azerbaijan, and Russia (where the commodity shock was aggravated by sanctions).

Given the data coverage (and especially given the availability of T-bill

[4] In some case, countries were only rated by one or two of the three rating agencies under study. Thus, the average rating may include underlying ratings of one to three rating agencies.

Figure 1: Downgrades to sub-IG across the world (number of downgrades to sub-IG by country and year)

Source: Bloomberg and authors' calculations.

data), only the second episode of major downgrade will be included. Although some countries in the sample have coverage from 1998 to 2015, the downgrade episodes under study fall exclusively into the post-global financial crisis period. The data set include 20 countries which are listed in the appendix. Uneven data coverage means that the sample under study is unbalanced. Eleven countries under study experienced a downgrade to sub-IG by at least one rating agency, while seven experienced a downgrade by a second agency.

Independent variables for equation 1 include annualized key economic fundamentals that impact credit ratings and short-term rates. These variables are all taken from the IMF World Economic Outlook (WEO, April 2016) and include GDP growth, the budget balance (in percent of GDP), net government debt (in percent of GDP), and the inflation rate.

The dependent variable in equation 2 is the short-term T-bill rate. These rates are retrieved from various sources which include Bloomberg, IMF International Financial Statistics (IFS), Haver Analytics, and Central Bank databases. In addition to independent variables obtained from equation 1 (expected rating, and unexpected rating), the other key variables are the downgrade dummies. Accordingly, two dummy variables were constructed from the foreign currency and local currency credit rating data, where a value of 1 represents the period in which a country had been downgraded to sub-IG by one rating agency and another dummy is used when it was downgraded by a second rater. The main control variable in Equation 2 is the policy rate which was obtained mostly from Haver. Gaps were filled using data from Bloomberg. Where policy rates were not available but interbank rates were, those were used as proxies for the policy rate.

5 A case study: Latvia after the global financial crisis

Before delving into the statistical analysis, it is worthwhile to map out a case where a country recently experienced a downgrade to sub-IG. Latvia is a good example, as it is an emerging economy which experienced consecutive downgrades, including to sub-IG, following the global financial crisis. The Latvian story is also instructive not only because it was downgraded but also as it was upgraded again to investment grade, illustrating a full cycle of credit downgrades and upgrades.

Figure 2 depicts Latvia's experience (using quarterly data). In response to the global financial crisis of 2007/8 Latvian GDP growth (q/q saar) con-

tracted sharply (the dotted line in Figure 2) and the fiscal accounts deteriorated markedly. In response, credit rating agencies cut their ratings successively (light grey line in Figure 2), by about four notches from pre-crisis levels. In response, T-bill yields started increasing markedly (dark blue line). The largest spike in yields occurred in the period when Latvia moved toward the threshold to speculative grade (speculative or sub-IG is equivalent to an S&P or Fitch letter grade of BB+ and below), when two raters moved to BBB- equivalent and finally two raters downgraded Latvian debt to sub-IG. Latvia experienced its first downgrade to sub-IG by S&P in 2009 Q1 (the first red-shaded area) which saw the yield spread spike 35 bps from the previous quarter and 390 bps from two quarters prior. Fitch closely followed in the next quarter (beginning of maroon-shaded area), being the second rater to downgrade Latvia to sub-IG.[5] This saw the T-bills yield spread spike by a further 640 bps over the next two quarters, resulting in the yield spread more than doubling due to the second downgrade to sub-IG.

Interestingly, the spike in T-bill rates was short-lived. As the pace of the economic contraction slowed and growth eventually turned positive, T-bill rates recovered, even before the average credit rating improved and long before the country moved back to investment grade in 2012. While this is an important observation it is important to note that it is difficult to determine the extent to which this is a consequence of ultra-loose monetary policy in developed countries which saw large inflows of portfolio investment to emerging economies (including Latvia). The downgrades followed closely after the financial crisis which saw Latvia's budget deficit worsen from 3.2% in 2008 to 7% in 2009. Net government debt (% of GDP) also doubled in 2008-2009 from 16.2% to 32.5% largely due to significant GDP contractions during the same period. The improvement in GDP allowed the budget balance to improve to a 0.1% surplus by 2012, although net government debt slightly increased further, to 36.9% by 2012.

