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Sovereign Risk and Public-Private Partnership During the Euro Crisis

Maura Campra
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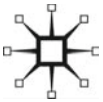

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Contents

List of Illustrations

Boxes

Figures

Tables

List of Abbreviations

AR	accuracy ratio
BOT	build operate transfer
CGU	cash generating unit
DBO	design build operate
DBFO	design build finance and operate
ECB	European Central Bank
EMS	European Monetary System
ENAC	Ente Nazionale Aviazione Civile (National Authority for Civil Aviation)
GFS	government financial support
IASB	International Accounting Standards Board
IFRIC	International Financial Reporting Interpretations Committee
IFRS	International Financial Reporting Standards
IQ	investment quota
LLP	loan loss provision
LTIC	long-term infrastructure contracts
LTRO	longer-term refinancing operations
MoD	Ministry of Defence
NMS	New Member States
NPL	non-performing loans
NPS	National Policy Statements
NTG	(Italian) national transmission grid
O&M	operation and maintenance
OIC	Osservatorio Italiano Contabilità (Italian Accounting Committee)
PA	public administration
PD	probability of default
PF	project financing
PFI	Private Finance Initiative
PPP	public-private partnership
PPPC	PPP contracts
PSC	Public Sector Comparator
PUs	public utilities
RFI	Rete Ferroviaria Italiana (Italian Railway Network)
ROSCO	rolling stock company

RP	ranking power
RTN	Rete di Trasmissione Nazionale (Italian National Trasmission Grid)
SAR	shadow accuracy ratio
SCA	service concession arrangement
SCDF	shadow cumulative default frequency
SIGAEC	integrated environmental management, energy and indoor environmental quality
VfM	value for money

1
Introduction

The financial crisis in Europe has led to a sharp increase in the levels of both sovereign risk and banking risk. The high correlation between sovereign risk and banking risk has produced a negative effect on the general economic system in terms of (i) lower public expenditure, (ii) less credit to corporates and SMEs and (iii) reduced private and public investment.

Government bond issue restrictions in Euro-periphery countries have also created negative effects on the real economy. The crisis has had a strong impact on the initiation of new infrastructure and on investments on capital intensive initiatives. Direct public intervention in the economy has declined.

At the same time, the ECB's longer-term refinancing operations (LTRO) programme has provided banks in the Euro Area with plenty of liquidity and avoided possible bank defaults. However, this liquidity has not flowed into the real economy, since the banks have invested it in either government bonds or bonds of their own (fixed income buy back).

The new Targeted Longer-Term Refinancing Operations (TLTRO) effectiveness must still be verified.

In the near future the Euro area's main problem will be to avoid deflation. The ECB has an opportunity to follow the Federal Reserve, the Bank of Japan and the Bank of England in applying quantitative easing tools. Quantitative easing can be structured in (i) a government bond buy programme, (ii) a private bond buy programme (on SME plain vanilla Asset Backed Securities) or (iii) a modified LTRO programme linked to new loans to corporates and SMEs. It is important not to lose momentum, given the turning point in the Euro economy.

Governments cannot pursue Keynesian policies without increasing their debt. However, we believe that public-private partnerships (PPPs)

would be a powerful tool (not yet fully implemented in the Euro-periphery) in order to boost real economy without any pressure on public debt and on sovereign risk.

PPPs, combined with other forms of credit mitigation or public support, would make companies creditworthy enough for banks to finance them. As a matter of fact, public-private partnerships usually have comparatively modest capital requirements, according to Basel's current regulations. In this context, directing bank liquidity towards PPPs would produce a positive effect on the real economy and on public finance.

Through PPPs countries would fail to meet the need of creating new infrastructure or investment or the need to develop innovative sectors, for which the funds and the necessary resources would not be available or for which the cost of procurement by the state would be excessive.

Therefore, it becomes very important to implement the construction of public infrastructure in order to push bank liquidity towards investments with a lower degree of credit risk. A system of concessions to private operators, in agreement with public operators, can realize and manage the infrastructure until the concession expires. Therefore, governments achieve the construction of infrastructure without charge, relinquishing for a given period, short or long, any yields resulting from its management.

