Evaluating the Cost of Government Credit Support: The OECD Context

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1. Introduction

　　Governments throughout the OECD and around the world allocate a significant share of societies' capital and risk through their credit-related activities. Those activities include explicit and implicit guarantees of too-big-to-fail private and international financial institutions and non-financial firms; direct and guaranteed lending; and credit-related insurance and guarantee programmes such as deposit insurance. In deciding whether to initiate or modify a credit programme, policymakers consider a broad array of political and economic factors. Costs play a prominent role in such deliberations--policies are often debated and ultimately justified or rejected on the basis of formal or informal cost-benefit analyses. Consequently, accurate cost estimates are a prerequisite for efficient resource allocation, informed and transparent government decision-making, and effective management and oversight of government programmes.

　　This paper explores how OECD governments and government entities determine the official costs of their credit-related activities, evaluates those methods against the metric of a "fair-value" approach, and illustrates the divergence between reported and fair-value cost estimates through an analysis of several major OECD government credit programmes. A fair-value approach measures program costs at market prices, or at some approximation thereto when directly comparable market prices are unavailable.[1]

　　The underlying premise--that governments systematically understate the cost of their credit activities because they misidentify their cost of capital as being their own borrowing cost--rests on two robust principles from financial theory. The first dates back to Arrow and Debreu (1954) and remains the cornerstone of modern-day asset pricing: The cost of capital for any project, public or private, depends on the undiversifiable (also often referred to as market or aggregate) risk associated with it. Relative to a unit of consumption today, an investment that pays off when the economy is strong is worth less than an investment with the same average payout but that pays off when the economy is weak. The second

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[1] More precisely, the fair value of an asset is the price that would be received if it were sold in what is known as an orderly transaction—one that occurs under competitive market conditions between willing participants and that does not involve forced liquidation or a distressed sale. The distinction between fair value and market value is particularly useful for valuing government assets and liabilities, many of which do not have an exact private sector analog; fair value accounting standards provide guidelines for how to handle such cases.

principle follows from the related logic of the famous Modigliani-Miller (MM) theorem (Modigliani and Miller, 1958) as it applies to governments.[2] The MM theorem established that as a first approximation, the cost of capital for a project (including financial projects) depends on the timing and undiversifiable risks of the associated cash flows, not on the mix of debt and equity used to finance it. Debt and equity holders collectively bear the entire undiversifiable risk of a project, and the cost of the total undiversifiable risk is the same no matter how it is divided across those claimants. The relevance to the government arises from the recognition that the undiversifiable risks inherent in most government credit activities are similar to those present in private credit transactions and that those risks are ultimately are borne by taxpayers and the general public, who are the *de facto* equity-holders in government investments.[3]

The analysis reveals a large divergence between how OECD governments account for the costs of credit support and the corresponding fair-value costs: Governments (and government-owned entities) systematically understate the costs of credit support, often by a considerable margin. Cost understatement has a number of potentially adverse consequences: It encourages over-reliance on credit support relative to other types of assistance, such as grants or in-kind transfers, for which costs are measured more fully. The impetus to use credit support in lieu of other types of assistance may be particularly strong during periods of fiscal consolidation when there is intense pressure to reduce measured spending. Cost understatement creates incentives for capital misallocations and overinvestment; and it underreports the size of the public sector. Furthermore, it encourages a larger buildup of financial risk by governments than would otherwise occur. That in turn increases the likelihood of future funding shortfalls that could hinder governments' capacity to respond to adverse shocks, and adds to the aggregate financial risk in the world economy.

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[2] Cost estimates based on a weighted-average or market cost of capital are often described as fair value estimates, and henceforth the terms are used interchangeably.

[3] That perspective was endorsed by the Financial Economists Roundtable (2012), a non-partisan group of senior financial economists, but remains controversial among U.S. budget practitioners.

The phenomenon of significant cost understatement and several valuation approaches that can be used to address it are illustrated through analyses of three OECD examples: (1) the European Bank for Reconstruction and Development (EBRD), a large international financial institution whose disclosures are typical of such organizations; (2) the Tennessee Value Authority (TVA), a wholly federally-owned firm responsible for about 1/6 of the electrical generation and transmission in the United States; and (3) the European Financial Stability Facility (EFSF) and its successor, the European Stability Mechanism (ESM), a permanent crisis resolution mechanism established by the euro area Member States as an intergovernmental organisation to ensure financial stability by providing financial assistance to ESM members experiencing or threatened by severe financing problems.

This analysis adds to a growing number of studies that address those issues as they pertain to the U.S. federal government (Lucas, 2012(a), surveys that literature). Similar analyses do not appear to have been performed for other OECD member states, despite the growing prevalence of government credit support by those countries and the significant differences from the U.S. in policies and institutions. The aim of this paper is to begin to fill that gap, and to draw attention to the importance of accurate cost measurement for credit support in the OECD context and the shortcomings of current practices. A caveat is that the conclusions drawn rely on examination of a small subset of the numerous government financial reports and budgetary documents where credit cost information may appear, as well as a reading of the relevant portions of the International Public Sector Accounting Standards (IPSAS) and related commentaries and conversations with OECD experts. A comprehensive analysis of OECD credit programmes and accounting practices was not attempted. Thus there may be important exceptions and variations that remain to be identified in future research.

As noted above, the fundamental conceptual reason for the systematic understatement of credit costs by OECD member states and government-owned entities is relatively straightforward: Governments generally equate their cost of capital with their borrowing rate, independent of the risk of the activity being financed. Relatedly, government entities use an accounting notion of profitability rather than an economic one. However, the practical impediments to a full recognition of credit costs are more

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numerous and complex. They include the panoply of legally binding directives and long-standing practices that allow the costs of many credit activities--particularly credit guarantees and other contingent commitments—to be entirely unaccounted for in government budgets, or to be accounted for on a cash basis that largely obscures the lifetime cost of new obligations at the time they are made. The U.S. federal government took the positive step of moving to an accrual basis of accounting for its direct loans and loan guarantees programmes, but its use of government interest rates for discounting results in downwardly-biased cost estimates. Even if one were willing to take reported costs at face value, identifying the relevant programmes and uncovering the available cost information is difficult. Reporting practices are not standardized, and cost information may be spread across a combination of budgetary accounts, financial statements, and special reports issued by multiple reporting entities.

Despite the complexity and heterogeneity of current practices, it is possible to characterize the differences in the information disclosed by government entities and by publicly-traded firms in a way that clarifies the relation between financial accounting, budgetary accounting, and market prices. That taxonomy represents an original contribution of this paper, and it is useful for several reasons. For one, it suggests the importance of recognizing the fair-value costs of credit support in budgetary accounts. Government financial statements, even when they include a fair value balance sheet, do not reveal the full cost of credit support. The observation is important because whereas government financial accounting has become increasingly standardized and is largely consistent with financial accounting practices in the private sector as more countries chosen to adopt IPSASB guidelines, international standard setters have offered much less guidance on budgetary accounting practices. Furthermore, many OECD government credit activities are conducted by entities such as international financial institutions, which evaluate their financial performance largely on the basis of data on their financial statements. The fair-value costs of their credit activities, which for a publicly traded firm would be reflected in stock price movements, are generally not estimated or recognized as relevant.

Adoption of a fair value approach to cost estimation by governments would involve a number of practical challenges. Those include the need to select appropriate methodologies for a variety of

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applications; the possibility that the resulting cost estimates would be less transparent and more open to manipulation than estimates based on simpler rules; and the costs of educating staff members on how to prepare and communicate fair value estimates to policymakers and the public. The case is made that those costs and risks would be largely mitigated if governments were to adopt the accounting standards and practices that have developed to guide and discipline the production of fair value estimates by private sector financial institutions.[4]

While accurate cost measurement is important for the many reasons noted, it is clearly not sufficient for policy evaluation--private benefits and any positive or negative externalities also must be taken into account. Although those broader issues are outside of the scope of the analysis here, there is an extensive academic literature on the broader effects of government credit support. Government credit support can improve social welfare when it alleviates informational and contractual frictions in credit markets (e.g., Stiglitz and Weiss, 1981, and Williamson, 1994). Credit market frictions and their consequences may be particularly severe during periods of financial upheavals. Relatedly, during downturns credit policy can be a powerful tool for delivering economic stimulus (Gale, 1991, and Lucas, 2012b). Public financing of infrastructure projects may improve welfare when it is infeasible for the private sector to collect sufficient revenues from users. Potential adverse effects of credit support include the crowding out of more productive investment activities; effects on prices that reduce the benefits to the intended beneficiaries; incentives for greater risk taking by guaranteed entities; and a build-up of debt by unsophisticated borrowers.

The remainder of the paper is organized as follows: Section 2 gives an indication of the size and scope of OECD government credit activities. Section 3 reviews the conceptual case for applying a fair-value approach to cost estimation in government accounting, and explains how credit costs are accounted for in practice. It then clarifies the complementary roles of budgetary accounting and financial accounting, and compares the information provided therein with information available to investors in

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[4] For a discussion of the concerns that have been raised about requiring fair value accounting by the private sector and a defense of that practice, see Laux and Leuz (2009 and 2010).

publicly traded firms that also have information about stock prices. Section 4 reports the fair-value costs to governments of the EBRD, the EFSF/ESM, and the TVA, and compares those estimates to the government-reported information on their costs. Those analyses demonstrate several of the approaches that can be used to estimate the fair-value of government credit support. Section 5 discusses some of the practical challenges in implementing a fair value approach and how they might be addressed. Section 6 concludes.

2. Government Uses of Credit Support

OECD governments provide credit support for many purposes, and by a variety of means. Governments provide explicit and implicit guarantees to too-big-to-fail private financial and non-financial institutions, and to international financial institutions. Direct government loans and loan guarantees programmes provide assistance for housing, education agriculture, small businesses, development, energy, trade, and to foreign and subnational governments. Certain government insurance programmes, such as those protecting bank deposits and private pension benefits, are effectively credit guarantee programmes. Government-owned firms that finance their investments through low-cost debt issuance provide credit support to the activities they engage in.

