Case Study:

DBRS Sovereign Rating of Portugal

Analysis of Rating Methodology and Rating Decisions

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1. Qualitative Analysis

    *   Historical Rating Decisions on Portugal
    *   Rating Approach

2. Replication of DBRS Sovereign Risk Model of Portugal

3. Empirical Analysis (following Vernazza. Nielsen and Gkionakis, 2014)

    3.1 Differences of ten fundamental rating effects among Big Three and DBRS (OLS)

    3.2 Subjective rating component among DBRS rating decisions (rating scale model by Studer and Winkelmann, 2016)

    ➡ Take more comprehensive discussion on sovereign ratings, understand what justifies investment-rating

Historical Rating Decisions on Portugal:

- "Big Three": Withdrawal of "investment-grade" since latest January 2012.

- DBRS: Lowest possible investment grade of "BBB-" since December 2012, comparably dovish rating behavior cannot be generalized across all other countries.
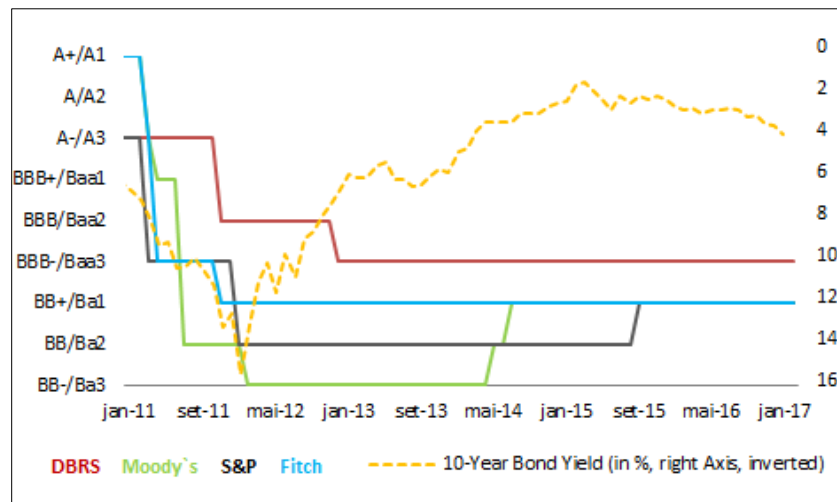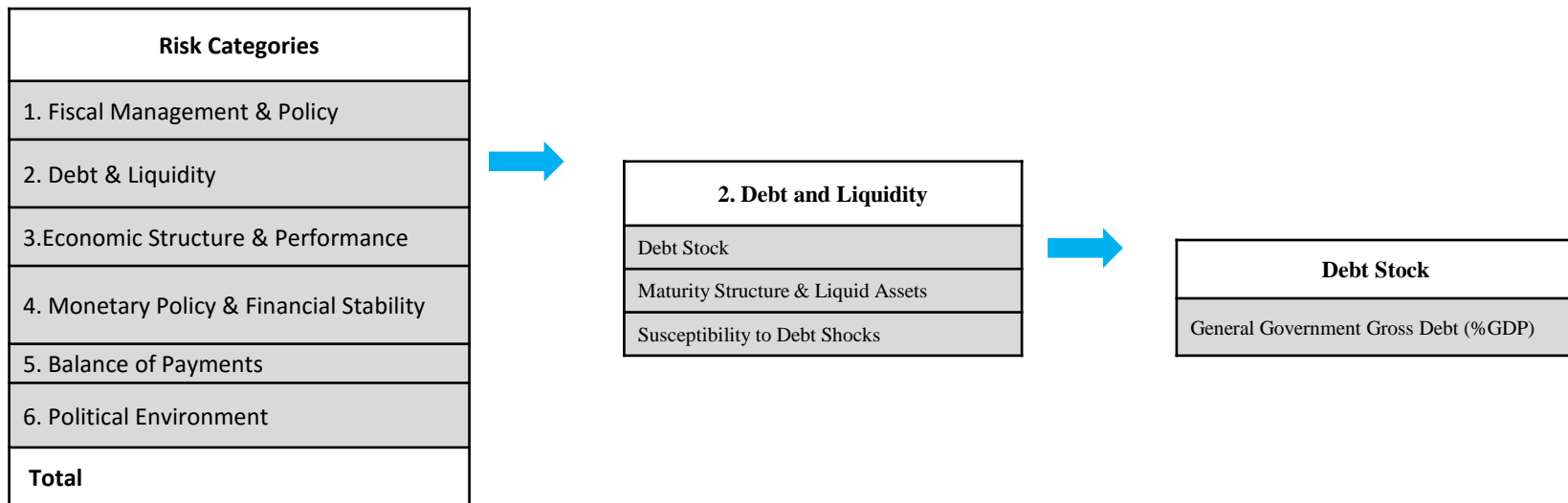

