

Putting the Finance into Public Finance: Theory, examples, and future directions

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Overview

1. Background
2. Application: Re-evaluating the profitability of SOEs
3. Other applications
4. Conclusions

References:

D. Lucas, "Evaluating the Cost of Government Credit Support: The OECD Context," *Economic Policy*, 2014

D. Lucas, "Valuation of Government Policies and Projects," *Annual Review of Financial Economics*, 2012

D. Lucas "Credit Policy as Fiscal Policy," *Brookings Papers on Economic Activity*, Spring 2016

Finance academics often focus on government as a regulator of private financial institutions



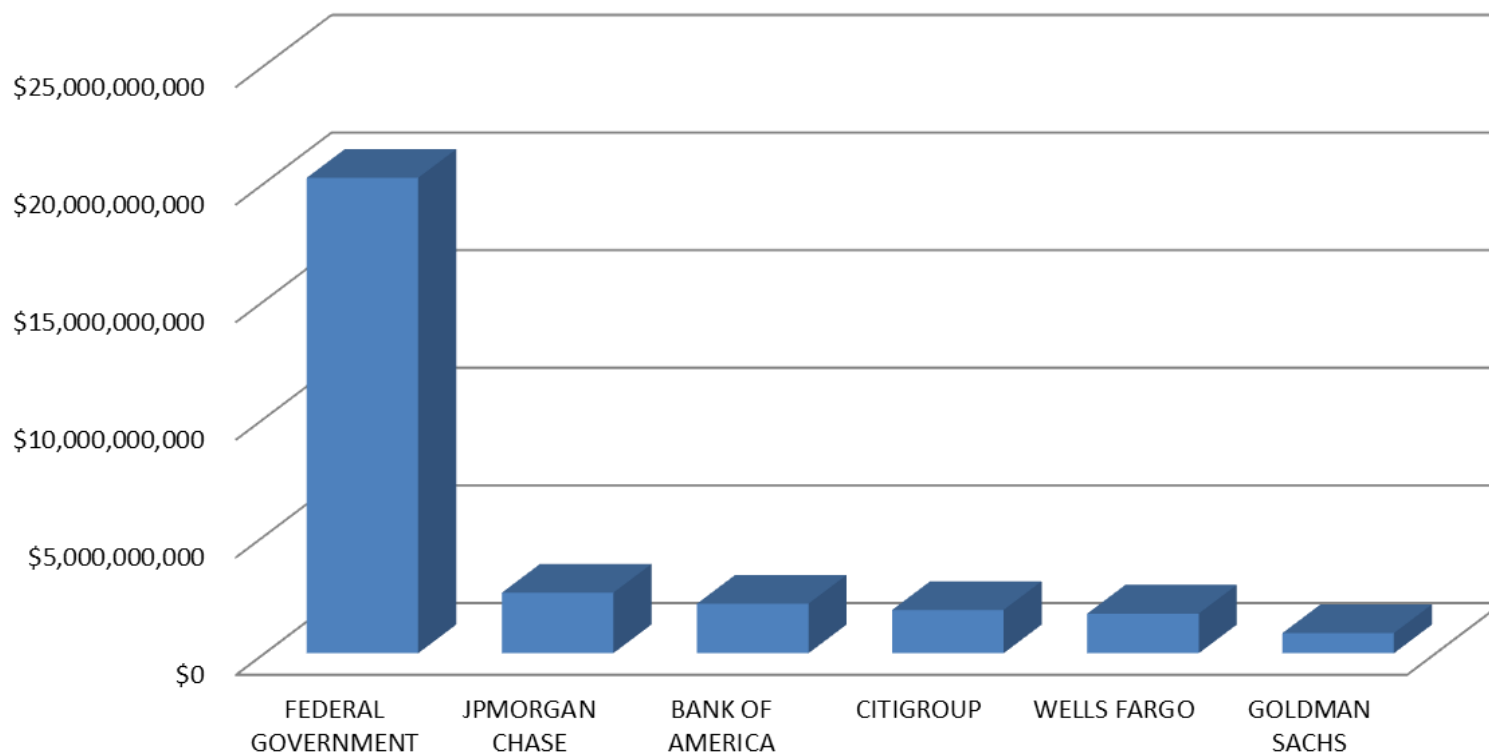
But in fact, governments are themselves the world's largest financial institutions and most important financial decision-makers



E.g., the federal gov't is the largest U.S. financial institution

Gov't obligations include mortgage guarantees, student loans, deposit insurance, small business and agricultural loan guarantees, etc. (excludes health and other insurance)

Assets or Insured Obligations (\$000s)



