

Contingent Liabilities Risk Management:
A Credit Risk Analysis Framework
for Sovereign Guarantees and On-Lending

Country Experiences from Colombia, Indonesia, Sweden,
and Turkey

Fritz Florian Bachmair



WORLD BANK GROUP

World Bank Treasury

Government Debt and Risk Management Unit

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Abstract

Sovereign credit guarantees and government on-lending can catalyze private sector investment and fulfill specific policy objectives. However, contingent liabilities stemming from guarantees and contingent assets stemming from on-lending expose governments to risk. Prudent risk management, including risk analysis and measurement, can help identify and mitigate these risks. This paper proposes a four-step structure for analyzing and measuring credit risk: (i) defining key characteristics to determine the choice of a risk analysis approach; (ii) analyzing risk drivers; (iii) quantifying risks; and (iv) applying risk analyses and quantification to the design of risk management tools. This structure is based on an assessment of approaches discussed in academia and applied in practice. The paper demonstrates how the four steps of credit risk management are

applied in Colombia, Sweden, and Turkey. It also discusses how the proposed framework is applied in Indonesia as it develops a credit risk management framework for sovereign guarantees. Country experiences show that although sovereign risk managers can draw on insights from credit risk management in the private sector, academic literature, and practices in other countries, approaches to risk management need to be highly context-specific. Key differentiating factors include characteristics of the guarantee and on-lending portfolio, the sovereign's specific risk exposure, the availability of market information and data, and resources and capacity in the public sector. Developing a sound risk analysis and measurement framework requires significant investments in resources, capacity building, and time. Governments should view this process as iterative and long-term.

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Fritz Florian Bachmair¹

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¹ The author is a Financial Officer in the Financial Advisory and Banking Department at the World Bank Treasury. He can be contacted at fbachmair@worldbank.org or +1 202 473 0749.

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Acronyms

CDS	Credit default swaps
CL	Contingent liabilities
COP	Colombian Peso
DD	Distance to default
DG	Directorate General
DGCPTN	Directorate General Public Credit and National Treasury (in Colombia)
DFRM	Directorate General of Financing and Risk Management (in Indonesia)
EAD	Exposure at default
EU	European Union
FPO	Fiscal Policy Office (Indonesia)
FTP1	Fast Track Program Phase 1
GDP	Gross Domestic Product
IFRS	International Financial Reporting Standards
IPPs	Independent power producers
IRB	Internal ratings-based
LGD	Loss given default
LIBOR	London interbank offered rates
PDs	Default probabilities
PLN	Perusahaan Listrik Negara
PPPs	Public private partnerships
SECO	Swiss State Secretariat of Economic Affairs
SMI	Directorate Investment Management System (in Indonesia)
SNDO	Swedish National Debt Office
SOEs	State-owned enterprises
S&P	Standard and Poor's
USD	United States dollar

1 Introduction

Sovereign credit guarantees and government on-lending can help to fulfill specific policy objectives by lowering borrowing costs and increasing investment for entities in prioritized sectors.² However, credit guarantees and on-lending imply risks to government finances. Guarantees and on-lending are sources of fiscal risks. Their materialization can create fiscal costs and may even impair fiscal sustainability.

In the case of credit guarantees, the government promises the respective lender to service debt the beneficiary entity has contracted in the event the entity is not able or willing to do so. As such, credit guarantees create an explicit contingent liability on a government's balance sheet. The liability is a contractual obligation contingent upon a specific but uncertain event that may materialize in the future.³ In the case of on-lending, the government borrows funds and on-lends proceeds to a beneficiary entity. On-lending creates a direct liability matched by a contingent asset on a government's balance sheet. The materialization of these risks creates a fiscal cost for the government. The government can either adjust current revenues or expenditures or borrow funds to cover associated costs, thereby increasing government debt.

In either case – guarantees or on-lending – the government is exposed to credit risk⁴ of the beneficiary entity. Credit risk stems from the possibility of an entity's inability or unwillingness to service its debt obligations to a third party lender in the case of guarantees or to the government in the case of on-lending. An entity's ability to repay depends primarily on the financial health of that entity while the willingness to repay may be influenced by arrangements in the risk sharing agreement and the relationship between the government and the beneficiary entity.⁵

Governments can manage these types of risks through a broad risk management framework that encompasses government debt and other explicit and potentially implicit⁶ contingent liabilities emanating from public private partnerships (PPPs), the debt of state-owned enterprises (SOEs), (natural) disasters, and the financial sector. A sound risk management framework includes well-defined risk management objectives, an analysis of risks, and the design and implementation of a risk management strategy incorporating monitoring, reporting, and reassessment procedures, as illustrated in Figure 1.1.

Risk analysis and measurement constitute the foundation for various stages in the risk management process, including the design of a strategy, the implementation of risk mitigation tools, and risk monitoring and reporting. Credit risk measurement helps to make costs explicit. It supports a full cost-benefit analysis where various mechanisms to achieve a policy objective can be weighed against each

² In some cases, government risk sharing may be a prerequisite for funds to become available to beneficiary entities.

³ Explicit contingent liabilities are government legal obligations to make a payment if a particular event occurs. Implicit contingent liabilities depend on the occurrence of a particular future event and on government willingness to act on them. Such obligations are typically not officially recognized until after a failure occurs. The triggering event, the cost at risk, and the required size of government outlay are uncertain. In most countries, the financial system represents the most serious contingent implicit government liability. For a detailed discussion of various types of fiscal risks and contingent liabilities see Polackova Brix and Moody, 2002.

⁴ Credit risk generally refers to the risk of non-performance by borrowers on loans or other financial assets, or by a counterparty on financial contracts.

⁵ Similarly, the choice of instrument by governments (i.e. guarantee vs. on-lending) is only partly driven by risk considerations but also other factors such as governance structures (e.g. degree of centralization, responsibilities for sub-nationals, governance of state-owned enterprises, etc.) and public sector accounting and reporting standards (as on-lending directly impacts governments' debt levels while guarantees create an off-balance sheet contingent liability without directly affecting the size of outstanding debt).

⁶ A risk management framework may start with explicit contingent liabilities as they are more straightforward to identify and may expand to include implicit CLs as a second step.

other. This includes, for example, comparing credit guarantees to on-lending, and direct government subsidies as well as the direct provisioning of services by the government.

Figure 1.1: Fiscal risk management framework



Source: Anderson and Abousleiman, 2011.

This paper provides guidance for sovereign risk managers⁷ interested in developing or improving a risk management framework related to guarantees and on-lending. While it focuses on explicit credit guarantees and on-lending, the framework presented applies to various types of government risks, with the caveat that it addresses risks related to individual obligations, not to portfolios of obligations.⁸ The paper does not address other types of government guarantees, including those used in PPP projects, such as minimum revenue guarantees; fiscal risks related to state-owned enterprises, such as subsidies; and the absorption of currency risk related to on-lending utilizing foreign currency borrowing. The paper does not fully explore issues related to other risk mitigation tools, governance aspects,⁹ legal aspects with respect to guarantee/on-lending agreements,¹⁰ and the recording of risk exposure.

Section 2 proposes a four-step process for credit risk analysis and measurement. Section 3 demonstrates how these steps apply to credit guarantee and on-lending risk management in Colombia, Sweden, Turkey,

⁷ Often risks from credit guarantees and on-lending are managed in debt management offices. However, this institutional setup is not uniform and not necessary for sound risk management. Depending on the respective beneficiaries of credit guarantees they may be managed in specialized units (e.g. in an Export-Import Bank, student loan agency, etc.). If fiscal risk management units exist, they may also be responsible for managing risks from credit guarantees and on-lending. For on-lending specifically, a lending unit may exist within the Ministry of Finance responsible for risk management.

⁸ The conclusion highlights portfolio risk estimation as a topic for further discussion. Portfolio risk estimation requires estimating correlations between individual risks and adds value for significantly large portfolios. However, this is beyond the scope of this paper. Of the country cases discussed here, only Sweden has recently started analyzing portfolio risks using an approach that goes beyond merely summing up individual risks.

⁹ Including the institutional setup for risk management, the decision making process for guarantee issuance and on-lending, etc.

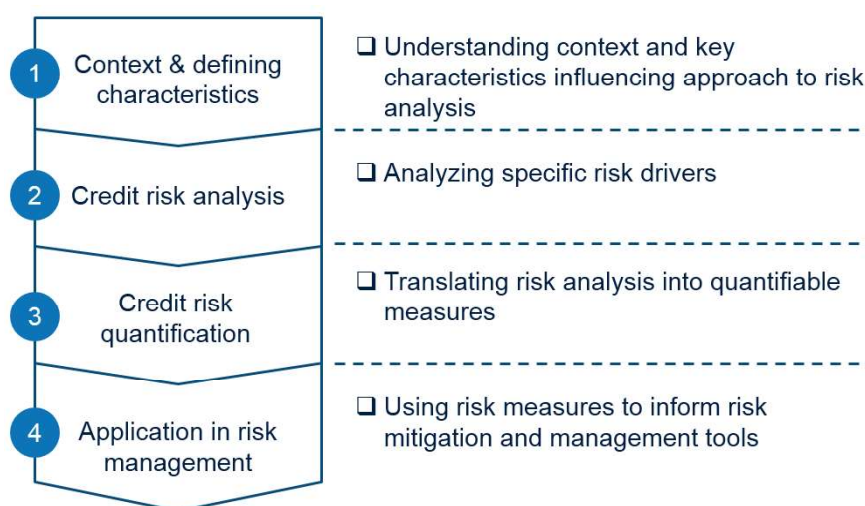
¹⁰ Including the use of collateral, the collection of receivables, penalties for late payments, etc.

and Indonesia. The conclusion addresses some additional issues governments should consider while implementing the risk measurement and analysis framework, and proposes topics for future research.

2 Risk analysis and measurement process

Sovereign risk managers can design a framework for credit risk analysis and measurement to inform the implementation of risk management tools. A risk analysis and measurement framework can be set up in four steps as depicted in Figure 2.1. First, risk managers need to have clear understanding of the context in which they are operating in and of important defining characteristics with respect to the credit guarantee and on-lent portfolio.¹¹ Second, key industry-specific risk drivers need to be identified and analyzed before credit risk assessment can be translated into quantifiable measures, such as expected losses or market values. Finally, the insights from credit risk analysis and quantification can be applied to design and improve various risk management tools, such as structuring guarantee agreements, risk-based guarantee fees, financial provisioning for losses, and risk monitoring and reporting (Figure 2.1).

Figure 2.1: Credit risk analysis and measurement framework



Source: Bachmair, 2014.

Designing and implementing a risk management framework is iterative. As risk managers develop a deeper understanding about credit risk management they may adapt their views on how insights from risk analysis can be used to design risk mitigation tools.

2.1 Context and defining characteristics

A consideration of country-specific institutional and economic contexts should be the first step in designing risk analysis and measurement. This includes defining a sovereign's risk exposure, understanding the guarantee and lending portfolio, evaluating the availability of data, and realistically assessing the government's capacity to execute effective risk management.

¹¹ While portfolio risk estimation is not in scope of this paper, an understanding of the characteristics of the guarantee/on-lent portfolio is important in choosing risk analysis approaches.

Definition of risk exposure

The discussion in this paper focuses on explicit credit guarantees and on-lending. The framework presented, however, is flexible to capture various types of risks governments are exposed to. Such risks could include implicit guarantees to SOEs and risks from (government guarantees to) PPPs. The definition of scope is particularly relevant when governments extend credit guarantees or on-lend to entities to which they are exposed to from other sources. For example, when governments provide credit guarantees to SOEs the explicit guarantee provided may be relatively small compared to an implicit guarantee that precedes the granting of an explicit guarantee.

Similarly, risk managers need to clearly define what triggers the materialization of risk (i.e. definition of default). For example, monopolistic SOEs providing essential services, such as electricity, may rarely default on loans to third party creditors because governments inject resources (e.g. subsidies, recapitalization) to avoid defaults. A narrow focus in defining risk as actual defaults may significantly underestimate a beneficiary's credit risk in such cases. Alternative definitions of a credit event could include the following: the government servicing individual debt payments in lieu of the beneficiary, without the beneficiary defaulting to the creditor; the government providing loans to the beneficiary to avoid default to a creditor; unexpected capital injections (i.e. capital injections to avoid default rather than planned capital injections to allow the beneficiary to undertake capital expenditure investments); the roll-over of a guarantee/on-lent loan if the beneficiary was not able to secure funding otherwise. The exact definition of a credit event needs to be highly context-specific and adapted to institutional arrangements in a country.

Characteristics of guarantee and on-lending portfolio

Key characteristics of guarantee and on-lending portfolios include size, both in absolute and relative terms, such as the portfolio size as a ratio to gross domestic product (GDP) or revenues, and the number of beneficiary entities.¹² Beneficiary entities can be classified by type, e.g. corporations (private vs. state-owned), sub-nationals, government agencies, or financial institutions (private vs. public such as development banks). Entities should also be differentiated by the industries or sectors they operate in. Common industries include power generation, power distribution, toll roads, airports, seaports, financial sector institutions, etc. Other context-specific characteristics may include the degree to which beneficiaries are systemically important to the economy, the relationship with the government, the degree to which an entity provides essential/politically sensitive goods and services, and the geography of operations. The degree of essentiality of the beneficiary's service provided will further inform the extent to which the government will step in to avoid a default. Analysis should not only comprise the current portfolio of credit guarantees and on-lending but also include the pipeline of future projects.

Data availability

Available approaches to risk analysis depend on the type and quality of data available. Simulation models, for example, require large amounts of data, while credit scoring may require more qualitative information. Relevant data include historic information on credit events (consistent with the type of default definition discussed above) matched with information on beneficiaries' risk factors. Risk factors

¹² Governments may also compile and track measures such as direct debt (including on-lending) plus guarantees in relation to GDP.

may include financial information, the assessment of business risks such as regulatory environment, competitive environment, and management quality.

When entering a guarantee/on-lending agreement risk managers should define information to be collected and assessed in the future. Risk managers may also want to explore third party and market information on beneficiaries and the sectors they operate. Third party information may include risk assessment by banks, rating agencies, or credit bureaus. Market information may include prices of traded debt and equity as well as credit derivatives (e.g. credit default swaps (CDS)).

However, governments should recognize that market conditions pertaining to beneficiaries and potential beneficiaries might reflect perceptions of implicit government support. Furthermore, the provision of a guarantee/on-lending may change the perceived implicit guarantee by market participants. In such cases, market prices would not accurately reflect risk, and risk managers may instead need to rely on market data from proxies with risk characteristics similar to the stand-alone¹³ risk of the beneficiary.