Cataloguing the size and scope of government credit support for OECD countries using a consistent approach across jurisdictions and programmes would be a worthwhile and challenging undertaking, but such an exercise has not been done and is not attempted here. Nevertheless, information is available that provides a sense of the magnitudes involved, and suggests credit supported by OECD governments amounts to several tens of trillions of Euros.

For the U.S., Lucas (forthcoming) provides an inventory of federal credit support programmes which underscores the very large size of those obligations when considered collectively. Exposures are measured by dollar amounts of outstanding of guaranteed obligations. Prominent implicit guarantees are included but state and local government obligations are not. That analysis concludes that for 2013, credit backed by the U.S. federal government topped $20 trillion. The major components include: traditional

direct loans and loan guarantees, primarily for low-income housing and higher education ($2.3 trillion);

backing for mortgages insured by Fannie Mae and Freddie Mac ($5.8 trillion); deposit insurance ($6.2

trillion); guarantees of private defined benefit pension plans by the Pension Benefit Guarantee

Corporation (about $2.8 trillion); and implicit guarantees to the Federal Home Loan Banks and the Farm

Credit System (about $1 trillion). In general, the fair-value cost of those obligations is much smaller. For

example, the U.S. Congressional Budget Office (CBO, 2012) reports that for the estimated $635 billion of

new direct loans and loan guarantees issued in 2013, the fair-value cost would be $11 billion.[5]
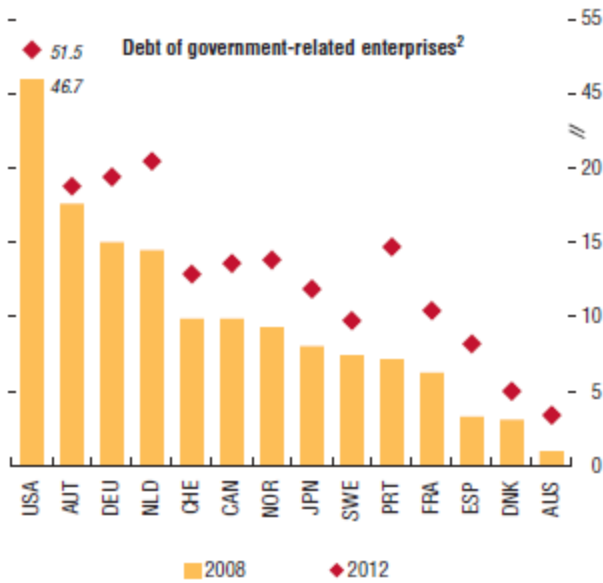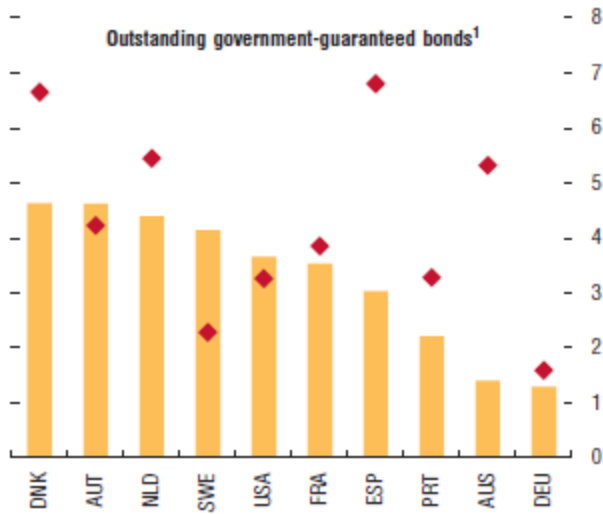
The International Monetary Fund (IMF) presents estimates of outstanding government-

guaranteed bonds and debt of government-related enterprises as a share of GDP for selected OECD

countries in 2008 and 2012 (IMF, 2012). That graph is reproduced here as Figure 2.1. It shows the

significant growth in those obligations over that period for almost all of the countries reported. In 2012,

government-guaranteed bonds reached close to 7 percent of GDP for Denmark and Spain, and exceeded 3

percent of GDP for 8 of the 10 countries shown. The U.S. tops the list at 51.5 percent of GDP for debt of

government-related enterprises (because of Fannie Mae and Freddie Mac), while for 10 of the other 13

countries shown such debt represents more than 10 percent of GDP. Details are not reported on the uses

of the funds, but the report notes that in some countries the largest shares go to financial institutions

including development banks (e.g., Germany) and housing agencies (e.g., Canada and Japan). The IMF

also notes that in some countries the amounts are likely to be underestimated given data constraints. The

totals also are not comprehensive in that they do not include various contingent liabilities such as those of

the European Stability Mechanism. National credit programmes, such as for student loans and deposit

insurance, also appear to be excluded.

Figure 2.1: Outstanding Government-Guaranteed Bonds and Debt of Government-Related Enterprises
(Percent of GDP)

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[5] That estimate excludes the cost of Fannie Mae and Freddie Mac, deposit and pension insurance, contributions to multilateral financial institutions, and implicit guarantees.

Outstanding government-guaranteed bonds[1]

Countries (left to right): DNK, AUT, NLD, SWE, USA, FRA, ESP, PRT, AUS, DEU

Debt of government-related enterprises[2]

51.5

46.7

Countries (left to right): USA, AUT, DEU, NLD, CHE, CAN, NOR, JPN, SWE, PRT, FRA, ESP, DNK, AUS

■ 2008   ◆ 2012

Sources: Dealogic; and IMF staff estimates.
Note: In some countries, amounts are likely to be underestimated given data constraints.
[1] Outstanding government-guaranteed bonds correspond to bonds that are issued by private and public banks and financial institutions and carry state guarantees. Short-term debt is not included.
[2] Bonds issued by government-owned or government-related institutions; includes both financial and nonfinancial institutions, subject to data availability. For the United States, includes mortgage-backed securities and other guarantees of government-sponsored enterprises.

Source: Reproduced from IMF 2012 Fiscal Monitor.

Survey information on national direct loan and loan guarantee programmes from 22 OECD countries shows a combined total stock outstanding of $2.5 trillion (Hawkesworth, 2010).[6] Loan guarantees account for $2.3 trillion of the total. Sectors receiving assistance (and their percent of the total) included the financial sector (76%); export (10%); other (8%); non-financial, non-agriculture (3%); and student loans (3%).

OECD members rely on international financial institutions, and particularly multilateral development banks, to provide credit and other financial support to projects in developing countries and regions. Such institutions are chartered by more than one country and hence are subject to international law. Individual countries provide capital by purchasing shares in the institutions. They also provide "callable capital" which commits them to buy additional shares when sufficiently large losses are incurred. In 2012, those institutions collectively held assets totaling more than EUR 1 trillion, as shown in Table 2.1.[7]

Table 2.1: Assets of Selected International Financial Institutions, 2012	(EUR billions)
African Development Bank[1]	25
Asian Development Bank[2]	95
European Bank for Reconstruction and Development	52
European Investment Bank	508
Inter-American Development Bank[2]	71
World Bank Group[2]	
International Bank for Reconstruction and Development	260
International Development Association	123
International Finance Corporation	58
Multilateral Investment Guarantee Agency	1
[1] UA 1 = EUR 1.2 [2] USD 1 = EUR .77	

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[6] Includes Australia, Austria, Canada, Denmark, Finland, Germany, Greece, Hungary, Iceland, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Sweden, Switzerland, Turkey, and the UK.

[7] Assets reported in dollars are converted to Euros at an exchange rate of EUR.77 per dollar. It is not clear whether the debt backing the assets of international financial institutions is included in the IMF calculations of guaranteed debt or debt of government guaranteed enterprises.

The data presented confirms the importance of credit support in OECD countries. It also suggests that credit assistance in most OECD countries is channeled through the financial sector, whereas in the U.S. the assistance is more often targeted to specific purposes through government agencies.

3. Estimating the Cost of Government Credit Programmes

This section briefly lays out the economic rationale for evaluating the cost of government credit programmes on a fair-value basis, and contrasts that approach with the practices that OECD governments follow in measuring and reporting credit costs. Most importantly, the differences between the information disclosures by government entities and by publicly traded firms are characterized in a way that clarifies the relation between financial accounting, budgetary accounting, and market prices. That decomposition points to the nature of underreporting under the most common accounting regimes, and suggests how accounting practices could be modified to incorporate more complete cost information.

3.1 Rationale for Fair-Value Reporting by Governments

Unlike most ongoing government programmes that may be modified by future legislation or administrative policy changes (e.g., unemployment benefits may be changed year to year), the terms agreed to in a credit contract represent a firm legal commitment that binds the government over the life of the contract. Therefore the grant-equivalent measure of cost for a credit contract must represent its lifetime cost—the net present value of the associated cash flows from and to the government. Those cash flows are inherently uncertain, but they can be characterized by a probability distribution of possible outcomes. For a direct loan, when the present value of future cash inflows (from interest payments, fees, and repayments of principal) falls short of the principal loaned out, the difference represents a cost to the government and a subsidy to the recipient. Similarly for a credit guarantee, when the present value of future cash outflows under the contract exceeds the present value of fees and recoveries, then the cost to the government is positive and a subsidy is conferred.

Present value calculations are quite sensitive to the choice of discount rates, and the results can only be meaningfully interpreted if appropriate discount rates are chosen. The discount rates used in the private sector take into account time value—that a dollar received today is worth more than a dollar received in the future. Private sector discount rates also include a risk premium that compensates investors for the risks associated with a particular investment that cannot be easily avoided through diversification. Those priced risks include market risk, and in some cases prepayment risk and liquidity risk.[8]

In practice, there are three basic approaches that are used to incorporate the cost of risk into present value calculations: comparable market prices, risk-adjusted discount rates, and option- or derivatives-pricing methods. All derive from the same underlying principles, and therefore should provide similar answers if correctly implemented. However, the most reliable and tractable approach is likely to vary with the application. For example, for contingent claims such as credit guarantees, it is often most straightforward to incorporate an appropriate set of discount rates using a derivative-pricing approach. (Ways in which governments could credibly implement fair value methodologies are discussed below in Section 5).

