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Tax-Exempt Debt and the Capital Structure of Nonprofit Organizations: An Application to Hospitals

GERARD J. WEDIG, MAHMUD HASSAN, and MICHAEL A. MORRISEY*

ABSTRACT

The availability of tax-exempt financing provides nonprofit (NP) organizations with their own tax-based incentives to issue debt. In this article, we develop a theoretical model in which NPs gain an indirect arbitrage from tax-exempt debt issuance, constrained by: 1) the requirement that fixed investment exceed tax-exempt debt flows (the project financing constraint), and 2) the constraint against share issuance. These constraints cause them to impute tax benefits to projects that afford access to the tax-exempt bond market. Empirical tests indicate that NP hospitals behave as if they have target levels of tax-exempt debt. Debt targeting is constrained by the availability of capital projects, while excess debt capacity stimulates investment.

FINANCIAL THEORISTS HAVE GENERALLY been reluctant to apply the tenets of corporate finance to nonprofit institutions. In particular, there has been little or no follow-up to the important work of Fama and Jensen on the relationships between agency, contracting, and ownership, written over a decade ago. Current understanding of the financial basis and behaviors of nonprofit institutions is limited to three basic insights provided by their prior work; 1) the attenuation of residual claims, characteristic of nonprofit organizations, addresses the agency problems associated with private donations (Fama and Jensen (1983b)); 2) like other organizations, nonprofits require decision systems that separate the processes of management and control (Fama and Jensen (1983a)); and 3) given certain preconditions, investment opportunities available to nonprofits can be evaluated with the net present value rule, using discount rates defined by outside capital markets (Fama and Jensen (1985)). These observations comprise much of what is currently known about nonprofit corporate financial behavior.

Foremost among the set of unresolved issues is the theory of debt issuance by nonprofits, an area not explicitly addressed by the Fama and Jensen

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analysis. In the nonprofit hospital sector alone, it has been estimated that there is over one hundred billion dollars of tax-exempt debt outstanding at any given time (Grossman *et al.* (1993)). The importance of debt as a financial vehicle begs the question of why nonprofits issue debt, how the organization benefits from debt issuance, and whether the special institutional features of nonprofits influence their borrowing decisions. In short, a theory of capital structure applicable to the special features of nonprofit institutions and their capital markets is needed.

Tax-exempt, nonprofit (NP) institutions appear, at first glance, to be unlikely laboratories for the study of capital structure. Their exemption from the corporate income tax seemingly eliminates the primary impetus for issuing debt. Nonetheless NP organizations can indirectly benefit from the tax shields provided to investors in the municipal bond market. Whereas debt issuance provides taxable corporations with tax abatement at the corporate level, the municipal bond market provides tax abatement at the personal level. Since some of the personal tax abatement is reflected in the yields on municipal bonds, a financial incentive exists for NP organizations to issue tax-exempt bonds.[1] This interesting parallel has been largely neglected in the literature, along with an assortment of related research issues, such as the determinants of capital structure in NPs and whether factors such as agency, bankruptcy, or other forces counterbalance the incentive to increase leverage.

In this article, we present a theory of NP capital structure that explains how the distinctive features of NPs affect their use of debt-generated tax shields. Our theory is developed from the following stylized scenario. A nonprofit organization chooses taxable and tax-exempt debt levels, together with fixed asset acquisitions, in order to maximize end-of-period resources to spend on its NP objectives. The NP organization can earn an indirect arbitrage by issuing low-yield tax-exempt debt in lieu of spending its cash balances. Against this obvious incentive to issue debt lies a collection of factors that cause the marginal cost of borrowing to increase as leverage increases (agency, bankruptcy costs, etc.). The combination of factors leads to the usual internal optimum, which consists of a mix of equity (fund balance[2]) and tax-exempt debt.

In addition, however, the NP organization must satisfy a legal precondition, unique to the municipal bond market, known as the "project financing" rule.