Resources and capacity

Sovereign risk managers need to invest in capacity and resources to implement a sound risk management framework. Different approaches to risk analysis and measurement require different skills. For example, fundamental risk analysis (e.g. credit scoring) requires an understanding of industries and their respective risk drivers. Governments should model their risk management framework around available capabilities and financial resources, and adapt the framework over time as capacities improve through training, hiring of new staff, and support from external consultants.

2.2 Credit risk analysis

Assessing the credit quality of entities benefitting from credit guarantees and on-lending is a core part of a risk management framework. First, risk managers need to understand what industry-specific factors are driving the risk of beneficiaries not servicing their debt obligations. Second, risk managers have to assess these risk drivers by beneficiary and on a regular basis.¹⁴

Governments can choose from a variety of approaches to credit risk analysis and tailor them to specific situations.¹⁵ The most common approaches include credit scoring, statistical models, scenario analysis, and structural models, which are discussed below.

Credit scoring

Credit scoring involves scoring and aggregating individual risk factors to arrive at an ordinal risk rating for an entity that is compared against other entities. Industry-specific scorecards can be used to guide credit analysts in their assessments, as exemplified in Table 2.1.

Rating agencies and financial institutions often apply credit scoring towards risk assessment.¹⁶ Financial institutions can also base risk analyses on an internal ratings-based (IRB) approach, as outlined by The

¹³ Refers to credit risk of beneficiary without implicit government support. For example, rating agencies sometimes provide stand-alone ratings.

¹⁴ Risk analysis should be undertaken before guarantees are issued or funds are on-lent and on a regular basis for risk monitoring.

¹⁵ This decision will depend on the size and complexity of the guarantee portfolio and available resources.

¹⁶ Rating agencies publish a significant amount of literature explaining their credit risk assessments. The three major rating agencies include Standard & Poor's, Moody's Investor Service, and Fitch.

Basel Committee (Basel Committee on Banking Supervision, 2004 and 2005). The World Bank Group also uses credit scoring approaches to rate sovereign borrowers, counterparties in financial derivative transactions, investment targets, and private sector borrowers.

Table 2.1: Moody's Investor Service score card for regulated electric and gas utilities¹⁷

Factor / Sub - Factor Weighting - Regulated Utilities			
Broad Rating Factor	Broad Rating Factor Weighting	Rating Sub-Factor	Sub-Factor Weighting
Regulatory Framework	25%	Legislative and Judicial Underpinnings of the Regulatory Framework	12.5%
		Consistency and Predictability of Regulation	12.5%
Ability to Recover Costs and Earn Returns	25%	Timeliness of Recovery of Operating and Capital Costs	12.5%
		Sufficiency of Rates and Returns	12.5%
Diversification	10%	Market Position	5%
		Generation and Fuel Diversity	5%
Financial Strength, Key Financial Metrics	40%	CFO pre-WC + Interest / Interest	7.5%
		CFO pre-WC / Debt	15%
		CFO pre-WC - Dividends / Debt	10%
		Debt/Capitalization	7.5%
Total	100%		100%
Notching Adjustment		Holding Company Structural Subordination	0 to -3

Source: Moody's Investor Service, 2013.

Score cards offer a flexible approach to conduct credit risk analysis since they can be tailored to reflect the specific risk exposure and facilitate a standardized evaluation of credit risk among entities in the same industry. However, developing scorecards and scoring guidelines requires a deep understanding of industry-specific risk drivers. Since scoring reflects credit analysts' subjective assessments, guidelines that prescribe scores for specific outcomes of the assessed credit metrics can be used improve objectivity. Credit committees that review analysts' ratings may also help to improve objectivity.

Statistical models

In statistical models, credit quality is measured using observable characteristics (e.g. financial ratios, competitive position, regulatory environment, etc.). A statistical model is estimated regressing historic outcomes (e.g. defaults) on historic characteristics. The output from a statistical model is a measure of the likelihood that a credit event will occur (default probability).

Edward Altman (1968) pioneered a statistical model using Z-scores to predict corporate defaults. To calibrate the model Altman chose financial ratios that most significantly drove bankruptcy in his data set (as shown in Figure 2.2.).¹⁸ Turkish Treasury's credit rating approach described below is based on a statistical model.

¹⁷ Moody's Investor Service 2013 provides a detailed rationale for the inclusion and definition of the various rating (sub-)factors included in this score card. This rating methodology paper also provides detailed scoring guidance for each rating (sub-) factor. Rating (sub-) factors shown in this score card are specific to utilities. Score cards for entities in other sectors would show different (sub-) factors. E.g. fuel diversity in the generation of power (such as coal, oil, gas, etc.) is a highly sector-specific driver of credit quality. CFO stands for cash flow from operating activities. WC stands for working capital.

¹⁸ The Risk Metrics Group developed a commercial product based on Altman's Z-score methodology (Altman, et al., 2010)

Figure 2.2: Original Altman Z-score model

$$\mathbf{Z\text{-}Score} = \mathbf{1.2A} + \mathbf{1.4B} + \mathbf{3.3C} + \mathbf{0.6D} + \mathbf{1.0E}$$

Where:

A = Working Capital / Total Assets

B = Retained Earnings / Total Assets

C = Earnings Before Interest & Tax / Total Assets

D = Market Value of Equity / Total Liabilities

E = Sales / Total Assets

Source: Altman, 1968.

When based on internal data to be estimated, a statistical model can capture specific risks the government is exposed to and be based on actual performance by beneficiary entities. Calibrating a model based on internal data requires a significant amount of historical information.

Scenario analysis

In scenario analysis, various scenarios for key risk drivers (e.g. macroeconomic variables, revenue drivers, cost drivers, etc.) are constructed. Risk managers then estimate how scenarios impact financial performance of beneficiaries and their ability to service debt.¹⁹ A scenario analysis model has to make assumptions about how key risk drivers interact with each other and how they affect an entity's performance. Also, risk managers may need to define a threshold beyond which financial performance translates into a credit event, such as a default.

Scenarios can be constructed using deterministic or stochastic processes. Scenario analysis based on deterministic processes usually uses a smaller number of discrete scenarios and often no probabilities are attached to the respective scenarios. Risk managers may define a base case (most likely scenario) and several risk scenarios defined by an adverse development in individual risk drivers or a combination of a few risk drivers. If stochastic processes are constructed, a probability distribution for key risk drivers and their dependent relationships are estimated. A large number of scenarios can be simulated (e.g. using Monte Carlo simulation).²⁰

The outcome of scenario analysis can be an estimate of the frequency of default events. A default probability distribution may be estimated if stochastic modeling of risk drivers has been employed.

The Swedish National Debt Office has implemented scenario analysis using simulation models as a tool to evaluate more complex guarantees. Also the Turkish Treasury developed a macroeconomic simulation model in the past (see below for both country examples).

¹⁹ Stress testing is one approach to scenario analysis. In stress tests macroeconomic, financial, and idiosyncratic shocks beneficiaries may be exposed to are designed. Next, the impact on beneficiaries is estimated and an assessment of credit risk in stress scenarios is deduced.

²⁰ In debt management scenario analysis is usually employed to assess the impact of market risks (interest rate and exchange rate risks) on debt portfolios.

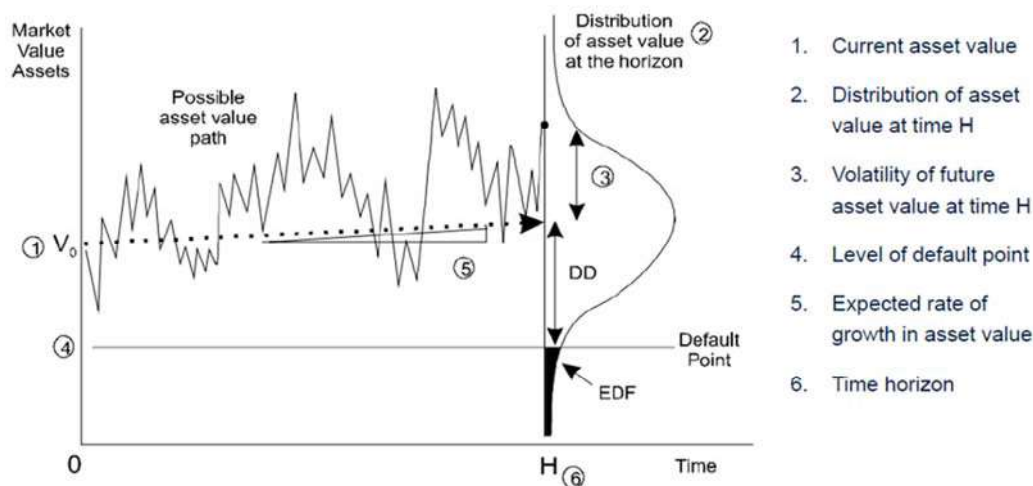
Scenario analysis models can capture project and context-specific situations and can be flexible in modeling particular risks the government may be exposed to. On the other hand, they can be quite complex and demand significant resource to be developed (e.g. time, data and quantitative skills).

Structural models

Structural models are based on the assumption that default events occur when an entity's asset value reaches a significantly low level compared to its liabilities. In this approach equity of an entity is viewed as a call option and option pricing theory is used to calculate default probabilities. The threshold asset level at which default occurs represents the strike price. If a firm's asset value is below the strike price equity holders do not exercise the option and sell the entity to debt holders.

Structural models were pioneered by Robert Merton in its original form based on the Black-Scholes option pricing theory.²¹ Kealhofer, McQuown, and Vasicek have developed a commercially successful model based on this approach, illustrated in Figure 2.3, below. In their model distance to default²² (DD) is measured using option pricing theory and DD is then matched with historic credit events to estimate default probabilities.

Figure 2.3: Illustration of KMV model based on Merton model²³



Source: Crosbie and Bohn, 2003.

Structural models offer the advantage of being relatively intuitive. Once assumptions have been made about model parameters an analytical or simulated solution can be obtained. On the other hand, estimating these underlying parameters, especially future asset value volatility, can be very difficult, particularly in the context of government credit guarantees and on-lending extended to non-publicly traded entities. Additionally, structural models dependent on similar assumptions as the Black-Scholes model may not be applicable in practice.²⁴

²¹ Sundaresan 2013 discusses the original Merton model further evolution in research on structural models.

²² DD represents the difference between an entity's asset value and the assumed default threshold.

²³ EDF is the expected default frequency, or default probability.

²⁴ Key assumptions in the Black-Scholes model include constant volatility, efficient markets, no dividends, constant interest rates, perfect liquidity, and the absence of transaction costs (Black & Scholes, 1973).

The approaches presented are primarily tools to assess entities' ability to service debt. Sovereign risk managers need to complement this analysis with a view on the drivers of willingness to repay which may be dependent on the institutional relationship with various parts of the government. Also, the willingness to repay may be driven by the respective arrangement. For example, willingness to repay may differ between credit guarantees and on-lending, as in some instances a default on payments to the government in the case of on-lending may be associated with lower default costs as a default on payments to commercial creditors. Willingness to repay may be estimated based on the historic relationship between the government and the beneficiary.

Irrespective of the credit risk analysis approach used, risk managers should critically assess the results obtained, reflect on the assumptions made and modeling techniques employed. The results obtained from credit risk analysis should not be blindly taken at face value but risk managers should be aware of the limitations of the model used and should complement the results from a risk analysis model with common sense, experience of risk managers, and other information available.

2.3 Credit risk quantification

The analysis of credit risk forms the basis for quantification. Credit risk analysis may already result in some quantified measures (e.g. default probabilities (PDs) in statistical models, distance to default in structural models that can be translated into PDs, losses attached to certain probabilities in scenario analysis) or ordinal measures (e.g. rating in credit scoring).

Policy makers, however, likely have an interest in understanding the cost of guarantees and on-lending in nominal amounts and to estimate the potential impact of guarantees and on-lending on the government's budget and balance sheet, including the sustainability of government finances. Results from credit risk analysis can be converted into nominal amounts or prices using two primary approaches. The first uses differentials in market prices. The value of a guarantee is seen as the difference between the price of a risky debt instrument (non-guaranteed) and the price of a risk-free debt instrument (guaranteed by the government) with the same characteristics. The prices of the respective debt instruments can be directly observed if the beneficiary entity has guaranteed and non-guaranteed traded debt outstanding. If this is not the case, market prices for proxies with similar risk characteristics (e.g. rating) may be used. Market information aggregated from rating agencies may be useful to compare average bond spreads for the beneficiary with those of the guarantor, as shown in Figure 2.4.²⁵

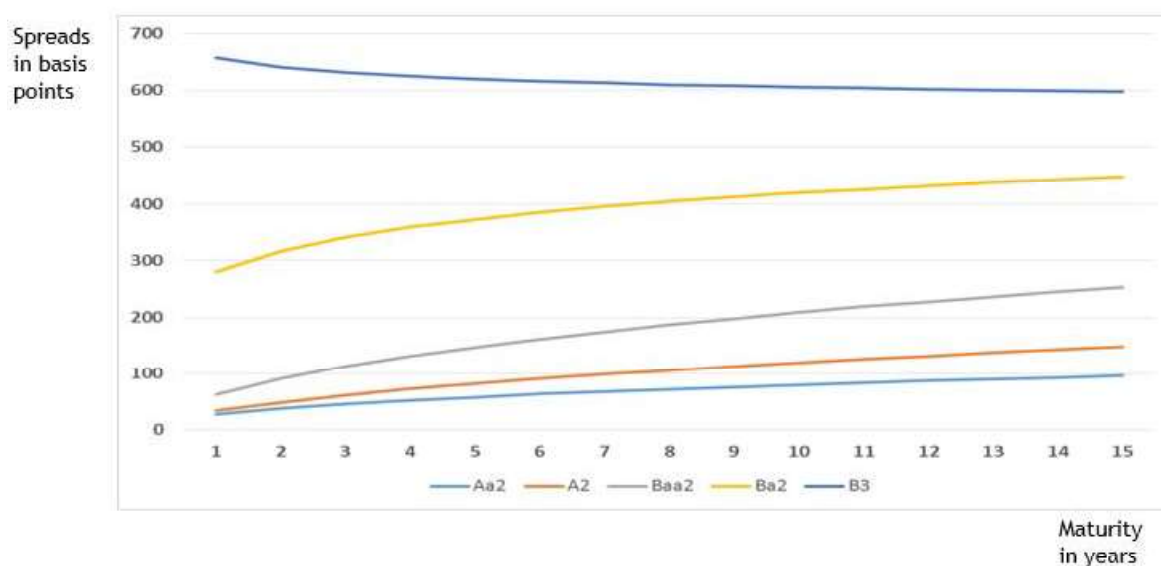
Using price differentials has the advantage of basing risk estimates on prices actually transacted in the market. If prices are available, the quantification of risk is fairly straightforward. On the other hand, market prices may not reflect the government's risk exposure if they reflect implicit government support.

