On the Self-Fulfilling Prophecy of Changes in Sovereign Ratings*

Ingmar Schumacher

IPAG Business School

Abstract

We empirically investigate the dynamic interactions between sovereign ratings and the macroeconomic environment using a Panel VAR on annual data for European countries from 1996 to 2013. Our results provide evidence for a significant two-way interaction between the macroeconomic environment and changes in sovereigns' ratings. Thus, rating changes are able to exacerbate a country's boom-bust cycle.

Keywords: sovereign ratings; Panel VAR; self-fulfilling prophecy.
JEL classification: E6; C33.

*IPAG Business School, Paris, France, and Department of Economics, Ecole Polytechnique Paris, France. ingmar.schumacher@ipag.fr. I am grateful for comments from two anonymous referees, Gaston Giordana, Thomas Mathä, Paolo Guarda, Pok-sang Lam, Francisco Nadal De Simone and Eric Strobl.

1 Introduction

The recent changes in sovereign ratings have received considerable attention from policy makers and researchers alike. For example, fears mounted that governments which are going through a period of crisis would be additionally adversely affected by rating downgrades.[1] As a consequence, downgrades would induce a self-fulfilling prophecy of instability. Supporting the possibility for this self-fulfilling prophecy is evidence suggesting not only that rating changes affect the macroeconomic conditions (e.g. Cantor and Packer, 1996; Kaminsky and Schmukler, 2002; Reinhart, 2002; Brooks et al., 2004; Ferreira and Gama, 2007), but also that macroeconomic conditions may, in turn, induce changes to ratings (e.g. Afonso et al., 2011; Hilscher and Nosbusch, 2010; Mellios and Paget-Blanc, 2006). However, the studies just cited focus on either the effect of ratings on macroeconomic variables or the other way around.[2] In contrast, a study of the self-fulfilling prophecy would require an integrated framework, allowing for two-way feedbacks between changes in ratings and changes in macroeconomic conditions. Our contribution in this article is, thus, to study whether there are those two-way feedbacks in the short-run that policy makers, investors and economists alike are so concerned about.

We construct a dataset of the 26 European countries (excluding Estonia due to data availability) ranging from 1996 to 2013. Our focus is on de-

[1] See e.g. Deen and Livesey (2011).

[2] Cantor and Packer (1996) study both but not in a dynamic, interactive way.

termining the short-run (i.e. up to 6 years) relationship[3] between variables proxying for the macroeconomic environment (GDP per capita, consumer confidence, primary fiscal gap indicator) and the sovereign ratings using a Panel Vector Autoregressive (PVAR) approach.

There have recently been some contributions that question whether changes in ratings are able to exacerbate a country's boom-bust cycle, since they find that changes to ratings were mainly reactions to news (Mora, 2006). Our panel VAR analysis allows us to investigate this question more fully. In particular, the main result of our study is that we find a significant two-way interaction between our macroeconomic variables and changes in sovereigns' ratings, suggesting that ratings are, indeed, able to exacerbate a country's boom-bust cycle.

In section 2 we introduce some background information on sovereign ratings. Section 3 gives an overview of the data and the methodology used. Section 4 provides the results of the econometric study and several robustness exercises. Finally, section 5 concludes.

2 Some basics on sovereign ratings

In Europe are, excluding regional branches, 21 credit rating agencies registered with the European Securities and Markets Authority (ESMA). Among

[3]Previous results have found mostly short-run relations between these variables (Afonso et al., 2011), and it furthermore seems unreasonable to presume effects extending for longer than six years.

these are Standard and Poor's (S&P), Moody's and Fitch, dubbed the Big Three, which share 95% of the market. S&P and Moody's both hold roughly 40% of the market, while Fitch has a market share of 15% (Bartels and Weder di Mauro, 2013). Thus, in terms of market structure it is clear that the sovereign rating market is faced with an oligopoly structure, with three firms dominating the market and the other rating agencies being left with a negligible market share. For Europe, it is the External credit assessment institution source (ECAI) that decides whether a rating agency's assessment may be used by credit institutions in their risk-weighting decisions, or which assets are accepted by the Eurosystem as collateral. Based on their historical rating performance and their nearly exhaustive coverage of the financial sector, the rating decisions of the Big Three tend to be incorporated into government regulation or drive market decisions.[4]