The Latvian experience is borne out in other countries. Figure 3 plotseT-bill rates for a number of countries, also highlighting periods in which these countries were downgraded—by one rating agency and two agencies respectively. As can be seen, in most cases T-bill rates increase well in advance of the downgrades and generally continue to do so in the year of the downgrades. This illustrates the extent to which the raters capture market sentiment. As the analysis below demonstrates, however, the opinions of rating

[5] The nominal T-bill briefly fell in this period. Yet looking at the spread with average European T-bill rates, the expected increase in borrowing costs can be observed.

Figure 2: A history of credit downgrades (and upgrades) in Latvia—Average foreign-currency credit rating, nominal T-bill and spread, GDP growth, and downgrade history.

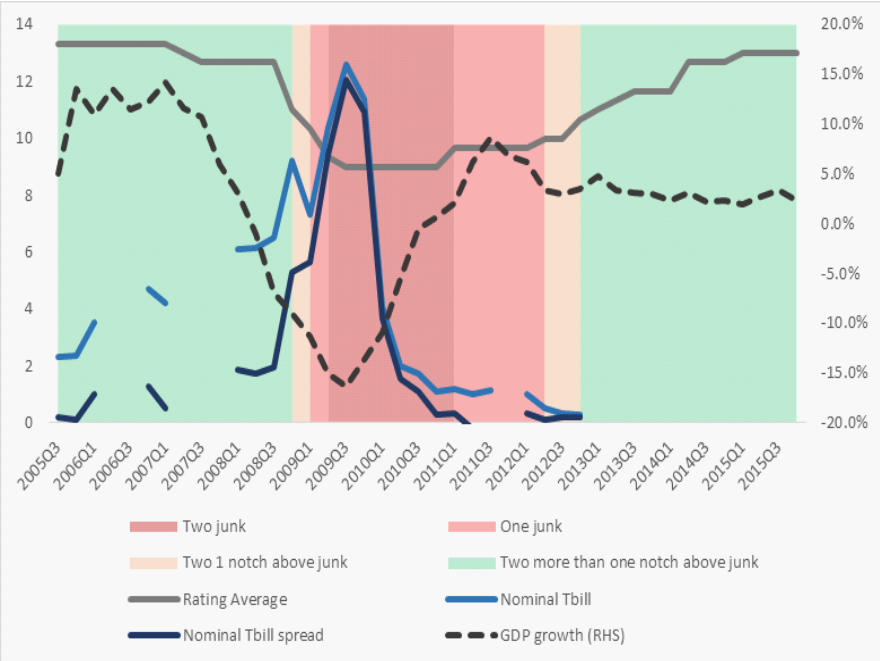
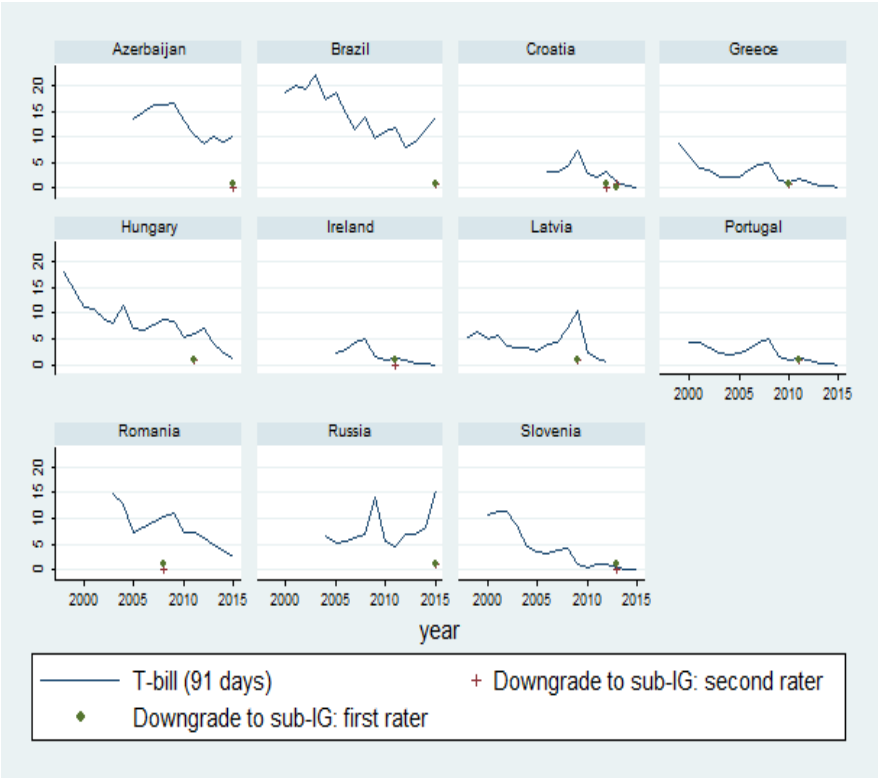