Historic Rating - Portugal

Rating Approach:

- DBRS claims for its rating decisions to be <u>more responsive to changes in fundamental characteristics</u> rather than to changes in "cyclical economic conditions" - technical justifications remain undisclosed

- Transparency on DBRS sovereign rating approach considerably low – characteristic for the (sovereign) credit rating industry as a whole

Objective:

Replicate rating model in order to assess DBRS sovereign rating methodology and to identify country-specific risk factors

Risk Categories
1. Fiscal Management & Policy
2. Debt & Liquidity
3. Economic Structure & Performance
4. Monetary Policy & Financial Stability
5. Balance of Payments
6. Political Environment
Total

2. Debt and Liquidity
Debt Stock
Maturity Structure & Liquid Assets
Susceptibility to Debt Shocks

Debt Stock
General Government Gross Debt (%GDP)

Replication Approach:

Construct Rating Model based on information provided of 16 risk indicators (including individual data evaluation, threshold application and weighting) as outline in hypothetical country rating model.

+ Augment model with 27 additional risk indicators collected form published risk indicator list

a)   <u>Data Evaluation</u>: Risk factors are evaluated based on their historical and prospective performance

Debt & Liquidity	Indicator	Data assessment
Debt Stock	General Government Gross Debt (%GDP)	Projected debt stock as of end of next calendar year
Private Sector Debt	Non-Financial Corporate Debt (%GDP)	Average of 5 years historical data
	Household Debt (%GDP)	Average of 5 years historical data
Maturity Structure and Liquid Assets	Short-Term Public Debt (%GDP)	Last available data
	Average Maturity of Public Sector Debt (Years)	Last available data
	State Borrowing Requirements (%GDP)	Average of 3 years projections
Susceptibility to Debt Shocks	Debt Sustainability Analysis - Change in Debt Stock	Total net change from base year 2016 to 2021 (mixed shock scenario) – IMF DSA 2016

a)   <u>Indicator Scaling</u>: each risk factor scaled from *0=low risk* to *10=high risk* under the application of individual – and mostly arbitrarily chosen - thresholds

Debt and Liquidity	Indicator	Unit	Thresholds		Value	Score (0-10)
			Low risk	High risk		
Debt Stock	General Government Gross Debt (%GDP)	%	30,00	130,00	127,73	9,77
Private Sector Debt	Non-Financial Corporate Debt (%GDP)	%	30,00	130,00	147,09	10,00
	Household Debt (%GDP)	%	30,00	130,00	86,70	5,67
Maturity Structure and Liquid Assets	Short-Term Public Debt (%GDP)	%	5	15	11,93	6,93
	Average Maturity of Public Sector Debt	years	10,00	3,00	8,42	2,25
	State Borrowing Requirements (%GDP)	%	3,00	10,00	9,17	8,81
Susceptibility to Debt Shocks	Debt Sustainability Analysis - Change in Debt Stock	%	5,00	30,00	18,50	5,40

a) <u>Weighting</u>: Risk factors are weighed individually and summed across six categories, generating an overall scorecard result from *0=no default* to *60=high default risk*