In terms of rating methodology, both S&P and Moody's choose according to very similar criteria, while Fitch's approach is less clear. As S&P states, "[t]he sovereign rating methodology... addresses the factors that affect a sovereign government's willingness and ability to service its debt on time and in full." In order to quantify this, S&P calculates a score out of five factors, institutional and governance effectiveness and security risks, economic structure and growth prospects, external liquidity and international

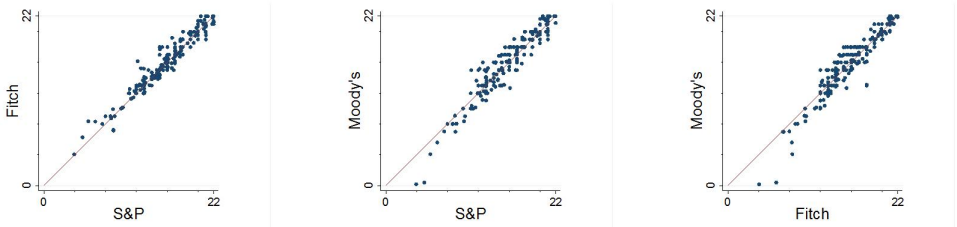
[4]Among the Big Three, there is only one further rating agency whose ratings may be used in Europe for collateral eligibility or risk-weighting, and that is Dominion Bond Rating Service (DBRS). However, DBRS currently does not rate all European sovereigns. As a result, we limit our focus to the Big Three.

investment position, fiscal performance and flexibility as well as monetary flexibility (Standard and Poor, 2013). Similarly to this, Moody's looks at an interplay of four key factors, given by economic strength, institutional strength, fiscal strength, and susceptibility to event risk (Moody's Investors Service, 2013). Just like for S&P, these key factors are then combined via scores into Moody's sovereign rating. In contrast to both S&P and Moody's, Fitch uses what it calls a cooperative rating process. This starts off with a modeling approach, and then a committee from Fitch will discuss this rating with the sovereign, relying both on quantitative and qualitative data (Fitch, 2010).

For this study we use the sovereign long-term ratings. We recode the ratings in a numerical form, ranging from 0 for DD to 22 for AAA for Fitch, from 0 for D to 22 for AAA in the case of S&P, and from 0 for C to 22 for Aaa in the case of Moody's. We take the average of the three ratings for each country at each point in time in order to obtain a balanced picture. Our argument here is that a change in each of the three ratings conveys information and thereby needs to be taken into account. In case there are several changes in a sovereign's rating within one year we weigh each rating by the number of days that the rating was active during that year.

In Figure 1 we plot the annual, weighted sovereign ratings of the Big Three. As can easily be seen, all three rating agencies have very similar sovereign ratings. Both Fitch and S&P tend to agree the most, with Fitch ranking sovereigns marginally better than S&P. In contrast, Moody's seems

Figure 1: Scatter plots of sovereign ratings



(a) (b) (c)

to rate more severely at the lower end of the rating scale, while somewhat more liberal at the higher end. If we look at the summary statistics of the ratings in Table 1, we can observe that differences in the mean are really only minimal (at maximum 0.08 points). Both the range and the standard deviations conform well with each other, with the lowest overall rating given by Moody's for Greece in 2011 and 2012. Finally, Table 2 shows the correla-

Table 1: Summary statistics

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Fitch	18.243	3.782	4.047	22
S&P	18.166	3.818	3.926	22
Moody	18.226	4.037	0.17	22

tion between the ratings of the Big Three during the period of consideration. We observe that the ratings allocated share roughly 94% of their variance. Thus, we can easily conclude that both means and changes contain very similar information.

Table 2: Cross-correlation table

Variables	Fitch	S&P
S&P	0.982	
	(0.000)	
Moody	0.968	0.969
	(0.000)	(0.000)

3 Data and Methodology

Our data consists of consumer sentiment, Gross Domestic Product per capita and Blanchard's primary fiscal gap indicator, all of which come from Eurostat, while the data on the sovereign ratings is taken from Fitch's Complete Sovereign Rating History and Bloomberg. We focus on European countries since this data is fully harmonized and thereby comparison is facilitated and meaningful.

In this study we use the ratings averaged over the three rating agencies and calculate the change in the ratings, denoted by $\mathbf{d(R)}$.[5] A sovereign's rating has been related to its probability of default and economic soundness (Reinhart, 2002). Thus, changes in ratings should drive investors' expectations on their potential returns and household expectations on their future income. Additionally, changes in ratings affect a sovereign's cost of financing its budget deficit (Brooks et al., 2004). In consequence, we also expect rating changes to impact a sovereign's deficit.