The second approach prices risk bottom-up through the use of default probabilities. Expected losses are estimated by multiplying PDs with the respective exposure at default (EAD) and loss given default (LGD). Loss given default is an estimate of the share of the guaranteed/on-lent amount the guarantor/on-lender has to undertake in the event of default that cannot be recovered later (e.g. through the collection of receivables). This bottom-up approach requires an estimation of all three components described above.

²⁵ Alternatively, CDS spreads may be used. Both bond spreads and CDS spreads may be an imperfect proxy for loan spreads. Also, spreads fluctuate over time, hence a longer term average may be useful for the context of sovereign guarantees/on-lending.

PDs are estimated either directly through the respective credit risk analysis approach applied or can be inferred from historic information if credit scoring is applied (example from Moody's in Table 2.2).

Figure 2.4: Median bond spreads over LIBOR by selected rating and maturity for corporate bonds



Source: Moody's Investor Service, 2015.

Table 2.2: Default probabilities from 1970 – 2013 by letter rating and maturity in years (in percent)

Rating	1	2	3	4	5	6	7	8	9	10
Aaa	0.000	0.013	0.013	0.037	0.104	0.170	0.241	0.318	0.401	0.489
Aa	0.022	0.068	0.136	0.260	0.410	0.550	0.682	0.800	0.900	1.017
A	0.062	0.199	0.434	0.679	0.958	1.271	1.615	1.995	2.387	2.759
Baa	0.174	0.504	0.906	1.373	1.862	2.375	2.872	3.386	3.965	4.623
Ba	1.110	3.071	5.371	7.839	10.065	12.123	13.911	15.700	17.479	19.323
B	3.904	9.274	14.723	19.509	23.869	27.957	31.774	34.993	37.936	40.560
Caa-C	15.894	27.003	35.800	42.796	48.828	53.270	56.878	60.366	63.730	66.212
Inv Grade	0.091	0.272	0.519	0.802	1.113	1.441	1.776	2.126	2.498	2.887
Spec Grade	4.460	9.161	13.634	17.571	21.014	24.042	26.690	29.035	31.212	33.234
All Rated	1.675	3.407	5.015	6.398	7.587	8.619	9.513	10.312	11.062	11.771

Source: Moody's Investor Service, 2014.

In any approach used, EAD is an essential requirement to quantify risk. EAD may be based on a debt repayment schedule and could include principal only or principal and interest payments, depending on the guaranteed amount.

LGDs may be estimated based on historical losses incurred by the guarantor/on-lender, commonly used estimates in the private sector,²⁶ or models where LGD is dependent on other factors, such as debt type and seniority, capital structure, industry, and macro-economic factors.²⁷ Another important factor driving

²⁶ The Basel Committee on Banking Supervision gives guidelines for financial institutions using an internal rating-based approach for credit risk assessment (Basel Committee on Banking Supervision, 2004).

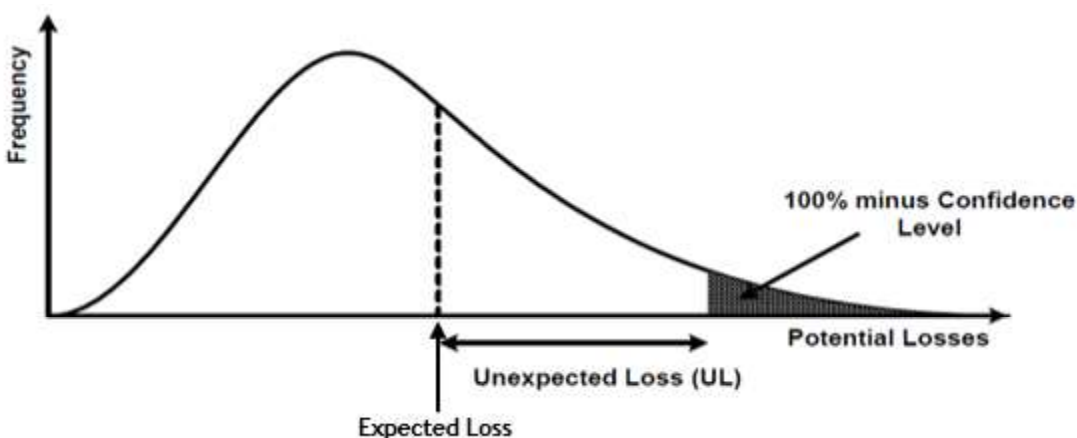
²⁷ Moody's has developed a model estimating LGDs based on various factors and their approach is described in more detail in (Gupton & Stein, 2002).

LGDs will be a government's collection policy, i.e. the contractual and institutional set up for recovering receivables.

This bottom-up pricing approach offers flexibility to base estimates on in-house credit risk analysis (e.g. of stand-alone risk not reflecting implicit government support). On the other hand, estimates of the three components are more subjective than reliance on traded market prices and their quality will depend on data availability.

When pricing risk, sovereign risk managers can target various measures. The choice between target measures mainly depends on how risk managers intend to use these measures in designing and implementing risk mitigation and management tools. Target measures include the face value of guarantees, maximum probable exposure, expected losses, market values, and unexpected losses. The face value of a guarantee reflects the loss to government if the beneficiary defaults on the entire amount guaranteed or on-lent. Identifying the face value does not require any risk analysis. Maximum probable exposure reflects the amount the government is exposed to in adverse scenarios such as a currency depreciation. It may be estimated if debt payments are uncertain (e.g. in the case of borrowing in foreign currency or at variable interest rates if interest payments are also guaranteed). Expected losses and market values are the most commonly used target measures for pricing credit risk. Expected losses reflect the average loss a government sustains in a large and well-diversified portfolio or over a long time horizon. Market values reflect the risk premium investors charge to hold credit risk in addition to expected losses. The risk premium investors charge depends on investors' estimation of credit risk, their degree of risk aversion and other factors such as liquidity premia. Unexpected losses relate to potentially large losses that occur rather rarely, beyond expectations (i.e. expected loss). Expected and unexpected losses together reflect the loss governments may incur in adverse scenarios, as illustrated in Figure 2.5.

Figure 2.5: Conceptual loss distribution illustrating expected and unexpected losses



Source: Based on Basel Committee on Banking Supervision, 2005.

2.4 Application in risk management

Insights from credit risk analysis and measurement can be used to design and improve risk mitigation and management tools. Initially, sovereign risk managers may design risk management tools that are not based on thorough credit risk analysis. For example, governments may choose to charge flat

guarantee/on-lending fees that apply to every beneficiary irrespective of creditworthiness. Over time, however, risk managers may aim to refine risk mitigation and management tools and differentiate these tools (e.g. guarantee fees) based on beneficiaries' credit quality.

Some countries use a combination of tools to meet risk management objectives, driven by context-specific factors such as the types of beneficiaries, the institutional setup and political economy, and the approach towards credit risk analysis. The most commonly applied tools include the setting of guarantee/on-lending limits, the decision making process for issuing guarantees or on-lending funds to a specific beneficiary, the structuring of guarantee agreements, the financial provisioning for losses, and risk reporting and monitoring.

Limits are a tool for governments to define their risk appetite. They can be set either based on the stock or the flow of guarantees/on-lending. Limits may also be differentiated by the degree of beneficiaries' risk. Higher limits can be set for less risky firms and vice versa. Also, an overall limit may be based on the risk composition of individual beneficiaries and adjusted over time based on the evolution of credit risk in the portfolio. Nominal limits on risk exposure are more common. These limits can be set based on an estimate of expected fiscal costs if guarantees were issued and on-lending was granted up to that amount. Also, risk managers may derive a limit based on assessment of the marginal cost of funding if materialized credit risk leads to an increase in government borrowing. In a holistic risk management framework guarantee/on-lending limits should be embedded in a view of the riskiness of the overall government balance sheet, including liabilities, such as direct debt and other contingent liabilities.

The decision-making process for issuing guarantees or on-lending funds may be standardized in secondary law or ministerial regulations. Such regulation may require credit risk analysis of the potential beneficiary before any decision on guarantee issuance/on-lending is taken. The decision should be based on a thorough cost-benefit analysis to which the analysis of the beneficiaries' creditworthiness is one element in the cost estimate. For example, governments may set risk thresholds to make beneficiaries eligible for guarantees/on-lending. Requiring risk analysis prior to guarantee issuance/on-lending increases the transparency of the process and helps in assuring that governments take a decision based on clearly defined criteria rather than taking decisions driven by ad hoc political considerations.²⁸

Following a decision to issue a guarantee/on-lend, risk managers should be involved in structuring the respective agreement between the government and the beneficiary. Elements of such an agreement that can be informed by credit risk analysis include the setting of guarantee/on-lending fees, the degree of risk coverage, and the use of collateral.²⁹ Guarantee/on-lending fees can be based on the riskiness of the beneficiary and are in most cases based on estimates of expected losses or market values. Fees may be charged directly to the beneficiary or a sponsoring entity, such as a line ministry, municipal government, or government agency. Fees may be charged upfront at the time a guarantee is granted or funds are on-lent, or at regular intervals (e.g. annually). Guarantee/on-lending fees create a cash inflow on the government budget and can reduce the cost of guarantees/on-lending to the government by offering compensation for the risk taken and may be a tool to reduce a bias towards guarantees/on-lending as

²⁸ Operational guidelines for approval and issuance of loan guarantees and for government on-lending should exist. These guidelines should provide details of how credit risk should be assessed, together with measures to minimize the budget effect of a credit event. This risk assessment should occur before the decision has been made to support a certain activity by the use of guarantees or on-lending.

²⁹ Types of collateral may vary and include government securities, future revenue streams, physical assets, and cash, among others.

beneficiaries do not receive the respective support instrument at no cost. On the other hand, fees may reduce the viability of a specific project by raising beneficiaries' capital costs. When providing credit guarantees, governments may structure them to only provide partial credit risk coverage. The degree of coverage may be derived from an assessment of the beneficiary's creditworthiness. Partial guarantees can reduce moral hazard by the lender by making it assume part of the credit risk as well as by the beneficiary by potentially increasing their cost of default. On the other hand, partial coverage may increase the borrowing costs for riskier firms and make their operations less viable. Requiring beneficiaries to post collateral for the time the government is exposed to credit risk is another risk mitigation tool that may be part of a guarantee/on-lending agreement. The amount and quality of collateral to be posted may be differentiated by beneficiaries' riskiness. Collateral can reduce the government's loss in the event a beneficiary does not service its guaranteed/on-lent debt obligations. On the other hand, posting collateral involves a cost for the beneficiary.

To prepare for the materialization of guarantees or the event that on-lent funds are not repaid, governments may provision actual funds for future losses. Provisions may come from various sources, including the government's budget, guarantee/on-lending fees, investment income on retained provisions, and the recovery of receivables from guarantees materialized in the past or on-lent funds not repaid. Provisions may be set aside at the time the government assumes the respective risk or over time (e.g. annually in the budgeting process). Governments may accumulate provisions in a contingency reserve account to create fiscal buffers. These reserve accounts may be actual, i.e. funds set aside in a separate account, or notional, i.e. accounting entries where provisions are for example used to pay down direct government debt. Actual or funded reserve accounts imply a cost of carry by absorbing governments' financial resources.

Once governments issue guarantees or on-lend funds beneficiary entities' creditworthiness should be regularly monitored and the government should report on the risk it has assumed. Risk monitoring and surveillance may allow risk managers to detect a deterioration in credit quality early, engage with various stakeholders to identify potential initiatives to mitigate risk, and trigger pre-specified responses. The surveillance function is often the most meaningful element of a guarantee program. The ability to identify and correct credit weakness early can greatly reduce financial losses. Risk reporting is important to provide transparency on a government's operations with respect to guarantees and on-lending. Reporting may be differentiated based on the target audience. For example, reporting to the public may not include a risk assessment by the government of individual entities due to the potentially detrimental effect on borrowing costs for these entities. Reporting on risks from government credit guarantees and on-lending may be embedded in a holistic reporting format on fiscal risks and contingent liabilities. Risks from contingent liabilities may also be an input in government planning, for example when developing a medium-term fiscal framework and in assessing debt sustainability.

All risk mitigation and management tools discussed have in common that they raise transparency and accountability with respect to governments' activities related to guarantees and on-lending. Thereby, they increase the comparability between these activities and alternative policies, such as subsidies, and contribute to a more explicit dialogue weighing the costs and benefits of issuing credit guarantees and on-lending funds.

3 Country examples in developing and applying a risk analysis and measurement framework

Chapter 2 outlined four steps in the risk analysis and measurement process, and highlighted various approaches used for risk analysis. This chapter provides practical examples on how countries manage risks related to credit guarantees and on-lending. Practices in Colombia, Sweden, and Turkey illustrate three countries with substantial experience in managing risks from credit guarantees and on-lending. The chosen cases aim to highlight the diversity in approaches used and the degree to which the respective context drives the choice in approaches and their detailed design and implementation.³⁰ The fourth country case on Indonesia illustrates how public risk managers have recently started developing a risk management framework for sovereign guarantees with the support from the World Bank Group. This case provides more detail as it focuses on the process of developing a risk management framework, while the other country cases illustrate the current status quo in risk management. The sections below highlight practices along the four steps in the risk analysis and measurement process rather than provide a comprehensive description of the entire risk management framework.

3.1 Colombia

Defining characteristics

During the 1990s, the Colombian government entered into PPP arrangements to promote private sector investment in critical infrastructure projects, including power generation, toll roads, and telecommunications. To attract private investors, the government guaranteed specific project risks, particularly demand risk (Lewis & Mody, 1997). As a result of an economic recession in the late 1990s several guarantees were triggered. Cumulative payments by the government amounted to 2 percent of GDP by 2004 (Cebotari, 2008). Following the crisis, the Colombian government passed legislation to require the national government and sub-national entities to improve CL risk management, including the provisioning for potential losses. Measures included requiring the government and sub-national entities to include debt service appropriations in budgets to cover potential losses from CLs, as well as the creation of a contingency reserve fund. Since 2004, CLs have also been incorporated in Colombia's medium-term fiscal framework.