[1] There is an obvious parallel here, with the financial models which hold that corporate tax abatement is ultimately bid into the yields of taxable bonds (DeAngelo and Masulis, (1980)). In that longstanding controversy, the issue is whether the **full** corporate tax benefit is bid away into the yields on taxable bonds and whether there is any incentive, at the margin, to issue taxable debt (Miller, (1977)). The case for issuing tax-exempt bonds is easier to make, since it only requires that some or all of the tax benefit of personal tax-exemption be bid into the (lower) yield of tax-exempt bonds.

[2] The term "fund balance" is derived from the practice of fund accounting, in which assets and liabilities are segregated by purpose. It is defined as the difference between total assets and total liabilities and is most analogous to paid-in capital and retained earnings in the for-profit enterprise. In the NP, fund balance is increased through excesses of revenues over expenses as well as through donations.

This rule requires the organization to undertake a set of approved capital projects whose dollar value equals or exceeds the flow of tax-exempt financing. Where this constraint does not bind, accumulations of tax-exempt debt are as described above, and investment and financing decisions do not interact. Where the constraint does bind, however, the organization is forced below its optimal leverage point and holds excess debt capacity. As a result, the organization is induced to invest in low-yield capital projects in order to access the tax-exempt debt market. In such financing regimes, the effective cost of capital becomes the marginal cost of tax-exempt financing.

Conversely, in some instances, the supply of high-yield projects may be abundant in relation to debt capacity. In these circumstances, not only is the project financing rule relaxed, but the NP institution may also find that it exhausts its debt capacity as well as its available stock of cash. Here, another distinctive feature of the NP form comes into play: the constraint against issuing shares. This constraint forces the hospital to issue tax-exempt debt beyond its optimal leverage point, generating financial losses associated with excess leverage. As a result, investment outlays are curtailed, somewhat, in order to reduce financing costs.

Our theoretical model shows how the unique institutional features of NP organizations affect their capital structure decisions. Similarities and differences with conventional (for profit) theories of capital structure emerge in the process. For example, the primary impetus for issuing debt, to gain a tax shield, has a direct analog in our model as discussed above. However, the legal constraints embodied in the project financing rule may limit the accumulation of debt below the point established by traditional determinants of capital structure, such as agency costs, bankruptcy costs, etc. In addition, our results point to an important role for internally-generated cash flow in the determination of debt flows, a direct result of the prohibition against issuing shares.

Our model also illustrates the various ways in which debt may interact with investment decisions. Investment flows are not directly tied to the level of current-period paid-in capital in the NP organization, since in most cases ex ante cash and fixed assets are used either to finance the outlay or to establish the capacity to issue debt. For this reason, projects do not generate their own debt capacity and are not automatically associated with the tax subsidies gained from debt issuance. Instead, tax subsidies are attached to specific (marginal) projects only, where they operate to relax the project financing constraint.

Empirical tests of these key aspects of our theory are presented in the second half of the article. Here, we apply adjustment costs and financial targeting behavior to our model, drawing on the previous work of Taggart (1977), Marsh (1982), Jalilvand and Harris (1984), and others. Applications of quadratic adjustment costs produce structural representations of the main theory. The main predictions of the model are then used to sign the coefficients of the structural model. For example, the basic hypothesis of debt targeting is tested with a variable that measures the difference of the debt target from lagged debt levels. Under debt targeting, the coefficient of this variable should be positive. Likewise, the constraining effect of the project financing rule is evaluated by gauging the effect of a variable that measures excess debt capacity, in financial regimes where the project financing rule binds. We test the resulting specifications using a time series of data on 155 California NP hospitals. Both single-equation and multiple equation (seemingly unrelated regression) estimates are provided for overall debt flows, taxable debt flows, tax-exempt debt flows, and fixed capital investment. Our empirical results provide strong qualitative support for the model's main hypotheses.