Figure 3: T-bills and rating downgrades post-global financial crisis

(T-bill rates and rating downgrades (first and second rater))



Source: Haver Analytics, Bloomberg and authors' calculations.

agencies, where they may diverge from easily observable economic fundamentals, have their own, independent effect on government borrowing costs.

6 Statistical estimation

6.1 Estimating credit ratings from economic fundamentals

The results of estimating credit ratings using equation 1 are depicted in Table 1. Looking first at the adequacy of the statistical specification, comparing the coefficients of the lagged dependent variables across models suggest that the GMM specification performs well: the coefficient lies above the fixed effects estimates, suggesting that the model does a reasonable job

at addressing the bias associated with dynamic panel estimation with fixed effects (Nickell, 1981). In addition, the instruments used in the GMM estimation are broadly valid: as required, the differenced residuals experience first order but not second order autocorrelation. The Hansen test of overidentifying restrictions is insignificant suggesting that the instruments are valid (although this test is weakened by the large number of instruments). The goodness of fit is unusually high with an R^2 above 0.91—this is largely owed to the fact that ratings are highly persistent

Examining the coefficients of the independent variables, the observed effects are as expected. Economic growth is associated with higher credit ratings (although this effect is not robust in the GMM specification for local currency ratings). A higher budget balance is associated with a stronger fiscal position and thus has a positive effect on credit ratings—public debt levels have the expected opposite effects. Higher inflation results in a lower credit rating. This effect may be due to multiple reasons, including an economy that is slipping out of internal balance. It may also point toward an expected depreciation of the currency, increasing the burden of external debt (although the evidence for this is weak as the coefficient would be expected to be larger for the foreign currency rating than the local currency rating, which is not the case). Since foreign and local currency ratings mainly differ in that the former adds another source of risk (the exchange rate), column 4 in Table 1 also controls for the current account balance. This is not statistically significant, however, and will thus not be considered for subsequent analysis.

The results from Table 1 are used to predict the foreign and local currency ratings, expected rating, and the associated residual unexpected rating. For the foreign currency rating, the results from column 3 are used; for the local currency ratings, column 7 is selected.

6.2 Estimating the effect of sub-IG downgrades on T-bills

Table 2 presents the results from the analysis of T-bills as a function of expected and unexpected credit ratings, downgrades to sub-IG, by one and two raters respectively, and the Central Bank's policy rate. Turning again to the adequacy of the empirical model, the lagged dependent variable coefficients, both for foreign currency and local currency ratings lie in between the pooled and fixed effects estimates. First order autocorrelation in the differenced residuals—and the lack of second order autocorrelation—as well as the Hansen test all point toward acceptable model specification.