[5]Rating changes are necessarily bounded. However, since no rating change is ever at a maximum bound, we argue that a PVAR approach still makes sense. As a robustness exercise we dropped all observations without rating changes. Our results continue to hold in that case.

The variable **d(CCI)** gives the change in the harmonized consumer sentiment index. As described in the background document of the European Commission, (European Commission, 2007), the CCI "is the arithmetic average of the balances (in percentage points) of the answers to the questions on the financial situation of households, the general economic situation, unemployment expectations (with inverted sign) and savings, all over the next 12 months." Thus, it is a forward-looking index of the household's perception on the developments of their financial situation. With this variable we capture the expectations of the households in our sample. We anticipate that improvements in their sovereign's rating should impact their expectations positively.

As the main indicator for the current economic situation we use the growth rate of GDP per capita. GDP is measured in market prices in Millions of Euro. We calculate the growth rate of GDP per capita in percentage terms and denote it by **g(GDPpc)**. We expect a positive two-way interaction between a sovereign's GDP growth rate and its sovereign's rating.

The primary gap indicator comes from Blanchard (1990). It is calculated as the debt to GDP ratio multiplied by the difference between the GDP growth rate and the real interest rate minus the government deficit to GDP ratio. This measure is an indicator that integrates information on the cost of the debt, on whether the economic expansion is sufficiently fast to allow the debt to GDP ratio to shrink over time, and on the current additions to the debt. A positive value indicates that a country's debt is on a sustainable

path, while a negative primary gap suggests that the country's evolution of its public finance may be unsustainable. We use the primary gap indicator as this combines information on both the government deficit and its debt into one simple measure. Only focusing on either government debt or the deficit would provide only a partial picture of a government's debt sustainability. As suggested in Cantor and Packer (1996) or Reinhard (2002), sovereign ratings may be affected by government debt, its deficit or its sustainability. We use the change in the primary gap indicator in our analysis ($\mathbf{d(FG)}$).[6]

Based on this data, our sample consists of the 26 European countries, namely Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.[7]

This gives us an unbalanced dataset consisting of at maximum 395 country-year observations ranging from 1996 to 2013.[8] The use of the annual data should minimize potential anticipation effects of fiscal policy changes (Ramey, 2006) and help us in avoiding spurious results due to cyclical effects. We present unit root tests in Table 3. As one can see, the Phillipps-Perron unit root tests are only conclusive for the ratings variable (R) and GDP per

[6]Another reason for focusing on the primary gap indicator is that the government deficit is a component of GDP and, thus, part of an identity. This could bias the regression results. This possibility is minimized with the primary gap indicator.

[7]There is no data on Estonia for reliable government debt at the ECB since Estonia has very limited government debt.

[8]For missing data of 2013 we use predictions of the ECB SDW or, in case there are no predictions, we average over the available data of 2013.

capita ($\log GDPpc$). In contrast, they reject the H0 that all panels contain unit roots for the fiscal gap variable (FG) and for consumer confidence (CCI). Once we use growth rates or changes, we find little evidence for unit roots. Thus, our choice of using growth rates or changes can be partly based on the unit root tests but rests mostly on the reason that we want to focus on the business cycle effects of changes in the variables, and consequently not the long-term effects.[9]

Table 3: Phillips-Perron Panel unit root tests, p-values

Variable	**Inv. chi-sq.**	**Inv. normal**	**Inv. logit**	**Mod. inv. chi-sq.**
FG	0.000	0.000	0.000	0.000
GDPpc	0.2335	0.6618	0.6722	0.2445
CCI	0.0058	0.0131	0.0079	0.0020
R	0.0000	0.7523	0.0487	0.0000
d(FG)	0.000	0.000	0.000	0.000
g(GDPpc)	0.000	0.000	0.000	0.000
d(CCI)	0.000	0.000	0.000	0.000
d(R)	0.000	0.000	0.000	0.000

The summary statistics are provided in Table 4, and the correlations in Table 5.