While, as noted, little has been written on the topic of NP capital structure, a previous effort by the authors bears mentioning here. In Wedig *et al.* (1988), it was shown that some of the factors which normally constrain corporate debt levels, such as the business risk of cash flows, also constrain overall debt levels in NP hospitals. In that case, however, incentives to issue debt were linked, empirically and theoretically, to certain biases inherent in the reimbursement formulae for hospital capital expense. We believe the present article to be more general, in that the incentive to issue debt is derived from the tax subsidies implicit in municipal finance. As a result, our results can be applied to NP organizations generally, since most NP organizations have access to municipal finance options. On the other hand, some of our stylized assumptions, such as conditioning on a fixed stock of equity, are arguably more relevant to health-care and present an agenda for future extensions of our work.[3]

The article is organized as follows. Section I provides a brief discussion of agency costs, financial distress, and the cost of debt financing in nonprofits. The existing literature on costly debt financing has yet to be extended to the nonprofit sector, but convex costs of debt financing are a key element of the stylized model developed in Section III. For this reason, Section I explains why many of the agency-related costs of debt financing are likely to apply in the nonprofit sector as well. Section II presents the theoretical model and derives different financial regimes under which the cost of capital varies and taxable and tax-exempt debt are used for different purposes. A graphic treatment is provided that shows how the organization's cost of capital varies across different regimes. Section II also offers an extension that derives empirical specifications from the basic model and summarizes the main hypotheses. Empirical methods and data are discussed in Section III. Results, using a time series of 155 nonprofit hospitals from California, are presented in Section IV. The article concludes in Section V with a discussion.

[3] One stylized feature of the NP hospital that distinguishes it from some other NP organizations is its relatively small reliance upon philanthropy for either operating costs or capital financing. For this reason, the role of donations is suppressed in our model. However, we believe that our model and its results easily could be extended to incorporate donations, for example, by including a donations function that depends upon the financial need of the organization. For an example of such a model see Wedig (1994).

I. Agency Costs of Debt in Nonprofit Organizations

In their original work, Fama and Jensen argue, in essence, that the nonprofit organizational form eliminates the role of residual claimant in order to guarantee that donors will not have their contributions expropriated by shareholders. In addition, control structures are developed to guard against expropriations by managers or other factors of production. Finally, use of the value maximization rule for investment decisions is justified on the basis that investments represent opportunities to substitute current for future donations. However, Fama and Jensen do not take up the role of debt financing, which is also a potential substitute for current donations or, at any rate, can be used to leverage the value of donations. Nor are the attendant costs of debt financing considered.

Though ignoring the agency costs of debt, Fama and Jensen (1983a) observe that in the nonprofit organization "incentives of other internal agents to expropriate donations remain" and that "agency problems between donors and decision agents in nonprofits are similar to those in other organizations." These statements have their basis in the fact that, like other organizational forms, nonprofits comprise a nexus of contracts between interested parties, with the attendant issues of agency and inefficiency. This offers a general rationale for exploring potential agency problems between nonprofits and debt holders.

Intuition suggests that many of the agency-related costs associated with debt financing may be applied to nonprofit organizations as well. The substantial literature on the agency costs of debt financing comprises a wide array of inefficient behaviors, including investing, shirking, as well as informational inefficiencies (Harris and Raviv (1991), Myers and Majluf (1984), Myers (1977), Jensen and Meckling (1976)). Features of the nonprofit enterprise suggest that many of the same issues may apply here as well. Both management and donors have an incentive to expropriate bond holders in order to further their personal goals, as well as the mission of the nonprofit enterprise.

Arguably, the single greatest difference in the case considered here is that debt need not substitute for equity per se, since the enterprise is constrained against paying dividends. For example, where substantial tax-exempt debt is issued, the nonprofit is likely to accumulate and preserve large stocks of cash (our data confirm these positive correlations). Crucially, however, the Internal Revenue Service (IRS) code regulating arbitrage of tax-exempt bonds prevents the nonprofit from structuring bond covenants in which the cash is used to directly collateralize the debt (Edwards (1992)).

For this reason, the issuance of tax-exempt debt is also likely to be associated with agency costs of various types. Cash made available (preserved) via the issuance of tax-exempt debt may be invested in risky projects (the asset substitution effect) or consumed by management and employees outright. Actions such as these may increase the risk of bankruptcy, but are undertaken because their cost is borne, in part, by bondholders.