Private sector discount rates depend primarily on the risks inherent in a particular investment, not on how it is financed: The value of a bank loan which is financed 90 percent by debt and 10 percent by equity is approximately the same as if it were financed with 50 percent debt and 50 percent equity.[9] Risk is distributed differently between debt and equity holders in the two financing schemes, but the total risk to be shared is the same. Hence the total cost of the risk, reflected in the weighted average cost of

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[8] Market risk is the aggregate economic risk that remains even after investors have diversified their portfolios to the fullest extent possible. Loans and loan guarantees expose the government to market risk because future repayments of loans tend to be lower when the economy is performing poorly and losses are more costly for the government to absorb. Prepayment risk arises when borrowers have the option to prepay a loan before its final maturity date. The prepayment option affects the probability and timing of defaults. Liquidity risk is the risk that market conditions may make it difficult to quickly find a buyer for an asset without large price concessions.

[9] This abstracts from the effects of taxes, financial distress, and other financing frictions, but those various effects push in different directions and their net effects vary, leaving risk as the central consideration that is relevant to the issues discussed here.

capital for the bank loan, is unaffected by how it is financed. This is the logic of the famous Modigliani and Miller (1958) theorem that remains a cornerstone of finance theory.

The risks inherent in government credit activities are similar to those in private credit transactions, but those risks are ultimately are borne by taxpayers and the general public in place of private equity holders. Consider a risky government loan, funded by the issuance of government debt. If the borrower repays the loan in full then the proceeds can be used to pay back the debt holders, and if there is money left over it can be used to increase other government spending or to reduce taxes. However, if the borrower defaults then the debt will be repaid using new tax revenues or reductions in other government spending. Taxpayers and the public are effectively equity-holders (albeit with unlimited liability) in government investments and bear the associated risks.

As we will see, the direct practical consequence of treating taxpayer-supplied equity as free is that countries' budgetary costs are downwardly biased, and the profits reported by government firms in their financial disclosures are upwardly biased. Those biases will be largest for credit activities that involve relatively large exposures to undiversifiable risk, such as government guarantees to financial institutions, and for government firms that achieve a very low borrowing cost because of public backing.

3.2 Current OECD Practices in Budgetary and Financial Reporting for Credit

The problems of incomplete and inconsistent cost measurement are more acute for credit support than for most other types of government spending because credit provision involves uncertain cash flows that often extend out over many years. That complexity, combined with the fact that governments tend to produce credit services in-house rather than purchasing them from financial institutions, creates latitude in how the costs of credit are measured and reported. Consequently, myriad approaches and formulas are used by OECD governments and government entities for estimating and reporting credit costs.

Budgetary costs are of particular importance because it is in the budget process that policymakers make tradeoffs between competing spending priorities. Whereas for government financial reporting there has been a move towards common standards across countries and with the private sector, there appears to

have been little effort to harmonize budgetary accounting across countries.[10] Nevertheless, for the purpose of understanding the most common budgetary practices and their main strengths and weaknesses, the various accounting approaches can be broadly characterised as: (1) off-budget; (2) cash basis; and (3) accrual basis.

Off-budget. For an important subset of OECD countries, some or all credit-related costs are omitted from national budgets. Survey data (Hawkesworth, 2010) indicates that for loan guarantees, no budgetary expenditures are reported apart from administrative fees for Canada, UK, Slovak Republic, Australia and Turkey. For direct loans, no expenditures apart from administrative fees appear for Canada, UK, Spain, Germany, Austria, Slovak Republic, Portugal and Turkey.[11] The survey responses also indicate that during the global financial crisis, some countries ignored general procedures due to the extreme circumstances or made adjustments to their standard procedures.[12]

Cash basis accounting. Those credit activities that are considered budgetary are most often accounted for by OECD countries on a cash basis. Cash accounting entails reporting the cash flows associated with a direct loan or credit guarantee in the years that they are realised.

Cash-basis accounting for credit has significant and widely recognized weaknesses. It delays recognition of the full cost of credit support until many years after the commitments are made, when cost information is most decision-relevant to policymakers. It distorts comparisons between the subsidies associated with economically equivalent direct loans and loan guarantees. Newly guaranteed loans may actually appear to make money because typically the government receives fees upfront and only bears the costs of defaults years later, often outside of the time horizon covered by the budget. By contrast, direct loans show a large upfront cost when principal is disbursed, even for loans that are likely to be repaid in

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[10] The International Public Accounting Standards Board endorses the use of accrual for budgetary accounting but does not require it: "The Cash Basis IPSAS encourages an entity to voluntarily disclose accrual based information, although its core financial statements will nonetheless be prepared under the cash basis of accounting. An entity in the process of moving from cash accounting to accrual accounting may wish to include particular accrual based disclosures during this process."

[11] Some countries (e.g., Norway and Denmark) report that no expenditures appear, but seem to contradict that by indicating that subsidy costs and write-offs of bad loans are reported. Presumably this reflects differences across programmes.

[12] The respondents for Denmark and Netherlands said they ignored the rules; those for Hungary, Finland, Mexico, Germany, Turkey, and the UK said they adjusted them.

full. Loans with high expected default rates appear initially to be no more costly to make or guarantee than those extended to the safest borrowers. Furthermore, cash accounting does not recognise the effects of time or risk on the value of cash flows.

A possible response to the shortcomings of cash-basis accounting is to simply not report credit costs in national budgets. However, excluding credit from budgetary accounts creates other problems, including that total government expenditures are underreported and that credit support becomes less transparent than other forms of spending. A more satisfactory alternative is to switch to an accrual basis of accounting for credit. When properly implemented, accrual accounting addresses all of the concerns noted above, although it has the disadvantages of somewhat complicating the preparation and interpretation of budgetary estimates.

Accrual accounting. Budgetary accruals measure the lifetime cost of new credit support in the year a commitment is made. Accruals are calculated by projecting the future cash flows associated with a loan or guarantee and discounting them to the present. Despite its conceptual advantages over cash accounting, the U.S. is the only major OECD country that appears to have adopted accrual accounting for activities classified as credit programmes.[13] That change, which took effect in 1996, represented a major improvement over the cash basis budgeting that preceded it. However, the implementation has some shortcomings—primarily the use of Treasury rates for discounting--that cause costs to be underreported, and that create inconsistences across the way functionally similar programmes are accounted for.[14]

The picture is brighter for financial reporting. The International Public Sector Accounting Standards Board (IPSASB) has promulgated accounting standards for public entities that are similar to

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[13] The U.S. budgetary system also includes a system of supporting accounts that are necessary to reconcile budgetary accruals for credit with the subsequently realized cash flows. As part of that reconciliation process, and to provide information about the accuracy of the initial cost projections, periodic cost reestimates that reflect realized cash flows and updates of projected cash flows are also reported. However, those reestimates do not affect the reported budget surplus or deficit.

[14] The stipulation in the law that U.S. Treasury rates be used for discounting causes those estimates to be a less-than-comprehensive measure of cost. For a few credit-related programs, most notably the Troubled Asset Relief Program enacted to respond to the 2007 financial crisis, the law requires budgeting to be on a fair value basis, which replaces discounting at Treasury rates with discounting at market-based rates. Other major U.S. credit support is classified as insurance and is budgeted for on a cash basis. Legislation has been passed in the House of Representatives that requires fair value accounting for most credit-related programmes (H.R. 3581) but the bill has not been taken up by the Senate.

the International Financial Reporting Standards (IFRS) that apply to private sector entities, but that allow specific differences that accommodate features special to public enterprises. Many OECD countries and government institutions have adopted some or all of IPSASB guidelines. Importantly, because it incorporates IFRS rules that require financial institutions to report balance sheet information on a fair-value basis, the IPSASB standards implicitly accept the relevance of market prices to governments. As a result of adopting those standards, government institutions such as multilateral development banks disclose a significant amount of information on their credit exposures and the value of loans and other financial holdings. However, as explained next, financial statement disclosures do not reveal the full cost of the credit support provided, and they were not designed to do so.

3.3 Extracting Cost Information: the Role of Budgetary Accounting, Financial Reporting, and Market Prices

An important question is how much can be gleaned about credit support costs from budgetary reports and financial statements, and how that information differs from what is available for publicly traded firms? The answer is shown here to depend on the budgetary accounting rules for credit support. Only when budgetary accounting is on a fair-value basis is the information provided equivalent to what is available for publicly traded firms.

It is useful to begin with a reminder of the different functions of government budgetary reports and financial statements. Budgets record a government's annual expenditures and receipts, primarily on a cash basis. Budgets are used to set spending priorities, and budgetary totals feed into the calculation of a country's official deficit.

Financial statements are designed to give a picture of the operations and overall financial health of a public or private sector enterprise. They also provide commentary on an enterprise's risk exposures. Financial statements include a balance sheet, which shows assets and liabilities; an income statement, which recognizes various categories of revenues and expenses generally using accrual concepts; and a

statement of cash flows, which tracks actual cash flows associated with different categories of receipts and payments.

Financial statements only provide partial information about the cost of capital: they treat interest payments on borrowed funds as an expense, but make no mention of the required return to equity capital. Instead, the difference between revenues and expenses is reported as earnings, which is an indication of the value accruing to equity holders. A government enterprise is generally referred to as "profitable" if those earnings are positive, even if they are insufficient to provide a fair rate of return on equity. Put differently, "economic profits" are only considered positive if returns exceed the weighted average cost of capital, whereas accounting profits are positive if returns exceed the cost of debt financing.

For a publicly traded firm, the fact that accounting profits exclude a return on equity is less consequential because of the availability of stock price information. Stock prices reveal whether the market views a firm's earnings as providing a fair rate of return to equity; when earnings fall short stock prices decline, and conversely when earnings exceed the required return. For that reason, a firm announcing a positive accounting profit may nevertheless see its stock price drop.

For national governments, budgetary cost estimates are the closest substitute for the information in stock price changes. Ideally, the budgetary cost of a programme represents the value of public resources committed to it. For grants and transfers, cash accounting achieves that objective. For credit support, budgetary accounting only represents the value of public resources committed—and stands in for the information in stock price changes for private firms--when it is carried out on a fair-value accrual basis. Because that is generally not the case, policymakers lack the cost information that is available to their private sector counterparts.

