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Measuring Financial Subsidies to SOEs:
An Asset Return Based Framework with an Application to TVA

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Abstract

Despite the large and growing importance of SOEs in the world economy, the question of how to comprehensively measure the financial subsidies that governments confer to them has received little attention. Financial subsidies lower the financing costs for SOEs relative to their private sector counterparts via preferential terms on securities such as government-owned or guaranteed debt and equity investments. We develop a practical and theoretically-grounded framework that can be used to estimate the value of government financial subsidies to most types of SOEs. The approach addresses the challenges of limited market data, the complications arising from interactions between the value of different types of financial subsidies, and the risks of omissions and double counting, by relying primarily on accounting data and pivoting to the asset side of the balance sheet. The example of the U.S. government-owned Tennessee Valley Authority illustrates how the approach can be applied, and the substantial hidden subsidies that it can reveal.

1. Introduction

State-owned enterprises (SOEs) play an increasingly important role in the global economy.[3][4] Much has been written about the pros and cons of state ownership, governance, and the economic and broader social consequences of the many types of SOEs in operation (e.g., state-owned financial institutions, manufacturers, and public utilities). However, the question of how to comprehensively measure the value of the financial subsidies that governments confer to SOEs has received much less attention. There is no agreed-upon conceptual framework for how those subsidies should be budgeted or otherwise accounted for, and in practice, there is wide variation in whether and how government authorities and policy analysts measure and report them.

By financial subsidies, we mean assistance in the form of underpriced guarantees of SOEs' debt liabilities, direct government lending to SOEs at below-market rates, and acceptance of below-market returns on government-held equity—in other words, subsidies that lower the financing costs for SOEs relative to their private sector counterparts. Governments also provide subsidies in many other forms: outright grants, favorable tax treatment, minimum revenue guarantees and other types of price support, underpriced land and mineral rights, and so forth, and there is a growing body of literature that examines the size of these various other forms of assistance in specific instances.

Total subsidies--the sum of financial and non-financial subsidies--can only be accurately assessed when the interactions between the various forms of assistance are taken into account. Consider, for example, a cash grant to an SOE. If it were used by the SOE entirely to pay dividends to the government, it would have no effect on government net worth and hence the net subsidy would be zero. If instead the funds were passed through to the SOE's other stakeholders, such as to workers in the form of higher wages, the subsidy would equal the full amount of the grant. Accounting for the grant without accounting for dividends received by the government, or vice versa, would cause an incorrect inference about the size of total subsidies to the SOE. Within the category of financial subsidies, accurately estimating their net value similarly requires taking into account the interconnectedness in the value of a government's various debt and equity claims. Importantly, part of the borrowing cost advantage to an SOE from

[3] Analysts differ on the criteria they use to classify a firm as an SOE. For example, cutoffs of 25% or 50% state ownership are sometimes chosen. Here the term is used broadly to refer to all enterprises where governments have significant ownership rights and intercede financially on their behalf.

[4] In 2018, assets of the world's largest SOEs were USD 45 trillion, equivalent to 50 percent of global GDP, while their debt amounted to USD 7.4 trillion (IMF, 2020). Many SOEs now rank among the world's largest companies, with their assets comprising 20 percent of assets of the world's largest 2,000 largest firms (IMF, 2020).

explicit or implicit government guarantees or below-market loans from state-controlled banks will be offset when the advantage is passed back in the form of higher returns to government-held equity.

Accurate assessments of the size of government financial subsidies to SOEs are important for a variety of reasons. One is fiscal transparency: Financial subsidies are large and opaque government expenditures that absorb public resources, fiscal space and government risk-bearing capacity.[5] Transparency about financial subsidies is also important at a more micro level. Unrecognized financial subsidies tend to distort SOEs' own investment and pricing decisions, and may lead to outcomes that are contrary to policy goals. For example, anticipation of the harms caused by climate change has led governments to commit to phasing out subsidies for industries that produce significant amounts of greenhouse gases, yet significant and often opaque financial support for high-emitting state-owned companies continues.[6] In the context of international trade, credible financial subsidy estimates could help settle disputes arising from allegations of unfair trade practices accommodated by state financial support.

In this paper we develop a practical and theoretically grounded framework that can be used to estimate the value of government financial subsidies to most types of SOEs. The suggested approach reflects multiple goals, including that the estimates be comprehensive, consistent with the valuation principles of financial economics, and feasible to implement given the limited information and analytical resources available to policy analysts. We illustrate the framework's practical application, and some of the estimation challenges, by considering the example of the Tennessee Valley Authority (TVA), a large electrical utility that is fully owned by the U.S. government.

Developing a general and tractable framework for financial subsidy evaluation is complicated by a number of factors. First as noted earlier, there are multiple channels by which governments provide financial subsidies and those can interact with each other in opaque ways. Estimation errors arising from omissions or double-counting are likely to occur unless the interactions between these different channels are properly taken into account. Second, only limited data are available. Most critically, there are no observable market prices for most government-held claims on SOEs. The value of government claims therefore must be imputed from accounting data and indirect market price evidence. The effects of time and risk on the value of many SOE subsidies (e.g., credit guarantees) necessitate using fair value

[5] Governments also may extract value from SOEs, for instance by requiring large dividend payments or directing an SOE to make payments on its behalf. Those flows reduce financial subsidies. They also may expand government control over fiscal resources while bypassing the normal budget process.
[6] The OECD reports that SOEs are responsible for an estimated one-fifth of direct carbon dioxide emissions globally.

and accrual accounting concepts, and the resulting estimates must then must be reconciled with the mostly cash basis accounting used by governments for most types of subsidy estimation.

The proposed framework addresses these challenges in two main ways. First, the complexities that arise from the many types of government financial support and their interactions are largely avoided by focusing instead on an SOE's reported assets and earnings. In other words, attention is shifted from the liability side of the balance sheet to the asset side. Second, SOE return statistics are constructed from accounting data and then compared either to similarly constructed return statistics for private sector firms or to a benchmark based on an asset pricing model. This largely avoids data limitations by relying on accounting information that many SOEs routinely report. Nevertheless, the fact that accounting measures often differ significantly from their market value counterparts has to be recognized and corrected for to the extent possible.[7] We approximate asset returns by dividing earnings before interest (EBI) by book assets, and show why this choice produces subsidy estimates that are more comprehensive and robust than the alternatives of return on assets (ROA) or return on equity (ROE) that are more commonly used in existing policy analyses of SOEs.

To illustrate how the framework can be operationalized and the sizeable hidden subsidies that it can reveal, we use it to estimate the annual financial subsidies to the Tennessee Valley Authority (TVA) over the period 2002 to 2024. TVA is a large wholesale provider of electricity that is fully owned by the US federal government. Whereas TVA reports that it is profitable in each year (as measured by net income) over the entire period, we conservatively estimate annual financial subsidies that exceed $400 million (in 2024 dollars) in each of those years. Those financial subsidies are not recognized in the federal budget and hence remain largely invisible to policymakers, TVA's managers, and the public. Using a related approach to infer tax subsidies, we find that TVA's exemption from federal income taxes provided an additional annual subsidy that prior to 2018 was roughly four times as large as the estimated financial subsidies. Tax law changes in 2018 reduced the tax subsidies in recent years to roughly the same size as the estimated financial subsidies.