The government differentiates between four major types of explicit CLs: legal claims against the nation, PPPs, callable capital from commitments to multilateral organizations, and guarantees to public credit operations, as shown in Figure 3.1. Natural disasters constitute an implicit CL.

This section focuses on public credit operations where credit guarantees are extended to public entities. The total guaranteed debt outstanding (i.e. exposure) stands at about USD 2.3 bn. (Figure 3.2). Potential beneficiaries include 1,134 municipalities, 32 departments, and 200 SOEs. Private entities are not eligible for government guarantees. Most beneficiaries the government is currently exposed to (12 municipalities and departments, and 16 SOEs) have a public credit rating from one Colombian rating agency.

³⁰ Representatives from Sweden, Turkey, and Colombia, were part of a peer-to-peer group dialogue between debt managers from several countries facilitated by the World Bank. Debt managers exchanged their respective risk management practices, shared their current work programs to further improve risk management, and discussed in depth various aspects of risk management, from credit risk assessment, to the setting of guarantee fees, and organizational structures, among others.

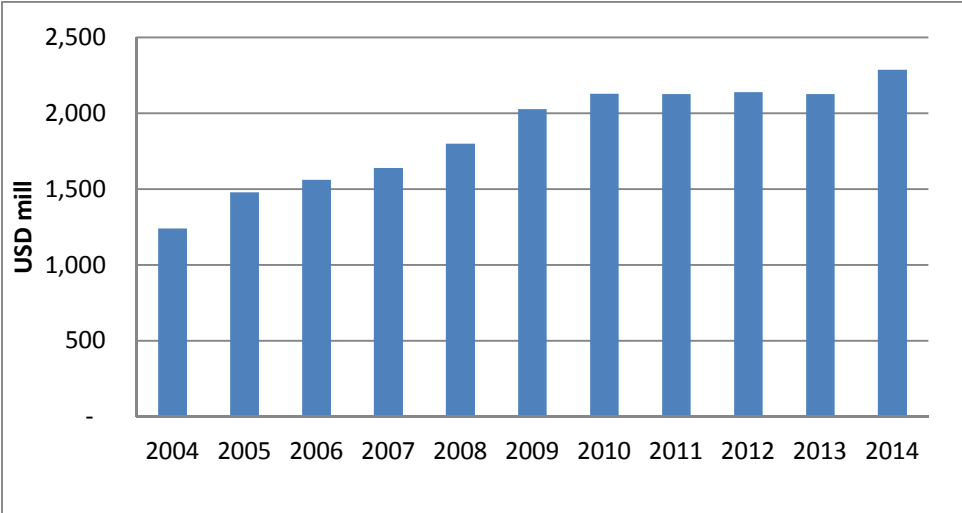
The Directorate General Public Credit and National Treasury (DGCPTN) has wide ranging authority with respect to government guarantees and is empowered to approve or deny any credit operation generating CLs to the government. It also sets fees and monitors and reports on risk. The credit risk team consists of three staff.

Figure 3.1: Stock of four types of explicit contingent liabilities in Colombia (in USD bn.)³¹



Source: Sub-directorate of Risk at the Directorate General Public Credit and National Treasury of Colombia

Figure 3.2: Stock of credit guarantees in Colombia



Source: Sub-directorate of Risk at the Directorate General Public Credit and National Treasury of Colombia

³¹ Amounts shown reflect size of reported contingent liability, not exposure. For guarantees to public credit operations, the reported CL represents the 99.9th percentile of losses, for other types of CLs different valuation methodologies are used. Exposure from credit guarantees amounts to about USD 2.3 bn., i.e. reported CLs are about 30 percent of total exposure for credit guarantees. Assuming an exchange rate of 2500 COP per USD.

Credit risk analysis

DGCPTN does not conduct its own assessment of credit risk of beneficiaries but relies on the risk assessment (i.e. rating) by domestic and international rating agencies. These public ratings form the basis for the quantification of risk. If beneficiaries are not rated by any rating agency endorsed in the country, DGCPTN assumes the lowest rating above default.

Credit risk quantification

DGCPTN estimates expected and unexpected losses from credit guarantees. Expected loss calculations are used in setting guarantee fees. The sum of expected and unexpected losses (explained below) represents the value of contingent liabilities reported by the government.³² Total exposure to guaranteed debt is also reported.

Expected losses are the product of exposure at default, probability of default and loss given default. Exposure at default is defined as the product of the guaranteed principal outstanding multiplied by the exchange rate between Colombian pesos and the borrowing currency. For the calculation of both, expected and unexpected losses, the exchange rate is stressed assuming a depreciation of the Colombian pesos by one standard deviation of annual historic exchange rate volatility.

The estimation of PDs is based on PDs for the Colombian sovereign. DGCPTN estimates a solvency curve for the Republic of Colombia. The solvency curve plots the probability of non-default for the sovereign over time. Based on the sovereign's solvency curve, solvency curves per rating category are estimated and applied to the respective guarantee beneficiaries depending on their rating relative to the sovereign.³³

LGDs are estimated at 75 percent if beneficiaries do not post sufficient counter-guarantees (i.e. collateral or lien). However, given sufficient (in amount and quality) counter-guarantees, DGCPTN may lower the estimate of LGDs. The adjustment of the LGD parameter is based on DGCPTN's assessment of counter-guarantees.

To estimate unexpected losses, DGCPTN follows the internal rating based approach outlined by the Basel Committee on Banking Supervision (Basel Committee on Banking Supervision, 2005). The Basel Committee provides a formula assuming a normal distribution of losses to estimate unexpected losses. DGCPTN chose the 99.9th percentile of the estimated distribution of losses (i.e. a confidence level of 99.9 percent) as the value of contingent liabilities, constituting the sum of expected and unexpected losses (see Figure 2.5 (end of section 2.3) for illustration of expected and unexpected losses).

Application in risk management

The DGCPTN applies various risk management tools, including the requirement of collateral from beneficiaries, guarantee fees, a contingency reserve account, and risk monitoring and reporting.

³² Size of contingent liability was defined as sum of expected and unexpected losses to strike a balance between potential over-reporting of liabilities when reporting face values and under-reporting of liabilities if only expected losses were reported.

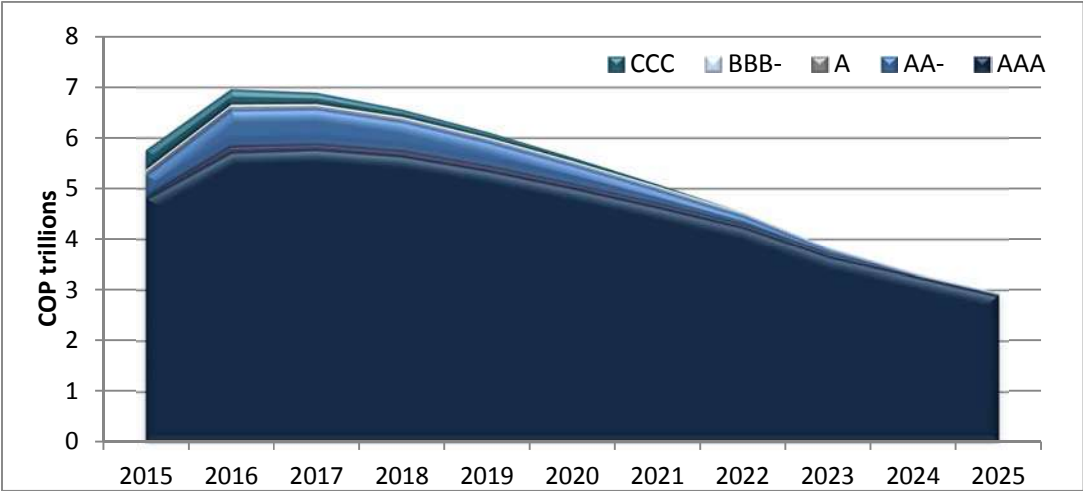
³³ DGCPTN models the evolution of a firm's credit ratings as a Markov process. The respective credit rating is therefore a random variable that evolves in time and whose future value given its current state is independent from previous ratings. Given the nature of the Markov process, if the probabilities of migrating from one rating to another are known, it is possible to determine the probability of future ratings (Ministry of Finance and Public Credit. Republic of Colombia, 2012).

A collateral generally covers at least 100 percent of the maximum guaranteed debt service payment in a given year. The level of the guarantee fee will be equivalent to the expected loss estimated. As the expected loss is based on an estimate for PD and LGD, the fee collected from the beneficiary will depend on its credit rating and the amount and quality of counter-guarantees posted. A higher credit rating will correspond to a lower PD, and better counter-guarantees will lower the LGD estimate, hence reducing the guarantee fee charged. Fees are to be paid annually or semi-annually and the first installment must be paid before the first disbursement of the guaranteed loan is made.

The contingency reserve account is an actual (i.e. funded) fund aimed at reducing the volatility of budget expenditures by creating buffers in case guarantees materialize and the government is required to undertake debt service payments on behalf of the beneficiary. The fund was introduced in 2005 and currently manages about USD 47 m. So far, the reserve fund has not been tapped to meet payments from materialized guarantees but has rather been built up over time. In addition to guarantee fees, the fund may be funded through budget appropriations and the collection of receivables on undertaken guarantees (loan recovery). The account also retains investment earnings from investments in fixed income instruments only.

DGCPTN monitors and reports on risks from guarantees. For monitoring, the maximum annual expected losses and the total contingent liabilities from individual guarantees over a ten year period are tracked as a signal for the potential materialization of credit risk. Reporting to the public includes a projection of guaranteed amounts by rating, based on the disbursement and amortization schedule of guaranteed borrowing (Figure 3.3; shown credit ratings are domestic credit ratings³⁴).

Figure 3.3: Reporting on guarantee exposure by domestic credit rating in Colombia



Source: Sub-directorate of Risk at the Directorate General Public Credit and National Treasury of Colombia

³⁴ Domestic ratings are relative to the respective sovereign. An AAA domestic rating is equivalent to that of the sovereign. For example, if the sovereign is rated BBB and the domestic rating of the beneficiary is A, the converted international rating of the beneficiary would be B.

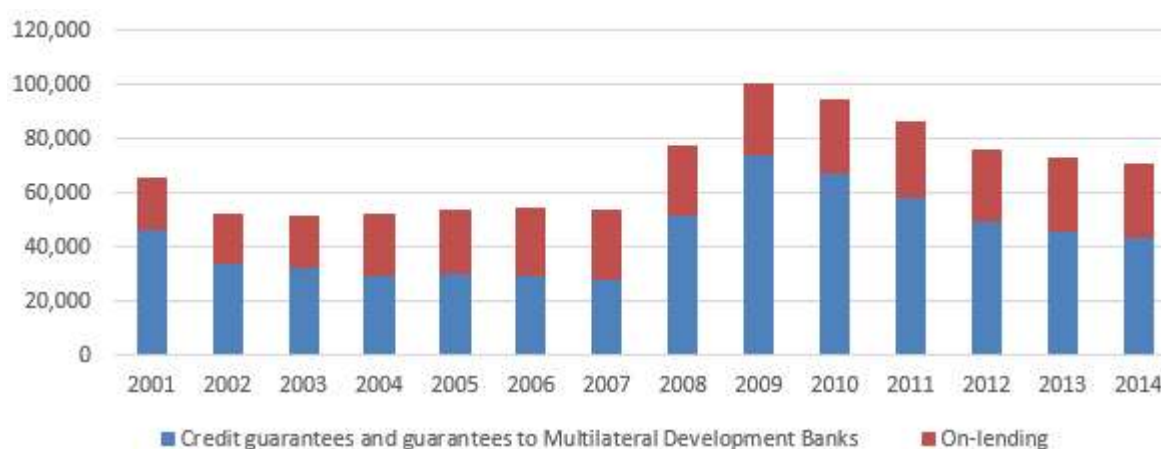
Another risk management tool not based on credit risk analysis and quantification is a guarantee limit imposed by law. The Colombian government has established a total guarantee limit of USD 9 bn. in the past.³⁵

3.2 Sweden

Defining characteristics

The size of Sweden’s total credit guarantee and on-lending portfolio stands at about USD 71 bn.³⁶ (about 12 percent of gross domestic product (GDP)), split into export credit guarantees (about 32 percent of total), student loans (about 35 percent), and other guarantees/on-lending (about 35 percent). Figure 3.4 shows guarantee and on-lending levels since 2001.

Figure 3.4: Stock of credit guarantee and on-lending portfolio in Sweden (in USD m)



Source: Swedish National Debt Office

The Guarantee and Loan department at the Swedish National Debt Office (SNDO) is tasked with managing the credit risk from non-standardized guarantees³⁷ and on-lending. The unit manages a portfolio of guarantees of about USD 4.4 bn. (about 40 entities) and on-lending of about USD 1.5 bn. (6 entities). Guarantees and loans managed by the Guarantee and Loan department are usually non-standardized instruments and one-off deals. Guarantee structures may be more complex and tailored to the individual beneficiary. Beneficiary entities include to a significant extent SOEs but no sub-national entities. Sweden has only a few existing PPP projects. In defining default events, SNDO follows Moody’s definition of default.³⁸

The risk management framework for guarantees and on-lending is characterized by a strong legal framework and governance mechanisms that were introduced after a financial crisis in the 1990s. The

³⁵ Currently it has an available space of USD 2.2 bn. for new guaranteed credits (about 0.7% of the GDP).

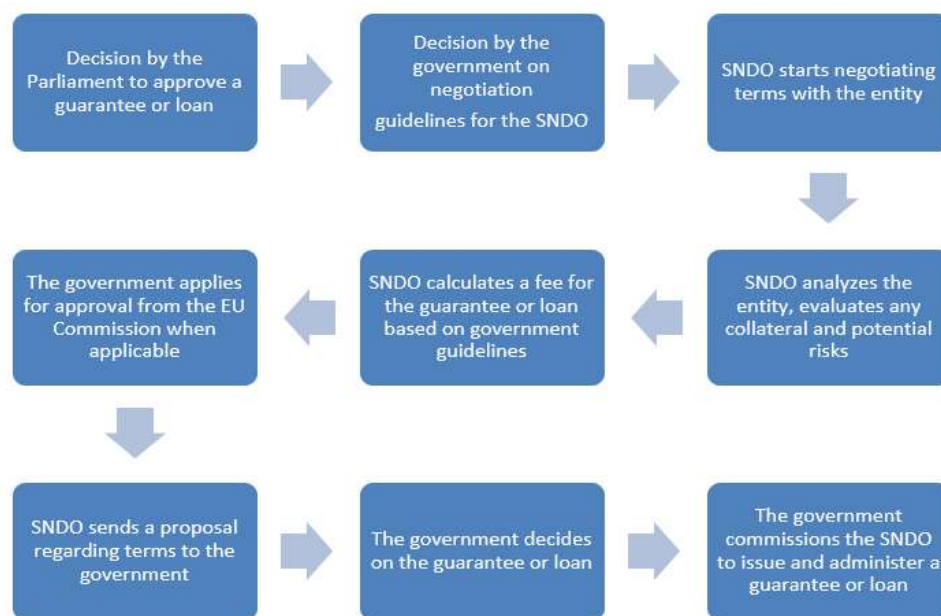
³⁶ Not including deposit insurance scheme (about USD 178 bn.).