For a government firm or international financial institution, the information in its financial statements is more salient to its decision-making than the budgetary information about it that is reported by national governments. For those enterprises, even when financial reporting is on par with the best private sector practices and it includes a fair-value balance sheet, the full cost of credit activities is not likely to be recognized because of reliance on the accounting definition of profitability.

This line of reasoning suggests two main conclusions. Firstly, if governments were to report the budgetary costs of credit support on a fair-value basis, then the combination of financial reporting and budget estimates would provide information that at least in principle is similar to the information available to investors and mangers of publicly traded firms through financial reports and stock prices. The second is that for government firms and international financial institutions, even when financial reports conform to IFRS guidelines, the cost of capital is generally not measured or reported, and there is often a misplaced emphasis on accounting profitability that is likely to have real effects.

4. Quantifying Fair-Value Costs

To demonstrate some of the approaches that can be used to evaluate the fair-value cost of government credit support, and to compare the resulting cost estimates with the cost information disclosed under current budgetary and financial accounting regimes, three examples are analyzed: (1) the European Bank for Reconstruction and Development (EBRD); (2) the U.S. Tennessee Valley Authority (TVA); and (3) the European Financial Stability Facility (EFSF) and the successor European Stability Mechanism (ESM).

Those examples were chosen with several considerations in mind. A substantial amount of credit assistance from OECD governments is channeled through international financial institutions such the EBRD, as shown in Section 2. The EBRD's structure, activities and financial disclosures are typical of those types of institutions, and the results are therefore suggestive of the costs for other development banks. With regard to TVA, although quite a bit has been written on the fair-value costs of U.S. government credit programmes, much less attention has been paid to the cost of credit support delivered through non-financial government firms. TVA serves as an example of how large credit subsidies are conveyed through government firms in the U.S. and elsewhere, and how those costs are obscured by current budgetary and financial reporting practices. The EFSF and ESM were chosen because of the size and importance of those facilities and because costs estimates do not appear to have been previously

attempted. That analysis also illustrates the greater challenges involved in estimating the cost of open-ended contingent guarantee programmes.

4.1 European Bank for Reconstruction and Development

The EBRD is an international financial institution that was established in 1991 to provide financial support for projects that "foster innovation and build sustainable and open market economies from central Europe to central Asia and in the southern and eastern Mediterranean."[15] It supports such projects with loans, equity investments, and guarantees. It also holds a portfolio of safe assets for liquidity, and it uses derivatives to hedge against interest rate and currency risk. Assets totaled EUR51 billion in 2012, of which EUR18.8 billion were loan investments in its banking portfolio.

The capital structure of the EBRD is similar to that of other large international financial institutions. The bank relies on mandatory equity contributions and so-called "callable capital" from its members to obtain low borrowing costs on the debt issued. Callable capital represents firm commitments from members to purchase additional shares up to an agreed upon maximum, should capital infusions become necessary.

The EBRD is owned by 64 countries, the European Union and the European Investment Bank. A member's equity stake consists of its paid-in capital plus cumulative returns, which may be negative. Table 5.1 shows the 2012 capital subscription (the sum of paid-in and callable capital) of the top 12 equity holders, which collectively accounted for about 70 percent of total subscriptions. The ratio of members' paid-in capital, reserves and surpluses; to its outstanding loans, share investments and guarantees; is required to be above 50 percent. Under the callable capital arrangement, members are obligated to increase their equity stakes if required by the Bank's Board of Governors. Effectively, equity holders provide the EBRD with a free call option. The callable capital creates a substantial cushion for its debt against default. Because of those protections, the EBRD is able to issue debt in international capital markets that has consistently carried an AAA rating.

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[15] EBRD Annual Report, 2012.

Capital calls are infrequent, but they do occur. For example, the EBRD Board authorized a capital

call in 2010 to comply with its statutory capital requirement. It increased paid-in shares immediately by

EUR1 billion and increased authorized callable capital shares by EUR9 billion. There are provisions in

the law for redeeming callable shares in the future if the bank has sufficient capital, but it appears that

equity purchases are essentially non-refundable cash expenditures by member countries.

Table 4.1: Top Capital Contributors to the EBRD

EBRD Top Capital Contributors	Capital subscription (000 Euros)
United States of America	3,001,480
France	2,556,510
Germany	2,556,510
Italy	2,556,510
Japan	2,556,510
United Kingdom	2,556,510
Russian Federation	1,200,580
Canada	1,020,490
Spain	1,020,490
European Investment Bank	900,440
European Union	900,440

4.1.1 Financial Reporting

In reporting its financial results, the EBRD generally follows IPSASB guidelines. Consequently,

the EBRD's reporting is quite informative about the value of its assets and liabilities, which it reports at

fair value as well as book value. Not surprisingly, the return on equity is considerably more volatile when

reported on a fair-value basis, as shown in Table 4.2. The EBRD also enumerates its various risk

exposures, and provides data that could inform a quantitative estimate of that exposure. For example, the

Bank reports the distribution of investments by credit risk category, by country and by industry.

As is standard in government and private sector financial reporting, the only component of capital

costs that is recognized in the EBRD's income statement is its interest costs. Those interest costs are

much below the full cost of capital for the bank, which includes a fair return on equity and the annualized

cost of callable capital. Put differently, the EBRD is reported to be profitable on an accounting basis in

any year where the return on equity is positive, whereas it is only profitable on an economic basis if the average return on equity and callable capital exceeds a fair rate of return.

Table 4.2: Returns to members' equity, fair value vs. book value					
	2012	2011	2010	2009	2008
Return on members' equity--IFRS basis*	8%	0%	12%	-2%	-15%
Return on members' equity--Realised basis*	7%	5%	8%	2%	3%
Source: EBRD Financial Report 2012					
*The IFRS basis corresponds to fair value returns, and the realised basis is a book value measure.					

4.1.2 Fair value vs. Reported Cost of Capital

A straightforward way to estimate the fair-value cost of capital for an enterprise such as the EBRD is to identify the cost of capital for private-sector firms in a similar line of business.[16] The calculation of the weighted average cost of capital here relies on the Capital Asset Pricing Model (CAPM) and a typical asset beta for the banking industry. The EBRD's activities are clearly similar to, but not identical to, those of private financial institutions. On the one hand, it is possible that the EBRD is exposed to more credit risk than a typical bank because it finances projects whose sponsors have had difficulty obtaining private sector funding. On the other hand, in some case those risks may be mitigated by the superior enforcement mechanisms available to the EBRD as compared to local banks. To the extent that any additional risk is largely idiosyncratic (e.g., arising from economic shocks to small countries), it would not affect the asset beta or the cost of capital calculation.

The components of the weighted average cost of capital calculation for the EBRD in 2012 are summarized in Table 4.3. The asset beta is set to 0.3, based on global data on banks over the last five years provided by Professor Damoradan.[17] The market risk premium (the difference between the short-term risk free rate and the required return on the stock market) is set to 6.5 percent, consistent with historical returns data and typical industry assumptions about this parameter. The 3-month government borrowing rate, which represents the risk-free rate, is set to .0003, consistent with the low interest rates in

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[16] The approach applied in this section is commonly used by financial practitioners and is recommended by standard corporate finance textbooks.
[17] The asset beta is based on returns data on 568 banks globally, as reported by Damodaran. http://pages.stern.nyu.edu/~adamodar/

that year. Together, those assumptions imply a required return on assets is .0003 + .3(.065) =1.98 percent. Multiplying the required return on assets by the value of bank assets implies a cost of capital for the year of (.0198)(EUR 52 billion) = EUR 1.03 billion.

The total annual financing cost implied by this calculation is about three times the cost of debt financing that appears in the EBRD's income statement. In its 2012 Annual Financing Report, the EBRD shows borrowing costs inclusive of hedging expenses of 0.89 percent on its debt of EUR 37.1 billion, which implies a borrowing cost of EUR 331 million. The difference—EUR 699 million (EUR 1030 million – EUR 331 million) is the unreported capital cost for 2012. The corresponding unreported capital cost for 2011 is EUR 716 million.

Table 4.3: Calculating the Weighted Average Cost of Capital for the EBRD		
	2012	2011
Interest Expenses	155	145
Hedging Expenses	176	118
Assets (Fair value, EUR millions)	52,015	46,622
Total Debt (Fair value, EUR millions)	37,106	33,724
Borrowing cost (interest plus hedging)	0.89%	0.78%
Risk Free Rate (3-month t-bill)	0.03%	0.15%
Market risk premium	6.50%	6.50%
Asset Beta	.3	.3
Required Return on Assets	1.98%	2.1%
Unrecognized capital subsidy	699	716
All euro amounts are in millions		

4.1.3 The Value of Callable Capital

The unrecognized capital costs reported in Table 4.3 include the annual required return on the EBRD's callable capital. However, to understand the fair-value cost to a government of entering into a new or incremental callable capital arrangement that will remain in force indefinitely, it is useful to be able to estimate the value of that standalone commitment over a longer time horizon. The estimates presented here can be interpreted as fair-value accruals, and the derivatives pricing approach used to

calculate them illustrates a flexible methodology that government analysts could adopt to budget for the cost of new callable capital commitments (in lieu of the current off-budget treatment that represents them as costless).[18]

The cost of callable capital for the EBRD is estimated using a derivatives-pricing approach that builds on Lucas and McDonald (2006, 2010), modified to replace bankruptcy events with periodic and stochastic draws on member capital. The cost has the interpretation of being the present value of future capital infusions associated with capital calls. The model builds on the basic insights in Merton (1974, 1977), and on the extensions of Crosbie and Bohn (2003) to a more complex capital structure. The basic idea is that adverse shocks may cause asset value, and hence equity value, to fall below a threshold that causes a capital call to restore target equity ratios and thereby protect debt holders from losses. The call option exposes governments to significant market risk, and its value reflects that it is most likely to be exercised when the economy is weak and the cost of capital is high. The model is dynamic, and incorporates that over time the EBRD will tend to adjust its leverage, but those adjustments are gradual and can only partially offset exogenous shocks to risky asset values. Appendix I describes the model and its parameterization in more detail.