It is also significant that some of the tools commonly used to address agency costs of debt issuance may not be available in a nonprofit context. For example, the strategy of repurchasing debt (Barnea, Haugen, and Senbet (1980)), is not easily exercised, since nonprofits frequently operate under capital constraints. Conversely, the ability to discipline management is curtailed, since the market for control of the enterprise is hampered by the absence of publicly traded equity. Finally, it is impossible for nonprofits to issue convertible debt, which might otherwise address the moral hazard with respect to project decisions. These various constraints aggravate the agency costs associated with debt issuance.

Even absent the behaviors associated with agency relationships, the issuance of debt will enhance the likelihood of bankruptcy. Where there are costs associated with bankruptcy (or near-bankrupt states), the costs of debt may also be increasing (Kraus and Litzenberger (1973), Altman (1984)). Some indirect evidence in support of the role of bankruptcy costs in nonprofit hospitals' leverage decisions is provided in Wedig *et al.* (1988). Independent covariates associated with bankruptcy risk, such as the variance of earnings, are shown to reduce leverage in a sample of nonprofit hospitals.

In addition, the issuance of tax-exempt debt is accompanied by special oversight from a bond trustee. This oversight may be viewed, to some extent, as exogenous in that it is a regulatory feature of these markets. Violation of specific bond covenants with respect to earnings typically triggers an active oversight and intervention by the trustee. It is plausible to assume that management wishes to reduce the likelihood of such interventions in order to preserve autonomy and, to some extent, secrecy. Moderation of the institution's leverage may be viewed as the key to reducing the likelihood of such interventions.

Both agency and bankruptcy considerations establish the presumption of an upward sloping cost of debt schedule in nonprofits. In what follows, these costs will be modeled in a simplified and stylized framework which, nonetheless, accounts for the general effects of agency and bankruptcy on the sorts of behaviors we wish to model. More rigorous modeling of debt contracting in nonprofit organizations can be a topic for future work in this area.

II. The Model

A. Assumptions

We model the NP organization's debt, capital, and other flows using a single-period model under perfect certainty. We dispense with the usual state-contingent cash flow model in order to focus on the project financing and share issuance constraints per se. While a full treatment of the problem would incorporate both dynamics and uncertainty, our approach captures essential intuition while retaining the virtue of simplicity.[4] As such, we regard our

[4] We have also derived a) steady-state analogs to the results shown below using a model with long-lived capital assets, and b) results under a state-contingent cash flow approach, which

approach as a useful partial model of NP financing decisions.[5]

NP organizations maximize end-of-period utility, which is a function of discretionary cash flow: profits which may be expended at the discretion of management or the board. Formally, they choose variables to maximize,

$$U = U(Z), \qquad U_Z > 0, \qquad U_{Z,Z} < 0, \tag{1}$$

where Z is discretionary cash flow.

While much has been written, there is little consensus as to the objectives of nonprofits. Our purpose here is not to revisit this issue, but to work with a problem which we interpret as separable and prior to the decision of how to expend surplus. Thus, U is to be regarded as the organization's indirect utility function, where the prices of inputs into the direct utility function are suppressed.[6]

Net income is an increasing and concave function of the net capital stock. For analytic purposes, we segregate assets into two categories: "exempt" and "nonexempt." Exempt assets qualify for tax-exempt financing by virtue of their producing services related to the charitable mission of the organization. Nonexempt assets are employed in activities unrelated to the charitable purpose and do not qualify for tax-exempt funding. However, they still generate discretionary income. Both classes of assets are associated with their own marginal revenue functions:

$$R^i = R^i(K^i), \qquad R^i_K > 0, \qquad R^i_{K,K} < 0, \quad i = (x, n), \tag{2}$$

where R is revenue net of non-capital expenses, K is the net capital stock, and the vector (x, n) refers to exempt and nonexempt assets respectively. We

incorporates specific forms of bankruptcy and agency costs. We choose to present one-period results under perfect certainty because the more complex derivations are more difficult to follow and add no additional intuition. Dynamics are partially introduced later in the form of quadratic adjustment costs.