The need for an improved financial policy paradigm

- Research agenda on “Governments as Financial Institutions”
 - Aims to put the finance into public finance...
- Recognizes importance of gov'ts as financial decision makers
 - Largest allocators of real and financial capital around the world
 - Government loans and financial guarantees, equity investments in SOEs, and infrastructure finance
- Aim is to create new information about costs, benefits and risks of gov't financial activities
 - **Data** collection and **creation** (because gov't statistics often insufficient)
 - **Conceptual clarification** of cost and risk
 - **Policy analyses** that apply robust valuation principles from financial economics to gov't decision-making

Three big questions

- **(1)** What is the right way for governments to think about their cost of capital (i.e., discount rate)?
 - *Answer:* The same way as large firms in the private sector
- **(2)** How do 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

Re-evaluating the profitability of SOEs

- **Macro approach to measuring misallocation of capital**

- E.g., Bai, Hsieh, Qian, BPEA, 2006; Hsieh and Klenow, 2009

- Output

$$Y = \gamma L^{(1-\alpha)} K^\alpha$$

- Optimization

Choose K to maximize

$$\gamma L^{(1-\alpha)} K^\alpha - rK - wL$$

- Efficiency requires setting $MPK = r$

$$\gamma(L/K)^{(1-\alpha)} = r$$

- **A firm is economically profitable if $MPK > r$**

Re-evaluating the profitability of SOEs

- **Financial approach to measuring misallocation of capital**

- E.g., David Schmid and Zeke (2018) show that taking risk adjustment into account helps to rationalize the persistent cross-sectional differences in productivity

- Output

$$Y = \gamma L^{(1-\alpha)} K^\alpha$$

- Optimization

Choose K to maximize

$$\gamma L^{(1-\alpha)} K^\alpha - r_A K - wL$$

- Efficiency requires setting $MPK = r_A$

$$\gamma(L/K)^{(1-\alpha)} = r_A$$

- **A firm is economically profitable if $MPK > r_A$**

From macro-finance to Modigliani-Miller

- 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:

$$\begin{aligned} E(r_A) &= r_f + \beta_A(r_f - E(r_m)) \\ &= \frac{D}{V}E(r_D) + \frac{E}{V}E(r_E) \end{aligned}$$

D = Debt

E = Equity

$V = D + E$

$E(R_A)$ = expected return on firm assets

$E(R_E)$ = expected return on firm equity

$E(R_D)$ = expected return on firm debt

R_f = risk-free rate

$E(r_m)$ = expected return on market portfolio

β_A = beta of firm assets

Economic profitability vs. accounting profitability

- $r_A \times A$ (\approx net income + interest in accounting terms)
- Economic profitability requires:

$$r_A \times A > r_D \times D + r_E \times E$$

- Accounting profitability requires:

$$r_A \times A > r_D \times D$$

- Profitability at SOEs is equated to accounting profits, not economic profits
 - Consistent with gov't view that cost of capital is own borrowing rate
 - But even worse because when using equity financing treats required return to equity as zero(!)
 - Same mistake can happen in private sector, but equity prices provide some discipline

Example 1:

Cost of capital for a large SOE



- This SOE is the largest wholesale supplier of electricity in its country, supplying about $\frac{1}{6}$ of total electrical power
 - Its assets include coal-fired, nuclear and hydroelectric generators and an extensive transmission system.
- It funds investments with debt issues and retained earnings
- Historically it has taken large losses
- It is rated AAA and able to borrow at low rates because of its implicit gov't backing

Cost of capital for a large SOE



- Simple weighted-average cost-of-capital (WACC) approach can be used to estimate capital costs
 - My calculation: **Annual cost** = $r_A \times A = r_D \times D + r_E \times E$
 - Gov't calculation: **Annual cost** = $r_D \times D$ (missing $r_E \times E$)
- **Procedure:**
- Step 1: Infer required return on assets from returns on similar private sector firms using the CAPM
 - Asset beta from Damoradan
 - Published financial statements provides relevant firm data
- Step 2: Compare implied financing cost to reported cost of debt financing. Difference is understatement of capital costs.

Cost of capital for a large SOE



Table 1: Calculation of Unrecognized Capital Cost Subsidies

| | 2012 | 2011 | 2010 | 2009 | 2008 |
|---|--------------|--------------|--------------|--------------|----------------|
| Interest Expenses ¹ | \$1,273 | \$1,305 | \$1,294 | \$1,272 | \$1,376 |
| Book Assets ¹ | \$47,334 | \$46,393 | \$42,753 | \$40,017 | \$37,137 |
| Total Debt ¹ | \$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 | 0.03% | 0.15% | 0.06% | 0.13% | 2.75% |
| Market risk premium | 6.50% | 6.50% | 6.50% | 6.50% | 6.50% |
| Asset Beta ² | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| Required Return on Assets ³ | 3.93% | 4.05% | 3.96% | 4.03% | 6.60% |
| Unrecognized capital subsidy⁴ | \$587 | \$574 | \$399 | \$341 | \$1,094 |
| In millions | | | | | |