The most closely related literature is an innovative set of reports by the OECD, and in particular, OECD (2021). The authors similarly aim to measure financial subsidies to SOEs on a fair or market value basis. The authors separately evaluate equity and debt subsidies using a mix of accounting and market data, and apply their methodology to a variety of non-financial industries. They find that the size of subsidies

[7] See Lucas (2012) and references therein for a discussion of the relevance of market valuations for public sector financial decisions. IMF (2014) endorses the use of market values for government financial reporting.

varies and that for some industries they are substantial. Although our approach is conceptually similar to the OECD's, we show why their implementation is more susceptible to measurement error and double-counting than the procedure recommended here. Both approaches build on Lucas (2014), which emphasized that SOE accounting profits significantly exceed economic profits because of the implicit assumption that government equity holdings are fairly compensated with a zero rate of return, but that analysis did not address the fundamental question of how to evaluate the size of financial subsidies. The IMF also reports metrics that are related to the size of SOE financial subsidies and profitability as part of its broader evaluation of SOEs in various regions of the world in a number of reports (e.g., IMF 2019 and 2021), but those studies do not attempt to comprehensively measure of financial subsidies and rely on metrics shown here to be noisy. OECD (2024) and OECD(2025) quantify credit but not equity subsidies to SOEs in a variety of non-financial industries. Other strands of the literature compare the capital costs of SOEs with those of private sector firms without quantifying the size of the associated subsidies. For example, DeWenter and Malatesta (2001) examine a large sample of countries and firms, and find that on average SOEs borrow at lower interest rates and earn a lower return on assets than private sector enterprises. The large role of SOEs in China has also motivated a growing literature on government credit and other financial support of those enterprises and its consequences, including Ru (2018), Harrison et. al. (2019), and Geng (2024). Technically, our suggested approach to subsidy measurement is closely related to methodologies that were developed in a practitioner-oriented literature in finance (e.g., Koller et. al., 2010, Bacidore et., al., 1997, and references therein) aimed at evaluating the financial performance of private sector firms for purposes such as aligning managerial compensation with value creation.

The rest of this paper is organized as follows. Section 2 reviews the basic financial principles behind the valuation framework and derives a simple expression for financial subsidies in a one-period setting. Section 3 explains the conceptual differences between similarly named accounting and economic variables that figure into to subsidy calculations, and suggests an implementation procedure for subsidy estimation that corrects for those differences to the extent possible, using SOE financial disclosures in combination with data on comparable private sector firms. Section 4 applies the framework to estimating the annual subsidies from the US government to TVA. Section 5 outlines how the framework could be extended to a multiperiod setting. Section 6 concludes.

2. Basic definitions and derivations

We first recap the basic principles of financial economics that guide and constrain the suggested framework for subsidy estimation, and then turn to more detailed measurement issues. The focus is on estimating the subsidy associated with an SOE's assets in place and the existing financial claims against those assets over a one-period horizon, but the principles apply also to multiperiod settings.

2.1 Financial valuation principles for subsidy estimation

Equation (1) summarizes the main insights from financial economics that we use here for several purposes: (i) to define a financial subsidy; (ii) to highlight the difference between economic and accounting profitability; and (iii) to justify an approach that focuses on assets and earnings rather than on debt and equity and their associated cash flows. [8]

(1) $$E(r_A) = r_f + \beta_A\big(E(r_m) - r_f\big) = \frac{\mathcal{E}}{A}E(r_{\mathcal{E}}) + \frac{D}{A}E(r_D)$$

The first equality is the familiar Capital Asset Pricing Model (CAPM).[9] It describes the expected market return on any real or financial asset, $E(r_A)$, in terms of two components. The first is a risk-free rate, r_f, that compensates for the pure time value of the money. The second term is a risk premium that covers the cost of the associated priced risk. In the CAPM formulation, the market risk premium, $\big(E(r_m) - r_f\big)$, is the excess of the expected return on a well-diversified market portfolio over the risk-free rate. An asset whose returns are highly correlated with the overall market will have a high asset beta, β_A, and will require a large risk premium, whereas assets whose returns are uncorrelated with the overall market only require compensation for time value.[10] Because different SOEs are exposed to different degrees of market risk (e.g., a state-owned oil company versus a water utility), the fair market return on their assets will also differ.

[8] The same insights arise from a more sophisticated utility-based general equilibrium modeling approach.
[9] We use the CAPM as a reference point because it succinctly captures the idea that a fair return compensates for time value and the cost of risk, and because it is likely to be familiar to practitioners. The CAPM equates the risk premium with the amount of undiversifiable or β risk associated with the asset. Other sources of risk may be priced as well. For the purpose of valuing subsidies, the specific representation can be replaced with an analysts preferred asset pricing model.
[10] A firm's asset beta represents the value-weighted average of its debt and equity betas. Because debt is relatively safe, its return is less correlated with the market than that of equity. Hence, a firm's debt beta is always lower than its equity beta. The more debt in the capital structure, the higher the equity beta. The process of estimating an asset beta by starting with an estimated equity beta and removing the effect of debt is known as unlevering beta.

The second equality is the Modigliani-Miller theorem (Modigliani and Miller, 1958). It states that expected return on assets will be a value-weighted average of the expected return on equity, $E(r_{\mathcal{E}})$, and the expected return on debt, $E(r_D)$. It reflects that the underlying assets are the source of the risky cash flows that will be distributed unevenly to different claimants according to contractual rules. The split between debt and equity financing—the firm's capital structure--does not affect the total value of financial claims because those are tied down by the total return on assets, at least as a first approximation. As a firm adds debt to its capital structure, both its debt and equity become riskier and the required return to both increases, but the weighted average of expected returns is unaffected because total risk is conserved. The proposition can be generalized to include additional types of claims such as deposits, preferred stock, and warrants, and modified to include tax effects.

For this analysis, an important implication of the conservation of total returns across claims is that if the government lends to an SOE at a below-market rate or provides it with underpriced debt guarantees, all else equal, it will increase the expected return on the government's equity holdings. And conversely, if the government extracts an above-market return on its lending to an SOE, the returns to its equity holdings will be lower. Those interactions, together with the opacity of government claims, make subsidy estimates based on summing subsidies arising from the liability side of the balance sheet problematic. In the formulation below, we sidestep these difficulties by focusing on comparisons of total asset returns for SOEs and comparable private sector firms.

2.2 Imputing Financial Subsidies

Financial subsidies arise when the expected returns on the combined claims held by the government are lower than what private sector investors would require to hold those same claims. That is, the government incurs an opportunity cost because it could earn a higher expected return by investing the same sum in private sector firms with the same risk characteristics. Relatedly, government costs are evaluated based on the fair value accounting principles, also called "mark-to-market" accounting, which is the practice of valuing assets and liabilities at their current market value or at the best available approximation thereof.[11]

Notionally, the subsidy on a one-period investment could be estimated by multiplying the amount paid for each government claim by the difference between its fair expected rate of return and the government's expected rate of return, and summing over all government claims. In practice that

[11] See Lucas (2012) and (2014) for discussions of the rationale for fair value accounting in the public sector.

approach is likely to be infeasible because it requires information that is rarely available for government claims about purchase prices and expected returns.

The innovation here is to pivot to the asset side of the balance sheet to estimate the value of subsidies. This avoids the need to estimate the value of and fair return on individual government claims, and the risks of double-counting or omissions. It relies on an implication of equation (1): The fair expected return on a portfolio that includes all investors' claims on the SOE is simply the fair rate of return on its assets. For many SOEs, the fair expected return on assets can be imputed from data on comparable private sector firms (i.e., with the same asset beta, or in the same industry). The financial subsidy to SOEs, φ_f, can then be measured based on the difference between an estimate of the fair expected return on SOE assets, $E(r_{A,SOE})$, and that of comparable private sector firms, $E(r_{A,PS})$, multiplied by asset value:

(2) $$Financial\ subsidy = \varphi_f = [(E(r_{A,PS}) - E(r_{A,SOE}))] \times A_{SOE}$$

Equation (2) defines the annual flow of financial subsidies from the government to an SOE on its existing assets.