[5] We regard our one-period treatment as incomplete in the sense that it fails to model the effects of current period decisions on the parameters of future problems. For example, if capital is long lived and irreversible, then the future demand for capital should be incorporated into current decisions. Similarly, if debt is long lived and irreversible (non-callable), then the future demands for both debt and capital may enter into the current period borrowing decisions. We anticipate that adding uncertainty to the mix would cause NP organizations to hedge current decisions to some degree.

The net effects of these omissions will be minimal to the extent that NPs are reasonably confident that the future will be similar to the present and to the extent that adjustment costs are small.

[6] The "indirect utility" function approach to modeling nonprofit hospitals' financial decisions is used previously in Wedig *et al.* (1988). One problem with the indirect utility interpretation is that some of the assets which contribute to cash flows may also contribute to utility directly (e.g., capital assets may provide direct utility as well as cash flows). In principle, this issue can be handled by positing a "hybrid" utility function which is increasing in both income and these assets. However, calculations using a utility function of this form yield the same qualitative findings as those which fall out of the simpler indirect utility approach.

assume that the net capital stock in period t is composed of assets in place at time zero plus investment expenditures made at time zero.

The law governing the use of tax-exempt debt is a central feature of our model. We consider a stylized depiction of the law in this area and model financial behavior accordingly.

Project Financing Rule: The flow of tax-exempt debt into the NP organization at time zero must be less than or equal to the flow of exempt investment expenditures at time zero.

$$(B^{x,t} - B^{x,o}) \leq I^{x,o}, \tag{3}$$

where $B^{x,t}$ is the stock of tax-exempt debt at time t and $I^{x,o}$ are exempt asset (investment) flows at time zero.[7]

The rule states that NP organizations must match specific approved projects[8] with their tax-exempt debt flows, so that tax-exempt financing is in effect "project financing." We also assume that NPs have a taxable debt option as well. Taxable debt can be issued without restriction, although its yield is strictly greater than that of tax-exempt debt at any level of organizational leverage (see assumptions below).

The interest rates paid on both taxable and tax-exempt debt are assumed to be increasing and convex functions of the ratio of total outstanding debt (tax-exempt and taxable) to the sum of cash and fixed assets. Formally,

$$r^i = r^i\left(\frac{B^{x,t} + B^{n,t}}{K^t + E^t}\right) = r^i(b), \quad r^i_b > 0, \quad r^i_{b,b} > 0, \qquad i = (x, n), \tag{4}$$

where r^i are the interest rates on each type of debt, E^t is the level of cash assets retained during period t, and b denotes the overall debt to assets ratio.

[7] There is a stricter interpretation of the law than the one provided in the project financing rule. A stricter interpretation requires NP organizations to expend all available cash resources prior to accessing the bond market, so that bonds are not used to earn arbitrage profits indirectly. Under this representation, tax-exempt bonds are solely a funding source of last resort after internal funds have been exhausted. For a variety of reasons, we believe that organizations can legally evade this interpretation of the law. For example, available cash can be designated by the organization to reduce the general credit risk of the organization. Alternatively, cash can be assigned to a future project. The stricter interpretation of the law, however, constitutes an alternative theory of financial behavior that can be tested in the paper's empirical section. See Edwards (1992), for a detailed discussion of these issues.

[8] An "approved" project is one which furthers the tax-exempt purpose of the organization, such as the rendering of patient care in the case of hospitals. Under this provision, certain projects do not generally qualify for tax-exempt funding. Examples would include the construction of physician office space, parking lot space, etc., in the case of hospitals.

This assumption is made in lieu of an explicit treatment of uncertainty.[9] Note that the two interest rates are different functions of the same argument, the overall leverage ratio.

We assume that the organization is endowed with cash and other liquid assets (e.g., marketable securities) at time zero. These assets may be expended at time zero. Any cash not expended at time zero remains in an interest-bearing account throughout the period, earning interest at a riskless rate equal to r^f. In addition, cash balances cannot be driven below zero. This implies, for example, that donations cannot be used to make up any cash flow deficits. This assumption is consistent with the generally small level of donations NP hospitals currently enjoy (Sloan *et al.*, (1990)).