As expected, when rating agencies rate a country (on average) higher

Table 1: Estimating credit ratings from economic fundamentals

	Foreign Currency Rating				Local Currency Rating		
Model	1	2	3	4	5	6	7
Estimator	Pooled	Fixed Effect	GMM	GMM	Pooled	Fixed Effect	GMM
Lag of Average Rating	0.948***	0.857***	0.897***	0.867***	0.916***	0.819***	0.845***
	(0.013)	(0.044)	(0.039)	(0.039)	(0.016)	(0.054)	(0.030)
GDP Growth	0.076***	0.086**	0.063*	0.066**	0.064***	0.071**	0.0438
	(0.023)	(0.033)	(0.035)	(0.033)	(0.021)	(0.032)	(0.035)
Budget Balance	0.030**	0.040***	0.057***	0.059***	0.033**	0.041**	0.066***
	(0.013)	(0.014)	(0.013)	(0.013)	(0.016)	(0.018)	(0.015)
Net Public Debt	-0.005*	-0.019**	-0.011**	-0.010**	-0.007**	-0.022**	-0.015***
	(0.003)	(0.008)	(0.005)	(0.005)	(0.003)	(0.010)	(0.005)
Inflation	-0.025***	-0.027***	-0.034***	-0.030***	-0.035***	-0.039***	-0.053***
	(0.006)	(0.006)	(0.010)	(0.008)	(0.008)	(0.008)	(0.014)
Current account				-0.013			
balance				(0.008)			
Constant	1.549***	4.033***	2.939***	2.601***	2.310***	3.359***	2.786***
	(0.366)	(1.215)	(0.802)	(0.688)	(0.370)	(1.157)	(0.645)
R-squared	0.95	0.91			0.95	0.91	
AR(1): Pr>z			0.007***	0.009***			0.007***
AR(2): Pr>z			0.104	0.101			0.112
Hansen test: Prob>chi2			1.000	1.000			1.000
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	345	345	345	345	369	369	369
# of countries		20	20	20		20	20

*** p<0.01, ** p<0.05, * p<0.1; GMM is System-GMM.

All right-hand side variables (except country dummies) are treated as endogenous in the GMM estimation.

Table 2: Estimating T-bills using estimated ratings, downgrades, and policy rates

Dependent Variable:	**T-bill (91 days/3 months)**							
	Foreign Currency Rating				**Local Currency Rating**			
Model	1	2	3	4	5	6	7	8
Estimator	Pooled	Fixed Effect	GMM	GMM	Pooled	Fixed Effect	GMM	GMM
Lag of T-bill	0.738***	0.386***	0.597***	0.612***	0.740***	0.382***	0.428***	0.425***
	(0.050)	(0.096)	(0.122)	(0.116)	(0.050)	(0.099)	(0.141)	(0.127)
Expected Rating	-0.027	0.018	-0.011	-0.204	-0.008	0.042	0.114	0.565
	(0.038)	(0.052)	(0.059)	(0.305)	(0.042)	(0.056)	(0.070)	(0.349)
Unexpected Rating	-0.538***	-0.249	-0.484*	-0.777**	-0.499***	-0.220	-0.340	0.0978
	(0.147)	(0.180)	(0.280)	(0.367)	(0.134)	(0.185)	(0.257)	(0.335)
Downgrade by First Rater	1.207	1.043*	1.383**	1.364**	0.332	0.692	0.541	0.510
	(0.813)	(0.549)	(0.587)	(0.599)	(0.647)	(0.729)	(0.669)	(0.703)
Downgrade by Second Rater	0.356	0.886	0.563	0.294	0.669	0.910	0.677	0.387
	(1.261)	(1.146)	(1.085)	(1.107)	(1.342)	(1.128)	(1.150)	(1.190)
Policy Rate	0.176***	0.355***	0.242**	0.242**	0.182***	0.370***	0.390***	0.389***
	(0.040)	(0.079)	(0.113)	(0.108)	(0.041)	(0.082)	(0.113)	(0.110)
Alternative Currency Rating				0.229				-0.487
				(0.287)				(0.389)
Constant	0.834	0.895	0.724	0.290	1.113	0.852	-0.123	0.175
	(0.853)	(0.707)	(0.724)	(0.634)	(0.945)	(0.791)	(0.884)	(0.781)
R-squared	0.86	0.74			0.86	0.73		
AR(1): Pr>z			0.014**	0.015**			0.034**	0.030**
AR(2): Pr>z			0.537	0.546			0.625	0.691
Hansen test: Prob>chi2			1.000	1.000			1.000	1.000
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	242	242	242	242	242	242	242	242
Number of countries		20	20	20		20	20	20