Typically, new activities initiated during the year also have associated financial subsidies that are not captured in equation (2). We extend the analysis to incorporate time-varying SOE activity levels and subsidy estimates that cover multi-year horizons in Section 5.

Debt subsidies are one component of financial subsidies. Debt subsidies arise either from below-market direct lending by governments, or from the provision of free or underpriced credit guarantees that lower the cost of borrowing from banks or from other investors. For non-SOEs that receive government credit support, financial subsidies and debt subsidies are one and the same.[12] However, for SOEs, using debt subsidies as a proxy for financial subsidies typically causes total financial subsidies to be underestimated because it omits the subsidies associated with government equity holdings.

Per period debt subsidies are computed by comparing the interest rate on subsidized SOE debt with the interest rate paid by comparable private sector firms, and multiplying the difference by the SOE's outstanding debt:

[12] Subsidies may also arise from various types of government-provided guarantees and insurance that are not classified as credit guarantees. For example, the government might back the pension obligations of an SOE. Although clearly these are financial, such subsidies would be classified as non-financial in this framework because like other subsidies classified as non-financial, they only indirectly affect the returns to government debt and equity claims.

(3) $$Debt\ subsidy = \varphi_D = (r_{D,PS} - r_{D,SOE}) \times D_{SOE}$$

Financial subsidies estimated using equation (2) are inclusive of any debt subsidies, but calculations using the proposed framework do not involve directly estimating interest rate differentials.

Financial subsidies as defined here do not include tax subsidies, which are an often-important component of total subsidies. We assume those are measured separately. However, because tax subsidies can be estimated in a way that is parallel to the suggested approach for estimating financial subsidies, and because it is informative to compare the size of tax and financial subsidies, we include formulas for computing tax subsidies in the Appendix.

2.3 SOEs with non-government funding sources

For an SOE that is fully government-owned, using equations (1) and (2) it is straightforward to see the equivalence between measuring total financial subsidies as the sum of return concessions on individual government claims, and measuring it based on the overall return concession on assets. However, many SOEs also partially rely on capital markets to raise funds, (i.e., by offering deposits, bonds, equity or other types of participating securities to the public).

One might wonder whether equation (2) still holds when there are also non-government investors. The answer is that it does as long as those other investors are participating voluntarily.[13] To voluntarily buy a claim on an SOE, an investor must expect to receive at least a fair market rate of return. It is therefore reasonable to assume that claims held by non-government investors have a non-negative net present value (NPV) and hence are not a source of additional financial subsidies to SOEs beyond what the government provides. However, it is possible that some investors receive above-market returns, such as if an SOE offers a rate premium to a favored investor constituency. We conclude that voluntary non-government investors in SOEs are not a source of financial subsidies, but they can be a recipient of them.

2.4 Incidence

Financial subsidies ultimately accrue to an SOE's various stakeholders, including consumers, managers, other employees, suppliers, and non-government liability holders. Consumer benefits may be in the form of products and services that are sold below cost. Employees may receive higher wages or

[13] Li et. al. (2008) examine the effects of the change from the Chinese government moving from holding non-tradeable shares in SOEs to a system where all shares are tradeable.

benefits, or greater job security, than those at comparable private sector firms. Suppliers may be paid higher prices for the goods and services provided. Favored investors might receive above-market returns on their debt or equity claims.

The framework suggested here only provides information about total financial subsidies; it cannot identify the incidence of the subsidies across stakeholders. While a breakdown of incidence allows analysts to answer a wider range of questions, it often requires significantly more information and modeling. Whether it is worthwhile to commit the additional resources needed to assess incidence will depend on the situation. Fortunately, estimates of total financial subsidies are adequate for many purposes. For example, to produce a comprehensive estimate of government subsidies to the fossil fuel industry, it is sufficient to calculate total financial subsidies to state-owned oil companies and add the estimates to other subsidy components. However, to estimate how many more tons of CO_2 will be emitted as a consequence of those SOE subsidies, it would be necessary to make inferences about to what extent the subsidies affected oil prices and net production decisions.

3. Implementation with accounting data

The discussion thus far has been about fair or market values and returns, whereas for SOEs most of the available information is in the form of accounting data from financial statements. To implement the proposed estimation method in a way that avoids making incorrect inferences from accounting data, the conceptual differences between similarly labeled accounting and market variables must be understood and corrected for. We begin with a discussion of those differences, and then suggest specific procedures that can be used to avoid mistakes. An example illustrates the significant distortions that can arise when accounting variables are misused as direct proxies for their market counterparts.

3.1. Balance sheets: book versus market values

A critical distinction is between the book and market value of assets and liabilities. When a private sector firm first acquires an asset, its book value and its market value are usually equal because the purchase price, which is typically a market price, is recorded as the initial book value. Over time book and market values may diverge, reflecting that book values are largely backward looking and adjustments are gradual, whereas market values are forward looking and immediately responsive to new information. Similarly, when a private sector firm raises funds by issuing debt or equity, the initial book value of the claims will be equal to their market value, which also to the amount of money raised. Over time, the book and market values of liabilities and equity also tend to diverge.

For SOEs, even initial book values can differ from market values because transactions often occur on non-market terms. For instance, to fulfill its policy objectives an SOE might purchase assets at above-market prices. This happens, for example, when a development bank lends money at below-market interest rates to support favored projects. For debt or equity sold by the SOE to the government, the book value will reflect the amount borrowed or paid in, but the market value will depend on the terms of the contract. For example, if the government buys bonds issued by an SOE that pay a below-market interest rate, then the book value that is initially recorded on the SOE's balance sheet will be higher than the market value of the associated payment stream to the government.

An example illustrates the effects of an SOE transacting at non-market prices on book versus market values, and some of the implications for subsidy imputations. Specifically, consider an asset purchase by an SOE at a price, A_{SOE}, that is greater than the asset's market value, A_{MKT}. The asset seller receives a subsidy of $A_{SOE} - A_{MKT}$. The asset purchase is funded by the SOE with a combination of cash-on-hand, C, and by issuing debt to the government, D_{SOE}, so that $C + D_{SOE} = A_{SOE}$. The debt is issued at a below-market interest rate. The government funds its debt purchase by issuing additional debt to the public, D_{GOV}, in an amount equal to D_{SOE}. The market value of the SOE debt held by the government, D_{MKT}, is less than its principal D_{SOE} (which is also its book value) because of its below-market interest rate. For simplicity, we assume that the government owns all of the SOE's equity.[14]

The effects of these transactions on book and market value balance sheets--of the SOE, the government *ex* SOE, and the consolidated government and SOE--are summarized in Figure 1. As shown in the top panel, on a book value basis there is no change in the equity position (i.e., the net worth) of the government nor of the SOE as a result of these transactions. The government loan of D_{SOE} to the SOE increases its assets and liabilities by an equal amount on a book value basis. The SOE has additional liabilities of D_{SOE} which are exactly offset by the change in its assets of $A_{SOE} - C$. On a consolidated balance sheet that recognizes the SOE as part of the government, the SOE's obligation to the government is both an asset and a liability and therefore cancels out.[15] What remains is an increase in net assets of $A_{SOE} - C$ and additional debt held by the public D_{GOV}, which both have equal book value.

[14] Following the logic of section 2.3, it is without loss of generality.

[15] The government funding could either be obtained using cash on hand, from an asset sale, or from the issuance of additional debt to the public. For this example, we assume that it issues debt to the public, but the net effect on equity are the same whatever the source of government funds.

