Evaluating the Cost of Government Credit Support: The OECD Context

Deborah Lucas
MIT Sloan

Prepared for the Inaugural Conference of the MIT Center for Finance and Policy, September 12-13, 2014, Cambridge, MA
Governments allocate a large share of societies’ capital and risk through their credit-related activities

Efficient resource allocation requires accurate information about costs
- Also about benefits and +/- externalities, but here the focus is on “grant-equivalent” cost

Governments systematically understate the cost of providing credit support
- This is codified in financial and budgetary accounting rules and laws
- It manifests itself in a number of ways
- The adverse consequences are significant, but have gone mostly unrecognized

Three examples illustrate the size and nature of the costs and some approaches to measuring them accurately
- TVA, EBRD, and ESM
Outstanding Government-Guaranteed Bonds and Debt of Government-Related Enterprises, OECD Countries (percent of GDP)

(Excludes contingent guarantees and national credit programs)

Source: IMF 2012 Fiscal Monitor
Three big questions

1. What is the right way for governments to think about their cost of capital?
   - *Answer:* The same way as large firms in the private sector

2. How do OECD governments think about their cost of capital in practice?
   - *Answer:* It’s a government’s own borrowing rate

3. How much does it matter that governments understate their cost of capital?
   - *Answer:* It matters a lot
     - for measurement, transparency, and resource allocation
What is the right way for governments to think about their cost of capital?

*Answer:* The same way as do large firms in the private sector.
Robust principles from finance theory

- The cost of capital is **related** to the priced risk (e.g., β risk) of the project financed
- The cost of capital is **not related** to the proportion of debt and equity used to finance the project (Modigliani-Miller)
  - This is a first approximation—taxes, etc. also affect cost

Key relations:

\[
E(r_A) = r_f + \beta_A (r_f - E(r_m)) = \frac{D}{V} E(r_D) + \frac{E}{V} E(r_E)
\]

- \(D = \text{Debt}\)
- \(E = \text{Equity}\)
- \(V = D + E\)
- \(E(R_A) = \text{expected return on firm assets}\)
- \(E(R_E) = \text{expected return on firm equity}\)
- \(E(R_D) = \text{expected return on firm debt}\)
- \(R_f = \text{risk-free rate}\)
- \(E(r_m) = \text{expected return on market portfolio}\)
- \(\beta_A = \text{beta of firm assets}\)
Financial guarantees are “put options”
- A put option gives the holder the right but not the obligation to sell a specified object at a preset price

Put options concentrate risk on the put writer
- E.g., loan guarantees are equivalent to a highly levered position in the stock of the guaranteed firm
- Therefore they have a high cost of capital
- Guarantees can be properly valued using an options-pricing approach
  - E.g., variations and extensions of Black-Scholes-Merton formula
Those robust principles also logically apply to government investments

- Importantly, the cost of capital for a risky government investment is higher than the interest rate it pays on its debt.

- **Example:** The government makes a risky loan to finance an investment in new electrical generation.
  - Principal is $100 million
  - Interest rate charged is 3%
  - Government borrowing rate is 2%
  - Maturity is 1 year
Why a government’s cost of capital exceeds its borrowing rate

- Notional government balance sheet right after loan is made:

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risky loan $100m</td>
<td>Government Debt $100m</td>
</tr>
</tbody>
</table>
Why a government’s cost of capital exceeds its borrowing rate

- Notional balance sheet at end of the year if the loan pays off in full:

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash $103m</td>
<td>Government Debt $102m</td>
</tr>
</tbody>
</table>

“Profit” of $1 million
Why a government’s cost of capital exceeds its borrowing rate

- Notional balance sheet at end of the year if the loan defaults and recovery is only $80m:

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash $80m</td>
<td>Government Debt $102m</td>
</tr>
<tr>
<td></td>
<td>Taxpayers -$22m</td>
</tr>
</tbody>
</table>

- Government borrowing costs are only low because of taxpayer backing, they are unrelated to the risk of a particular investment.

- **Taxpayers and the public are de facto equity holders in government investments**—they absorb any gains or losses.

- Hence, the government’s cost of capital is logically a weighted average of the cost of debt and equity (as for a private sector firm).
  - Cost depends on the undiversifiable risk of the project, not how it is funded
How do governments think about their cost of capital in practice?