Finally, the NP organization must satisfy two cash flow identities. At the beginning of the period, expenditures on both categories of investment (exempt and nonexempt) must be balanced with depletions of cash and additions to debt. At the end of the period, net cash flow, Z, is equal to net revenues, R^i plus interest earnings on cash minus debt service. Formally,

$$I^{x,t} + I^{n,t} = (E^o - E^t) + (B^{x,t} - B^{x,o}) + (B^{n,t} - B^{n,o}), \tag{5a}$$

$$Z^t = R^x(K^{x,t}(I^{x,t})) + R^n(K^{n,t}(I^{n,t})) + (1 + r^f)E^t - (1 + r^x)B^{x,t} - (1 + r^n)B^{n,t}. \tag{5b}$$

In our notation, we distinguish between the endowed levels of assets and their subsequent choice levels using the superscripts o and t. It is understood that investments, debt, and liquid asset flows all occur at the beginning of the period, while net cash flows, revenues, interest earnings, and debt service occur at the end of the period.

B. *Model Solution*

Utility is maximized by maximizing discretionary income, Z. The problem can be stated

$$\max Z = R^x(K^{x,t}(I^{x,t})) + R^n(K^{n,t}(I^{n,t})) + (1 + r^f)E^t - (1 + r^x)B^{x,t} - (1 + r^n)B^{n,t}, \tag{6}$$

$$\text{subject to } (B^{x,t} - B^{x,o}) \leq I^{x,t}, \tag{6a}$$

$$E^t = E^o - I^{x,t} - I^{n,t} + (B^{x,t} - B^{x,o}) + (B^{n,t} - B^{n,o}), \tag{6b}$$

$$E^t \geq 0. \tag{6c}$$

[9] According to this assumption, cash and fixed capital are perfect substitutes in the reduction of bondholder risk. While cash may seem less risky, arbitrage law prohibits cash from being pledged directly as collateral for tax-exempt debt. Hence we justify our treatment of cash and fixed assets as symmetric in the reduction of bondholder risk. For a more detailed treatment of the determinants of yields on hospital tax-exempt bonds, see Grossman *et al.* (1993).

The choices are over $B^{x,t}$, $I^{x,t}$, $B^{n,t}$, and $I^{n,t}$. Conditional upon these choices, E^t is determined by equation (6b).

The first order conditions for $B^{x,t}$, $I^{x,t}$, $B^{n,t}$, and $I^{n,t}$, respectively, are (suppressing time superscripts),

$$(r^f - r^x) - r_b^x((b^x)(1 - b)) - r_b^n((b^n)(1 - b)) = (\mu - \Omega), \tag{7a}$$

$$R_I^x - (1 + r^f) = (\Omega - \mu), \tag{7b}$$

$$(r^f - r^n) - r_b^n((b^n)(1 - b)) - r_b^x((b^x)(1 - b)) = -\Omega, \tag{7c}$$

$$R_I^n - (1 + r^f) = \Omega, \tag{7d}$$

where μ is the shadow price of constraint (6a) (the project financing constraint), and Ω is the shadow price of constraint (6c) (referred to henceforth as the "cash constraint"). All notation is as before, with the exception of b^x and b^n. These symbols refer to the ratios of tax-exempt debt to total assets and taxable debt to total assets, respectively (e.g., $b^x = (B^x/(E + K^n + K^x))$.

Equations (7a–7d) define the NP's optimal debt and investment flows. Notation notwithstanding, the results are intuitive. In the case of debt (equations (7a) and (7c)), the left-hand side gives the net arbitrage (positive or negative) associated with debt issuance. The arbitrage is the difference between the risk free rate and the full marginal cost of debt issuance, including its effects on the interest rates r^i. The net arbitrage is equated with the shadow prices of the financing constraints (6a) and (6c). Thus, for example, the negative arbitrage associated with taxable debt issuance (equation (7c)) is equated with its marginal value in relaxing the cash constraint, (6c). For investment, (equations (7b) and (7d)) the marginal returns on exempt and nonexempt assets are set equal to the risk-free rate of return plus the shadow price of the relevant financing constraint. Exempt projects help to relax the project financing constraint (μ), whereas nonexempt projects do not. Both types of projects use cash and may be assigned shadow costs, Ω, associated with the cash constraint.