³⁷ Standardized guarantees include export credit guarantees and housing credit guarantees. Non-standardized guarantees represent credit guarantees with individually negotiated and structured guarantee agreements to specific entities.

³⁸ Four events constitute default under Moody’s definition. Missed or delayed interest or principal payment; bankruptcy filing or legal receivership; distressed exchange; and a change in payment terms of a credit agreement.

Swedish Parliament decides on the amount and purpose of a guarantee/on-lending and then, via the government, tasks the SNDO with pricing, negotiations, and risk management (see Figure 3.5).

Figure 3.5: Issuance process for government guarantee or loan in Sweden



Source: Swedish National Debt Office

The Guarantee and Loan department at the SNDO currently consists of 11 staff members primarily with backgrounds in credit risk analysis, financial markets, and quantitative analysis. The size of the team fluctuates with the size of the guarantee/on-lending portfolio (plus/minus 2–3 persons).

Credit risk analysis

The SNDO applies a toolbox of approaches to analyze credit risk. These include fundamental risk analysis based on a rating methodology, the use of simulation models, and other methods such as structural models. SNDO heavily favors the rating approach due to its ease of replication, transparency, cost efficiency, and the access to information from third parties such as rating agencies. Simulation models are primarily used for unique, complex, and large risks due to the significant resource investment (quantitative skills, time, and cost) required. Structural models based on option pricing theory have been scarcely used in the past but not currently. With the proper adjustments such models could be useful for risk monitoring regarding publically traded companies (e.g. Moody’s Public Expected Default Frequency Model). However, structural models are deemed less useful for pricing, as the assumptions required for the model rarely hold in practice, in the view of SNDO credit analysts.

The rating based approach relies heavily on rating methodologies used by international rating agencies. If beneficiaries have public ratings, SNDO is mostly relying on these ratings. However, SNDO may deviate from rating agencies’ assessment due to the specific risk exposure the government is taking. If no public ratings are available, SNDO performs its own credit rating assessment based on score cards developed by Moody’s as they are most explicit in describing their rating methodologies (Table 3.1 provides an

example of a rating methodology score card SNDO is applying, adopted from Moody's). To acquire information and skills, SNDO subscribes to Moody's and S&P for access to rating methodologies, and sometimes staff attends credit risk analysis courses offered by rating agencies.

Table 3.1: Rating methodology score card for government owned infrastructure projects used in Sweden

Broad Rating Factor	Factor Weighting	Rating Sub-Factor	Sub-Factor Weighting
Market Position	40%	Asset Type	10%
		Operating History	10%
		Competition	10%
		Service Area Characteristics	10%
Performance Trends	30%	Annual Traffic	5%
		Traffic Profile	5%
		5 - Year Traffic CAGR	5%
		Ability and Willingness to Raise Rates	15%
Financial Metrics	20%	Debt Service Coverage Ratio	10%
		Debt to Operating Revenue	10%
Capacity, Capital Plan and Leverage	10%	Capital Needs	5%
		Limitations to Growth / Operational Restrictions	5%
Total	100%	Total	100%

Source: Moody's Investor Service; Swedish National Debt Office

When developing a simulation model for a specific guarantee, SNDO analysts follow a seven-step approach. These include the identification of significant risk drivers with respect to the specific guarantee or loan; the construction of a loss function from the relationship between these risk drivers (e.g. construct a dependent variable that determines default); make assumptions about the stochastic behavior of the risk factors (i.e. probability distributions), factoring in potential correlations between risk factors; collect and adapt available data to estimate parameter distributions; estimate the expected value of the resulting loss function through simulations; and stress-test the model to validate it.

SNDO has developed a simulation model for the Öresund link, a bridge between Denmark and Sweden. At an exposure of about USD 2.5 bn. this bridge constitutes the largest guarantee in portfolio managed by the Guarantee and Loan department at SNDO. The key risk drivers identified were traffic revenues, operational and financial costs, extraordinary events (e.g. disasters), and dividends. SNDO contracted several consulting firms to model behavior of the respective risk drivers and then simulate their behavior in a loss function to estimate the probability of default, and hence the guarantee being called.

In addition to analyzing risks of individual guarantees/loans, the Swedish government has tasked SNDO to conduct an analysis of the government's aggregated guarantee and on-lending portfolio. This analysis includes an analysis of credit risk and liquidity risk (i.e. the risk of marginally higher borrowing costs if the payment of a guarantee is very large and/or needs to be executed in an extraordinary short period of time). The analysis includes behavior of risk drivers with respect to idiosyncratic risk (i.e. concentration

of a significant share of total exposure to individual entities), and systematic risk, such as geographic concentration, industry concentration, and general economic volatility. Additionally, the deposit insurance scheme³⁹ and the new bank recovery and resolution framework are included in the analysis as well.

Credit risk quantification

SNDO calculates expected losses or market values for guarantees/on-lending.⁴⁰

To calculate expected losses when a rating methodology has been applied to analyze a beneficiary, SNDO needs to estimate PDs and LGDs. Default probabilities are derived from the respective default rate tables of rating agencies based on historic data for similar types of entities. LGDs are also derived from rating agencies' information on historic bond and loan recoveries. LGDs are differentiated by the bond/loan seniority stipulated in the respective agreement. If SNDO requires collateral to underwrite a guarantee/on-lend, LGD estimates may be adjusted accordingly. The valuation of collateral may be outsourced to third parties. Additionally, SNDO sometimes adjusts LGD estimates based on a qualitative assessment.

If a simulation model has been used to estimate the distribution of a loss function, expected losses are inferred from the frequency of losses resulting in default. LGDs can be inferred from the severity of losses in default events.

To conduct a market value assessment, SNDO compares yields to maturity for corporate bonds and comparable government bonds. Yields of corporate bonds are taken from corporates with the same credit rating as the guarantee beneficiary's internal credit rating as assessed by SNDO. Differences in yield hence reflect credit and liquidity premia. SNDO also studies credit default swaps (CDS) to perform market value assessments.

Application in risk management

SNDO applies various risk mitigation tools to manage the fiscal risk stemming from exposure to credit risk from guarantees and on-lending, including guarantee fees, partial guarantee coverage, appropriations to a notional reserve account, and risk reporting.⁴¹ Sweden has currently not set an aggregated limit on the flow or stock of guarantees and on-lending. However, in several cases there are annual limits set for specific agencies.

Fees charged to beneficiaries are set to cover expected costs which comprise expected losses from the guarantee/on-lending operation and administrative costs for the issuance and monitoring of the guarantee/loan. Fees are mostly charged on an annual basis. Parliament can decide to reduce or waive fees to be paid by beneficiaries. In such cases, the subsidy element must be recorded as budget expenditure and appropriated to the reserve account. In SNDO's portfolio, about half of the exposure refers to guarantees and loans where the fee is subsidized (in part or full). In other areas, e.g. export credit guarantees, there are no such subsidies at all. In cases where European Union (EU) state aid rules apply (e.g. where beneficiaries' operations have cross-border effects), a fee reflecting the market value of a

³⁹ The deposit insurance scheme is also managed at SNDO. It is managed under the Financial Stability and Consumer Protection department, not the Guarantee and Loan department discussed in this paper.

⁴⁰ Depending on the application of EU state aid rules discussed below.

⁴¹ On a case by case basis, SNDO may also incorporate the requirement to post collateral in guarantee agreements.

guarantee must be charged from the beneficiary. Also, if EU state aid rules apply, the maximum degree of risk coverage is 80 percent.

Guarantee/on-lending fees are booked against a notional contingency reserve account. This account is unfunded (i.e. an accounting entry) and appropriations to the fund are used to pay down sovereign debt thereby creating space for marginal borrowing for the undertaking of defaulted loans or bonds. Only expected losses are appropriated to the fund. Administrative fees collected are paid in a separate account and the portion of fees exceeding expected loss (e.g. if market based fees are charged) is transferred to the state budget.

SNDO closely monitors guarantee/loan beneficiaries through a semi-annual risk assessment (e.g. updating risk rating applying credit score cards). SNDO also publishes an annual report of the aggregated guarantee and on-lending portfolio, including overall exposure, governance principles around the issuance of guarantees and risk management, and expected losses.

3.3 Turkey

Context and defining characteristics

Contingent liabilities are not managed centrally in Turkey, but different types of CLs are managed in various government units. The Undersecretariat of the Treasury is mandated to manage risks from government guarantees and on-lending. Government guarantees include credit and investment⁴² guarantees, as well as debt assumption commitments in PPP projects. Guarantees or on-lending are only provided for external borrowing. The stock of guaranteed debt stood at about USD 11.2 bn. (about 4.24 percent of government debt) at the end of 2014, and hardly any new on-lending was extended in recent years (Figure 3.6 shows flows over last 12 years). The Undersecretariat of the Treasury extends guarantees and on-lending to four major types of beneficiaries: SOEs, public banks and development banks, municipalities, and affiliates of municipalities. About 83 percent of guarantees outstanding are to banks, 9 percent to SOEs and 8 percent to municipalities.

The Turkish Treasury has been issuing guarantees for more than 30 years and has been able to collect data on historic default events and financial information of the respective beneficiaries, allowing the credit risk team to adopt a statistical model based on Treasury's historic risk materialization.

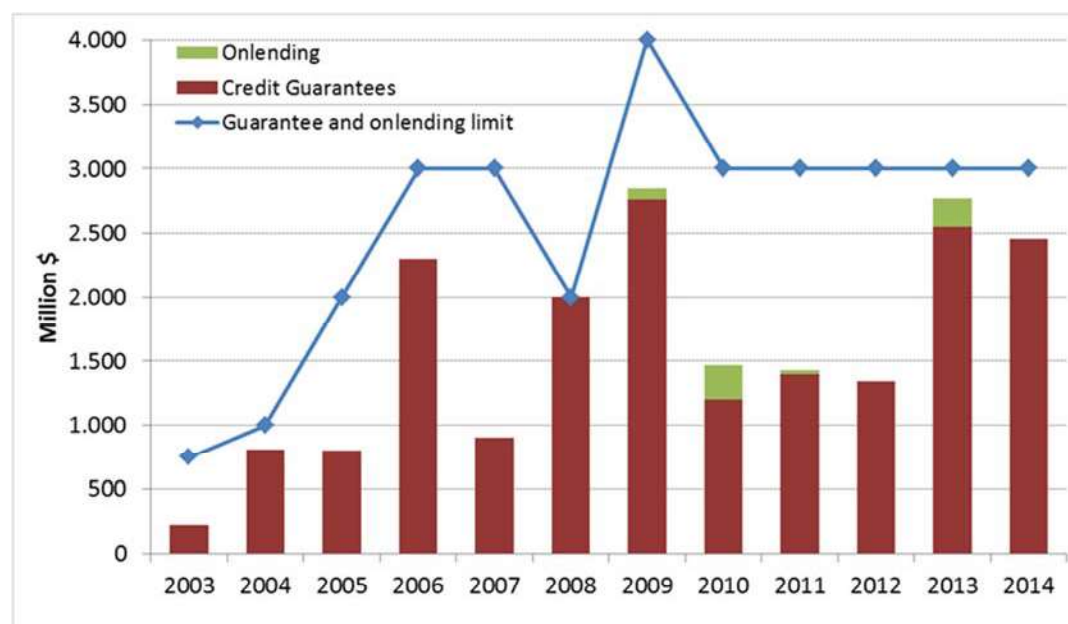
Importantly, Treasury defines default of beneficiaries on an annual basis and as default on payments to Treasury in the case of on-lending or when Treasury has to undertake payments to creditors in the case of credit guarantees. Hence, a guaranteed entity that cannot meet its payment obligations does not default to creditors but applies to Treasury to undertake a payment installment.⁴³

Risks from guarantees and on-lending are managed by the credit risk management unit which constitutes one of four sub-units in the middle office of the Directorate General (DG) of Public Finance. The unit consists of four experts and one head of department.

⁴² Investment guarantees refer to counter-guarantees provided by Treasury on certain commitments of public institutions in PPP contracts.

⁴³ In some instances, beneficiaries may receive capital injections from Treasury to support their businesses. These injections, however, are not defined as defaults and hence the definition of default applied in the risk model may overestimate credit quality of beneficiaries.

Figure 3.6: Flow of credit guarantees and on-lending in Turkey⁴⁴



Source: Turkish Treasury

Credit risk analysis and quantification

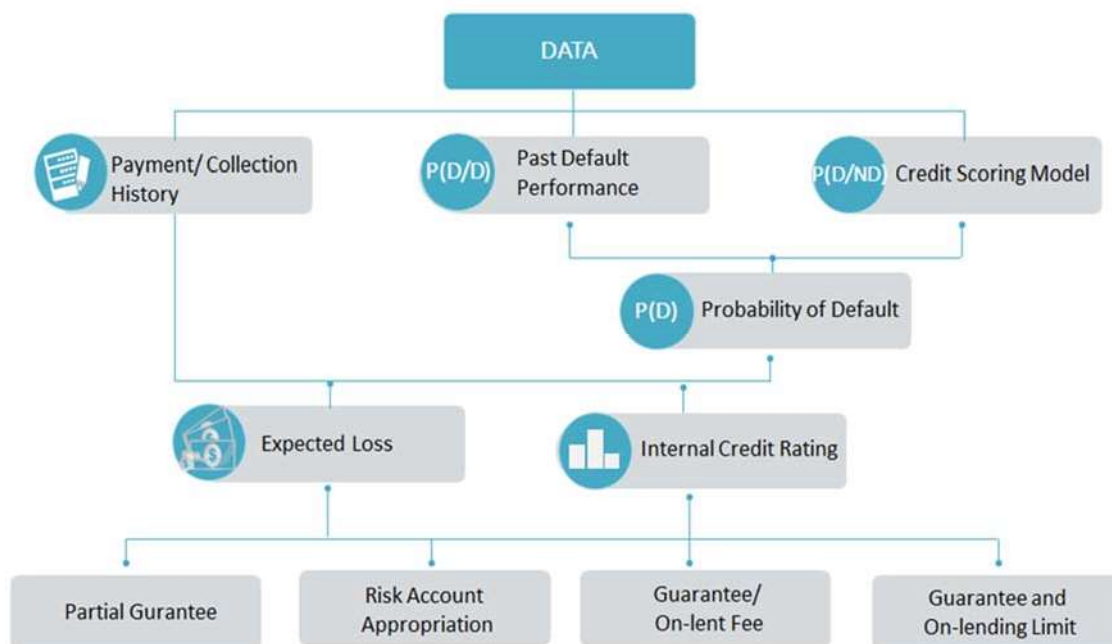
In response to Turkey’s financial sector crisis in the early 2000s, the government aimed for improved management of contingent liabilities, including the analysis and quantification of risks related to guarantees and on-lending. The first model Treasury developed with the support of an external consultant in 2002 was a macroeconomic simulation model that estimated default probabilities and expected losses derived from simulated paths of macroeconomic variables and their impact on specific sectors and entities, including electricity, gas, the Turkish Investment Bank, the Izmit Water Build-Operate-Transfer, state owned entities in general, and municipalities. Treasury, however, found the model difficult to maintain and assessed the simulation of macroeconomic variables not to be the core competency of the credit risk team.