By contrast, on a market value basis there is a change in the value of equity on all three balance sheets shown in the bottom panel of Figure 1. For the SOE, the net change in equity is $A_{MKT} - C - D_{MKT}$. The change could be positive or negative depending on whether the premium paid for the asset is more or less than the savings from issuing over-priced debt to the government. For the government when the SOE is off balance sheet, there is a net reduction in equity value equal to the difference between the principal lent to the SOE, $D_{gov} = D_{SOE}$ and the market value of the debt, D_{MKT}. The reduction in equity value for the consolidated position of the government and SOE is the value of the subsidy to the asset seller, $A_{SOE} - A_{MKT}$. In sum, the fundamental source of the financial subsidy in this example is the overpayment by the SOE for the assets it purchases. The government absorbs the cost through a mix of concessional government debt funding and a reduction in the value of the government's residual equity stake in the SOE.

Figure 1: Fair value versus market value balance sheets
(assets purchased for more than market value; debt issued to government for more than market value)

SOE Book Value Changes			
Assets		Liabilities	
Assets	$+A_{SOE}$	SOE debt	$+D_{SOE}$
Cash	$-C$		
		Equity	0

Gov't Book Value Changes			
Assets		Liabilities	
SOE debt	$+D_{SOE}$	Gov't debt	$+D_{GOV}$
		Equity	0

Consolidated Book Value Changes			
Assets		Liabilities	
Assets	$+A_{SOE}$	Gov't debt	$+D_{GOV}$
Cash	$-C$	SOE debt	$+D_{SOE}$
SOE debt	$+D_{SOE}$		
		Equity	0

SOE Market Value Changes			
Assets		Liabilities	
Assets	$+A_{MKT}$	SOE debt	$+D_{MKT}$
Cash	$-C$		
		Equity	$+A_{MKT} - C - D_{MKT}$

Gov't Market Value Changes			
Assets		Liabilities	
SOE debt	$+D_{MKT}$	Gov't debt	$+D_{GOV}$
		Equity	$+D_{MKT} - D_{GOV}$

Consolidated Market Value Changes			
Assets		Liabilities	
Assets	$+A_{MKT}$	Gov't debt	$+D_{GOV}$
Cash	$-C$	SOE debt	$+D_{SOE}$
SOE debt	$+D_{SOE}$		
		Equity	$+A_{MKT} - C - D_{GOV}$
			$= A_{MKT} - A_{SOE}$
			= *-subsidy*

This analysis of balance sheet effects underscores several important conclusions. First, the net value of concessions made by an SOE to its stakeholders, in this example, overpayment to a supplier, determines the size of the government subsidy to the SOE and the corresponding drop in government net worth. Second, the values of the various government claims on the SOE are interconnected, and differentially affected depending on the mechanisms used to deliver the subsidies. For example, when the government lowers the interest rate on lending to an SOE, it lowers the value of that debt but increases the value of the government's residual equity holdings, and vice versa. Estimating total financial subsidies based on the value of government claims requires taking into account those interactions. Generally, the alternative of estimating subsidies based on the asset side of the balance sheet is simpler and less prone to errors of omission or double-counting. Lastly, neither the total subsidy, nor how it is distributed across different government claims, can be directly inferred from the book value information provided in financial statements.

In estimating SOE asset value to operationalize equation (2), the discussion thus far suggests several cautions. One is not to extrapolate from the market prices of SOE debt and equity claims held by the public to infer SOE asset value. That follows from the observation that the market values of investor-owned claims on an SOE are independent of the size of government subsidies. Rather, the subsidies affect the market values of government-held debt and equity claims, which are not observable. Analysts also need to be aware that SOE assets acquired at negotiated prices may have book values that exceed their market values, even initially.

Using the book value of assets as a proxy for the economic value of assets is the most practical choice for operationalizing equation (2) given data limitations. Fortunately, conceptually it is also our preferred approach. Recall that equation (2) is intended to capture the financial subsidies associated with existing assets and obligations. Book values likewise are limited to existing assets and obligations. Omitting the effects of future actions on market values also makes it more straightforward to compare the realized returns for an SOE to those of comparable private firms. Expressing the subsidy as a rate-of-return concession on book value may also be preferred in cases where book values are a better approximation of what the government has invested than are market values that are reduced by concessional transactions.

Thus far the discussion has focused on stock variables--balance sheet entries that represent the capitalized values of current and future cash flows associated with assets and liabilities. We turn now to the flow accounting variables that can be used to estimate rates of return.

3.2 Economic versus accounting profits

The profit and rate-of-return measures reported in financial statements often differ significantly from their economic or fair value counterparts. Those differences must be taken into account and adjusted for to correctly operationalize the return variables in equation (2), and to interpret and explain the resulting estimates.

An important distinction is between economic and accounting profit. Again consider a simple one-period setting where at time 0 a firm buys capital (i.e., assets), funded by issuing debt and equity. It produces and sells output, liquidates any remaining capital, and pays wages, any other operating costs incurred, and taxes. The remaining cash is paid first to debt holders and then to equity holders at time 1.

Accounting profits measure what is left over to pay equity holders after all other costs, including interest expenses, are covered. Accounting profits, π^{acct}, can be written as:

(4) $$\pi^{acct} = r_A A - D \times r_D$$

Economic profit is defined by the difference between realized returns and the amount necessary to provide a fair return to equity holders after debt obligations have been paid. Economic profits, π^{econ}, can be written as:

(5) $$\pi^{econ} = r_A A - [D \times r_D + \mathcal{E} \times E(r_{\mathcal{E}})]$$

Comparing (3) and (4), it is clear that accounting profits can be positive when economic profits are negative because the former does not recognize the need for an economically profitable firm to earn enough to provide a fair rate of return to its equity holders.

Relatedly, the subsidy estimated using equation (2) can be positive even when an SOE's accounting profits are positive. SOEs with positive accounting profits often describe themselves as unsubsidized because they are profitable for the government. This overlooks the fact that accounting profitability is not a measure of economic profitability, and that a "profitable" enterprise may generate returns that are inadequate to provide a fair return on the government's equity stake. For an SOE to be unsubsidized, it must be expected to generate non-negative economic profits. Consistent with this, equation (2) equates financial subsidies with negative economic profits.

3.3 Rate-of-return estimation

Turning to the building blocks for the rate-of-return estimates that enter into equation (2), both SOEs' and private sector firms' financial statements routinely report the return on assets (ROA) and the return on equity (ROE). We start with some definitions, explain why reported ROA and ROE statistics are inappropriate as direct inputs into subsidy estimates, and suggest simple adjustments that yield conceptually correct return measures.

In financial statements, the numerator for both ROA and ROE is net income (NI), and their respective denominators are book assets and book equity. Loosely speaking, net income is what is left from an equity holder perspective after all other expenses are paid. It is an annual flow variable. Formally:

(6) $$NI = revenues - expenses - taxes - interest - depreciation \,\&\, amortization$$

(7) $$ROE = NI/E_{book}$$

(8) $ROA = NI/A_{book}$

A related statistic is earnings before interest (EBI):

(9) $EBI = NI + interest$

EBI represents the value that accrues to asset owners, i.e., debt and equity holders, after all other obligations have been paid. We choose to use EBI in subsidy estimates over two other popular earnings statistics, EBIT and EBITDA, for several reasons. Neither EBIT nor EBITDA subtracts out tax payments, which is a problem for estimating financial subsidies because taxes affect what is left for debt and equity holders. EBI and EBIT subtract depreciation and amortization, which roughly captures the effects of capital expenditures on what is left for debt and equity holders. EBITDA overstates the amount available to debt and equity by neglecting both the effects of taxes and capital expenditures, and EBIT overstates the amount by neglecting the effect of taxes. However, for firms that report EBIT and taxes, EBI can be inferred by subtracting taxes from EBIT.