Cost of capital for a large SOE



- This SOE could be anywhere, but it happens to be the U.S. Tennessee Valley Authority
- Real consequences:
 - TVA managers think of the firm as profitable when it isn't
 - Underpricing of electricity
 - History of over-investment
- *Notes to table:*
 1. As reported in TVA 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 $.0003 + .6(.065) = 3.93\%$ based on the CAPM
 4. Unrecognized subsidy = $(\text{Required return on assets}) \times (\text{assets}) - (\text{Interest rate}) \times (\text{debt})$

Economic profitability of SOEs in China

- Plan is to apply this approach to SOE sector in China
 - To provide clarity about size of financial subsidies
 - To help policymakers understand which enterprises are relatively efficient and which are not, and to make transparent the economic cost of inefficient capital allocation
- Challenges include
 - Finding appropriate benchmark for market cost of capital
 - Required returns in international markets is one natural choice
 - Validity of using book values to represent market values
 - Correcting for year-to-year noise in profitability
 - How to treat other subsidies; avoiding omissions or double-counting

Measurement mistakes and public perception

www.news.cn



XINHUANET

Thursday, J

China's industrial profits up 16.5 pct

Source: Xinhua | 2018-06-27 13:49:15 | Editor: Liangyu



Xinhuanet App



BEIJING, June 27 (Xinhua) -- China's major industrial firms posted increased profit growth in the first five months of 2018, official statistics showed Wednesday.

Profits at China's major industrial firms grew 16.5 percent in the first five months, quickening from the 15-percent expansion for the January-April period, according to the National Bureau of Statistics (NBS).

“NBS statistician He Ping attributed the sound growth to the country's supply-side structural reforms, which led to falling production costs **and lower leverage ratios.**”

Accounting profits and deleveraging

- Consider a firm with
 - Income = 100,000
 - Debt = 1 million
 - Interest rate = 6%
 - “Profit” is $100,000 - 60,000 = 40,000$
- Fair value swap of 100,000 equity for 100,000 debt
 - Income = 100,000
 - Debt = 900,000
 - Interest rate = 6%
 - “Profit” is $100,000 - 54,000 = 46,000$
- Reported profit up 15%, but economic profit is unchanged
- This also happens for private sector firms, but stock market returns provide a counterbalance

Example 2:

Cost of Capital for the EBRD



- 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 lots of debt, member equity, and **callable capital**

Cost of Capital for the EBRD



- EBRD treats its cost of capital as its borrowing cost, and on a book value basis it appears 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 β 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; missing $r_E \times E$)

Cost of Capital for the EBRD



European Bank
for Reconstruction and Development

Table 4:

| Calculating the Weighted Average Cost of Capital for the EBRD | | |
|---|------------|------------|
| | 2012 | 2011 |
| 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 | | |

Cost of Callable Capital for the EBRD



European Bank
for Reconstruction and Development

- **Multi-year cost of Callable Capital**
 - Multilateral development banks rely on guarantees in the form of **callable capital** to absorb losses and keep borrowing costs low
 - Callable capital allows the EBRD to demand payments from its members when equity falls 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

Cost of Callable Capital for the EBRD



European Bank
for Reconstruction and Development

- Callable capital over a multi-year horizon 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
 - asset vol of 3.75% => cost of **EUR 2.7 billion** and the call is exercised in 1.4% of years;
 - asset vol of 10% => cost of **EUR 11.8 billion** and the call is exercised in 9.7% of years.

Ongoing project on development banks

- **“Toward Comprehensive Measures of the Costs and Risks of Development Banks”**
 - Generalized EBRD option pricing model
 - With various international coauthors
 - KDB (Korea, w/Sung Kwan Lee), BNDES (Brazil, w/Marcio Garcia),
 - Turkey (w/Zeynep Onder)

Other examples and ongoing work

- Public Private Partnerships (P3s)
 - Incorrectly seen as expensive because government has to cover private cost of capital
 - Often the true cost is that gov't provides partners with underpriced financial guarantees that are not accounted for
- Barriers to sale of gov't-owned assets at market prices
 - Discounting at own borrowing rate means that sales at market prices can cause a budgetary loss, discouraging efficiency-improving sales
- Credit subsidies
 - Fossil fuels, mortgages, student loans,...

Conclusions

- Thank you!

MIT Golub Center for Finance and Policy

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- **Innovative educational materials and curricula** that will make state-of-the-art financial tools relevant and accessible to students of public policy, employees of public institutions, and policymakers

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