*Answer:* It’s the government’s own borrowing rate
Governments treat their cost of capital as their own borrowing rates

- National governments, local governments, international government financial institutions, and government firms all tend to follow that practice

They define profits as accounting profits, not economic profits

- Accounting profits are positive if expenses including interest costs are less than revenues
- Economic profits are positive if expenses including the full cost of capital (i.e., the project WACC inclusive of equity costs) are less than revenues
- Often accounting profits are positive but economic profits are negative

Consequently, the subsidies arising from credit and investment programs often are unrecognized in budgetary accounts and financial statements
Cost information appears in financial statements and in budgets
- Budgetary accounting is often the more decision-relevant

Under IPSAS rules, government accounting standards are similar to private sector IFRS standards
- In particular, government financial institutions are required to show a fair value balance sheet under IFRS
- But guarantees are off-balance-sheet
- And income statements do not include a fair return to equity as a cost

Budgetary accounting is much less standardized
- Credit is on cash basis for many countries, and on a naïve accrual basis for the U.S.
- Many countries do not report guarantee costs in their budgets until losses are realized
A few words on accounting

- Useful to compare the available information about the cost of government credit to that for publicly-traded financial companies
  - Both have similar financial statements
  - Publicly-traded companies have observable stock price changes
  - Governments have observable budgetary costs

- The information revealed for public and private entities is similar only when budgetary costs are reported on a fair value basis
  - Budgetary costs on a fair value basis are in principle the same as the stock price change upon announcement of a new investment
    - Stock price changes by the NPV of the investment; fair value budgetary effect is the NPV of the investment
  - In practice, most governments budget on a cash basis and ignore the ex ante cost of financial guarantees
How much does it matter that governments understate their cost of capital?

*Answer:* It matters a lot.
Potential adverse consequences of understated capital costs

- **Overinvestment and capital misallocation**

- **Over-reliance on credit support** (e.g., government loans and loan guarantees) relative to other types of assistance, such as grants or in-kind transfers, whose costs are measured more fully
  - Credit programs can appear to make money
  - Especially tempting during periods of fiscal consolidation

- **Reduced government transparency**
  - Unrecognized subsidies
  - Underreporting of the size of the public sector
  - Unrecognized aggregate financial risk in the world economy

- **Encourages a buildup of financial risk by governments**, increasing the likelihood of future funding shortfalls that could hinder governments’ capacity to respond to future adverse shocks
Quantitative examples illustrate:

- **Methods** used to infer government capital costs
- **Magnitudes** of government cost underestimates

The paper analyzes three examples:

- Capital costs for Tennessee Valley Authority (TVA)
- Capital costs and value of callable capital for European Bank for Reconstruction and Development (EBRD)
- Cost of callable capital for European Stability Mechanism (ESM)
Cost of capital for TVA

- TVA is the largest wholesale supplier of electricity in the U.S., supplying about 1/6 of total electrical power
  - Its assets include coal-fired, nuclear and hydroelectric generators and an extensive transmission system.
- It is wholly owned by the U.S. federal government
- It funds investments with debt issues and retained earnings
- Historically it has taken large losses
- Nevertheless, it is rated AAA and able to borrow at low rates because of the implicit backing of the federal government
Simple weighted-average cost-of-capital (WACC) approach can be used to estimate capital costs

- My calculation: Annual cost = \( r_A \times A \) (forward-looking)
- Gov’t calculation: Annual cost = \( r_D \times D \) (historical)

Procedure:

- **Step 1**: Infer required return on TVA assets from returns on similar private sector firms using the CAPM
- **Step 2**: Compare implied financing cost to reported cost of debt financing. Difference is understatement of capital costs.
### Table 1: Calculation of Unrecognized Capital Cost Subsidies to TVA