*** p<0.01, ** p<0.05, * p<0.1

All right-hand side variables (except country dummies) are treated as endogenous in the GMM estimation.

The 'Alternative Currency Rating' for the foreign currency rating is the local currency rating and vice versa.

than markets would expect from fundamentals, T-bill rates fall—it is cheaper for the government to borrow. The coefficient of the unexpected rating variable is negatively signed and statistically significant for the foreign currency credit rating across specifications in Table 2 (it does matter for local currency ratings). Interestingly, the expected rating element is not statistically significant, although it is signed in line with expectations. The policy rate is positive and significant, underlining the general co-movement of policy rates and T-bill rates.

Turning now to the effect of downgrades on T-bill rates it is striking that it is the first downgrade to sub-IG that matters; and it only matters in the case of foreign currency ratings, local currency rating downgrades to sub-IG have no discernable effect on T-bill rates—even though T-bills tend to be local currency denominated. On average, the first downgrade to sub-IG on the foreign currency long-term rating resulted in an increase in T-bill yields of 138 basis points. While the coefficients of the first downgrade to sub-IG dummy bears the expected sign, suggesting downgrades are associated with higher T-bill rates, the coefficients are not statistically significant in the case of the local currency rating. The second downgrade dummy to sub-IG has the expected positive coefficient for both the foreign and local currency downgrades, associated with an additional increase of 56 and 68 basis points respectively, yet it is not statistically significant. The results are robust to the inclusion of the 'alternative' currency rating (the local currency rating in column 4 and the foreign currency rating in column 8). Thus, according to this analysis, T-bills are determined by their history (the lagged dependent variable), the Central Bank policy rate, the unexpected part of a credit rating, and when a first rating agency declares a country's national debt as 'speculative'.

7 Conclusion

This study draws on the experience of countries after the global financial crisis to study the effect of a downgrade of the sovereign credit rating to sub-IG. It feeds into a broader literature demonstrating the effect of downgrades for borrowing costs, not just for firms but also governments. A downgrade to sub-investment grade on the foreign currency rating is associated with an average increase of 138 basis point in T-bill rates. A second downgrade appears anticipated by markets and even though it makes the rating category 'official' (for a sub-IG rating to become official coincident ratings by at least two rating agencies are required) the effect is small (56 basis points,

although this is not statistically significant). This effect is large and can pose considerable additional financing costs to governments, and yet it does not take into account the effect on the yield curve. T-bills tend to be largely influenced by policy rates while risk premia play more of a role for longer-maturity debt. The effect for longer-term government debt is thus likely to be even larger.

It is important to note a number of caveats. Downgrades of sovereign ratings to sub-IG are still relatively rare—they have only occurred a few times during the Asian financial crisis and more recently in the aftermath of the global financial crisis. This means that there are relatively few occurrences available for analysis, making it more difficult to generalize to all countries. This study is a first attempt at this, but further research will be required to refine it. In particular, to better capture the different nature of countries—e.g. countries with fixed currencies (i.e. many European countries) may have very different experiences from countries with floating currencies (such as Brazil, India, South Africa, etc.). Moreover, most of the analysis falls in an unusual time of ultra-low interest rates and quantitative easing in developed countries, making it more difficult to generalize from the results to periods with a different monetary policy environment. This study also paints with a broad brush, not taking into account several economic feedback effects, be it e.g. through banks or state-owned enterprises that could differentiate the results across countries.