Looking at the correlations in Table 5 reveals all are significant at the 1% significance level and all variables are moderately positively correlated. The highest percent of variation shared is between changes in the fiscal gap

[9]We would also argue that these unit root tests suggest that a cointegration or error correction approach may give rise to erroneous results. In addition, our main focus is on the interaction between the macroeconomic variables and the sovereign ratings. Since these ratings are bounded, a cointegration analysis does not make sense in any case.

Table 4: Summary statistics

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
g(GDPpc)	0	4.807	-18.279	18.871
d(FG)	0	335.394	-1595.95	2157.31
d(CCI)	0	6.406	-26.546	21.394
d(R)	0	0.78	-5.939	1.687

indicator and per capita GDP growth (15.44%), while the lowest is between changes in consumer confidence and the fiscal gap (4.7%). Ratings share 7.13% of the variance with consumer confidence, 12% with per capita GDP growth, and 13.5% with the fiscal gap. The correlation is only an indication of the strength of a potential contemporaneous relationship between two variables. We now investigate the relationship more fully with a dynamic model.

Table 5: Cross-correlation table

Variables	g(GDPpc)	d(FG)	d(CCI)
d(FG)	0.393		
	(0.000)		
d(CCI)	0.230	0.217	
	(0.000)	(0.000)	
d(R)	0.346	0.368	0.267
	(0.000)	(0.000)	(0.000)

As our estimation strategy we resort to a Panel Autoregressive Regression (PVAR) with two lags. Since we expect all variables to be at least weakly endogenous we resort to the reduced-form VAR approach as this avoids imposing a detailed structural model. Furthermore, the VAR approach allows

us to identify the dynamic effects of our variables, which we argued in the previous section to be important for understanding the full interaction between rating changes and macroeconomic variables. It furthermore allows us to isolate the individual effects of each variable via orthogonalized impulse responses, which we decompose based on the Cholesky decomposition (see e.g. Hamilton, 1994). We estimate the model itself via system GMM based on the STATA routine provided by Inessa Love (see Love and Zicchino, 2006). Firstly, we time de-mean the series[10], which controls for time-specific effects. Secondly, we helmert transform the variables, which is a forward mean-differencing of the variables in order to take away fixed effects without introducing serial correlation. As a disclaimer, it must be said that this PVAR method is not very good at controlling for spatial spillovers. Though some spillovers will be taken care of by the time de-meaning, spillovers like those occurring through a sovereign default would be difficult to handle. Consequently, the results of this study have to be read with this disclaimer in mind.

We choose the ordering {g(GDPpc), d(FG), d(CCI), g(R)}. Due to the Cholesky decomposition, a variable is allowed to react in the same period to all variables ordered before it, but does not contemporaneously react to any of the variables ordered after it. Our ordering is based on the view that the ratings are responding to all other shocks contemporaneously. Thus, we align

[10]This is done via calculating the average of each variable at each point in time, and then subtracting these from the actual variables.

ourselves with the results in Mora (2006), namely that ratings react to news, and thereby set the stage against a contemporaneous feedback from ratings to macroeconomic variables. If we, even in this case, find evidence in favor of a two-way relationship, then this would provide the strongest support for the self-fulfilling prophecy.

4 Results

The results for the variance decomposition are shown in Table 6, while the impulse response results are presented in Figure 2. The variance decomposition has a forecasting horizon of ten periods. The impulse responses use 5% confidence bands generated by Monte Carlo simulations with 3000 replications.[11] Overall, our results indicate significant dynamic interactions between changes in countries' ratings and their macroeconomic environment, providing support for the self-fulfilling prophecy.

Table 6: Variance decomposition

	g(GDPpc)	d(FG)	d(CCI)	d(R)
g(GDPpc)	85.14	3.11	1.09	10.66
d(FG)	27.34	50.87	3.92	17.87
d(CCI)	14.47	1.27	81.37	2.9
d(R)	4.28	7.99	4.60	83.14

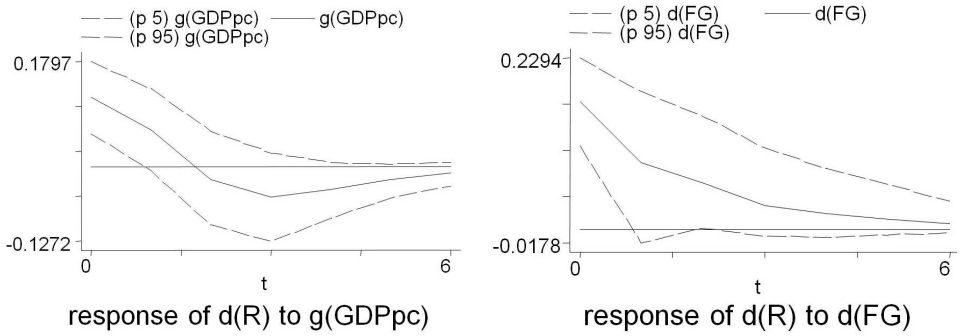
In particular, our results show that 83.14% of the variance in sovereign