The model is calibrated using EBRD financial data for 2012. Asset volatility, which is not directly observable, is a critical parameter affecting guarantee value. For publicly traded firms, asset volatility can be inferred from market data using a derivatives pricing approach, but for government firms that data is not available. For the EBRD, the annual standard deviation of asset values used in the guarantee cost calculation is .075, which is based on the standard deviation of the reported fair-value equity of .104 from Table 4.2, and an assumed standard deviation for debt values of .03, weighted by the 2012 proportions of debt and equity. Setting asset volatility to .075 may be conservative; Damodaran reports volatility of bank assets of 29 percent.

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[18] Using a derivatives pricing model is generally the most accurate way to value call options, and it is a frequently-used approach in practice.

Another important but unobservable parameter is the liability-to-equity threshold for capital calls. The threshold rule is based on the EBRD's stated requirement that equity be maintained at a level of at least 50 percent of risky assets. However, it is restated for this analysis in terms of a maximum liability-to-equity ratio that triggers a call.[19] The distribution of the size of the equity infusions when capital is called depends on multiple parameters, but most importantly on asset volatility; the level that the liability-to-equity ratio is restored to when new capital is added; and how often the threshold condition is checked. In the base case, equity is restored to 45 percent of liabilities, which is typical for that ratio for the EBRD over the last five years. Risky asset values are shocked monthly, but the threshold condition is checked only quarterly. The trigger is checked only quarterly to capture policy inertia and the fact that financial statements tend to be updated at that frequency.

Under the base case parameterization, the cost of total callable capital over a 20-year horizon is EUR 7.2 billion.[20] The call option is exercised in about 6 percent of years. As is to be expected, the cost of the option is considerably less than the amount of callable capital outstanding (which stands at EUR 23.4 billion), but is nevertheless significant. The estimate is sensitive to the various modeling assumptions and in particular to the assumed volatility of assets. For example, if average asset volatility is lowered to 3.75% then the cost falls to EUR 2.7 billion and the call is exercised in 1.4% of years; and if volatility is increased to 10 percent then the cost rises to EUR 11.8 billion and the call is exercised in 9.7% of years. More generally, the calculation underscores why omitting the cost of contingent credit liabilities from budgetary totals can significantly understate government expenditures.

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[19] The model tracks the market value of risky assets, not their book value. Stating the capital call trigger in terms of a maximum market asset to equity ratio can create the perverse situation where an increase in the market value of risky assets triggers a capital call. That problem is avoided by using a book liability ratio to express the trigger and target ratios.

[20] The present value of costs is calculated over a horizon truncated at 20 years for several reasons. One is that policies are unlikely to remain unchanged over long horizons, reducing the relevance of costs predicted to be incurred in the more distant future under current policy. Furthermore, with a longer horizon parameter uncertainty becomes more of an issue, and small errors in assumptions about growth rates or discount rates are compounded.

4.2 Tennessee Valley Authority

TVA, the largest wholesale supplier of electricity in the United States, is wholly owned by the federal government. Its assets, which include coal-fired, nuclear and hydroelectric generators and an extensive transmission system, have a reported book value of $47.3 billion in 2012.[21]

TVA funds its assets primarily through long-term debt issues to investors and also from earnings. Under the 1959 TVA Self-Financing Act, TVA is one of the few federal agencies in the U.S. that issues debt in its own name rather than through the U.S. Treasury. Its debt is subject to a cap, currently of $30 billion. Despite a history of losses that have repeatedly threatened its solvency, its debt has maintained a rating of AAA and its borrowing costs have historically exceeded comparable maturity Treasury bonds by only about 40 basis points. As emphasized by Logue and MacAvoy (2003), the low borrowing cost reflects the implicit guarantee from the U.S. government on its debt obligations.[22] Similarly to other government firms, TVA does not recognize in its financial statements any cost of the implicit guarantee provided by taxpayers.[23]

The estimated market value of the annual subsidy associated with the implicit debt guarantee is calculated using a weighted average cost of capital approach parallel to that used for the EBRD in Section 4.1.2. The required return that investors would demand on TVA's assets is based on the CAPM and the asset beta for electrical utilities. Following Logue and MacAvoy, the asset beta is taken to be 0.6. The market risk premium is fixed at 6.5 percent, a standard assumption for this parameter. The 3-month T-bill rate, which varies across years, represents the risk-free rate. For example, the required return on assets is estimated to be 3.93 percent: .0003 + .6(.065) for 2012. Applying that to the book value of assets (and hence approximating the market value of assets by the reported book value), a fair return to TVA's

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[21] TVA reports under GAAP, and is not required to report on the fair value of its operating assets.

[22] See Logue and MacAvoy (2003) for a more complete description of the history and operations of TVA.

[23] The implicit guarantee on its debt is one of several types of direct and indirect government subsidies TVA receives. The company does not pay corporate taxes on earnings, nor does it pay local or state property taxes. It does make payments equal to 5 percent of revenues in lieu of taxes to the counties and states which house the system, but on net it receives a tax subsidy. TVA is restricted to operating within its service area, where it has a legislatively enforced monopoly. Its pension fund, which was underfunded by $4.9 billion in 2012, also is thought to have an implicit government guarantee.

investors debt and equity holders collectively would be (.0393)($47,334 million) = $1.860 billion. TVA reports a borrowing cost of 5.08 percent on debt of $25,078, for a total capital cost of $1.273 billion. The difference between the fair return to all investors and the borrowing costs is the unreported capital cost: $587 million in 2012. Table 4.4 shows the result of that calculation for the years 2008 to 2012. Over that period, the understatement of capital costs totaled about $3 billion.

The understatement of capital costs in TVA's financial statements has been mitigated in recent years by the interaction of two factors: the long average maturity of about 17 years for TVA debt; and interest rates on average have declined over the last two decades. To abstract from those effects, Table 4.4 also shows what the understatement of capital costs would have been had TVA borrowed anew each year at the prevailing AAA bond rate.[24] Under that counterfactual, the understatement of capital costs over the 2008 to 2012 period would have been $4.38 billion.

Table 4.4: Unrecognized Capital Cost Subsidies to TVA					
	2012	2011	2010	2009	2008
Interest Expenses	$1,273	$1,305	$1,294	$1,272	$1,376
Book Assets	$47,334	$46,393	$42,753	$40,017	$37,137
Total Debt	$25,078	$24,431	$23,424	$22,640	$22,619
Borrowing cost	5.08%	5.34%	5.52%	5.62%	6.08%
Risk Free Rate (3 month t-bill)	0.03%	0.15%	0.06%	0.13%	2.75%
20-year Constant Maturity Treasury +50bps	3.20%	4.78%	5.00%	3.96%	4.85%
Market risk premium	6.50%	6.50%	6.50%	6.50%	6.50%
Asset Beta	0.6	0.6	0.6	0.6	0.6
Required Return on Assets	3.93%	4.05%	3.96%	4.03%	6.65%
Unrecognized capital subsidy at historical interest rates	**$587**	**$574**	**$399**	**$341**	**$1,094**
Unrecognized capital subsidy at current interest rates	**$1,058**	**$711**	**$522**	**$716**	**$1,373**
All dollar amounts are in millions					

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[24] The AAA bond rate is based on the 20-year constant maturity Treasury rate plus 50 basis points.

The understatement of capital costs is under current accounting conventions invisible to TVA's managers and to policymakers. TVA is accounted for by U.S. budgetary agencies on a cash basis, which does not discriminate between revenues, expenses and capital expenditures, and which excludes capital charges except to the extent that interest payments reduce revenues. Specifically, the effect of TVA on the reported surplus is the difference between revenues (e.g., from electricity sales), and operating expenses plus capital expenditures. Statements in TVA's 2013 Budget Proposal support the contention that TVA's management does not perceive the implicit guarantee on TVA's debt as a cost. It states that: "TVA has not received federal government appropriations since 1999. Additionally, TVA makes annual returns to the U.S. Treasury on the government's original $1.4 billion appropriated investments in the power program. Through fiscal year FY 2014, TVA expects to have paid approximately $3.7 billion, principal and interest, to the U.S. Treasury."

The understatement of TVA's cost of capital in its accounting statements and the omission of a capital charge to recognize the cost of the risk to taxpayers in the federal budget almost certainly has real effects on regional electrical consumption and on TVA's investment policies. Under the TVA Act of 1933, the company is required to deliver a reliable supply of power (and a variety of other public services such as flood control) at the lowest possible rates to consumers. Because rates are set with the goal of recovering costs, the definition of costs affects electrical rates and hence the demand for electricity. The subsidized borrowing rate in itself reduces perceived costs and hence utility rates, which increases demand relative to its unsubsidized level. To the extent that different power generating technologies embody different amounts of market risk, the focus on its borrowing rate as its cost of capital distorts choices between alternative types of generating capacity.

4.3 European Financial Stability Facility and European Stability Mechanism

The EFSF was created in May 2010 in response to the Eurozone crisis. It was structured as a temporary rescue mechanism with the mandate of safeguarding financial stability in Europe by providing financial assistance to euro area Member States. In October 2010, EFSF participants decided to create a

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permanent rescue mechanism, the ESM. The ESM has the same membership, mission and structure as the EFSF. Going forward, any new assistance will be funded and managed by the ESM. However, the EFSF will continue to administer and fund ongoing programmes for Greece, Portugal and Ireland. For the purposes of this analysis, they are effectively a consolidated enterprise (and referred to as EFSF/ESM).

The EFSF/ESM has authority to issue bonds or other debt instruments on the capital markets. Member capital and callable capital allow it to maintain a high credit rating (currently AA+) and hence to borrow at favorable interest rates.[25] Paid-in capital is invested in low-risk and liquid securities to serve as a buffer for losses. New debt is issued to make loans to member countries experiencing or threatened by severe financing problems and agreeing to the conditions set. The funds may also be used to purchase bonds in the primary or secondary bond markets, to fund precautionary assistance in the form of a credit line, and to finance recapitalisations of financial institutions through loans to governments.