The ratio, EBI/A, is the closest accounting proxy for r_A, and hence for the combined annual return to debt and equity holders from existing assets, for both SOEs and private sector firms. The realization of EBI/A in any year is noisy and will deviate from its expected value. The simplest way to estimate $E(r_{A,SOE})$ is by averaging the realized EBI/A over a number of years.

Non-financial government subsidies will often have an effect on NI and EBI. For example, tax breaks or government grants will increase reported earnings. Hence, non-financial government subsidies will increase the return to government equity, all else equal. Measuring total subsidies as the sum of financial and non-financial subsidies properly accounts for these potential offsets.

There are several options for estimating $E(r_{A,PS})$.[16] The first is to use average realizations of EBI/A for comparable private sector firms over the same time period as for the SOE. Doing so has the advantage of controlling for common market and industry conditions that could cause returns for both SOEs and private sector firms to differ from expectations for an extended time period. To the extent that accounting data is available for firms that are not publicly traded, it also expands the universe of available comparison firms.

[16] OECD (2021) discusses these options in the context of evaluating equity return subsidies and applies them to large industrial firms.

A second option is to estimate $E(r_{A,PS})$ is with an asset pricing model. For example, the CAPM can be calibrated using asset betas obtained from academic or commercial suppliers, or estimated from market data.[17] For SOEs that don't have close private sector counterparts, this approach can provide a reference point, albeit a noisy one, based on a broader comparison group such as all industrial or financial firms.

Equation (2) can be estimated as either:

(10a) $\left[E(r_{A,PS,mkt}) - E\left(r_{A,SOE,mkt}\right)\right] \times A_{SOE,mkt} \approx [E(EBI_{PS}/A_{PS,bk}) - EBI_{SOE}/A_{SOE,bk})] \times A_{SOE,bk}$

when private sector comparison returns are also estimated using accounting data, or as

(10b) $\left[E(r_{A,PS,mkt}) - E\left(r_{A,SOE,mkt}\right)\right] \times A_{SOE,mkt} \approx [E(r_{A,PS,mkt}) - EBI_{SOE}/A_{SOE,bk})] \times A_{SOE,bk}$

when private sector comparison returns are estimated using an asset pricing model like the CAPM.

3.5 Comparing alternative metrics

We have shown that a comprehensive evaluation of financial subsidies to an SOE requires taking into account the government's rate-of-return concessions on both its debt and equity holdings, and that an approach based on asset returns avoids omissions and double-counting. A stylized example, summarized in Table 1, illustrates how mistaken inferences about the adequacy of SOE returns can be drawn from some commonly reported metrics. It also suggests the robustness to variations in capital structure of financial subsidy estimates based on asset returns.

In this example, the financial performance of an SOE is evaluated by comparing it with three different (groups of) comparison private sector firms. All are in the same industry and of the same size as the SOE, with assets of 100. All the comparison firms have the same expected return on assets, which is set to 8%. The comparison groups differ in their assumed capital structure, with debt ranging from 30% to 70% of assets. Firm 2 has the same capital structure as the SOE with debt equal to 50% of assets. The expected return on debt is assumed to vary with leverage, reflecting the greater risk to debtholders of more levered firms. Given the assumed returns on assets and on debt, the expected return on equity is calculated to be the fair rate using the second equality in equation 1 (e.g., for Firm 2, 8% = .5 x 3% + .5 x 13%).

[17] A popular source of estimates is Professor Damodaran's webpage at: https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/Betas.html, where the column "unlevered beta" reports industry asset beta estimates.

For simplicity, we assume that all of the SOE's debt and equity is held by the government; and that all subsidies are financial (and hence there are no tax differentials). The SOE is assumed to have a 2% lower expected return on its assets, for instance because its operating costs are higher or it charges less for its products. It has a lower expected return on its debt because the government lends to it at a below-market rate.

The reported SOE financial subsidy is calculated using equation (2), or equivalently, equation (10). The SOE debt subsidy is calculated using equation (3).[18] The results in each column are based on the SOE's and each respective comparison firm's data from the top block of Table 1.

Table 1: Performance and Subsidy Measures

	SOE	Firm 1	Firm 2	Firm 3
Assets	100	100	100	100
Debt	50	70	50	30
Equity	50	30	50	70
$E(r_A)$	6%	8%	8%	8%
$E(r_D)$	1%	4%	3.0%	2%
$E(r_\varepsilon)$	11.0%	17.3%	13.0%	10.6%
EBI	6.0	8.0	8.0	8.0
profit (book)	5.5	5.2	6.5	7.4
ROE	11.0%	17.3%	13.0%	10.6%
ROA	5.5%	5.2%	6.5%	7.4%
SOE debt subsidy		1.5	1.0	0.5
SOE financial subsidy		**2.0**	**2.0**	**2.0**

The profitability metrics reported in Table 1 include book profits, ROE, and ROA. Those are calculated using the data for each firm type individually using equations (4), (8) and (9). It is immediately clear from

[18] Here for simplicity, we abstract from the difference between the promised and expected return on debt. For fairly safe firms the two will be similar and the conclusions of the example are not sensitive to this approximation.

the results that comparisons between any of those metrics for the SOE and the reference firms is highly sensitive to capital structure differences, whereas for EBI/A there is no variation.

The results underscore a general conclusion: an important advantage of asset return-based financial subsidy estimates is that they are invariant to capital structure. By contrast, differences in the capital structure of the otherwise identical comparison firms significantly affect all of the other subsidy and profitability measures shown, reducing the reliability and informativeness of those metrics.

Recall that a firm is economically unprofitable if its returns are insufficient to cover the fair return to all financial claimants. Relatedly, a firm with a positive financial subsidy always earns negative economic profits. The SOE is this example is clearly economically unprofitable. However, none of the common profitability metrics presented—book profit, ROA, and ROE--consistently leads to the conclusion that the SOE is comparatively unprofitable. Its book profits are positive, and fall within the range of book profits for the comparison firms (all of whom have zero economic profit by construction). Comparisons to more highly levered firms tend to make the SOE look profitable in terms of ROA but unprofitable in terms of ROE. Conversely, comparisons with firms that have less leverage tend to make the SOE look profitable in terms of ROA but unprofitable in terms of ROE. The comparisons with Firm 2, which has the same capital structure, go in the right direction in this particular example, showing the SOE to be relatively unprofitable. However, if the SOE had a larger debt subsidy and therefore lower interest payments, the conclusion of lower profitability could have been reversed even when leverage is controlled for.[19]

While debt subsidies are only one component of total financial subsidies, for some purposes they may be of interest in themselves. In this example, the estimated debt subsidy is lower than the total financial subsidy, whichever private sector firm is used for comparison. This will be true in general because the debt subsidy fails to account for inadequate returns to government-held equity. The variation in the debt subsidy across comparison firms arises because the fair interest rate is increasing in leverage. This underscores the importance for debt subsidy estimation of controlling for leverage, along with other factors that influence interest rates such as the maturity structure of the debt.[20]

[19] Empirical investigations of SOEs (e.g., Bai et. al., 2018) suggest they tend to be more highly levered than private sector firms. This would cause comparisons based on ROA to overstate the extent to which private sector firms are more profitable.

[20] When comparison firms have long-term debt in their capital structures issued under interest rate conditions that no longer prevail, their realized interest costs are a noisy proxy for fair market rates.

In this example, all subsidies were in the form of below-market expected returns to government-held debt and equity. Adding non-financial subsidies like tax preferences or grants would not change the main conclusion, which is that the returns-based subsidy measure is relatively robust and comprehensive compared to leading alternatives. However, non-financial subsidies, to the extent that they affected asset returns, would affect the financial subsidy estimates. To assess total subsidies, financial and non-financial subsidies always have to be added together.