The first part of this book focuses on the analysis and assessment of sovereign and bank risks in the Eurozone and the United Kingdom (UK) and examines the relationship between PPPs and the public debt ceiling or sovereign rating in detail. Public companies wishing to receive benefit from capital markets have to show investors that they are able to afford the debt service and pay it back in accordance with the measures taken and within the due date.

A key issue in the effectiveness of PPP schemes is risk management of the timing and costs of execution. On the one hand the PPP is an excellent financing tool but, on the other hand, there is a substantial risk of requests for revision and renegotiation of agreements by the dealers. If PPPs are poorly managed the final cost to governments can be high.

In this context, the International Financial Reporting Interpretations Committee 12 (IFRIC 12) on *Service Concession Arrangements* has taken a fresh look at how PPP investments are represented and evaluated in the financial statements of private entities. This examination by IFRIC 12 is very important and represents a good starting point for a quantitative analysis of PPPs.

The second part of this book analyses three countries (UK, Italy and Spain) and the management of several utilities (energy, transportation

and water) in order to find out how differently these countries cope with these issues and which practices prove to be the best among the ones put into action.

In the UK the Bank of England has used quantitative easing on a large scale and there is a long experience of PPP schemes. The situation is different in Spain and Italy, where there is not an extensive experience of PPP schemes and the ECB has not yet applied quantitative easing tools.

An analysis of the legislation and national regulations on the subject of concessions led us to identify a number of areas of activity covered by these aspects. For each identified sector we analysed case studies drawn from the most relevant operational realities in each country, selected as part of the companies listed on regulated markets.

Our analysis showed that the highest concentrations of PPP activities are developed in the following areas:

- Transportation management (airports, railways, highways)
- Energy management (gas, electricity, hydrocarbons, waste)
- Water management

There are other industries with a high level of PPP activity, such as the betting and gaming sector, which are not discussed this book.

We believe that in the near future the number of public-private partnerships will increase in the Euro area due to the constraints of both internal stability pacts for public finance and the fiscal compact.

Italy and Spain are two out of a group of countries that need to activate PPP schemes in order to help their economic recovery; while the UK is a country with an extensive use of PPP schemes and an economy strongly supported by the Bank of England.

Although this book has been written with the joint contribution of all the research group members, the chapters are to be attributed to the following authors: Chapter 1: Maura Campra and Gianluca Oricchio; Chapter 2: Gianluca Oricchio; Chapter 3: Paolo Esposito; Chapter 4: Maura Campra; Chapter 5: Paolo Esposito; Chapter 6: From 6.1 to 6.10: Paolo Esposito, and from 6.11 to 6.15: Eugenio Mario Braja (special acknowledgement to Lucia Taruffo for her help in researching and processing balance data in paragraph 6.11); Chapter 7: From 7.1 to 7.2 and 7.5 Paolo Esposito, and from 7.3 to 7.4 Eugenio Mario Braja; Chapter 8: Maura Campra and Gianluca Oricchio.

2
Sovereign Risk: Credit Risk Analysis and the Role of PPP Schemes

2.1 Lessons learnt from the financial crisis: the strong link between sovereign risk and bank risk

The financial crisis has brought to light a strong link between sovereign risk, bank risk and corporate risk. Initially, the crisis originated in the banking sector and then spread so quickly it acquired sovereign risk status, especially in majorly indebted countries, such as the periphery countries to the euro zone (Figure 2.1).