[11] Already the use of 500 replications leads to robust results.

ratings changes can be attributed to an own shock, while the rest of the variance is explained by changes in the fiscal gap indicator (7.99%), per capita GDP growth (4.28%) and by changes to consumer sentiment (4.60%). Thus, though in line with the previous literature on the sustainability of government finances (e.g. Afonso et al., 2011), we also find a relevant role for per capita GDP growth and for expectations. In addition, changes in sovereign ratings are able to explain 10.66% of the variance in per capita GDP growth, only 2.9% of changes in expectations, but 17.87% of the variance in the changes in the fiscal gap.

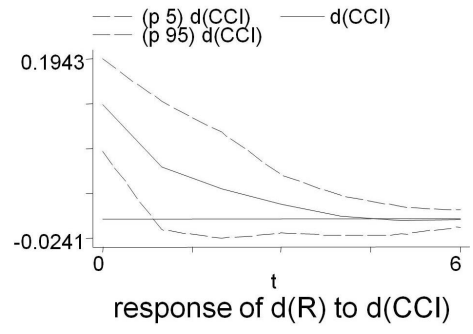
We now turn to the results from the impulse responses as shown in Figure 2. As a main result, we observe significant feedback effects from the macroeconomic variables to changes in the sovereign ratings and vice versa. In particular, the effect of changes in a sovereign's GDP growth rate is short-run and impacts its rating for two periods (panel (a)). A one standard deviation increase in the GDP growth rate increases that country's sovereign rating by roughly 0.2 points. Thus, GDP growth is a relevant contributor to a country's rating. This is supported by the fact that positive GDP growth tends to indicate a healthy economy with rising income levels. A sovereign's rating will be increased by roughly 0.3 points following a one standard deviation increase in that country's fiscal gap indicator (panel (b)). Thus, a country that is closer to a sustainable fiscal path as measured by the fiscal gap indicator will have a higher rating. This thus confirms previous results on the effect of government debt or deficit on ratings (e.g. Cantor and Packer,

Figure 2: Impulse response results

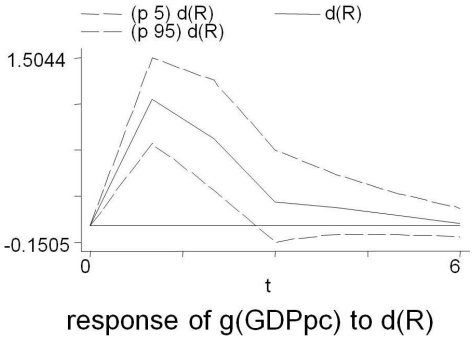


(a)

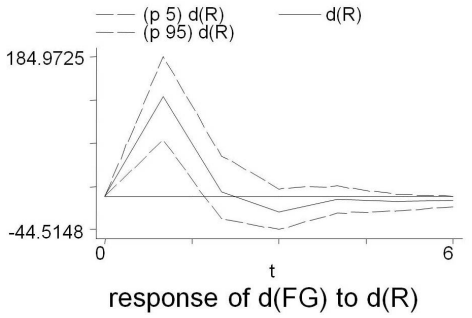
(b)



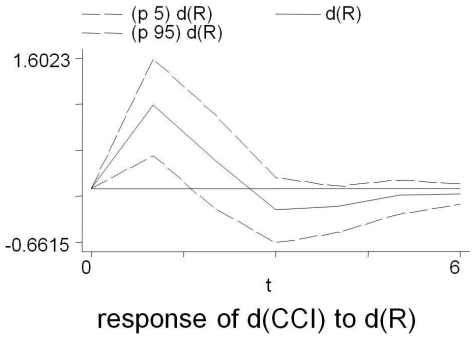
(c)



(d)



(e)



(f)

1996). Changes to consumer sentiment lead to a statistically significant and short-term increase in a sovereign's rating (panel (c)). Here we find that a one standard deviation increase in consumer sentiment raises a sovereign's rating by roughly 0.15 points. Consumer sentiment captures consumers' expectations and proxies for many things like unemployment expectations, a country's stability as seen from the consumers' point of view, as well as the evolution of the stock markets (expectations and stock prices tend to be highly correlated). In this respect, the positive impact from consumer sentiment to sovereign ratings should not be surprising.