4. Estimating Financial Subsidies to the Tennessee Valley Authority

Here we estimate the annual financial subsidies TVA received over the 2002 to 2024 period, using the framework laid out in Sections 2 and 3, and specifically, equations 10a and 10b. TVA, one of the largest wholesale providers of electricity in the US, serves about 10 million people in seven southeastern states. Its assets include coal-fired, nuclear and hydroelectric generators and an extensive transmission system. TVA is fully owned by the US federal government.[21]

Like many SOEs, TVA's financial statements are publicly available and include similar information to what private sector corporations report. Asset data are taken from its balance sheets, and net income and interest expense from its income statement.

Comparisons are based on (1) large publicly traded electrical utilities operating in the same or adjacent regions, and (2) on an estimate of required returns based on the CAPM. The comparison utilities are Florida Power and Light (FPL), Alabama Power Company (APC), Georgia Power Company (GPC), Southern and Southern Power Company (SPC). The same balance sheet and income statement information as for TVA is extracted from their financial statements, and we also record income taxes paid.[22] In the CAPM comparison, the asset beta for electrical utilities is set to 0.5, the equity premium to 7%, and the risk-free rate is the average 3-month Treasury yield in a given year.

The ratio *EBI/A*, the measure of total financial returns, is plotted over time for TVA and each comparison firm in Figure 2. The CAPM-implied return is also plotted. To make the differences clearer, *EBI/A* for individual comparison firms is replaced with an equally weighted average of individual ratios. There is considerable variation in the ratios over time, which is to be expected as variables such as demand and

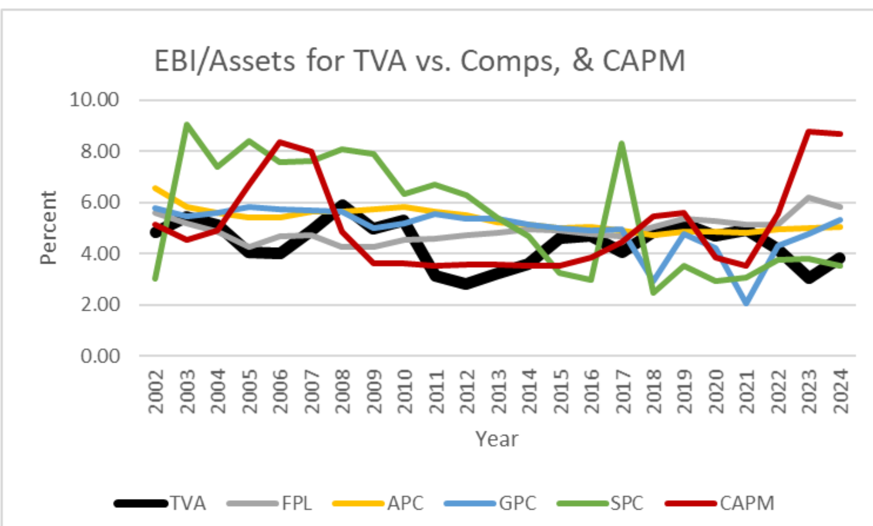
[21] The US has relatively few SOEs, and apart from Fannie Mae and Freddie Mac, TVA is its largest.
[22] NextEra Energy fully owns FPL. Southern Company owns APC, GPC and SPC. The parent companies report data for the individual companies in their 10K filings.

input costs change. However, in most years TVA's financial returns were lower than those of any of the comparison firms and lower than the CAPM benchmark.

Taking average financial returns as a proxy for expected financial returns, TVA's average *EBI/A* over the 23 years is 4.41%. That is lower than any of the comparison firms, whose averages ranged from 4.96% for Florida Power and Light to 5.49% for Southern Power Company. Across the comparison firms and across time, the equally weighted average *EBI/A* is 5.19%. The CAPM average is 5.1%. The difference of 5.19% and 4.41%, which is 0.78% (or 78 basis points) is the estimate of the financial subsidy rate for TVA.

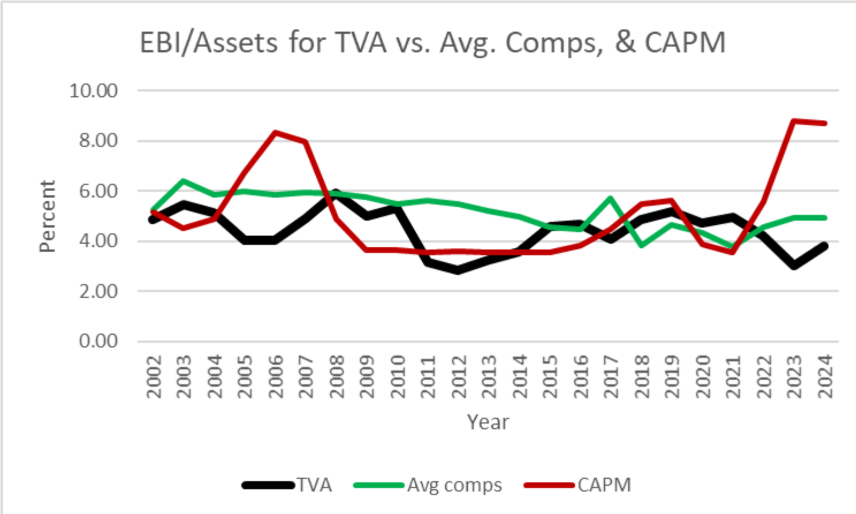
Applying the subsidy rate of 78 basis points to TVA book assets, the financial subsidy was $450 million in 2024, and has exceeded $350 million in every year since 2011. Figure 4 plots the estimated nominal dollar subsidy along with the real dollar subsidy in 2024 dollars, over time. The real subsidy exhibits little variation because real assets have also been fairly constant and a constant subsidy rate is applied.

Figure 2.



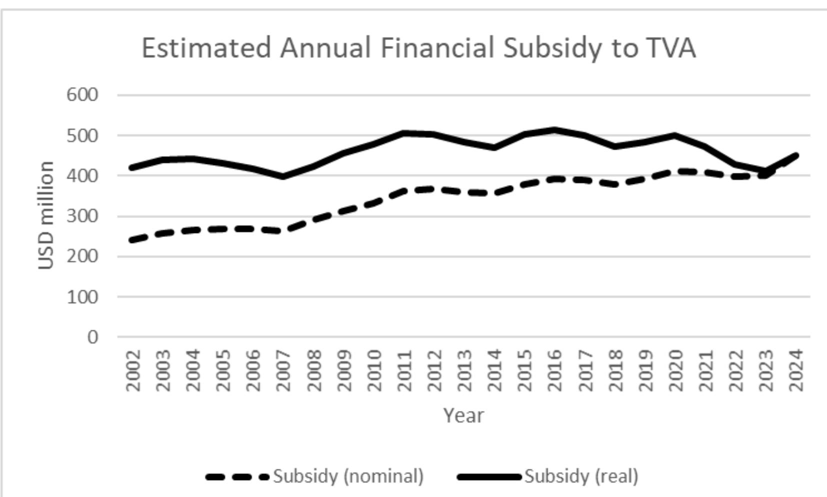
Notes: Authors calculations from data extracted from 10K filings for Southern Company and NextEra. CAPM rate is based on annualized 3-month Treasury rate, market risk premium of 7%, and asset beta of 0.5.

Figure 3.



Notes: Authors calculations from data extracted from 10K filings for Southern Company and NextEra Energy. CAPM rate is based on annualized 3-month Treasury rate, market risk premium of 7%, and asset beta of 0.5.

Figure 4.



Notes: Inflation adjustments use the CPI. Real subsidies are in 2024 dollars. The subsidy rate of 78 bps is based on authors' calculations. Nominal book assets as reported by TVA in their financial disclosures.