In 2006, Treasury developed a statistical model based on insights from the Altman Z-Score methodology discussed above to estimate expected losses on government credit guarantees. Expected losses are estimated based on a statistical credit scoring model to estimate default probabilities and an estimate of recovery values in the case of default, based on historic experiences of Treasury in collecting receivables from undertaken guarantees (Figure 3.6). In the model, PDs are a combination of PDs given non-default (i.e. the beneficiary did service its debt in the previous period) and PDs given default (i.e. Treasury had to undertake debt service payments on behalf of the beneficiary in the previous period). PDs given non-default are derived from a regression analysis of historic defaults on historic financial performance of beneficiaries (Z-score methodology). Regression models are calibrated individually for the four different types of entities to which guarantees and on-lending are provided. This allows the model to reflect sector-

⁴⁴ On-lending has been included in limit since 2009.

specific risk drivers. Financial information from beneficiaries is obtained from audited balance sheets and income statements for SOEs and banks and from realized budget figures for municipalities. PDs given non-default are based on Treasury’s own historic record of collecting receivables from defaulted beneficiaries. Resulting annual PDs are then multiplied with annual debt service payments, discounted using the Treasury yield curve, and added up to arrive and a present value for expected losses at the time of guarantee issuance.

Figure 3.7: Structure of Turkish credit rating model



Source: Turkish Treasury

Treasury was able to use a statistical model for risk analysis due to its rich history of information, stemming from the collection of data for a 30 year time period and a large number of beneficiaries. Although the quality of financial statements available to Treasury has significantly improved after a public fiscal management reform in 2002, data quality can still be an issue. Treasury attempts to deal with such issues by working with other government entities to obtain quantitative and qualitative information.

The internal credit rating model is run on MS Excel and the regressions to estimate Z-scores are conducted in EViews. The financial ratios used in the model are updated annually while the coefficients of the model are updated every five years. Going forward, Treasury is considering complementing the statistical model through the use of more qualitative information in risk assessment.

Application in risk management

Turkish Treasury applies the insights from its statistical risk model in various risk management and mitigation tools. Model outcomes support the decision on whether to grant guarantees/on-lend funds, the

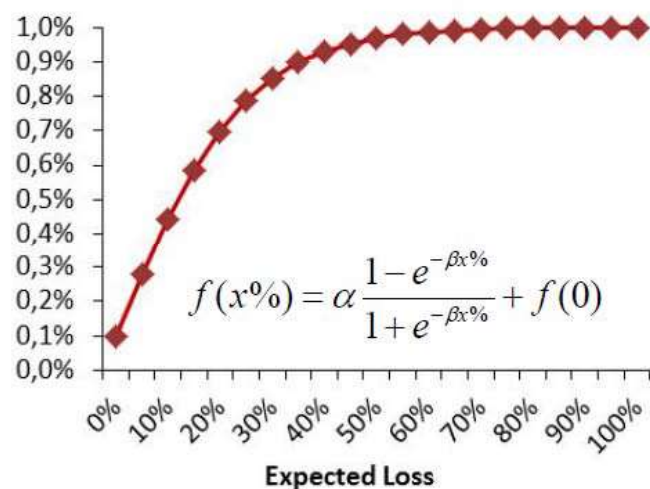
setting of guarantee and on-lending limits, the setting of guarantee fees, the degree of risk coverage, and appropriations to the risk account (Figure 3.8).

While the issuance of guarantees and the on-lending of funds is a political decision taken by the minister in charge of the Treasury reflecting considerations beyond a credit risk perspective, risk analysis for the potential beneficiary is undertaken before a guarantee/on-lending is granted and the result helps inform the decision makers about the potential risks.

Limits on flows are set annually on the nominal amount of new guarantees and on-lending and have been fairly stable at USD 3 bn. in recent years. Treasury recommends limits based on the expected risk exposure from new issuances and changes in the risk profile of the existing guarantee/on-lent portfolio.

By law fees are capped at 1 percent of the guaranteed/on-lent amount. Within that limit, fees are an increasing concave function of expected losses, as shown in Figure 3.8. Receipts from fees are transferred to a reserve account.

Figure 3.8: Guarantee and on-lending fee in Turkey, based on expected losses



Source: Turkish Treasury

Partial guarantees cover a maximum of 95 percent of borrowing and the degree of risk coverage is inversely related to the expected loss from a guarantee.⁴⁵

Turkey has established a contingency reserve account to provision for future losses from guarantees. Revenue sources of the account are not only guarantee/on-lending fees but also collected receivables from undertaken payments by Treasury, investment returns, and budget appropriations if the account does not cover expected losses. The central bank acts as an agent for Treasury in managing the account.

3.4 Indonesia

The cases of Colombia, Sweden, and Turkey illustrate situations where sovereign risk managers have well-established risk analysis and measurement frameworks that inform risk management around

⁴⁵ In the case of borrowing from multilateral sources and export credit agencies, up to 100 percent of the borrowed amount can be guaranteed by Treasury.

sovereign credit guarantees and on-lending. In many countries, however, such frameworks are not in place yet and risk managers have to design a framework from a basic level. To provide guidance, this section outlines how the contingent liabilities unit at the Directorate General of Financing and Risk Management (DGFRM) in the Indonesian Ministry of Finance went through the process of establishing a risk analysis and measurement framework and how the insights from this analysis will influence the design and implementation of risk management tools. DGFRM is going through an iterative process covering the four steps in the risk analysis and measurement framework outlined in chapter 2. In setting up a context-specific framework, DGFRM draws upon experiences from other countries through a peer-to-peer group dialogue, risk managers at the World Bank, and third party information (such as rating methodologies by rating agencies). DGFRM then integrates these insights to capture the idiosyncrasies in Indonesia.

The World Bank Group has been supporting DGFRM in improving its risk management practices around contingent liabilities since October 2012. Contingent liabilities risk management constitutes one of three components of the Government Debt and Risk Management technical assistance program between the World Bank and Indonesia, which is funded by the Swiss State Secretariat of Economic Affairs (SECO).

The risk analysis and measurement framework developed by DGFRM currently focuses on explicit government guarantees, but the approach and insights from designing a risk analysis system could be quite easily amended to include risks from other types of contingent liabilities, such as on-lending and implicit CLs to SOEs and sub-nationals.

Context and defining characteristics

The Indonesian government is exposed to a range of contingent liabilities, including legal claims against the government, banking crises, implicit support to state-owned enterprises, an emergency fund facility, a deposit insurance scheme, support for export credit, callable capital to international organizations, and explicit government credit and investment guarantees. DGFRM's mandate is to manage risks from explicit government credit and investment guarantees.

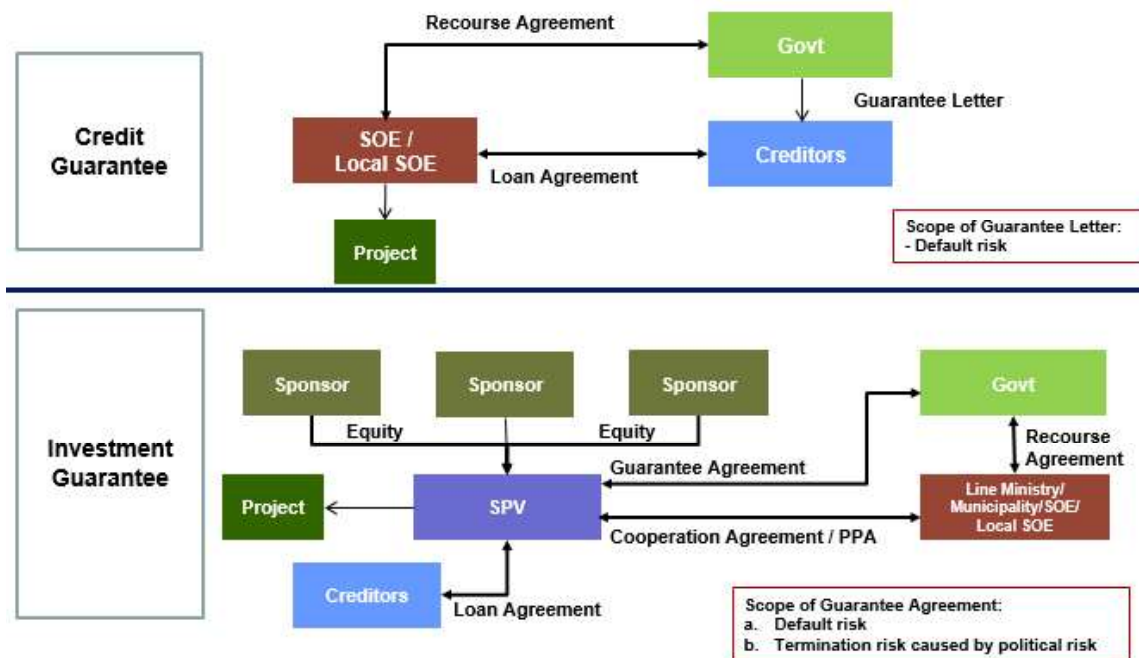
Definition of risk exposure

Guarantee beneficiaries are mostly owned and/or controlled by the government and hence risk exposure to the government from these entities comprises various types of fiscal risks, including volatility in dividends paid, their ability to provision essential public services, implicit contingent liabilities (e.g. default on non-guaranteed debt). The risk exposure in scope for DGFRM, however, is risks from explicit government credit and investment guarantees.

Credit guarantees are extended to the power sector (i.e. PLN) through Fast Track Program Phase 1 (FTP1) and to the water sector through the Clean Water Availability Program. These guarantees insure default risk of beneficiaries (PLN and water utilities) in corporate finance lending. Investment guarantees can be extended to the power sector through FTP2 and to PPPs in various sectors through the Indonesia Infrastructure Guarantee Fund (IIGF). Investment guarantees protect investors against the termination risk caused by the materialization of political risk in project finance deals. Investment guarantees are also extended to independent power producers (IPPs) to guarantee the off-take of electricity at a pre-set tariff by PLN (see Figure 3.9). Under this scheme, if PLN fails to pay for electricity delivered by IPPs in

accordance with an off-take agreement, the government’s guarantee is called and the government is obliged to make payments to IPPs to cover PLNs shortfall. DGFRM defines a credit event as an unexpected payment by the government to the beneficiary entity which would otherwise not be able to meet a debt service payment or a situation where the government takes over the full amount of guaranteed debt.

Figure 3.9: Credit and investment guarantee schemes managed by DGFRM in Indonesia



Source: Indonesian Directorate General of Financing and Risk Management

Characteristics of guarantee portfolio

DGFRM manages risks from government guarantees extended under four presidential decrees. Within this portfolio, the government’s largest exposure is to Perusahaan Listrik Negara (PLN), the state-owned electric utility with a monopoly on electricity distribution (about USD 13.5 bn. or 1.6 percent of GDP) and credit guarantees to water utilities (about USD 16 mn.). Additionally, the government engages in a co-guarantee scheme with IIGF that results in about UD 3.2 bn. exposure.⁴⁶ While the total size of the current guarantee portfolio is fairly limited, the Ministry of Finance expects the portfolio to grow significantly in the future given the government’s ambitious infrastructure investment aspirations. To finance infrastructure investments the government intends to leverage private sector funding through the use of risk sharing mechanisms such as credit and investment guarantees. In addition to current exposure in the power and water sectors, the government expects growing exposure in infrastructure sectors such as toll roads, air ports, sea ports, railways, and waste management, as well as telecoms.

⁴⁶ IIGF was set up to promote private investment to finance infrastructure projects by providing investment guarantees under PPP schemes. Due to its limited capital, IIGF currently is only able to take relatively small guarantee exposure.

On-lending is not managed by DGFRM but by the DG Treasury. Hence, on-lending is not in scope of the risk management framework developed at DGFRM. However, due to the similar nature of credit risk involved in on-lending, the design and implementation of the risk management process described here could be easily extended to include on-lending.⁴⁷

Data availability

DGFRM has recently started to collect historic information on the performance of guarantee beneficiaries, including information from financial statements such as balance sheets and income statements as well as qualitative information (e.g. assessment of regulatory environment, management quality, competitive environment, etc.). Outright defaults of beneficiaries where beneficiaries default to commercial creditors who then accelerate debt service payments have not materialized in the past. PLN has not defaulted. Water utilities have defaulted in the past and information on defaults is available. However, defaults have only occurred at water utilities that borrowed through on-lending from the government, not at water utilities conducting commercial borrowing with government guarantees. Given the potential difference in willingness to repay in on-lending operations discussed above, and a potential bias towards less viable water utilities borrowing through on-lending from the government, historic default events at water utilities may be inappropriate for use in the analysis of guaranteed water utilities. Going forward DGFRM has discussed an adaptation of the definition of default. Rather than focusing on outright defaults to commercial creditors, DGFRM may define default as missed debt service payments (e.g. individual installments) that are paid for to the creditor by the government.

PLN has been rated by international rating agencies (Moody's, S&P, and Fitch) and has traded corporate bonds outstanding for which information is available on Bloomberg. It is important to note that market prices factor in implicit government support and spreads between the Indonesian government and PLN are relatively tight. For water utilities, however, only very few companies are rated by local rating agencies and no traded corporate debt securities are outstanding.