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interest Expenses</strong></td>
<td>$1,273</td>
<td>$1,305</td>
<td>$1,294</td>
<td>$1,272</td>
<td>$1,376</td>
</tr>
<tr>
<td><strong>Book Assets</strong></td>
<td>$47,334</td>
<td>$46,393</td>
<td>$42,753</td>
<td>$40,017</td>
<td>$37,137</td>
</tr>
<tr>
<td><strong>Total Debt</strong></td>
<td>$25,078</td>
<td>$24,431</td>
<td>$23,424</td>
<td>$22,640</td>
<td>$22,619</td>
</tr>
<tr>
<td><strong>Borrowing cost</strong></td>
<td>5.08%</td>
<td>5.34%</td>
<td>5.52%</td>
<td>5.62%</td>
<td>6.08%</td>
</tr>
<tr>
<td><strong>Risk Free Rate</strong></td>
<td>0.03%</td>
<td>0.15%</td>
<td>0.06%</td>
<td>0.13%</td>
<td>2.75%</td>
</tr>
<tr>
<td><strong>Market risk premium</strong></td>
<td>6.50%</td>
<td>6.50%</td>
<td>6.50%</td>
<td>6.50%</td>
<td>6.50%</td>
</tr>
<tr>
<td><strong>Asset Beta</strong></td>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td><strong>Required Return on Assets</strong></td>
<td>3.93%</td>
<td>4.05%</td>
<td>3.96%</td>
<td>4.03%</td>
<td>6.60%</td>
</tr>
<tr>
<td><strong>Unrecognized capital subsidy</strong></td>
<td>$587</td>
<td>$574</td>
<td>$399</td>
<td>$341</td>
<td>$1,094</td>
</tr>
</tbody>
</table>

All dollar amounts are in millions.
Cost of capital for TVA

- **Consequences:**
  - TVA managers think of the firm as profitable when it isn’t
  - Underpricing of electricity
  - History of over-investment

- **Notes to table:**
  1. Reported in TVA 2012 Annual Report
  2. Based on historical data and CAPM calculations for utility industry, as reported in Logue and MacAvoy (2003)
  3. The required return on assets is for 2012 is \(0.003 + 0.6(0.065) = 3.93\%\) based on the CAPM
  4. Unrecognized subsidy = \((\text{Required return on assets}) \times (\text{assets}) - (\text{Interest rate}) \times (\text{debt})\)
What is the EBRD?
- A multilateral development bank
- Owned by 64 member countries
- Established in 1991 to provide financial support for projects to build sustainable and open market economies from central Europe to central Asia and elsewhere

How is it structured?
- The bank supports projects with loans, guarantees and equity. Also holds a portfolio of safe assets for liquidity
- Financed by debt, member equity, and **callable capital**
EBRD treats its cost of capital as its borrowing cost, and on a book value basis it appear profitable in most years.

Debt issues have a AA+ rating and carry a low interest rate because of member backing.

As for TVA, the difference between its true cost of capital and its borrowing cost gives the unreported capital cost.

The true cost-of-capital can be approximated using the CAPM, and taking the $\beta$ to be that of international banks.

- My calculation: Annual cost = $r_A \times A$ (forward-looking)
- EBRD calculation: Annual cost = $r_D \times D$ (historical)
### Calculating the Weighted Average Cost of Capital for the EBRD

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assets (Fair value, EUR millions)</strong></td>
<td>52,015</td>
<td>46,622</td>
</tr>
<tr>
<td><strong>Total Debt (Fair value, EUR millions)</strong></td>
<td>37,106</td>
<td>33,724</td>
</tr>
<tr>
<td><strong>Borrowing cost (interest plus hedging)</strong></td>
<td>0.89%</td>
<td>0.78%</td>
</tr>
<tr>
<td><strong>Risk Free Rate (3-month t-bill)</strong></td>
<td>0.03%</td>
<td>0.15%</td>
</tr>
<tr>
<td><strong>Market risk premium</strong></td>
<td>6.50%</td>
<td>6.50%</td>
</tr>
<tr>
<td><strong>Asset Beta</strong></td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td><strong>Required Return on Assets</strong></td>
<td>1.98%</td>
<td>2.1%</td>
</tr>
<tr>
<td><strong>Unrecognized capital subsidy</strong></td>
<td>699</td>
<td>716</td>
</tr>
</tbody>
</table>

All euro amounts are in millions
Multi-year cost of callable capital

Callable capital allows the EBRD to demand additional funds from members should its equity fall below a threshold

- Member countries are writers of the call options

- Governments usually recognize no cost of the call options until they are exercised

- Call options represent a significant upfront cost to governments
Callable capital is valued with a generalized options-pricing approach following Lucas and McDonald (2006 and 2010)

- Structural approach based on current assets, asset volatility, dynamic capital structure adjustment rules, call threshold

Cost of committed callable capital over 20 years for EBRD estimated to be **EUR 7.2 billion to member countries.**

- Annual probability of call estimated to be about 6 percent
  - Significant uncertainty around point estimate, sensitive to parameter assumptions
  - Estimated cost is most sensitive to asset volatility assumption
The EFSF was created in May 2010 to respond to Eurozone crisis. A rescue mechanism with the mandate of safeguarding financial stability by providing financial assistance to euro area Member States.