Basing the financial subsidy estimates on our base-case average CAPM return would have produced similar results. However, we emphasize the analysis based on the returns of comparison firms for several reasons. One is the considerable uncertainty about the asset beta for TVA. Available estimates for retail electrical utilities suggest asset betas between .3 and .6. That implies a range for comparison returns of 3.7% to 6.5%, holding all other CAPM assumptions fixed. Uncertainty about the market risk premium and the base risk-free rate further widen this range. The implied range for the fair return based on the CAPM is thus much wider than what is suggested by the range of outcomes for the comparison firm data. Using the CAPM also creates an asymmetry, which is reflected in Figures 2 and 3. Changes in the base risk-free rate sometimes cause large and rapid changes in the CAPM return benchmark, whereas TVA's return, which is based on EBI, and book assets, is relatively insensitive to interest rate changes.

These subsidy estimates may be conservative. Various studies (e.g., Frontier, 2020) suggest that for wholesale power suppliers, the asset beta is higher than for retail utilities, whose returns are smoothed by rate regulation. In our comparison sample, Southern Power is the only other wholesale power provider, and at 5.5% it has the highest *EBI/A* among the comparison firms considered. Other wholesale providers in the region are much smaller and less diversified than TVA. Estimates based on a comparison to Southern Power would increase TVA's financial subsidy rate to about 1% of assets, and its estimated annual financial subsidy would increase by about 36%, e.g., in 2024 subsidy would increase to $613 million from $450 million.

Comparisons based on ROA and ROE are more common than those based on the EBI/A measure proposed here, despite the shortcomings of those metrics explained in Section 3. It is informative to consider those alternative statistics and how they differ from our preferred measure. Figures 5 and 6 plot the time series of ROA and ROE respectively.[23] Table 2 reports average values of EBI/A, ROA, ROE and leverage (liabilities/assets).

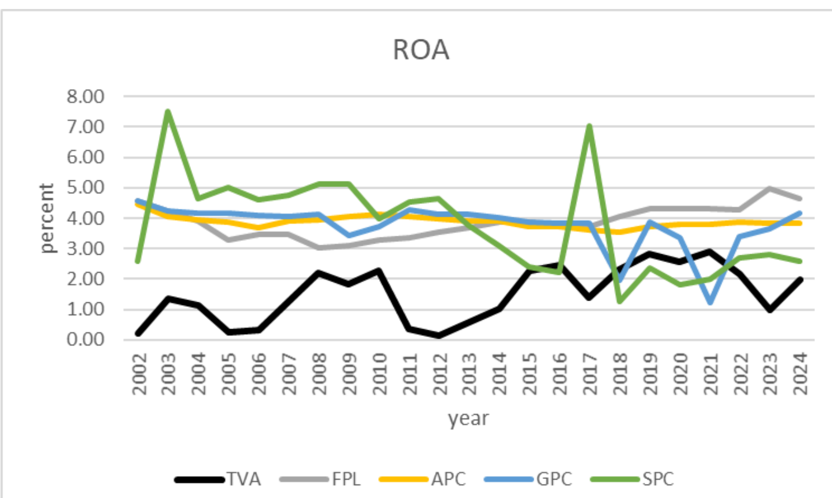
Several observations emerge from those comparisons. Average leverage varies considerably across the firms. It is highest for TVA, whose liabilities on average are 84% of assets, versus an average of 62% for the other utilities. Despite its high leverage, TVA's debt generally receives the same high rating as that of the U.S. government, currently set to AA+ by Fitch. The less leveraged comparison utilities have lower ratings, also investment grade but at single A and below. ROE varies considerably over time and across firms. By that measure, TVA appears no less profitable than the comparison utilities. By contrast, TVA's ROA is considerably lower than for the comparison firms, averaging 1.5% compared to a tight range of

[23] Liability information for FPL is not broken out before 2013 and hence ROE is not computed for those earlier years.

3.8% to 3.9% for the other utilities.[24] TVA also has the lowest returns based on EBI/A, but the gap between TVA and the comparison utilities is much smaller for EBI/A than it is for ROA.

All of these outcomes are consistent with what we would expect to see based on the theoretical considerations discussed in Section 3 that point to favoring EBI/A over alternative profitability metrics. TVA's ROA is considerably lower than that of the comparison utilities in part because it is much more highly levered. Even if it were unsubsidized, it would be expected to have a lower ROA for this reason (see Table 1). The fact that TVA's ROE is in line with the unsubsidized firms also is a reflection of its relative high leverage (see Table 1). Furthermore, TVA's net income is potentially elevated by its relatively low borrowing costs because of the implicit government guarantee on its debt. Comparing EBI/A and ROA, the financial subsidy to TBA rightly appears smaller based on EBI/A compared to ROA because EBI/A accounts for TVA's higher leverage. EBI/A also properly accounts for the possibility that part of the interest rate advantage is accruing to the government in the form of a higher equity return. Relatedly, while measurements based on EBI/A accounts for both debt and equity subsidies, ROA and ROE are only related to the equity component of the subsidy. Starting with ROA or ROE, finding the total financial subsidy would require an assessment of the interest rate subsidy and any offsetting effects.

Figure 5.



[24] Rate-of-return regulation may partially explain the tight ROA range for the other utilities.

Figure 6.

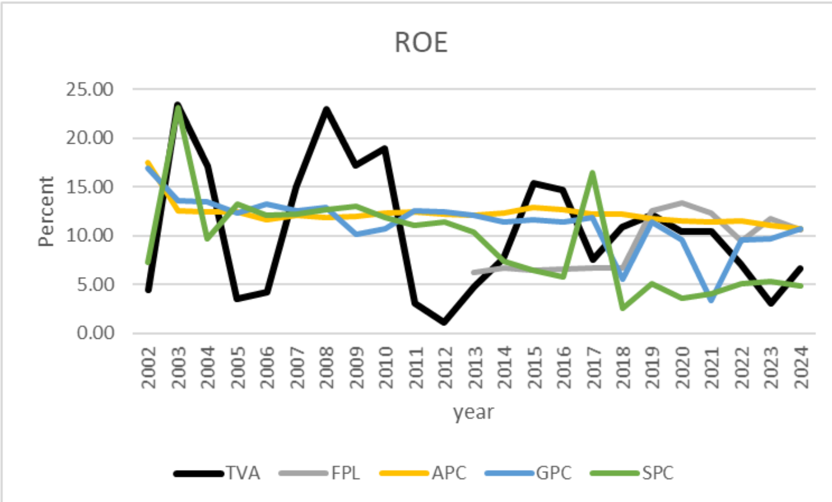


Table 2: Comparison of average return measures and leverage

	Average ROA	Average ROE	Average EBI/A	Average Liabilities/Assets
TVA	1.51	10.52	4.41	84.44
FPL	3.87	9.12	4.96	51.00
APC	3.89	12.25	5.33	68.11
GPC	3.75	11.27	4.99	66.40
SPC	3.76	9.35	5.49	57.62

In addition to financial subsidies, TVA benefits from a full exemption from federal income taxes.[25] Using the formulas in the Appendix for calculating an annual tax subsidy rate relative to assets, and using reported income tax payments by the comparison firms averaged over the 2002-2024 period, TVA's average tax subsidy rate ranges from 1% to 2%. Average tax subsidies to TVA appear larger than its financial subsidies by as much as a factor of 2. However, a substantial reduction in the top corporate tax rate from 2018 onward suggests lower tax subsidy rates in recent years.