As in a chain reaction, no sooner had the crisis flowed from the banking system into financial markets than it instantly affected the real economy. Since then, banks have been registering an unprecedented increase in funding costs and capital absorption due to both the procyclical effects of Basel's regulations and a non-stop growth of non-performing loans. Falling back on raising capital seemed to be much too dilutive a solution. As a consequence, the main trend was towards "crunching the credit" by restricting lending activities in the real economy, especially by reducing assets in general, or risk-weighted assets in particular. That was like adding fuel to the flames and triggered a downward economic spiral. So far, ensuing business bankruptcies, layoffs and profit decreases have reduced domestic demand and have had a negative impact on tax revenues and national budgets. Just like the banks, heavily indebted economies on the European periphery found it impossible to access financial markets in order to increase their debt. Despite uncertainties, all enterprises were nevertheless directed towards refinancing existing debt.

A link between bank credit risk and sovereign credit risk was established at once. Many banks have since stopped working correctly, thus impeding the normal functioning of transmission mechanisms of monetary policies. The relatively helpful rescue operations actually

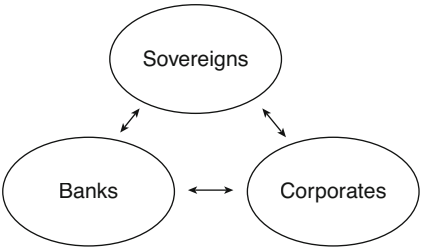

Figure 2.1 Bank–sovereign–corporate risk relationship
Source: Our elaboration on the IMF Financial Stability Report, 2013.

overburdened national budgets and the cost of government bonds reached (and sometimes exceeded) the margins of safety. Immediately, an upswing in government bonds yield spread (measured as the difference between the yield of a government bond and the yield of a bond offering the same duration) caused banks and companies to come to terms with rising financing costs. The European Central Bank (ECB) might have had to face a breakup of the euro zone. In accordance with Basel's regulations, the ECB decided to rescue the euro by saving the banks in the first instance through a variety of tools aimed at expanding the monetary base. Most importantly, for three years long-term refinancing operations (LTRO) provided the banks with the liquidity necessary (rated at one per cent) to survive independently of the financial markets. As a result, banks in the euro zone periphery were easily able to pay back their obligations and give way to bond buybacks, which should have brought significant capital gains. However, rather than pouring money into the real economy, the high liquidity introduced into the banking system was mainly invested in the acquisition of government bonds, deemed to be not only less risky but also more remunerative than investing in companies. This tendency started a carry trade which did not prevent national economies of the European periphery from defaulting. It also did not help the real economy to recover. How memorable is the ECB president's pledge to do "whatever it takes" to preserve the euro and price stability.

Current events have been characterized by a strong connection between sovereign rating and bank rating: considerable upswings in the value of bank stocks are directly proportional to downturns in the government bond spread, and vice versa. It follows then that sovereign risk must be analysed and discussed jointly with bank risk (Figure 2.2).

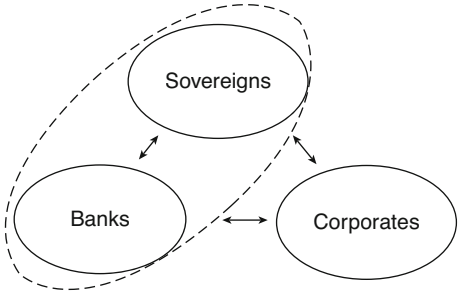

Figure 2.2 Bank-Sovereign-Corporate Risk Relationship: Bank and sovereign risk are highly correlated

Source: Our elaboration on the IMF Financial Stability Report, 2013.

The relationship between sovereign risk and bank risk is analysed in the next section that look at a fundamental analysis of sovereign and bank rating models.

2.2 Sovereign and bank rating models

There are three main methodologies which can be used to develop a PD model, as summarized in Table 2.1 and as illustrated here below:

- good/bad analysis, applied principally to SME corporate and retail segments;
- pure expert ranking method, used typically for the development of large corporate models;
- shadow rating approach, specific to segments characterized by a limited number of defaults, but distinguished/differentiated as those given an official rating by an external agency (such as Standard & Poor, Moody or Fitch).

The most statistically robust method is the good/bad analysis, where factors can be tested for how they predict actual default patterns and an optimal combination of factors and modules can be found to predict the value of the binomial variable: "did the party default in the following 12 months?"