Resources and capacity

The contingent liabilities team at DGFRM consists of three sub-units, including risk analysis, the structuring of guarantee agreements, and risk monitoring and reporting. The head of the team is supported by seven staff who rotate between sub-units to balance workloads and build skills across the entire spectrum of guarantee risk management. Staff have a general background in finance and economics and have often worked in various units of the debt management office. However, staff mostly do not have previous professional experience in credit risk analysis.

The Risk Management Unit from the Fiscal Policy Office (FPO) has recently been integrated into DGFRM. This unit also has responsibilities with respect to managing risks from government guarantees and state-owned enterprises. The integration of this team into DGFRM could help strengthen risk management capacity. Other government(-related) entities involved in credit risk analysis include the

⁴⁷ Attention has to be given to differences in the institutional setup of guarantees and on-lending. While ability to repay would be the same in both cases and only dependent on the credit quality of the respective beneficiary, willingness to repay may differ depending on whether on-lending or guarantee agreements are in place.

Directorate Investment Management System (SMI) under DG Treasury which manages on-lending by the central government, and IIGF which provides guarantees to PPP projects.

Credit risk analysis

DGFRM has studied several approaches for risk analysis before deciding to develop an internal credit scoring system to analyze risks from explicit guarantees. With the support of a consultant from the Turkish Treasury, DGFRM reviewed the Turkish approach to risk analysis and quantification based on a statistical model building on the Altman Z-Score methodology. DGFRM also reviewed literature on alternative approaches to risk analysis, such as structural models and scenario analysis. DGFRM was involved in a peer-to-peer group exchange facilitated by the World Bank. Through this exchange DGFRM was exposed to practices with respect to CL risk management in Colombia, Sweden, Turkey, as well as South Africa.

Based on this review of approaches in literature and country practices and an assessment of the specific context, including the characteristics of the guarantee portfolio, the government's risk exposure, data availability, and resources and capacity at DGFRM, the CL team decided to implement a credit scoring approach. Given the limited information on historic financial performance and credit events of beneficiaries and the relatively small number of beneficiaries, a statistical model would have been difficult to implement. A credit scoring model allows DGFRM to leverage information on rating methodologies available from rating agencies when developing score cards. Also, a scoring model is very flexible in incorporating qualitative information and being specific to the particular risk exposure of the government. Furthermore, credit scoring helps the CL team at DGFRM to build capacity for a fundamental understanding of credit risk which facilitates ongoing credit monitoring and the implementation of risk mitigation measures. On the other hand, the relative subjectivity in scoring risk factors may make it more difficult to convince policy makers of the validity of risk assessment. To manage this concern, the formalization of a clear scoring methodology, including scoring guidelines for each scoring factor, based on a methodology by a major rating agency can help raise credibility of the chosen risk analysis approach.

Given the current guarantee portfolio, DGFRM decided to start developing score cards for the electric utility and water utilities. The development of score cards is an iterative process. The first score card for electric utilities DGFRM developed was very closely related to Moody's methodology for rating regulated electric and gas utilities. As DGFRM staff applied the scoring methodology for the electric utility, discussed the results and sought feedback from the World Bank team, and researched further rating methodologies (e.g. corporate score card from S&P), the score card was refined by changing and adding scoring factors (e.g. management quality), adding modifiers (e.g. liquidity, financial policy), and changing weights for factors (see Table 3.2).

DGFRM followed a similar process developing a score card for water systems. To test the validity of the score card for water utilities, DGFRM applied it to several water utilities that have defaulted in the past. Using information from financial statements and other assessments by the government of defaulted water

utilities before they defaulted, DGFRM checked if their score card was useful in picking up deteriorating credit quality. Based on insights from this back testing, DGFRM was able to further refine its score card.

To institutionalize the process of developing credit rating methodologies and to conduct the assessment of individual beneficiaries, the Ministry of Finance is planning to form a credit committee staffed by professionals from various related backgrounds and headed by the head of the middle office of DGFRM with a leading role for the head of the CL unit at DGFRM. This committee can have an important role in further refining score cards, developing new scoring methodologies, and discussing the assessment of entities thereby ensuring that the major risks have been identified.

Table 3.2: DGFRM's score card for electric utilities

Internal Credit Rating SPU for Company XYZ	Weight	Sub Score	Final Score
Regulatory Framework	20.0%		0.70
a. Legislative and Judicial Underpinnings of the	10.0%	4	
b. Consistency and Predictability of Regulation	10.0%	3	
Ability to Recover Cost and Earn Return	20.0%		2.60
a. Timeliness of Recovery of Operating and Capital	10.0%	12	
b. Sufficiency of Rates and Return	10.0%	14	
Diversification	10.0%		1.30
a. Market Position	5.0%	12	
b. Generation and Fuel Diversity	5.0%	14	
Management	10.0%		1.40
a. Strategic Positioning	3.3%	15	
b. Operational Effectiveness	3.3%	12	
c. Governance (BoD)	3.3%	15	
Key Credit Metrics	40.0%		5.1
a. (CFO pre + Interest)/(Interest + Principal)	15.0%	12	
b. CFO pre/WC Debt	15.0%	12	
c. Debt/Total Asset	5.0%	18	
d. Foreign Currency Debt/Domestic Currency Debt	5.0%	12	
Base Rating			Ba1
			11.0

Modifiers	Factors	Base	Notch	Adjusted Score
	Base Rating	11.10		
	Liquidity	3	0	11.10
	Financial Policy	2	0	11.11

Source: Indonesian Directorate General of Financing and Risk Management

Next steps in risk analysis for DGFRM will be to further refine the existing score cards based on insights from their application and discussions in the credit committee. DGFRM may consider applying the score cards not only for guaranteed beneficiaries but also entities in the same industry as beneficiaries to broaden the scored universe. Also, DGFRM is in the process of developing additional score cards for municipalities (given the recourse agreement to municipalities in investment guarantees) and more complex structures such as project finance deals in sectors currently in the pipeline (e.g. toll roads,

seaports, airports). As DGFRM guarantees types of political risk when issuing investment guarantees, DGFRM may develop a scoring methodology to assess various peril types it insures through these types of guarantees (e.g. expropriation, breach of contract, and change in law).

Credit risk quantification

DGFRM is considering to use expected losses and market values as metrics for quantifying credit risk from sovereign guarantees. Calculating two metrics allows DGFRM to compare different estimates and draw conclusions (e.g. about risk premia demanded by investors, difference in government's perception of credit risk and that of market participants) from the comparison of results. DGFRM can also use the results from the two metrics and the range between them in designing risk management tools depending on the respective policy objective.

To estimate expected losses, DGFRM converts internal credit scores from the application of its score cards into letter ratings that correspond to those of international rating agencies. Using information on historic defaults by rating and time horizon published by rating agencies (see Table 3.1. for an example from Moody's) DGFRM converts the letter rating into default probabilities for the maturity of its guarantee or annual values.⁴⁸ DGFRM estimates LGDs to be 50 percent, based on international standards and Indonesia specific experience (especially for water utilities). Exposure at default (EAD) is derived from previous disbursements and amortizations on guaranteed loans for credit guarantees and the termination purchase price (which consists of an equity and debt component) in the case of political risk insurance in the case of investment guarantees. Expected losses are then estimated as the product of EAD, PD, and LGD.

To estimate market values two approaches are used. To estimate the marginal value of explicit guarantees for beneficiaries where traded debt securities are outstanding, DGFRM compares the yield on Indonesian government bonds with those of the beneficiary entity with the same maturity. In the current guarantee portfolio this is only possible in the case of PLN. This spread represents the marginal annual value of an explicit guarantee. Alternatively, for beneficiaries without outstanding traded debt securities or to value a guarantee, including explicit and implicit government support, DGFRM calculates the spread of government bonds and corporate bonds of a large sample of entities with the same rating as the rating DGFRM assigns the beneficiary in its internal scoring process.

Going forward, DGFRM builds an internal database recording the performance of beneficiaries. Information recorded includes financial performance from financial statements, the assessment of qualitative factors deemed important for credit scoring, as well as credit events (e.g. outright defaults or proxies such as capital injections from the government). Over the long run and assuming a growth in the guarantee portfolio, DGFRM may be able to use this information to calibrate an in-house credit risk model to quantify credit risk based on risks specific to the Indonesian government when issuing guarantees, rather than relying on information from third parties such as rating agencies.

⁴⁸ Dependent on application in risk management tools (e.g. annual PDs for budget appropriations; maturity of guarantee to guide decision on guarantee issuance and structuring of guarantee agreement).

Application in risk management

DGFRM is currently in the process of designing and amending risk management and mitigation tools to incorporate insights gained from risk analysis and quantification based on their internal credit scoring approach. A ministerial regulation has been drafted and is currently being discussed. This regulation covers sovereign guarantees managed anywhere in the Ministry of Finance and establishes a firmer mandate for DGFRM in the process of issuing and monitoring sovereign guarantees and to implement stronger risk management tools. The regulation covers the use of various risk management and mitigation tools such as the setting of a guarantee limit, assessment of a guarantee application, the structuring of guarantee agreements, the proposal of guarantee fees, the provisioning for financial losses, and the recording, monitoring and reporting of risks from guarantees. The regulation is fairly high-level and does not detail the exact specifications of the respective risk management tools, giving DGFRM discretion in designing and improving them in an iterative process based on experience gained over time.

Indonesia's medium-term debt management strategy for 2013 – 2016 currently limits the flow of sovereign guarantees to 2.57 percent of GDP over that time period. DGFRM is considering to propose a refined limit based on the assessed credit risk by beneficiary. Such a limit may be based on the government's marginal borrowing capacity in an adverse situation, where the adverse situation may be defined by economic circumstances and a high incidence of guarantees being called.

When applying for government guarantees, potential beneficiaries need to submit information to facilitate the assessment of project feasibility and creditworthiness of beneficiaries, including cash flow projections for the project to be financed, audited financial statements of the beneficiary, projections for future financial performance, and a proposal for risk sharing. Before a decision on the issuance of a guarantee can be made, an assessment based on internal credit scoring approach must be conducted and risks must be quantified (expected losses). The assessment will be undertaken by a credit committee once it is established. The committee will issue a recommendation to the minister of finance on the issuance of a guarantee.

DGFRM proposes budget allocations for contingent liabilities from government guarantees to be set based on the estimation of expected losses. If not used for the undertaking of guarantees in a given budget year, allocated resources should then be transferred to a contingency reserve account. This reserve account would act as a buffer for future government payments under guarantee agreements ensuring timely payment and minimizing significant adverse impacts on the budget in a given year.

Under the proposed regulation, DGFRM would be responsible for submitting regular reports to the minister of finance on portfolio exposure and the results of regular risk evaluations. These reports shall include an assessment of credit risk of the overall portfolio, quantified credit risk analysis based on the internal credit scoring approach, and recommended risk mitigation tools. To conduct regular risk monitoring, DGFRM is authorized to request information on project progress, audited financial statements, and other information to assess credit risk from beneficiaries.

3.5 Key insights from country examples

The four country cases discussed illustrate the heterogeneity of frameworks used for analyzing and managing credit risk from guarantees and on-lending. Even if the same general approaches are used in

risk analysis, quantification, and application in risk management, the design details differ significantly and are very context-specific. Appendix A provides a stylized summary of country cases.

Key context-specific drivers that lead to a differentiation in risk analysis and measurement frameworks include the following: The characteristics of the guarantee and on-lending portfolios (e.g. overall size relative to debt or GDP, diversity of guaranteed entities). The relationship between the government and the respective beneficiary institutions (e.g. governance structures, regulation, ownership). The availability of historic data (e.g. financial information of beneficiaries, past credit events such as default or capital injections) and third party information (e.g. credit rating by rating agencies, traded debt securities). Available resources (e.g. number of staff, staff capacity, and financial resources to purchase third-party information).

Risk analysis is conducted in-house in Indonesia, Sweden and Turkey. Indonesia and Sweden rely on methodologies developed by rating agencies for credit scoring. Sweden complements a rating approach with simulation models for individual guarantees/loans. Turkey developed a statistical model relying on internal and quantitative information. On the other hand, Colombia does not conduct its own risk analysis but relies on credit risk assessments from rating agencies.

To quantify risks all four countries estimate either market values or expected losses, or both. The chosen target measure depends on its use in risk management. In Sweden expected losses are usually calculated for setting fees and reserve account appropriations while market values are used if EU rules require it. In Colombia both market values and expected losses are estimated for different uses, to set guarantee fees and for risk monitoring and reporting respectively. Indonesia intends to follow similar practices as Colombia. Turkey relies on expected losses to inform various risk management tools.

In all four countries the insights from risk analysis and quantification inform important risk mitigation and management tools. Colombia, Sweden, and Turkey all charge guarantee fees differentiated by beneficiaries' creditworthiness.⁴⁹ While Turkey bases fees on expected losses, in Colombia they are based on market values, and in Sweden both approaches are used. All three countries also use contingency reserve accounts to provision for financial losses but these can be either notional accounts (Sweden) or actual accounts (Colombia, Turkey). Risk monitoring and risk reporting is an integral part of the respective risk managers in all four countries but the degree to which information is made available to the public differs. Only the Colombian DGCPTN consistently requires collateral while in Sweden collateral is requested on a case by case basis. Turkey and Colombia have set guarantee and on-lending limits based on nominal amounts in exposure while Sweden has not set a guarantee/on-lending limit.

While Colombia, Sweden, and Turkey have significant and varied experience in measuring and managing risks from sovereign credit guarantees and on-lending, risk managers in all three countries are continuously improving their practices and emphasize that designing and implementing a risk management framework is an iterative process. Similarly, Indonesia sees the development of strong credit risk management practices as a long-term process.

⁴⁹ Indonesia plans to do the same.

4 Considerations in implementing a risk analysis and measurement framework

Governments which intend to implement a risk analysis and measurement framework for government guarantees and on-lending need to consider several factors to ensure sound risk management practices.⁵⁰ These factors include the institutional setup and governance arrangements for risk management, the sequencing of the scale up of a risk management framework, political economy considerations, and the avoidance of common pitfalls in implementation.