Debt and Liquidity	Indicator	Individual Score	Averaged within Primary Element	Weighting within Category	Individual overall rating weight
Debt stock	General Government Gross Debt (%GDP)	9,77	9,77	30%	5,00%
Private Sector Debt	Non-Financial Corporate Debt (%GDP)	10,00	7,83	20%	3,33%
	Household Debt (%GDP)	5,67			3,33%
Maturity Structure & Liquid Assets	Short-Term Public Debt (%GDP)	6,93	6,00	20%	3,33%
	Average Maturity of Public Sector Debt (Years)	2,25			3,33%
	State Borrowing Requirements (%GDP)	8,81			3,33%
Susceptibility to Debt Shocks	Debt Susceptibility Analysis - Change in Debt Stock	5,40	5,40	30%	5,00%

b) <u>Scorecard mapping</u>: composite numeric score lastly transformed into respective alphanumeric rating grade following a sovereign scorecard map

Credit Rating	Minimum score
AAA	12
AA range	18
A range	24
BBB range	30
BB range	36
B range	42
CCC range	48
CC range	54
C range	60

Results:

Categories	Scorecard results
Fiscal Management & Policy	6,78
Debt & Liquidity	7,32
Economic Structure & Performance	4,34
Monetary Policy & Financial Stability	5,43
Balance of Payments	6,17
Political Environment	3,98
Total	34,02

= lower "*BBB*" range

Identified high-risk categories:

- Debt and Liquidity
- Fiscal Management and Policy

Positive momentum emanating from:

- Political Environment
  (highly subjective assessment!)

- Arbitrary individual data assessment and indicator-scaling

- Susceptibility to debt shocks (presented as one of major analytical pillars) significantly underrepresented (5% total rating weight)

- "Political commitment to fiscal consolidation" identified as striking justification for ongoing investment-grading of Portugal (highest single rating weight of 8.33%)

- No tangible rules or adjustment ranges for subjective rating adjustments on scorecard-generated results

Objective:

Compare risk factor sensitivities across agencies

Approach:

Replicate OLS regressions from Vernazza, Nielsen and Gkionakis (2014) for DBRS rating decisions, alphanumeric rating variables are converted into numeric values ("*AAA*"= 24, "*D*" =1)

Data set: total 224 end-of-year DBRS rating decisions of 36 different countries i from Nov 2000 until March 2017 are OLS-regressed on the fundamental variables vector χ_{it} and a macro time effect Z_t.

$$rating_{it} = \beta' \chi_{it} + Z_t + \varepsilon_{it}$$

Fundamental variables:

Fundamental Variable	Definition
Nominal GDP	GDP in current prices
GDP per capita	Nominal GDP per person, PPP-adjusted
GDP growth	Average annual real GDP growth, t-9 to t
Public Debt	General government gross debt
Current Account	Annual current account balance
External Debt	Gross external debt
Past Default	Dummy variable taking value 1 in all years following a default event since 1960, 0 otherwise
Advanced Country	Dummy variable taking the value 1 if country classified as Advanced Country by IMF, 0 otherwise
Government	World Bank Government Effectiveness Index
Law	World Bank Rule of Law Index

Results:

Variable	Moody's[+a]	S&P[+a]	Fitch Ratings[+a]	DBRS[+]
Nominal GDP	0.13	0.17	0.13*	0.24***
	[0.09]	[0.12]	[0.07]	[0.07]
GDP per capita	0.15***	0.14***	0.14***	0.02
	[0.04]	[0.04]	[0.04]	[0.03]
GDP growth	0.10**	0.23***	0.11***	0.44***
	[0.05]	[0.06]	[0.04]	[0.13]
Public Debt	-0.04***	-0.04***	-0.03***	-0.02***
	[0.01]	[0.01]	[0.01]	[0.01]
Current Account	-0.05***	-0.02	-0.02*	-0.04
	[0.01]	[0.01]	[0.01]	[0.05]
External Debt	-1.5E-4***	-1.3E-4*	-8.5E-5***	-5.4E-4
	[2.6E-5]	[7.0E-5]	[1.9E-5]	[3.6E-4]
Past Default	-1.75***	-0.27	-2.05***	-3.1***
	[0.51]	[0.33]	[0.67]	[0.65]
Advanced Country	3.23***	3.98***	2.95**	0.01
	[1.09]	[0.98]	[1.18]	[1.16]
Government	0.64***	1.01***	1.11***	3.5***
	[0.41]	[0.32]	[0.34]	[0.96]
Law	0.48**	0.27	7.6E-4	0.95
	[0.45]	[0.34]	[0.33]	[0.75]
No. Observations	999	1108	971	224
No. Countries	94	103	94	36
R-sq.	0.79	0.82	0.79	0.98

➡️ *Past Default*, long-term *GDP growth*, *Government* and *Law Index* are predicted to have significantly stronger impact under the DBRS rating framework than it is the case for the Big Three.