This methodology requires a significant number of default data points for the analysis to be valid. This makes the analysis inappropriate for bank and country segments, since not enough default data are available.

Table 2.1 Methodological approaches

	Good/bad	**Pure expert ranking**	**Shadow rating**
Development	Prediction of the (binary) default event	Selection and weighting of factors based on expert judgement	Mimic external ratings
	Preferably through logistic regression; alternatively, multivariate discriminate analysis and neutral networks		Linear regression against PDs of external ratings
Validation	Test on out of sample	Comparison to expert judgement of results	Out of sample
	Alternatively, cross validation	Compared to bond ratings or good/bad data, if available	Compared against good/bad data, if available
Data	At development: at least 30 defaults per explanatory variable	At development: none	At development: at least 100 rated counterparts
	At validation: at least 10% of development sample for holdout sample; none for cross validation	At validation: a representative sample of counterparts	At validation: at least 50 rated counterparts
Discriminatory power	Highest discriminatory power possible	Highly dependent on the quality of expert judgement	Good discriminatory power
	Danger of overfitting	Typically not better than Statistical methods	Limited by the quality of External rating

Where good/bad analysis cannot be used, shadow (bond) methodology offers a less robust but statistically valid alternative. It uses a factor's ability to predict default modelled on a proxy by measuring its ability to forecast an external rating agency's predicted default rate.

The analysis is based on the probability of default that corresponds to the bank's (or country's) external ratings, according to a calibration table that associates each agency's rating grade to a precise probability of default (see Table 2.1).

If two or more external ratings are available for the same enterprise (e.g. Moody, Standard & Poor and/or Fitch), the final PD is an average between the available PDs.

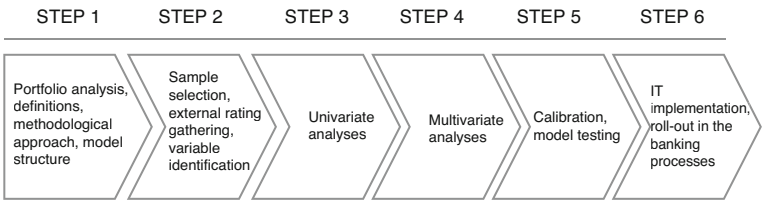

Figure 2.3 Main steps in developing a shadow rating model

A shadow rating model aims to replicate external ratings by using both quantitative (financial for banks, macroeconomic or financial for countries) and qualitative factors (extracted from questionnaires filled in by internal credit analysts).

In this case, also, the univariate analysis tests the forecasting capability of a factor's long list; the selected ones (medium list) will be successively transformed and put in relation to each other by means of a multivariate regression that will determine the subset of final variables (short list) designed to constitute the forecasting model.

Once the weights and final factors have been defined one proceeds with the calibration curve that will assign the score computed by the regression for a default probability.

The calibration curve will be determined by means of statistical analysis techniques directed to maximizing the fit with the initial PDs, so that the credit class assigned by the model to the single sample entity will not differ more than one or two notch(es) from that determined by the external rating.

In Figure 2.3 the main steps for the development of a shadow rating model are illustrated; in the two following Paragraphs we will examine exclusively the aspects which make this typology of models different from the traditional ones, based on the approach good/bad, extensively described in Chapter 2 to which the reader can refer to complete the treatment.

2.2.1 Country rating model

The credit risk relative to a sovereign is composed of two factors: the "sovereign risk" and the "transfer risk".

The sovereign risk refers to the likelihood of default by the country counterparty, while the transfer risk is relative to the unlikelihood of collecting the granted credit from a counterparty resident in a foreign country. Both aspects will have to be taken into account when building a model.

2.2.1.1 Step 1: portfolio, definitions, methodology and model structure

As the chosen methodological approach is a kind of shadow rating, the first selection criterion for indentifying the development sample(s) is the existence of at least one external rating (from Moody, Standard & Poor, Fitch etc.) assigned to the selected counterparty.