Our impulse response results show that all three macroeconomic variables in our model are significantly positively related to changes in ratings. A one standard deviation increase in a country's rating increases per capita GDP growth by roughly 1.8 percentage points after a period of two years (panel (d)), while its consumer sentiment increases by approximately 1.1 points after one year (panel (f)). Thus, positive rating changes tend to improve a country's growth perspective and also its inhabitants' expectations. We find that a one standard deviation increase in a country's rating increases a country's fiscal gap indicator by roughly 120 points (panel (e)). This effect, however, is short-term. Indeed, one would have expected that a country's downgrade induces this country towards more fiscal austerity. However, we find a positive relationship between ratings and a country's fiscal gap. Thus, a decrease in a sovereign's rating will worsen the fiscal sustainability of that country. With this analysis we are obviously not able to identify whether

downgrades lead to more or less fiscal austerity or whether a country's interest rate payments will be negatively affected by the downgrade. But what we can clearly say is that the net effect, namely the effect on fiscal sustainability as measured by the fiscal gap indicator, is negative. As a consequence, a downgrade that occurred because of a weak fiscal position tends to have an additional, second-round adverse effect on fiscal sustainability.

Robustness

We now provide several remarks on the robustness of the results above. The figures associated to these robustness exercises are available in a separate robustness appendix available from the author.

As a first robustness exercise we varied the lag length to one and three years. Our results remain qualitatively the same compared to the results presented above with two lags.

The assumed ordering tends to be important for the impulse responses due to the Cholesky decomposition. Thus, we inspected the robustness of the results with alternative orderings of the variables. Ordering rating changes first implies that ratings are not contemporaneously affected by the other variables, while changes in ratings may induce immediate changes in those variables that are ordered after ratings. In this case we still find that the macroeconomic variables react statistically significantly to changes in ratings. Furthermore, we find that rating changes are affected statistically sig-

nificantly by only those macroeconomic variables that are ordered before ratings. The reason is the following. Our impulse response functions show that a shock in a macroeconomic variable has the strongest impact on itself and other macroeconomic variables during the same period. Since the effects of the own shocks die out rather quickly (mostly within one year), then not allowing for a contemporaneous impact from macroeconomic variables to ratings implies weaker shocks in the next round. Thus, we conclude that rating agencies are likely to only react to immediate shocks in the macroeconomic variables. Consequently, our results support our initial ordering that ratings should be ordered last since they react at once to contemporaneous information (see also Mora, 2006).

As an additional robustness check we introduce a variable that proxies for the role of the financial sector in the transmission mechanism shown above. For example, a country with a highly leveraged financial sector may be very responsive to changes in its sovereign rating, as this may impact the amount of regulatory, risk-weighted capital it has to hold. One of the most-widely used indicators that provides a wealth of information on a financial's funding and risk-taking strategy is the leverage ratio. The leverage is calculated as the amount of assets held divided by a financial's capital. The higher this leverage ratio the more adjustments a financial institution may need to undertake to its balance sheet in case of financial distress, and the more costly will those changes be. This leverage ratio is believed to be an important accelerator of the 2007 financial crisis, with two-way feedback effects between

asset prices and leverage (Adrian and Shin, 2010; Brunnermeier and Pedersen, 2009). As a robustness exercise we study whether the leverage ratio had a significant two-way feedback with ratings, or whether it introduced changes to the relationship between the macroeconomic variables and ratings that we studied above.[12] We thus obtained yearly data on the aggregate capital and assets holdings of each country's monetary financial institution (MFI), which cover both the credit institutions and money market funds. Based on the literature cited above, we would expect downgrades of sovereigns to reduce that country's MFIs risk-taking as well as asset prices, thus leading to reductions in leverage. Overall, our impulse response results indicate little evidence for feedback effects (see robustness appendix) between leverage and rating changes. We do not find that the impact from rating changes on leverage growth is statistically significantly different from zero, while we find that leverage growth is marginally statistically significant in explaining rating changes. However, this last result is not robust across different lags or Cholesky orderings. Hence, we conclude that, at least in our sample, there is little evidence supporting feedbacks between ratings and that country's financial leverage, and there is no evidence for a two-way feedback. This may come as a surprise for some readers, especially having the recent impact of e.g. Cyprus' fragile financial sector in its rating in mind. However,