Objective:

Disentangle credit rating into objective and subjective rating component following Vernazza, Nielsen and Gkionakis, 2014: Subjective rating component defined as difference between actual and fitted ratings (generated by 10 fundamental variables).

Significant alterations on Vernazza, Nielsen and Gkionakis Approach:

a)   Apply alternative rating model (OLS vs QMLE)

b)   Adjust & alter fundamental variables (accounting for DBRS rating approach and data evaluation)

Variable	Definition	Data Evaluation
Public Debt	General Gov. Gross Debt	Projected next calendar year value
GDP growth	Real GDP growth rate	10 years historical data + 3 years projections
GDP p. c	Nominal GDP p. c	10 years historical data
Structural Balance	General Gov. Structural Balance	10 years historical data + 3 years projections
Current Account	Current Account	5 Years historical data + 3 years projections
Investment	Total Investment	5 Years historical data + 3 years projections
Unemployment Rate	Unemployment rate	5 Years historical data + 3 years projections
Inflation	Inflation, Average Consumer Prices	5 Years historical data + 3 years projections
National Savings Rate	Total National Savings	Last available data
External Debt	Gross External Debt	Last available data

Identified Shortfalls of OLS Model (Vernazza, Nielsen and Gkionakis)

- Dependent variable unbounded

- Variables treated as cardinal, categories assumed to be equidistant

- Constant marginal effects

Clear Alternative:

Ordered Probit Models

Identified Shortfall:

- Variables treated as ordinal

- Model analysis laborious with increasing number of categories

Introduction of alternative statistical rating model

- Conditional expectations respect upper and lower bound (limited dependent variable)

- Non-constant marginal effects

Alternative rating scale model (Studer and Winkelmann, 2016)

Model: Generalized linear model

Random component y_{it} follows Bernoulli distribution, lying within the range of $[0, y_{max}]$ with P=1 and y_{max} as the rating grade "*AAA*",

with expected value (mean response) of dependent limited variable y_{it} depending linearly on predictors of explanatory variables through probit link function

Dependent variable y_{it} are computed as follow:

$$y_{it} = (y_{it} - 2)/y_{max} \qquad \text{with } y_{max} = 22$$

With a scaled probit model version of

$$G(x'_{it}\beta + \gamma Z_t) = y_{max}\phi(x'_{it}\beta + \gamma Z_t)$$

and the Bernoulli quasi-likelihood function for n observations of

$$L = \prod_{i=1}^{n} \left(\frac{G(x'_{it}\beta)}{y_{max}}\right)^{\frac{y_{it}}{y_{max}}} \left(\frac{y_{max} - G(x'_{it}\beta)}{y_{max}}\right)^{\frac{1-y_{it}}{y_{max}}}$$

and fitted fractional rating grades y_{it}^* are obtained as follow:

$$y_{it}^* = y_{it}^{fitted} * y_{max} + 2$$

*As dependent variable not binary but a rating variable, Studer and Winkelmann (2016) apply robust SEs

Results

- The model attests DBRS a comparably "dovish" rating behavior in Portugal, on average inflating the objective rating by one rating notch (+1.01).