Financial information on the EFSF/ESM is available from the ESM's 2012 Annual Report and the websites of both organizations. To date, the bulk of assistance has gone to Greece, Portugal and Ireland. For those countries, Table 4.5 summarizes the disbursed amounts (which total EUR 168 billion) and remaining amounts authorized (which total EUR 18.9 billion) as of July 2013. The ESM has also provided financial assistance to Spain for the recapitalisation of its financial sector, and is providing funding to Cyprus.

Table 4.5: EFSF Amounts Disbursed and Available

	Already disbursed	Remaining amount available	Max. total
Ireland	**14.4**	**3.3**	**17.7**
Portugal	**21.1**	**4.9**	**26**
Greece	**133.04**	**10.66**	**144.6***

In €billion
*Includes EUR 0.95bn of a facility whose availability period has ended.

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[25] The bonds are also eligible for purchase by the ECB.

A measure of the maximum prospective exposure of ESM members under current agreements is remaining subscribed capital available to be called, which stands at EUR 620 billion. (However, the rules allow for increasing that amount if certain conditions are met.[26]) To date, EUR 80 billion has been paid in. The largest top 5 subscriptions account for 83 percent of the total in each category.[27]

The prospective fair-value cost to EFSF/ESM members is measured here as the present value of expected future capital calls over a horizon of 20 years, as was done for the EBRD earlier.[28] The calculations employ a derivatives-pricing approach, implemented with a modified version of the EBRD model. However, estimating cost for the EFSF/ESM is more challenging, and there is more uncertainty associated with the estimates.

Capital calls by the EFSF/ESM are likely to be less frequent but larger when they occur than for a development bank, because they are associated with particularly negative shocks to Eurozone economies and financial markets. Hence, the growth rate of the ESM's future assets and liabilities is likely to be highly variable, with long periods of no growth or shrinkage as existing loans are paid off, followed by a rapid balance sheet expansion in the course of a year or two if a major crisis were to develop. The amount of new assistance forthcoming not only depends on financial market developments, but also on policy decisions of the EFSF/ESM in terms of what countries to assist and in what amounts. In most years there will be little new activity because episodes of the sort the EFSF/ESM is designed to protect against are rare. Crises are likely to occur when the European and world economies are weak and the cost of capital is relatively high, and clearly the activities entail considerable undiversifiable risk, but the fair value cost of risk during a crisis is hard to determine.[29] Furthermore, the EFSF/ESM's loans outstanding are much less diversified than that of a typical development bank, and may experience discontinuous losses in value

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[26] It takes unanimous agreement among members for certain major changes including making capital calls. However, there is an emergency voting procedure that brings the required share-weighted approval rate down to 85% if the EC or ECB think there is an event that would threaten the economic and financial stability of the euro area.

[27] The largest subscribers are: Germany EUR 190 billion; France EUR 142 billion; Italy EUR 125 billion, Spain EUR 83 billion; and Netherlands EUR 40 billion.

[28] Related analysis (CBO, 2010, and Veronesi and Zingales, 2010), examine the cost of facilities created by the U.S. government to respond to the 2007 financial crisis.

[29] In this analysis no risk premium is attributed to jump risk, which imparts a conservative bias to the cost estimates.

when borrowers experience new difficulties. Unlike for smaller government firms, general equilibrium effects the ESM's actions also must be taken into account, at least informally. Importantly, the presence of the ESM may reduce the likelihood of future financial distress relative to the past. To the extent possible, effect of the policy on the probabilities of future events and losses should be reflected in the choice of model parameters.

Despite those complicating factors, it is informative to model the prospective cost of the programme and to consider the implied costs over a range of parameterizations. A relatively simple approach is taken here that is intended to illustrate the range of possible costs rather than a definitive estimate. The model could be expanded to incorporate more information about the size of exposures of individual members, differences in the probabilities of requiring assistance, and a more explicit correlation structure between them, but that is left to future research.

To adapt the EBRD model for the EFSF/ESM, stochastic jump processes are incorporated that govern the probability and severity of upward jumps in the size of its balance sheet, and that allow downward jumps to existing risky asset values. Incorporating jump processes is one way to incorporate the idea that the tails of the relevant distributions are fatter than those of normal distributions. In the base case, the jump process is set to trigger a crisis in about 6 percent of years. That frequency was chosen based on the observation that large international crises such as the Great Depression or Great Recession occur at a lower rate, but that for countries and regions serious financial problems have historically arisen more frequently.[30] Consistent with EFSF/ESM's policies, balance sheet growth caused by the jumps is modeled as being financed with additional debt issuance. Capital calls are triggered in the model when the ratio of liabilities-to-equity rises above a threshold level. That ratio may rise either because of balance sheet growth financed with debt issues, or because of a drop in the value of existing assets. Capital

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[30] Some might argue that the likelihood of a crisis in the Eurozone over the next few years is much higher, given the imbalances and stresses in the system. The model can accommodate a time-varying probability of a crisis, but such cases were not explicitly examined. However, the sensitivity analysis shows that an increase in the assumed frequency of crises from occurring in 6% of years to 9% of years, doubles the estimated cost of the committed callable capital.

infusions are invested in safe assets, and enough capital is called to restore the target liability-to equity ratio. The model and its parameterization are described more fully in Appendix 2.

The cost of undiversifiable risk is incorporated in the pricing of the callable capital through the assumption about the risk premium on risky assets. The expected return on risky assets is set at 2.7% over the risk-free rate, and 2% over the EFSF/ESM's borrowing rate (which is also assumed to be higher than the short-term risk-free rate, consistent with observed yields). EFSF/ESM purchases of distressed sovereign claims are likely to occur when those assets have been trading in the market at spreads in excess of the assumed risk premium. However, consistent with the idea that fair values exclude any distress or abnormal liquidity premium, and taking into account that observed spreads contain compensation for expected losses as well as a risk premium, the spread is chosen to be in line with bonds on the border between investment and non-investment grade.

Under the base case parameterization, the fair value cost to member governments of providing callable capital over 20 years is EUR 36 billion. However, that estimate is quite sensitive to changes in the assumed parameter values. Table 4.6 reports the cost estimates for a variety of parameterizations, with each row showing the effects on cost of changing one parameter at a time. All other parameters are held at their base case values, which are listed in Appendix Table A2.1. Altering one parameter at a time highlights which assumptions the model is most and least sensitive to.[31] The assumed frequency and severity of a crisis has the largest effect on predicted cost, whereas the estimates are relatively insensitive to the parameters driving portfolio risk during non-crisis periods. That is to be expected; the target amount of equity capital to risky loans already acquired is high and the risk of needing equity beyond what has already been paid in to absorb losses is low. However, new crises tend to trigger the need for large capital infusions.

The sensitivity analysis suggests that the cost of current callable capital commitments is likely to be in the range of 20 to 80 billion euros for a plausible range of parameter values, and depending most

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[31] Combinations of parameter variations are also not considered because information is not available to inform assumptions about their joint distribution.

critically on the assessed probability and severity of future crises.[32] Some might argue that the current

imbalances and stresses in the Eurozone system make the likelihood of a crisis over the next few years

higher than the 6% annual rate assumed in the base case. Increasing the assumed frequency to a 9% rate

doubles the estimated cost of the callable capital relative to the base case, and put it near the high end of

the range considered.[33] By contrast, in its financial statements (which consolidate the finances of the

EFSF and the ESM), the ESM shows a modest loss of EUR 498 million, none of which is related to

prospective costs. The budgetary treatment of paid-in and callable capital by member countries has not

been verified, but it is probable that callable capital is off-budget and hence effectively is treated as

having no cost. Of course the benefits of having a safety net in place may far outweigh the estimated cost,

but that can only be determined when information about cost is made available.

The reported cost estimates are based on an average over many Monte Carlo simulations. Figure

1 shows the distribution of cost estimates across 5,000 Monte Carlo simulations. The modal outcome is

that the EFSF/ESM makes no capital calls over a 20-year period. However, there is a long right tail, and

outcomes of over EUR 100 billion are observed in about 2% of runs.

The lack of recognition of the cost of capital by the EFSF/ESM has a direct effect on the pricing

of assistance to member countries. The EFSF/ESM's philosophy about cost recovery is prominently

stated in its Annual Report: "The ESM does not aim to generate profit on financial support granted to

beneficiary member states." In keeping with that policy, and with the standard practice of government

institutions of treating taxpayer equity capital as costless, the ESM charges interest rates on the risky

loans that it makes that effectively pass through its own borrowing costs plus a small spread to cover

administrative expenses. A 200 bps penalty rate is imposed on delinquent loans. Adding to the opacity of

costs, the EFSF/ESM's financial reporting is much less revealing than that of a typical multilateral

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[32] No probabilities are associated with different values in the reported range because of the difficulty of assessing the probability of crisis states, of alternative ESM policy reaction functions, and so forth. The range of parameter values considered was chosen to cover a plausible range for each component, taking into account factors such as the historical frequency of financial crises.