[12]There is evidence for a relationship between various macroeconomic variables and leverage (e.g. Pozsar et al., 2012; Gorton and Metrick, 2011; Coval et al., 2009). Whether this impacts the ratings of sovereigns or the relationship between ratings and macroeconomic variables has seen little study.

two explanations may be forwarded. Firstly, in our sample there might have been simply too few rating changes as a direct consequence of a highly leveraged financial sector so that we were unable to find an important feedback between ratings and the financial sector. Secondly, it could very well be that a failing financial sector impacts its sovereign's rating only indirectly via the sovereign's ability to bailout the financial institutions. In this case it would be more likely that a stronger relationship between an unsustainable sovereign debt and its rating is observed than the indirect link via the failing financial sector.

One question is whether the results are robust across different periods. For example, it might be expected that macroeconomic feedback effects changed during the sovereign debt crisis that started in 2010. Firstly, there were simply stronger and more rating changes during the sovereign debt crisis, and also macroeconomic variables like the fiscal gap changed much more strongly. Secondly, rating agencies had been highly criticized in the aftermath of the 2007 financial crisis, which subsequently led to the 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act. In Title IX, Subtitle C, congress laid out further regulation of rating agencies which potentially lead to a (significant) change in the procedures and methodologies of rating agencies. In addition, rating agencies have to be more transparent about the way they provide ratings. These two points may have induced a change in the relationship between the macroeconomic variables and ratings. To see whether there was a difference, we ran the panel VAR again but excluded the

years of the sovereign debt crisis 2010-2013. The impulse response functions show that, while the response of ratings to the macroeconomic variables is preserved, we find a statistically insignificant response of the fiscal gap and consumer confidence when ratings change. Our methodology does not allow to identify whether this is due to the new regulation or the smaller variations in the variables prior to the sovereign debt crisis.

As an additional robustness study we looked at whether the panels in our study are actually poolable. If the sample is not poolable, then it could be the case that non-linear effects drive our results. In this case we would have to potentially constrain our analysis to a poolable sub-sample. In order to study poolability we implemented the Roy-Zellner poolability test (see e.g. Baltagi, 2008).[13] Table 7 shows that our sample is clearly poolable and, consequently, results should be robust across countries. This is to be expected, since the rating agencies tend to use the same model for rating different sovereigns. Though they may sometimes place different priority on different items that they use to obtain the rating, it seems that these differences are either well-captured by the variables that we use to explain the ratings, or do not matter so much.

As a final robustness exercise we separate the ratings variable into the individual series of Fitch, S&P and Moody's. It could potentially be the case that macroeconomic variables react more strongly to one of the rating agencies, and that we potentially lose information by averaging over the

[13]This test is also robust to potentially non-spherical disturbances.

Table 7: Roy-Zellner Poolability test

Equation	**F-Stat**	**p-value**
g(GDPpc)	25.62	.999
d(FG)	24.02	.999
d(CCI)	32.29	.999
d(R)	44.32	.87

ratings. Though this is unlikely since both the levels and the changes in the ratings of the Big Three are so highly correlated, this possibility can nevertheless not be excluded ex ante. For example, as we have shown above, Moody's tends to grade somewhat more strongly at the lower end, while a little softer at the upper end of the rating spectrum. Our findings based on the results from separately looking at the Big Three ratings remain fully robust. As a result we can be sufficiently confident that informational loss is not an issue when averaging across the ratings.

5 Conclusion

In this article we find evidence for the self-fulfilling prophecy caused by changes in sovereigns' ratings, suggesting that ratings are, indeed, able to exacerbate a country's boom-bust cycle. Thus, ratings seem to have a similar impact as marking-to-market of balance sheets. While marking-to-market of balance sheets may lead to fire sales and additional rounds of feedbacks between asset sales and asset prices (Plantin et al., 2008), thereby poten-

tially rendering an otherwise sound institution illiquid, rating changes may exacerbate a sovereign's boom-bust cycle by two-way feedbacks between its rating and its macroeconomic condition.