The institutional setup for risk management includes the organizational structure of the guarantee and on-lending risk management team as well as the integration of risk management across various types of CLs. In many countries, credit guarantees and on-lending are managed by separate units (often within the ministry of finance). Given the very significant similarities in credit risk between these two options of government support, governments may consider integrating credit risk management of both in one unit or at least ensuring strong collaboration. In the countries discussed in this paper, sovereign credit guarantees are managed by the respective debt management offices. While it is useful to ensure strong coordination with debt managers (e.g. by including a strategy on guarantees and on-lending in the government's debt management strategy), it is not necessary for guarantee and on-lending risk management to be conducted within debt management offices. The organizational setup may depend on the specific history of institutional development and should take into account the skill set required of staff to conduct risk analysis and quantification. Staff with previous professional experience in credit risk analysis (e.g. at commercial banks) and a strong quantitative background are usually good fits for the tasks required. Often the management of various types of CLs (e.g. natural disasters, guarantees, on-lending, financial sector vulnerabilities, deposit insurance, etc.) are managed by separate units, although usually within ministries of finance. Strong coordination and closer integration of CL risk management may be recommended in many instances to facilitate a government's holistic view on risks from CLs and to be able to develop a comprehensive risk management strategy.

Sovereign risk managers should develop a clear view on sequencing the various steps, as well as scope and depth of a guarantee and on-lending risk management framework. It may be advisable to start developing a framework with a narrower scope in the beginning and then scale it up over time. This approach is being followed by DFRM in Indonesia. DFRM first started developing a risk analysis approach for credit guarantees to the most important types of beneficiaries in the guarantee portfolio. Credit guarantees are the most common type of guarantees and are more straightforward in risk analysis than more complex structures such as investment guarantees. Over time, DFRM plans to expand its risk analysis to other types of guarantees and beneficiaries in the current portfolio and then develops risk analysis and quantification approaches to assess risks with respect to guarantees in the pipeline.

Technical level staff responsible for risk analysis and quantification need to consider how to best communicate and present the insights from their work, so to increase the likelihood of policy makers taking their recommendations and insights into consideration when making decisions. Ultimately, the

⁵⁰ This section only provides a short overview on considerations in implementation which is not the focus of this paper. A deeper understanding of these factors requires an in-depth discussion with risks managers from countries experienced in developing a risk analysis and measurement framework and with experienced experts.

granting of guarantees or on-lending should be a political decision based on a cost-benefit analysis. By assessing credit risk, risk managers provide an important insight on potential costs but they usually do not conduct a full cost-benefit analysis. Risk managers should, however, ensure that their cost assessment is made explicit and to present it so policy makers taking decisions on the granting of guarantees and on-lending (including aspects such as the setting of guarantee fees and provisioning for financial losses) are more likely to factor in the cost of guarantees and on-lending when weighing these instruments against other policy alternatives. When deciding between the instruments of credit guarantees or on-lending, risk managers need to weigh several factors. These may include a difference in willingness to repay as discussed above. Additional factors include the different impact on direct government debt: While on-lending immediately increases government debt, credit guarantees do not at the moment of issuance. Related, credit guarantees may facilitate hiding risks and transfers to beneficiaries while on-lending makes those more explicit. On the other hand, on-lending likely reduces the cost of borrowing for the beneficiary as even with a guarantee it would incur borrowing costs higher than those of the sovereign (See (Danemarks Nationalbank) for a more detailed discussion of differences between credit guarantees and on-lending). Secondary legislation requiring a proper risk assessment before guarantees are granted or on-lending is extended can help institutionalizing a sound decision making process. Furthermore, reporting (internally and to the public) can support transparency and accountability by highlighting risks for issuing guarantees and on-lending.

Learning from their own experience and that of other countries, sovereign risk managers should aim to avoid common pitfalls in implementing a risk analysis and measurement framework. Sometimes risk managers try to accomplish too much at once. They may aim to develop a full risk analysis approach covering all sectors, types of guarantees, and beneficiaries before starting to actually conduct risk analysis. Developing a risk analysis approach or model is an iterative process. By applying a first cut of a model, risk managers can draw many insights to improve the model in further iterations. Also, risk managers may start with a model for a specific industry or beneficiary and only develop models for other industries/beneficiaries once capacity and skills have been built from the application of the first model.

Furthermore, risk managers may have an interest in developing a quantitative model that provides unambiguous answers (i.e. risk estimates) and leaves little room for judgment that may be more difficult to be questioned by superiors or policy makers. Doing so risk managers may choose a risk analysis approach that does not match the country specific context (e.g. resources and capacity, availability of historic information). A sophisticated-looking quantitative model may also mask a lack of understanding of the fundamental drivers of credit risk. As every model's output heavily depends on the assumptions made in specifying a model and the quality of data input, there is no shortcut for fundamentally understanding risk drivers to arrive at valuable insights from risk analysis. Also, it is important to understand how single point risk estimates derived from models should be questioned using common sense and a full understanding of the respective beneficiary. Risk analysis tools can be very powerful in structuring the process of analyzing risks and creating valuable insights, however, human skills in contextualizing results and judging interdependencies between risk drivers and factoring in more qualitative information are invaluable complements.

Similarly, risk managers may relatively quickly focus on risk analysis before investing enough time and effort in understanding the specific risk exposure. Guarantee structures (especially with respect to types

other than credit guarantees, such as government guarantees in PPP projects) may be very complex and the exact exposure of governments may be difficult to define. Additionally, the relationship between beneficiaries and the government may complicate the definition of risk exposure given the interdependencies between several factors (e.g. in the case of SOEs where the government may act as owner, regulator, and banker to the SOE).

Lastly, collaboration in risk management among various units in the government may prove difficult. Often various government units are involved in managing risks from guarantees and on-lending and information on the respective beneficiaries may be spread across government units. Especially if beneficiaries are SOEs or sub-national governments, information on these entities (e.g. financial statements, past performance vis-à-vis the government, risk assessment, and other qualitative information) may be available within the government (e.g. in the ministry of SOEs) but not the units tasked with guarantee and on-lending risk management. In other instances, government units managing risks may not be authorized to seize beneficiaries' assets and collect receivables in the case of credit events. Strong collaboration and information sharing among various government units involved can create significant synergies by reducing the cost of duplicating risk analysis and by decreasing the likelihood of missing important information on risk drivers in risk analysis. Furthermore, collaboration between units responsible for managing risks related to various types of CLs can help in forming a holistic view of the government on CL risk management and may allow for the spill-over of sound risk management practices across units.

5 Conclusion

Sovereign credit guarantees and on-lending can create significant contingent liabilities and assets on governments' balance sheets. Risks related to these contingent liabilities and assets should be managed in an integrated risk management framework. This allows leveraging private sector resources for important investments through risk sharing by the government while maintaining prudent risk levels. Analyzing and measuring credit risk from guarantees and on-lending is a core foundation for such a risk management framework. Also, making costs related to guarantees and on-lending explicit and transparent helps create a level playing field to compare alternative policy options for government support.

This paper outlined a structure for analyzing and measuring credit risk in four steps – the definition of key characteristics to determine the choice of risk analysis approach, the analysis of risk drivers, the quantification of risks, and the application of insights from risk analysis and quantification in risk management tools.

Country practices discussed in this paper illustrate how context-specific the design and implementation of risk analysis and measurement frameworks is. While sovereign risk managers can draw important insights from risk management practices in peer countries, academic literature, and approaches used in the private sector, they need to base any framework on a deep understanding of the defining characteristics with respect to their specific risk exposure, the guarantee and on-lent portfolio, and institutional setup within the government. For risk analysis, risk managers should not be too optimistic for gaining valuable insights from quantitative models without a solid understanding of risk drivers specific to the respective industry of the beneficiary. A sophisticated-looking quantitative model may mask a lack of understanding of the

fundamental drivers of credit risk. As a result, developing a sound risk analysis and measurement system requires significant investments in resources, capacity building, and time. Governments should view this process as iterative and long-term.

Strong technical understanding of risk analysis and measurement alone is not sufficient to ensure sound risk management practices. Risk managers need to take into consideration the institutional setup and political economy questions to tailor risk management frameworks. Policy makers need to be convinced that risk managers' recommendations add significant value in helping policy makers take decisions.

This paper has focused on risk analysis and measurement of individual explicit sovereign credit guarantees and on-lending, and how insights from risk analysis and measurement can inform the design of risk management and mitigation tools. Some broader issues with respect to risk management and other types of government guarantees have been touched upon but not fully explored. Further work with respect to contingent liabilities risk management may discuss these issues in more depth. This may include a broader discuss on risk management practices and cover CLs related to implicit government guarantees, government guarantees in PPP projects. Additionally, the valuation of risks from guarantee and on-lending portfolios may be addressed. Countries in early stages of the risk management process may require additional guidance in setting a baseline, i.e. identifying risks they are exposed to. This may require an analysis of outstanding guarantees, on-lending, and potentially other types of CLs managed by various government units.

Appendix A - Stylized summary of risk management practices in four countries

Process/ country	Colombia	Sweden	Turkey	Indonesia ⁵¹
Context and defining characteristics	<ul style="list-style-type: none"> ▪ USD 700 m. exposure managed by DGCPN ▪ SOEs and sub-nationals potential beneficiaries ▪ 3 staff in credit risk team 	<ul style="list-style-type: none"> ▪ USD 4 bn. exposure managed by Guarantee and Lending unit at SNDO ▪ Beneficiaries mostly SOEs, no sub-nationals ▪ 11 staff 	<ul style="list-style-type: none"> ▪ USD 11.2 bn. exposure managed by credit risk team at Treasury ▪ Beneficiaries SOEs, banks, municipalities ▪ 5 staff 	<ul style="list-style-type: none"> ▪ USD 16.7 bn. exposure managed by CL team at DGFRM ▪ Beneficiaries SOEs and infrastructure fund ▪ 8 staff
Credit risk analysis	<ul style="list-style-type: none"> ▪ No internal risk assessment; public credit rating used 	<ul style="list-style-type: none"> ▪ Credit rating models favored, simulation models, and structural models; ▪ Industry-specific score cards using rating agencies' methodologies 	<ul style="list-style-type: none"> ▪ Statistical regression model for each type of beneficiary ▪ Model calibrated using historic data of beneficiaries performance vis-à-vis Treasury 	<ul style="list-style-type: none"> ▪ Industry-specific internal credit rating methodology developed for electric utilities and water systems ▪ Score cards based on rating agencies' methodologies
Credit risk quantification	<ul style="list-style-type: none"> ▪ Expected and unexpected losses ▪ PDs based on transition matrices and solvency curve ▪ LGDs at 75 percent, adjusted for collateral 	<ul style="list-style-type: none"> ▪ Expected losses and market values ▪ PDs based on rating agency databases ▪ LGDs based on rating agency databases ▪ Market values based on spreads in borrowing costs 	<ul style="list-style-type: none"> ▪ Expected losses as result of regression model ▪ PDs estimated using financial ratios of beneficiaries ▪ LGDs based on historic performance vis-à-vis Treasury 	<ul style="list-style-type: none"> ▪ Expected losses and market values ▪ PDs based on rating agency databases ▪ LGDs based on standards and historic performance ▪ Market values based on spreads in borrowing costs
Application in risk management	<ul style="list-style-type: none"> ▪ Guarantee approval, collateral, guarantee fees, actual contingency reserve account, monitoring and reporting ▪ Fees equal expected losses 	<ul style="list-style-type: none"> ▪ Guarantee fees, partial guarantee coverage, notional reserve account, monitoring and reporting ▪ Fees based on expected costs or market values 	<ul style="list-style-type: none"> ▪ Decision to grant guarantees, guarantee fee, partial guarantee coverage, limit setting, actual reserve account, monitoring 	<ul style="list-style-type: none"> ▪ Potential tools include guarantee approval, guarantee fees, reserve account, limit setting, monitoring and reporting

Source: Sub-directorate of Risk at the Directorate General Public Credit and National Treasury of Colombia, Swedish National Debt Office, Turkish Undersecretariat of the Treasury, Directorate General of Financing and Risk Management in the Indonesian Ministry of Finance, author

⁵¹ Credit risk management practices are currently being developed.

Bibliography

- Altman, E. (1968). Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy. *The Journal of Financ*, 589 - 609.
- Altman, E., Rijken, H., Balan, D., Watt , M., Forero, J., & Mina, J. (2010). *The Z-Metrics Methodology For Estimating Company Credit Ratings And Default Risk Probabilities*. RiskMetrics Group.
- Anderson, P., & Abousleiman, I. (2011). Risk Management Framework and Financial Solutions. *Presentation*.
- Bachmair, F. (2014). Risk Measurement Process. *Presentation at Sovereign Debt Management Forum*. Washington.
- Basel Committee on Banking Supervision. (2005). *An Explanatory Note on the Basel II IRB Risk Weight Functions*. Bank for International Settlements.
- Basel Committee on Banking Supervision. (2004). *International Convergence of Capital Measurement and Capital Standards*. Bank for International Settlements.
- Benzschawel, T. (2012). *Credit Risk Modelling - Facts, Theory and Applications*. London: Risk Books.
- Black, F., & Scholes, M. (1973). The Pricing of Options and Corporate Liabilities. *Journal of Political Economy*, 637-654.
- Capuano, C., Chan-Lau , J., Gasha , G., Medeiros, C., Santos, A., & Souto, M. (2009). *Recent Advances in Credit Risk Modeling*. International Monetary Fund Working Paper.
- Cebotari, A. (2008). *Contingent Liabilities: Issues and Practice*. International Monetary Fund Working Paper.
- Crosbie, P., & Bohn, J. (2003). *Modeling Default Risk*. Moody's KMV.
- Ekstrom, K. (2013). *Quantitative tools - pricing of guarantees and loans*. Swedish National Debt Office.
- Gupton, G., & Stein, R. (2002). *LossCalc: Model for Predicting Loss Given Default (LGD)*. Moody's KMV.
- Irwin, T., Klein , M., Perry, G., & Tobani, M. (1997). *Dealing with Public Risk in Private Infrastructure*. Washington, DC: The World Bank.
- Marrison, C. (2001). Risk Management for Contingent Liabilities. *Presentation*.
- Ministry of Finance and Public Credit. Republic of Colombia. (2012). *Contingent Liabilities - Methodologies in Colombia*. Bogota.
- Moody's Investor Service. (2010). *Government-Related Issuers: Methodology Update*. Rating Methodology.
- Moody's Investor Service. (2013). *Rating Methodology: Regulated Electric and Gas Utilities*.
- Moody's Investor Service. (2014). *Annual Default Study: Corporate Default and Recovery Rates, 1920 - 2013*.
- Polackova Bixi, H., & Mody, A. (2002). Dealing with Government Fiscal Risk: An Overview. In H. Polackova Bixi, & E. Schick , *Government at Risk*. Washington: Oxford University Press.
- Sundaresan, S. (2013). A Review of Merton's Model of the Firm's Capital Structure with its Wide Applications. *Annual Review of Financial Economics*, 5:5.1 - 5.21.