- ESM is the permanent version.

Authority to issue bonds backed by member capital and callable capital.

- Bonds are rated AA+ because of the EUR 620 billion callable capital.

Governments recognize no cost of the call exposure until losses are realized.

Callable capital again can be valued using a generalized options-pricing approach (this time including jumps) following L&M 2010.

Cost of committed callable capital to members over 20 years for EFSF/ESM estimated to be EUR 20 to 80 billion.
OECD governments systematically understate their cost of capital by treating it as their borrowing rate

- More accurate cost accounting would switch many credit activities and projects from appearing profitable to appearing unprofitable
  - Some projects that are unprofitable may still be socially beneficial
  - That switch of sign is especially salient to policymakers

- Cost understatement is particularly severe for financial guarantees
  - Often not reported as having any cost unless a loss is realized

- Correcting that situation would require major changes in the budgetary accounting practices of OECD governments
  - For most it would require a move from cash to fair value accruals
  - Legislative proposal in U.S. would implement such changes
Conclusions and final thoughts

- More research is needed to
  - **Inventory credit support and the available information about cost** (at national and subnational levels, around the world)
  - **Inventory and compare budgetary accounting practices** for credit and other investments across countries
  - **Develop and implement robust/practical methodologies for cost estimation**
  - **Apply those methodologies** to measure the cost of large credit support programs
  - **These are part of the research agenda being supported by the new MIT Center for Finance and Policy**
  - Thank you!
Cost of Callable Capital for the EFSF/ESM

Methodology (in brief)

- “Risk-neutral” Monte Carlo valuation model
- Risky assets evolve stochastically
  - A jump process indicates occurrence of infrequent crisis state
  - Asset volatility process can be time- and state varying; tricky to calibrate
- Liabilities increase by the amount of new loans made in a crisis
- Capital is called when the ratio of liabilities-to-equity exceeds a trigger threshold
  - The amount called is set to restore target liability-to-equity ratio
  - New capital is invested in safe liquid assets
- Cost of callable capital is present value of model-predicted call amounts, averaged over 20,000 Monte Carlo runs over 20 years
Table 4.6: Prospective Cost and Call Probability for EFSF/ESM Callable Capital
Sensitivity to Key Parameters

(EUR billions)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>0</th>
<th>.03</th>
<th>.06</th>
<th>.09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual crisis probability</td>
<td>Cost</td>
<td>1</td>
<td>13</td>
<td>36</td>
</tr>
<tr>
<td>Annual call probability</td>
<td>0.0%</td>
<td>1.3%</td>
<td>3.1%</td>
<td>5.3%</td>
</tr>
<tr>
<td>Risky asset multiplier in crisis</td>
<td>1.25x</td>
<td>1.5x</td>
<td>1.75x</td>
<td>2x</td>
</tr>
<tr>
<td>Cost</td>
<td>8</td>
<td>36</td>
<td>80</td>
<td>139</td>
</tr>
<tr>
<td>Annual call probability</td>
<td>1.0%</td>
<td>3.1%</td>
<td>4.4%</td>
<td>5.3%</td>
</tr>
<tr>
<td>Asset jump frequency, annual, no crisis</td>
<td>0</td>
<td>.05</td>
<td>.1</td>
<td>.2</td>
</tr>
<tr>
<td>Cost</td>
<td>35</td>
<td>36</td>
<td>36</td>
<td>37</td>
</tr>
<tr>
<td>Annual call probability</td>
<td>2.9%</td>
<td>3.0%</td>
<td>3.1%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Risky asset volatility (non-jump component), annual</td>
<td>.05</td>
<td>.1</td>
<td>.15</td>
<td>.2</td>
</tr>
<tr>
<td>Cost</td>
<td>35</td>
<td>35</td>
<td>36</td>
<td>37</td>
</tr>
<tr>
<td>Annual call probability</td>
<td>2.7%</td>
<td>2.8%</td>
<td>3.1%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Trigger liabilities-to-assets (relative to target ratio)</td>
<td>1.05x</td>
<td>1.1x</td>
<td>1.2x</td>
<td>1.3x</td>
</tr>
<tr>
<td>Cost</td>
<td>39</td>
<td>38</td>
<td>36</td>
<td>34</td>
</tr>
<tr>
<td>Annual call probability</td>
<td>6.4%</td>
<td>4.5%</td>
<td>3.1%</td>
<td>2.4%</td>
</tr>
</tbody>
</table>

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