As noted in Section 2, the data used for financial subsidy estimation is not informative about the incidence of the subsidies. For policy evaluation it would be of considerable interest to know to what

[25] TVA is required to make state and local "tax equivalent payments" that are similar to the revenues from other utilities.

extent the subsidies are being used to lower electrical rates, or to invest more in renewables, or to maintain a larger or more highly compensated labor force than comparable utilities. Additional data might provide clues about the answers, but that analysis is left to future research.

5. Multiperiod estimates

In some cases, the decision-relevant cost is the present value of prospective subsidies extending over a multiperiod horizon. For example, a multi-year financial subsidy estimate would be one element of a cost-benefit analysis of a proposed new SOE to undertake a multi-year infrastructure project, or of a proposed major expansion in the operations of an existing SOE. Estimating the present value involves projecting future financial subsidy values and discounting them to the point in time that the evaluation is being conducted.

The simplest assumption about future annual subsidy flows, and one that is consistent with the framework proposed here, is that in each future year the subsidy is a constant multiple of the projected average value of the SOE's assets. The constant subsidy multiplier can be estimated using the approach described in Section 3 for existing SOEs, or for new enterprises it can be inferred from historical data on similar SOEs. The dynamics of the subsidy flows over time will then depend on the assumed dynamics of the SOE's asset value. Asset values generally change over time, with market conditions and with operational policies. Uncertainty about future economic conditions and managerial actions suggest that the evolution of asset values, and hence the flow of subsidies, is stochastic. There may also be a deterministic component to asset value changes, such as the scheduled completed construction projects. For a simple NPV calculation then, it is necessary to project the average value of assets each period over the projection horizon.

To translate the implied path of future expected annual subsidies into a present value, the simplest approach is to apply a risk-adjusted discount rate to the projected average future subsidies. Under the assumption of a constant subsidy multiplier, the priced risk associated with the subsidy is the same as for the SOE's assets. Hence, a discount rate that is risk-adjusted using the SOE's asset beta is a natural choice.

Continuing with the TVA example, imagine that in 2024 policymakers were considering privatizing TVA and were interested in the value of the savings from reduced financial support that would be created over the next 10 years. Based on the data from 2002-2024, the arithmetic average annual growth rate of book assets was 3%, with a standard deviation of 4.5%. The discount rate based on TVA's asset beta and the current 3-month Treasury rate was 10%. Applying the 0.78% subsidy rate from Section 4 to projected future asset values, the present value of savings over 10 years is $3.2 billion. The estimate is sensitive to assumptions about the asset growth rate and the discount rate, and there is uncertainty about both. The geometric average asset growth rate over the sample period was 2.8%. The 3-month Treasury rate in 2024 of 5.2% was higher than the average implied forward rates in the yield curve over the forecast period, presumably because inflation was expected to normalize. Setting the risk-free rate to a more typical value of 2.5% reduces the implied discount rate to 7.3%. Under those alternative rate assumptions, the 10-year savings increases to $3.6 billion.

Multiperiod estimates may also answer budget-relevant questions. Budgetary cost estimates inform policymakers about the incremental effect of proposed government expenditures. For example, imagine that Congress is considering funding of $3 million for new carbon-scrubbing equipment that TVA can use to reduce emissions from its coal plants, and that the equipment has a service life of 5 years and no salvage value. The same approach to financial subsidy estimation can be applied to the incremental asset value, taking into account the life of the assets and the pattern of depreciation.

For some types of financial support, the relation between financial subsidies and asset values is fundamentally non-linear. Taking into account nonlinearities can be especially important for valuing individual financial subsidy components, such as contingent government guarantees. When a non-linear claim can be represented as a derivative of SOE assets, and it can be valued using a derivatives pricing approach. However, to implement a derivatives pricing approach, complications specific to SOEs have to be taken into account. Those include differences in the dynamics of book and market value, and the lack of market price information. How those complications can be adjusted for is beyond the scope of this analysis, but we are exploring this in ongoing research.

6. Conclusions

The footprint of SOEs in the global economy is large and growing, and their financial connections with their state sponsors are varied and complex. This points to the importance and also the difficulty of understanding the fiscal implications of SOEs, either individually or collectively. Empirical studies such as DeWenter and Malatesta (2001) and OECD (2021) suggest that the value of preferential government financing is a significant component of total fiscal support provided to SOEs, but there is no generally agreed-upon framework for more rigorously and comprehensively assessing the value of financial subsidies to individual SOEs.

In this paper we have proposed a methodological framework for measuring SOE financial subsidies that we believe is both tractable and theoretically grounded, and demonstrated its application with the example of the U.S. federally-owned Tennessee Valley Authority. The framework addresses the complex and interacting financial clams that governments hold on SOEs by pivoting from the liability to the asset side of the SOE balance sheet. Whereas the fair rate of return on any individual government claim will be sensitive to contractual details and to the rest of the capital structure, the fair rate of return on assets is more stable and easier to estimate. The lack of market price information for SOE government claims is addressed with the use of accounting data. We show why estimates based on earnings before interest payments will produce more robust and less noisy estimates of financial subsidies than do the more commonly used metrics of ROA and ROE.

We plan in future research to apply this approach to several types of SOEs, starting with development and other government banks. We hope that other researchers and analysts will undertake investigations of financial subsidies to SOEs for various countries and sectors as well. However, an institutional impediment to governments officially estimating and recognizing these subsidies are budgetary rules and other government accounting conventions that preclude the inclusion of non-cash opportunity costs. Revising those rules to allow the full cost of financial subsidies to be recognized would provide policymakers with more complete information about, and control over, the fiscal effects of SOEs.

Appendix

Estimating Tax Subsidies

We have not included tax subsidies in this analysis because the financial subsidies related to government-held securities, which are our focus, are only indirectly affected by taxes. Instead, we assume that tax subsidies are calculated separately along with other non-financial subsidies, and then added to financial subsidies to estimate total subsidies. However, government tax claims are another type of financial claim. From that perspective, the annual tax subsidy to an SOE can be approximated using similar formulas to those for debt and equity. We consider tax subsidies evaluated against a baseline of what similar private sector firms pay in taxes, normalized by assets as a scaling variable.[26] The realized tax rate relative to assets for entity *i*, τ_i, is

(A1) $$\tau_i = taxes_i / A_i$$

where $taxes_i$ is the tax payment in a given year. The annual subsidy associated with tax breaks to an SOE on existing assets is approximated by:

(A2) $$Tax\ subsidy = \varphi_\tau = (\tau_{PS} - \tau_{SOE}) \times A_{SOE}$$

where a subscript *PS* denotes outcomes for comparable private sector firms. This tax subsidy component can be added to estimates of financial subsidies from equation (7) without double-counting because the capital subsidy is measured after taxes. Adding it in based on these formulas is equivalent to incorporating it in the financial subsidy calculation by starting with earnings before interest and taxes (EBIT) in place of EBI in equation (2). Calculating the two pieces separately avoids potential confusion about what is included in the definition of financial subsidies.

[26] Using tax rates for similar firms is not the only possible baseline, and doing so may understate tax subsidies for some purposes. For example, if all oil and gas firms are subject to a lower tax than other industries, then a baseline of taxes on non-SOE firms in the same industry would counterfactually show a tax subsidy of zero. In general, the appropriate baseline for tax subsidies may differ with the question being asked. The comparison to tax rates on similar firms is relevant to assessing competitive advantage effects of government support. The alternative of using the domestic corporate tax rate as the baseline captures subsidies that are industry-specific. However, it makes it difficult to interpret studies that compare SOE subsidies internationally. With country specific baselines, firms that are counted as subsidized in a high-tax jurisdiction may in fact pay taxes at a higher rate than unsubsidized firms in a low tax-rate jurisdiction. Therefore, choosing a common international baseline may be preferred in those instances. A version of equation (A2) will apply whatever tax baseline is chosen.

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