To increase the statistical and economic relevance of the model(s) it is appropriate to group the countries in mostly homogeneous sub-segments (according to the economic development level, political considerations, etc.) and then proceed to the construction of distinct models for each sub-segment. As an example, one can assume the need to build two distinct models: the first for developed countries, the other for emerging countries.

2.2.1.2 Step 2: developing samples and data

If large portfolios are present, it is recommended that the selected development sample comes from outside the an external rating, according to a physical criterion: countries with a limit (of short or medium period)[1] greater than a given amount.

Then, assign to each country an external rating standardized by proper calibration tables (based on the link between each agency rating grade and a probability of default).

In Table 2.2, as an illustrative example, a possible calibration of the external agency X is shown; the table permits to compare the rating assigned by the agency X with the one expressed by the agency Y

Table 2.2 Calibration table for the rating agency X

Rating grade	PD of rating agency X
1	0.01%
2	0.03%
3	0.07%
4	0.12%
5	0.24%
6	0.40%
7	0.70%
8	1.20%
9	3.50%
10	6.10%
11	10.5%
12	20.0%

transformed, in turn, into default probability – obviously, with respect to the same default definition between the to considered Agencies.

When two or more different external ratings are available for the same counterparty (e.g. Moody, Standard & Poor and/or Fitch), an average of the available PDs is calculated according to the formula:

$$PD_{external} = \frac{1}{n} \cdot \sum_{i=1}^{n} PD_i,$$

where n ($n \geq 1$) is the number of external available PDs (for the considered counterparty), while PD_i is the default probability assigned to the i-esime external agency.

As the objective of an internal rating model is to estimate the default probability up to one year from the time of the counterparty evaluation by means of the available data, to the macroeconomic and qualitative factors relative to the year t, when developing, should be associated to the external PDs relative to the year $t+1$.

In general, for countries in the development sample, it is necessary to use data from two years before the date of default (for bad counterparts) or of the forecast (for good counterparts).

A one-year time lag is caused by the fact that the model has to estimate a one-year default frequency; moreover, it is assumed that one year before the default (forecast) only the data from the year before is available, this causes the whole time lag to be two years.

A list of macroeconomic or financial and qualitative factors which could be expected to be predictors of default, and hence used by rating agencies to predict the probability of default, should be drawn up.

Then the quantitative and qualitative factors have to be classified into different categories to test different aspects. The main purpose of this categorization is to provide a structure when defining and working with the factor list (the so-called long list). Ideally, the final model should contain a broad representation from across the categories, with no two factors containing similar information.

Table 2.3 illustrates the categorization of quantitative and qualitative factors for a country's rating model.

While the quantitative factors could be acquired from an external provider, qualitative factors need to be gathered through a qualitative questionnaire drawn up by an internal expert.

Table 2.3 Quantitative and qualitative categories for a country model long list

Quantitative category	Qualitative category
Banking system	Debt servicing record
Current account	Economic conditions
Debt	Foreign relations
Government finance	Quality and stability of the financial system
Growth	Social and political conditions
Liquidity	
Monetary Policy	
Structure	

Because the qualitative elements are, by their nature subjective, to ensure their objectivity and consistency it is very important that:

- every question is given a grade on a scale where answers are ordered by good (factor value 1) to bad (factor value 5);
- to ensure consistency in assigning these grades among different experts, each question is supplemented with a guideline.

2.2.1.3 Step 3: univariate analyses

For high-default portfolios the first step in determining the optimal combination of quantitative or qualitative factors is to analyse each factor individually.

This step has three main purposes:

- data cleaning
- identification and removal of outliers (in this case, quantitative factors only)
- (quantitative) factor transformation and normalization, so that they are set to the same scale, where outliers are given less weight and scores have the same average and standard deviation.
- measurement of the predictive power of the factors on a standalone basis

The first three points in the list above are substantially equal to the ones already described in this chapter. But in the absence of a good/bad state, for the measurement of the predictive power of a standalone factor, or of the module score, it is necessary to adopt an adjusted accuracy ratio measure.