[33] The model can accommodate a time-varying probability of a crisis, but to more cleanly demonstrate the magnitudes of the effect of parameter changes on the predicted costs, such scenarios are not reported.

development bank. The EFSF/ESM did not adopt IPSASB guidelines, and notably, it omits a fair value balance sheet from its financial statements.
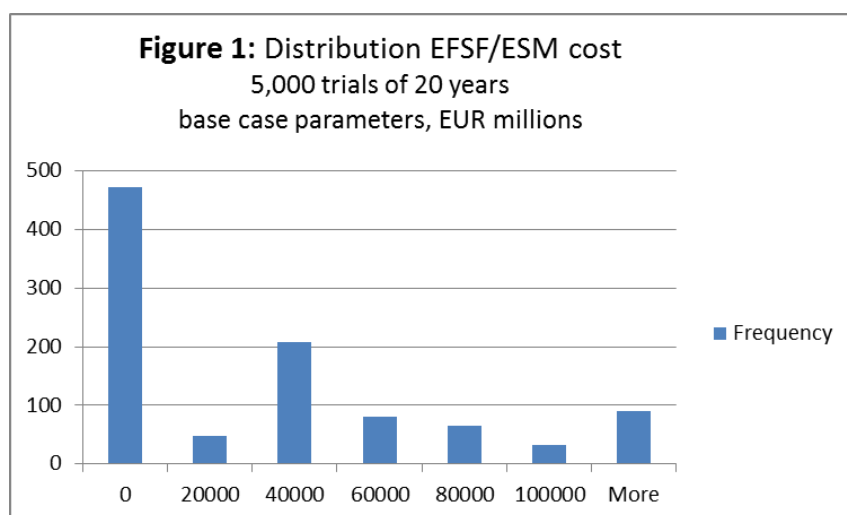
Figure 1: Distribution EFSF/ESM cost
5,000 trials of 20 years
base case parameters, EUR millions

Table 4.6: Prospective Cost and Call Probability for EFSF/ESM Callable Capital
           Sensitivity to Key Parameters

(EUR billions)

Annual crisis probability	0	.03	.06	.09
Cost	0	19	38	59
Annual call probability	0.0%	1.5%	3.2%	5.0%
Risky asset multiplier in crisis	1.25x	1.5x	1.75x	2x
Cost	12	38	65	92
Annual call probability	0.9%	3.2%	4.6%	5.2%
Asset jump frequency, annual, no crisis	0	.05	.1	.2
Cost	38	38	39	39
Annual call probability	3.0%	3.1%	3.3%	3.4%
Risky asset volatility (non-jump component), annual	.05	.1	.15	.2
Cost	34	36	38	42
Annual call probability	2.8%	3.0%	3.2%	3.7%
Trigger liabilities-to-equity (relative to target ratio)	1.05x	1.1x	1.2x	1.3x
Cost	41	40	38	35
Annual call probability	5.3%	4.3%	3.2%	2.4%

Note: Each row varies only the listed parameter from its base case value.

5. Implementation challenges

Even if a switch by governments to fair value accounting for credit support is advantageous in principle, whether it would be an improvement over the status quo would depend in part on the quality of the implementation. Practical challenges include the need to establish rules for selecting methodologies for a variety of applications; the possibility that fair value estimates would be less transparent and more manipulable than ones based on simpler rules; and the costs of educating government analysts on how to prepare and communicate fair value estimates to policymakers and the public. Political resistance to disclosing higher budgetary costs is likely to be an obstacle as well, although a constituency for greater government transparency also exists. These issues are briefly discussed in this section and deserve more attention than in future studies.

It appears that many practical concerns could be addressed by the adoption of the accounting standards and practices that have developed to guide and discipline the production of fair value estimates by private sector financial institutions. Because fair value calculations play such a prominent role in the private sector (in mandated financial disclosures as well as in transactional analyses), valuation and accounting consultancies have developed considerable expertise in the available methodologies and in model-building, and something of a consensus has emerged about the best practices for a variety of applications. That foundation could be drawn on by governments to provide discipline and consistency to fair value cost estimates, as a source of private contractors to assist in model building and auditing, and as a resource for educating government employees. Another mitigating factor is that most government credit support is provided through large and ongoing programmes. Once models and approaches are established and vetted for a given program, the incremental costs of producing fair value estimates should be similar to that of preparing accrual estimates using government rates for discounting.

For guarantee programs such as the EFSF/ESM that involve the insurance of tail risk, there will always be differences of opinion on modeling assumptions and little data to resolve them. Certainly that has been the experience with the stress-testing that has been mandated for systemically risky banks.

Nevertheless, in such cases the modeling exercise provides important information that is absent for guarantees under current practice that only quantifies *ex post* costs.

Manipulation is a legitimate worry, but arguably a switch to fair value accounting would make it easier to detect than under the status quo of discounting at government interest rates. Government entities release little or no information about the cash flow forecasts that underlie their reported accrual estimates, and those cash flow forecasts are at least as easily manipulated as the choice of discount rates. The plausibility of fair value cost estimates tends to be easier to assess when data is available on the pricing of similar private sector transactions (e.g., for mortgages). By contrast, meaningful comparisons based on market pricing data are not possible when governments use their own borrowing rates for discounting.

It is difficult to predict whether the political consensus that is needed to implement such accounting changes will emerge. Two observations suggest that it might: One is the adoption of IFRS standards (which have increasingly embraced fair value concepts) by the International Public Sector Accounting Standards Board. Another is the steps taken that direction in by U.S., including the adoption of fair value estimates in the budgetary process for select programmes, and the passage of a bill in the House of Representatives that mandates fair value accounting for credit programmes. Research leading to greater awareness of the bias toward cost understatement and its consequences could also change perceptions among policymakers about the advisability of change.

5.1 Would Fuller Recognition of Capital Costs Improve Incentives for Public Managers?

Whether the benefits of implementing a switch to a fair value accounting regime would outweigh the costs depends among other things on whether it would result in better decision-making by public sector managers and policymakers. Some evidence that it could be beneficial in that regard is found in the experiences of private sector firms that have adopted a measure of "economic value added" or EVA.

A switch to evaluating the profitability of government firms net of its weighted average cost of capital (rather than net of borrowing cost) would be akin to the practice in the private sector of using an EVA approach to evaluating managerial performance. EVA was popularized in the 1990s as a way to

better align managers' incentives for investment choices with stockholder interests. Rogerson (1997) demonstrates the theoretical potential for improvement; he shows that in a variety of settings with asymmetric information between principals and managers, incentive contrasts based on EVA can elicit first best behavior by managers.

Evidence on the effects of EVA adoption by private sector firms suggests that decision-making in the public sector might be improved by a fuller recognition of the cost of capital. For example, Daske et. al. (2013) find that the seriousness with which firms rely on EVA principles varies, but that serious adopters exhibit superior performance. The incentives facing public and private sector managers clearly would remain different, particularly because government pay is more weakly tied to performance than in private firms. Nevertheless, one would expect that if managers received more accurate signals from accounting data about firm profitability, project choices at least on the margin would be improved.

6. Conclusions and areas for further research

Accounting data--budgetary cost estimates and financial statement entries--comprise the price system facing policymakers. This paper makes the case for the importance of providing the most accurate available price signals about the costs of credit support, and for using fair value cost estimates to do so, particularly for budgeting purposes. A look at the accounting policies of OECD governments reveals the wide gap between that recommendation and current practice: For many types of credit support little or no cost information is provided, and reported costs are systematically and often significantly understated.

Analyses of the EFSF/ESM, EBRD and TVA illustrate the magnitude of the disparities between fair value estimates and the costs currently reported by governments. These examples also demonstrate the feasibility of developing fair value estimates even for relatively complex credit support arrangements. However, the analyses presented here are not intended to be the final word on the costs of any of these programmes, and it is possible that other approaches or assumptions could improve the estimates. What is important is that while there is significant uncertainty around any of the point estimates, in contrast to official figures, there is no reason to suspect a systematic upward or downward bias in the estimates.

Furthermore, the exercise of model-building is useful in identifying costs and risks that might be otherwise overlooked. Although adoption of fair value accounting for credit support by governments would involve additional costs and challenges, the infrastructure developed to support fair value reporting by private sector firms could be used as a source of expertise and to provide discipline to the process of cost estimation.

The most striking results are for the EFSF/ESM, where the cost of the outstanding amount of subscribed callable capital to member countries is estimated to be in the range of 20 and 80 billion euros (depending on one's assessment of the likelihood and severity of future crises), but for which no cost is reported by the EFSF/ESM or by member countries in their budgets. The cost of subscribed callable capital for the EBRD is similarly absent from government reports, but it is estimated here to be about EUR 7 billion on a fair value basis. A calculation of EBRD's capital costs on an annual basis shows a fair value financing cost that is about three times the cost of debt financing that appears in the EBRD's income statement. For TVA, the cost of capital for 2012, inclusive of the implicit government guarantee of its debt, is estimated to be $587 million more than the borrowing costs that appear in its income statement.

The analysis suggests several fruitful directions for future research. A foundational project would be to compile a comprehensive inventory of credit support for all OECD countries and international financial institutions, along with the rules governing their budgetary and accounting treatments.[34] Relatedly, subnational government credit support activities and account procedures, e.g., credit extension by local governments, could be systematically investigated. Compiling that information in one place and on a consistent basis would shed light on the total amounts of credit support and the exposures of different governments. It would also lay the groundwork for other researchers and policy analysts to

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[34] A first step would be to define the scope of what constitutes credit support, for instance, whether or not to count the implicit guarantees that are widely expected to be honored but that do not have legal standing. Challenges would include defining categories of credit that cut across the classifications used by different governments, and representing the size of the obligations in a way that is most comparable across types of support.

undertake more detailed analyses of the costs and risks of government credit support, including the development of new valuation models for the many large and complex contingent claims on governments.

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Appendix 1
Modeling the Cost of Callable Capital for the EBRD

The cost of callable capital for the EBRD is estimating using a derivatives pricing model, implemented using Monte Carlo simulation. This Appendix describes the logic and main equations behind the model, and lists the base case parameters. The code, which is in VBA, is available upon request.

A risk-neutral version of the model is used for valuation, and a corresponding set of equations with actual expected returns and therefore actual probabilities is used to calculate the physical probability of default. (Only the equations for the risk-neutral representation are shown here.) The EBRD's assets are divided into safe and risky ones. The time evolution of the risky assets follows a log-normal process:

$$(A1.1) \quad A_{t+h} = A_t Exp\left[(r_f - .5\sigma_{A,t}^2)h + \sigma_{A,t}\varepsilon\sqrt{h}\right]$$

where h is the time step, which is set to one month, t subscripts represent time, r_f is the risk-free rate, $\sigma_{A,t}$ is the volatility of risky assets, and ε is a draw from a standard normal distribution. The volatility parameter is subscripted by time because the model accommodates time-varying volatility.[35] The corresponding actual evolution of risky assets follows the same process, but with their expected return (as described earlier) in place of r_f.