- The subject component among all DBRS cross-country ratings is neutral. (panel average: -2.5E-5)

- The subjective rating component of Portugal gradually diminishes over time, suggesting the DBRS rating grade to gradually "catch-up" with ratings suggested by actual macro fundamentals.
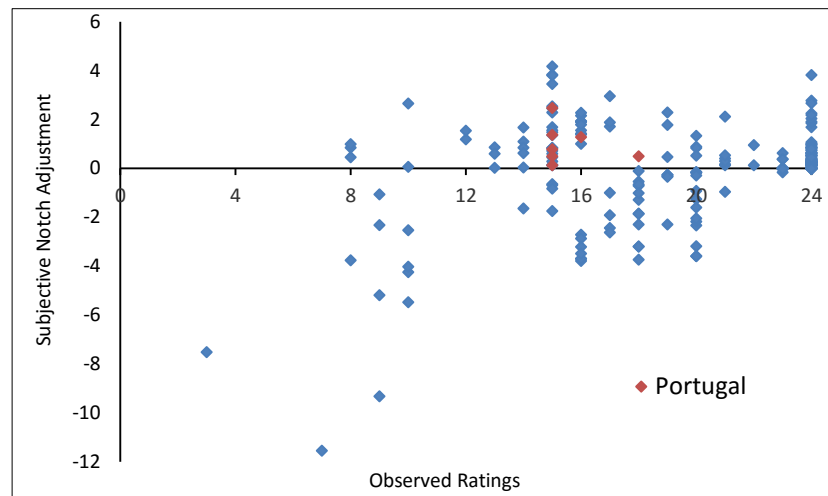
Panel results
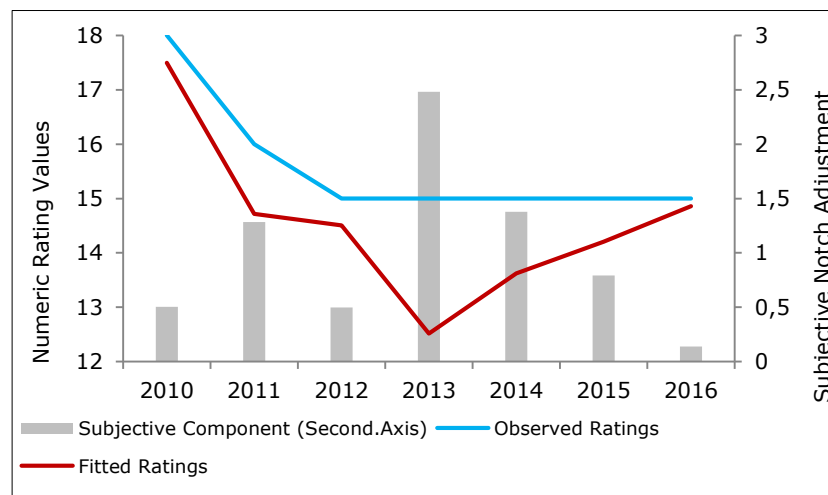
Portugal - Subjective rating component over time

➡ **Both qualitative and empirical findings attest DBRS a comparably lenient rating behaviour on Portugal - in comparison to other rating agencies as well as within the DBRS cross-country rating decisions**

- Replicated sovereign risk model of Portugal identifies "*political commitment to fiscal consolidation*" as striking justification for ongoing issuance of investment-grade, susceptibility to debt shocks significantly underrepresented, rating methodology lacks of transparency

- OLS regression identifies a country's *past default history*, *government effectiveness*, *rule of law and long-term growth rate* to have significantly greater effect under the DBRS rating framework than it is the case for S&P, Moody's and Fitch Ratings.

- Rating Scale Model attests DBRS to subjectively inflate its objective (fundamental) rating decisions of Portugal on average by one rating notch. Portugal's subjective rating componente has been diminishing over time, suggesting the rating grades to gradually approach their "fundamental" values. The cross-country subjective adjustment average is neutral.

Interesting to study further:

Rating scale model by Studer and Winkelmann (2016)

- Elaborate what events or indicator changes could underlie the extraordinary positive subjective rating adjustment in 2013

- Extend subjective rating component analysis for e.g. Cyprus, Argentina and Greece (specifically its component developments during sovereign debt crisis)

- Elaborate further on appropriateness and robustness of model, compare results with ordered probit model

Final Remark:

- Suggestion: Publicate two distinct credit ratings (D'Agostino and Lennkh, 2016)

   a) purely quantitatively derived grades as well as

   b) final rating including rating agency's subjective adjustment

➡ allow market participants to assess & evaluate appropriateness of subjective rating adjustment by themselves

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Muito obrigada pela vossa atenção.