2.2.1.3.1 The shadow accuracy ratio (SAR)

In relation to the traditional accuracy ratio (AR), for the evaluation of the rank ordering power, in a shadow rating approach framework the first step consists of computing the ranking power (RP), where the shadow cumulative default frequency (SCDF), represented on the y-axis in Figure 2.4 is calculated as:

$$SCDF_1 = \frac{PD_{external,\,1}}{\sum_{j=1}^{n} PD_{external,\,j}}$$

$$SCDF_i = SCDF_{i-1} + \frac{PD_{external,\,i}}{\sum_{j=1}^{n} PD_{external,\,j}}, \qquad \text{for } i = 2, \ldots, n.$$

where n is the number of sample conterparts.

By computing the shadow default rate (*SDR*) as:

$$SDR = \frac{\sum_{j=1}^{n} PD_{external,\,j}}{n},$$

it is possible to determine the B area depicted in Figure 2.4 and then the model ranking power (RP_{model}) as:

$$RP_{\text{model}} = \frac{Area(A)}{Area(A) + Area(B)}.$$

In the shadow rating approach the ideal model, which orders the counterparts in the best possible way, is the one defined by the same external agency's PDs and has a forecasting power lower than 100 per cent (see in Figure 2.4).

To obtain a value of the examined model's accuracy ratio, which is more comparable with the one computed with the standard approach (good/bad sample based), it is necessary to correct the examined model's ranking power with the ranking capability of the ideal, that is the one that exactly replicates the external agency's judgement, using the formula:

$$SAR = SAR_{\text{model}} = \frac{RP_{\text{model}}}{RP_{\text{shadow rating}}}.$$

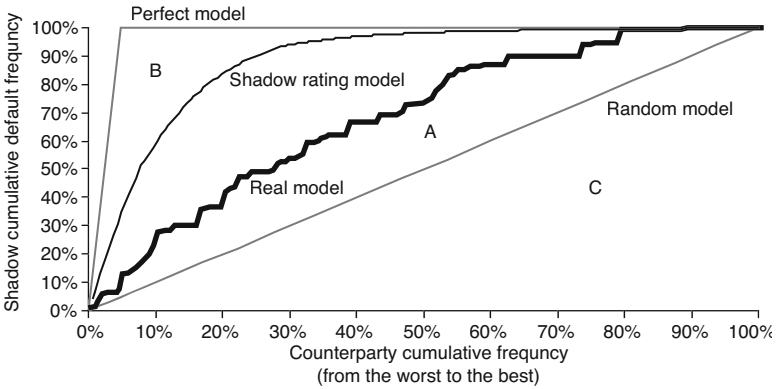

Figure 2.4 Shadow accuracy ratio

2.2.1.4 Step 4: multivariate analyses

The multivariate analyses are conceptually the same in both SME corporate and retail models.

Having completed the univariate analyses, by means of which the medium list variables' ranking powers and scores have been computed (see Step 3 for details), the next step is to order the selected factors to identify the subset capable of best replicating the judgement expressed by the agencies' PDs ($PD_{external}$).

For each of the two modules (qualitative and quantitative) the specified model will be a combination of weighted factors to arrive at an evaluation of each country's creditworthness (score).

The score produced as an output by each module will be, successively, integrated into one unique score which, through a calibration phase, will be translated into the final output of the country model: the default probability estimated by the bank for each country.

The multivariate factor analysis is carried out by means of a multivariate linear regression, in which independent variables are factors, which have been transformed and normalized, and the dependent variable is the log-odd of the judgement expressed by the rating agencies ($PD_{external}$).

Indeed, it can be empirically found that the PD tends to be distributed as a logit function with respect to the score, that is:

$$Y^i = \ln\left(\frac{1 - PD^i_{external}}{PD^i_{external}}\right) = \beta_0 + \beta_1 \cdot x_1^i + \ldots + \beta_k \cdot x_k^i + \varepsilon^i, \quad \forall\ i = 1,\ \ldots,\ n,$$