Finally, the study does not detect any effect of local currency rating downgrades on T-bill yields—even though they are denominated in local, not foreign currency. This may be due to the fact that there are even fewer local currency rating downgrades than foreign currency ones, limiting the statistical power of an empirical panel approach. While the study does not find effects for local currency rating downgrades it does not preclude them.

8 Bibliography

Almeida, Heitor, Igor Cunha , Miguel A. Ferreira, and Felipe Restrepo. 2016. "The Real Effects of Credit Ratings: The Sovereign Ceiling Channel." *Journal of Finance (forthcoming).*

Arellano, Manuel, and Olympia Bover. 1995. "Another Look at the Instrumental Variables and GMM: Estimation and Testing." *Stata Journal,* 3(1), 1-31.

Arellano, Manuel, and Stephen R. Bond. 1991. "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Em-

ployment Equations." *Review of Economic Studies,* 58(2), 277-297.

Blundell, Richard, and Stephen R. Bond. 1998. "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models." *Journal of Econometrics,* 87(1), 115-143.

Chang, Jung-Hsien, Mao-Wei Hung, and Feng-Tse Tsai. 2015. "Credit Contagion and Competitive Effects of Bond Rating Downgrades Along the Supply Chain." *Finance Research Letters,*15, 232-238.

Goh, Jeremy C., and Louis H. Ederington. 1993. "Is a Bond Rating Downgrade Bad News, Good News, or New News for Stockholders?" *Journal of Finance,* 48(5), 2001-2008.

Graham, John R., and Campbell R. Harvey. 2001. "The Theory and Practice of Corporate Finance: Evidence from the Field." *Journal of Financial Economics,* 60, 187-243.

Hansen, Lars P. 1982. "Large Sample Properties of Generalized Method of Moments Estimators." *Econometrica,* 50, 1029-1054.

Hanusch, Marek, and Paul Vaaler. 2013. "Credit Rating Agencies and Elections in Emerging Democracies: Guardians of Fiscal Discipline?" *Economic Letters,* 119(3), 251-254.

Hanusch, Marek, and Paul Vaaler. 2015. "Credit Ratings and Fiscal Responsibility." MFM Discussion Paper No 4, The World Bank.

Hung, Chi-Hsiou, Shammyla Naeem, and K.C. John Wei. 2016. "Credit Rating Changes of Peer Firms and Corporate Capital Structure." EFMA Working Paper.

Judson, Ruth A. and Owen, Ann L. (1999) 'Estimating Dynamic Panel Data Models: A Guide for Macroeconomists' Economics Letters 65(1) 9-15.

Kisgen, Darren J., and Edward Rice. 2006. "Credit Ratings and Capital Structure." *Journal of Finance,* 61(3), 1035-1072.

Nickell, Stephen J. (1981) 'Biases in Dynamic Models with Fixed Effects' Econometrica 49(6) 1417-1426.

Raddatz, Claudio, Sergio L. Schmukler, and Tomas Williams. 2014. "International Asset Allocations and Capital Flows: The Benchmark Effect" Policy Research Working Paper Series 6866, The World Bank.

9 Appendix

Table 3: Countries included in analysis

No.	Country List	Sample Period	No.	Country List	Sample Period
1	Azerbaijan	2005 - 2015	11	Korea	2008 - 2015
2	Brazil	2000 - 2015	12	Latvia	1998 - 2012
3	Bulgaria	2005 - 2015	13	Portugal	2000 - 2015
4	Colombia	2010 - 2015	14	Romania	2003 - 2015
5	Croatia	2006 - 2015	15	Russia	2004 - 2015
6	Egypt	2006 - 2015	16	Slovenia	2000 - 2015
7	Greece	1999 - 2015	17	South Africa	2000 - 2015
8	Hungary	1998 - 2015	18	Thailand	2002 - 2015
9	India	2002 - 2015	19	Tunisia	2001 - 2008
10	Ireland	2005 - 2015	20	Uruguay	2007 - 2012