The risk-neutral evolution of the safe assets held for liquidity is deterministic:

$$(A1.2) \quad B_{t+h} = B_t Exp\left[r_f h\right]$$

The corresponding actual process is also deterministic but assumes a 50 bps higher return on the assets. The existence of a positive spread on assets that are treated as being risk-free can be interpreted as a liquidity premium; it is included in order to make the assumed rates of return on the bank's liquid asset

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[35] Volatility is assumed to be constant in the reported results. However, Lucas and McDonald (2006) shows that if managers substitute towards riskier assets when equity is low, the estimated cost of a government guarantee may be significantly higher than under the assumption of constant volatility.

portfolio more realistic. Notice that no dividends are paid to equity holders; returns on assets are assumed to be reinvested in the bank, as appears to be historical practice. Therefore in the model, actual bank assets grow on average over time at the expected rate of return on investments. An assumption of faster or slower growth would affect the cost estimates.

To capture the rebalancing between risky and liquid asset that occurs over time as loans mature or liquid securities are sold and replaced by new investments, the model incorporates a periodic partial adjustment towards the target asset mix. The adjustment rate is assumed to be asymmetric, with desired increases in risky asset holdings occurring more rapidly than desired decreases in risky asset holdings. As for callable capital, adjustments occur quarterly. Upward adjustments of the risky asset-to-equity ratio move 50% of the way to the target for that ratio over the course of a year, whereas downward adjustments move only 3% to the target. The target ratio is close to the actual ratios reported for 2011 and 2012. The adjustment rates are chosen to capture the idea that it is fairly easy to sell liquid assets and reinvest them in riskier ones, but there may not be enough desirable risky projects available to immediately restore the target asset mix. The rate of downward adjustment is assumed to be much slower because of the difficulty of liquidating risky and opaque bank loans. Allowing for adjustment to the asset mix maintains a more stable and realistic ratio of risky assets-to-equity than if no adjustments were allowed. A faster speed of downward adjustment would lower the estimated cost of callable capital, whereas a faster speed of upward adjustment would increase the cost. However, the cost estimates are similar to what is reported in the base case for modest changes to the assumed adjustment speeds.

Debt liabilities, L, are assumed to increase deterministically at a rate equal to the interest rate paid on them (with the same 50 bps difference between the risk-neutral and actual processes as for liquid assets):

(A1.3) $\quad L_{t+h} = L_t Exp[r_f h]$

Because the rate paid on the debt is the same as the rate earned on liquid assets held, an increase in liquid asset holdings has an equivalent effect on cost as an equal-value decrease in debt. The specification

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implies that interest paid out is financed by additional debt issues, so that debt outstanding grows over time. Equity is then calculated as the difference between assets and liabilities:

(A1.4) $E_t = A_t + B_t - L_t$

Capital is called when the ratio of liabilities-to-equity, L_t/E_t, exceeds the trigger, which is based on interpreting the statutory requirement that equity be maintained at a level of at least 50 percent of (book) banking assets as corresponding most closely in the model to a relation between liabilities and equity. The condition for whether the trigger is tripped is checked quarterly, reflecting that monitoring and the production of new information about asset values is fairly infrequent. When capital is called, it is in an amount that restores the target liability-to equity ratio. The new capital is assumed to be initially invested entirely in risk-free liquid assets.

The logic of the Monte Carlo simulation is as follows: At the beginning of each Monte Carlo run, variables are initialized to the values of risky and riskless assets and liabilities in 2012. Each month going forward over a 20-year period, a draw of a standard normal random variable, scaled by σ_A, determines the evolution of risky assets according to equation A1.1. Safe assets, liabilities and equity evolve according to A1.2, A1.3, and A1.4 respectively. Every quarter, L_t/E_t is compared to the trigger value for a capital call. If the trigger is tripped, equity is called in an amount that restores L_t/E_t to its target ratio. Also every quarter, the ratio A_t/E_t is compared to its target value, and the mix of risky and risk-free assets are adjusted towards the target for that ratio according to the adjustment rule described above. Along each Monte Carlo path, the amount and timing of each capital call is recorded, and the payments are discounted to time 0 using the risk-free rate in the risk-neutral representation of the model. The reported fair value cost of the guarantee is the average cost over the 10,000 Monte Carlo runs. The physical call probabilities are based on the results of applying the same shocks to the evolution of actual risky assets and averaging over the Monte Carlo runs. Table A1.1 lists the main parameter values used in the base case calculations.

Table A1.1: Parameters for EBRD Callable Capital Model	
Name	Base Case Value
Number Monte Carlo runs	10,000
Time horizon	20 years
Risk-free rate, r_f (annual)	.003
Return on liquid assets and liabilities, r_B (annual)	.0078
Expected return on risky assets, $E(r_A)$ (annual)	.0198
Initial liquid assets, B_0 (EUR millions)	26,528
Initial risky assets, A_0 (EUR millions)	25,487
Initial liabilities, L_0 (EUR millions)	37,106
Volatility risky assets, σ_A	.15
Liability-to-equity target	2.91/1
Liability-to-equity trigger	2.24/1
Target risky asset-to-equity ratio for rebalancing asset mix	1/.65
Adjustment rate of A_t/E_t to target when A_t/E_t > target	.03
Adjustment rate of A_t/E_t to target when At/E_t < target	.5

Appendix 2

Modeling the Cost of Callable Capital for the EFSF/ESM

Estimates of the cost of callable capital are derived using a variant on the model for the EBRD. Apart from a recalibration and rule changes that reflect policy differences, the main technical change is the incorporation of two jump processes. The first process represents the occurrence of a crisis (i.e., an event that triggers the purchase of additional assets) in the Eurozone, and the second allows for a discrete downward jump in the value of existing balance sheet loans. The probability of a downward jump in the value of existing assets is assumed to increase during a crisis. Those jumps effectively create a fatter lower tail for asset values than if they were normally distributed. The occurrence of a crisis causes the purchase of additional risky assets, and an equal increase in debt liabilities. Existing loans amortize over time, but there is no rebalancing between risky and risk-free assets.

Under a risk-neutral representation in discrete time, risky assets (generally taking the form of risky sovereign debt) on balance sheet evolve according to:

(A2.1) $$A_{t+h} = (1 + I_{J,t}\omega_t)A_t Exp\left[(r_f - p_j\omega_t - .5\sigma_{A,t}^2)h + \sigma_{A,t}\varepsilon\sqrt{h}\right] - A_t\alpha + I_{C,t}\Delta A_t$$

where h is the time step (taken to be one month in the simulations), t subscripts represent time, r_f is the risk-free rate, $\sigma_{A,t}$ is the possibly time-dependent normally distributed component of the volatility of asset value, ε is a draw from a standard normal distribution, ω is the non-stochastic jump size, $I_{J,t}$ is an indicator that a jump in existing assets has occurred (the probability of which jumps up during a crisis), $p_j h$ is the probability of a jump over an interval of length h, α is the constant fraction of balance sheet assets repaid each period, $I_{C,t}$ is an indicator that a crisis occurs, and Δ is the increase in risky assets during a crisis, based on the amount currently on ESM's balance sheet inflated at a 2% annual growth rate. The actual evolution of risky assets is identical except that r_f is replaced by the expected return on assets r_A.

New equity from capital calls is invested in liquid assets. The risk-neutral evolution of liquid assets is:

(A2.2) $$B_{t+h} = B_t Exp[r_D h]$$

The rate earned, r_D, is the same rate paid by ESFS/ESM on their debt. Notice that no dividends are paid to equity holders; asset returns are assumed to be reinvested in the bank. Debt liabilities, L, increase deterministically at a rate equal to the interest rate paid on them, and decline by the amounts repaid each period as risky assets are retired. They also increase by the amount of new assets purchased during a crisis:

(A2.3) $$L_{t+h} = L_t Exp[r_D h] + -A_t \alpha + I_{C,t} \Delta A_t$$

Equity is then calculated as the difference between assets and liabilities:

(A2.4) $$E_t = A_t + B_t - L_t$$

Capital is called when the ratio of liabilities-to-equity, L_t/E_t, exceeds the trigger, which is assumed in the base case to be 20% higher than the target for this ratio. The target is taken to be the current ratio of liabilities to equity. The condition for whether the trigger is tripped is checked quarterly. When capital is called, it is in an amount that restores the target liability-to equity ratio. The new capital is assumed to be initially invested entirely in liquid assets.

The logic of the Monte Carlo simulation is as follows: At the beginning of each Monte Carlo run, variables are initialized to the values of risky and riskless assets and liabilities. Each month going forward over a 20-year period, a draw of a standard normal random variable, scaled by σ_A, determines the normal component of the evolution of risky assets according to equation A2.1. Two draws from a uniform distribution each month determine whether there is a crisis and an increase in risky asset holdings, and whether there is a jump down in the value of existing risky assets. Safe assets, liabilities and equity

evolve according to A2.2, A2.3, and A2.4 respectively. Every quarter, L_t/E_t is compared to the trigger

value for a capital call. If the trigger is tripped, equity is called in an amount that restores L_t/E_t to its

target ratio. Along each Monte Carlo path, the amount and timing of each capital call is recorded, and the

payments are discounted to time 0 using the risk-free rate in the risk-neutral representation of the model.

The reported fair value cost of the guarantee is the average cost over the 20,000 Monte Carlo runs. The

physical call probabilities are based on the results of applying the same shocks to the evolution of actual

risky assets and averaging over the Monte Carlo runs. Table A2.1 lists the main parameter values used in

the base case calculations.

Table A2.1: Parameters for EFSF/ESM Callable Capital Model	
Name	Base Case Value
Number Monte Carlo runs	20,000
Time horizon	20 years
Risk-free rate, r_f (annual)	.003
Return on ESM debt and liquid assets, r_B (annual)	.01
Fair value expected return on risky assets (annual)	.03
Initial liquid assets, B_0 (EUR millions)	80,000
Initial risky assets, A_0 (EUR millions)	39,461
Initial liabilities, L_0 (EUR millions)	39,461
Annual rate of asset repayment, α	.027
Volatility risky assets, σ_A non-jump component	.15
Probability crisis,	.06
Risky asset multiplier if crisis, Δ	1.5x
Probability jump down in risky assets, p_J, non-crisis, annual	10%
Probability jump down in risky assets, p_J, crisis, annual	25%
Jump size as percent of risky assets in crisis, ω	-20%
Liability-to-equity target	39.461/80
Liability-to-equity trigger	1.2 x target