The obvious advantage of sovereign ratings is that they provide debt holders and investors with an idea about the probability of a sovereign's default. Another advantage is that rating downgrades will place pressure on governments to address structural problems that otherwise might get postponed and potentially result in larger costs than those incurred by immediately tackling the problems. The disadvantage, as we have shown, arises from the fact that changes in ratings can induce a downward spiral and essentially aggravate existing problems. To find the welfare trade-offs between the advantages and the disadvantages as well as potential policy solutions should prove to be a fruitful future research agenda.

References

Adrian, T. and H.S. Shin, "Liquidity and leverage," *Journal of Financial Intermediation*, 2010, *19* (3), 418–437.

Afonso, A., P. Gomes, and P. Rother, "Short-and long-run determinants of sovereign debt credit ratings," *International Journal of Finance & Economics*, 2011, *16* (1), 1–15.

Baltagi, B.H., *Econometric analysis of panel data*, 4th ed., New York: Wiley, 2008.

Bartels, B. and B. Weder di Mauro, "A rating agency for Europe - A good idea?," *mimeo*, 2013.

Blanchard, O., "Suggestions for a New Set of Fiscal Indicators," OECD Economics Department Working Papers 79, OECD Publishing 1990.

Brooks, R., R.W. Faff, D. Hillier, and J. Hillier, "The national market impact of sovereign rating changes," *Journal of Banking & Finance*, 2004, *28* (1), 233–250.

Brunnermeier, M.K. and L.H. Pedersen, "Market liquidity and funding liquidity," *Review of Financial Studies*, 2009, *22* (6), 2201–2238.

Cantor, R. and F. Packer, *Determinants and impacts of sovereign credit ratings*, Federal Reserve Bank of New York New York, 1996.

Coval, Joshua, Jakub Jurek, and Erik Stafford, "The Economics of Structured Finance," *Journal of Economic Perspectives*, 2009, *23* (1), 3–25.

Deen, M. and B. Livesey, "S&P Puts 15 Euro Nations on Watch for Downgrade Amid Sovereign-Debt Crisis," http://bloom.bg/sjF7ci, Bloomberg.com, 6 Dec 2011.

European Commission, *The joint harmonised EU programme of business and consumer surveys: User Guide*, European Commission Directorate - General for Economics and Financial Affairs, 2007.

Ferreira, M.A. and P.M. Gama, "Does sovereign debt ratings news spill over to international stock markets?," *Journal of Banking & Finance*, 2007, *31* (10), 3162–3182.

Fitch, "Fitch Sovereign Ratings Rating Methodology," 2010.

Gorton, G. and A. Metrick, "Securitized banking and the run on repo," *Journal of Financial Economics*, 2011.

Hamilton, J.D., *Time series analysis*, Vol. 2, Cambridge Univ Press, 1994.

Hilscher, J. and Y. Nosbusch, "Determinants of Sovereign Risk: Macroeconomic Fundamentals and the Pricing of Sovereign Debt," *Review of Finance*, 2010, *14* (2), 235–262.

Kaminsky, G. and S.L. Schmukler, "Emerging market instability: do sovereign ratings affect country risk and stock returns?," *The World Bank Economic Review*, 2002, *16* (2), 171–195.

Love, I. and L. Zicchino, "Financial development and dynamic investment behavior: Evidence from panel VAR," *The Quarterly Review of Economics and Finance*, 2006, *46* (2), 190–210.

Mellios, C. and E. Paget-Blanc, "Which factors determine sovereign credit ratings?," *The European Journal of Finance*, 2006, *12* (4), 361–377.

Moody's Investors Service, "Sovereign Bond Ratings," 2013.

Mora, N., "Sovereign credit ratings: guilty beyond reasonable doubt?," *Journal of Banking & Finance*, 2006, *30* (7), 2041–2062.

Plantin, G., H. Sapra, and H.S. Shin, "Marking-to-Market: Panacea or Pandora's Box?," *Journal of Accounting Research*, 2008, *46* (2), 435–460.

Pozsar, Z., T. Adrian, A. Ashcraft, and H. Boesky, "Shadow banking," 2012.

Reinhart, C.M., "Default, Currency Crises, and Sovereign Credit Ratings," *World Bank Economic Review*, 2002, *16* (2), 151–169.

Standard and Poor, "Sovereign Government Rating Methodology And Assumptions," 2013.