Note that all aspects of financial behavior, including the cost of capital, the flow of investment, the marginal source of capital financing, and the leverage level vary, depending on whether the constraints associated with μ and Ω are binding. For this reason, the full solution is most accurately understood as four distinct solutions corresponding to different financing "regimes." Here, a regime is defined by which, if any, of the two constraints bind. There are four regimes defined by whether (a) μ binds, (b) Ω binds, (c) neither Ω nor μ binds, or (d) both Ω and μ bind.

A specific NP organization's regime depends upon the initial conditions of its problem, including its level of endowed cash, debt, investment opportunities, and market interest rates. Moreover, since different behaviors are predicted in each regime, it is useful to analyze the regimes independently. This is done by a) interpreting the first order conditions (7a)–(7d) under the specific assumptions about μ and Ω, and b) conducting separate comparative statics with respect to shifts in the marginal return schedules, R_I, initial cash levels, E^o, and shifts in the level and spread between yields on taxable and tax-exempt bonds.

B.1. Regime 1: Project Financing Rule Binds; Cash Constraint Does Not

Define regime one as the regime in which only the project financing constraint binds ($\mu > 0$, $\Omega = 0$). Since the cash constraint does not bind, the NP organization carries a positive stock of cash. In addition, with Ω set to zero, equation (7c) is not satisfied at any positive level of taxable debt. Instead taxable debt issues are set equal to zero, since they are not needed to relax the cash constraint, and they are associated with a negative financial arbitrage. On the other hand, since the project financing rule does bind, ($\mu > 0$) organizational leverage is forced below its unconstrained optimum. Intuitively, NP organizations in this regime are "cash rich" in relation to their investment opportunities. Their cash resources generate excess debt capacity, which forces them against their project financing constraint as a result. At the optimum, there is still a positive arbitrage associated with marginal tax-exempt debt issuance, but insufficient numbers of exempt projects to access this debt.

Insights into the marginal cost of capital for exempt projects follow from combining equation (7a) with (7b). This gives:

$$R_I^x - 1 = r^f - \mu = r^x + r_b^x((b)(1 - b)). \tag{8}$$

For exempt projects, the marginal cost of capital is less than the risk-free rate and equal to the marginal cost of financing with 100 percent tax-exempt debt.[10] For nonexempt projects, (7d) (with Ω set to zero) indicates that the cost of capital is equal to r^f. These results are intuitive. Given that the organization is constrained to carry less tax-exempt debt than it desires, it finances all marginal exempt projects with tax-exempt debt and assigns exempt projects a marginal cost of capital equal to the marginal cost of those funds. Nonexempt projects, which do not qualify for tax-exempt debt, are financed out of cash, which has an opportunity cost of r^f.

Formal comparative statics (see Table I) confirm these results. Panel A signs the comparative statics of the choice variables with respect to a) positive,

[10] It is easy to show that the expression ($r^x + r_b^x$(b)(1 − b)) is the marginal capital cost of financing a fixed capital asset with all tax-exempt debt. Consider the expression for total interest expense in this case:

$$\text{IE} = r^x B^x,$$

where IE is interest expense. Differentiate total interest expense with respect to the level of capital investment while assuming all debt financing. This yields,

$$\text{IE}_I = r^x + r_I^x B^x = r^x + r_b^x b - r_b^x b^2.$$

Simplification yields the desired result. The second term on the right side reflects the effects of incremental debt on the interest rate, whereas the final term represents the effect that acquiring fixed capital assets has on the interest rate (increases in capital increase the asset base and reduce the interest rate).

Table I

Model Comparative Statics Separately By Financial Regime

Each matrix provides the signed results of comparative statics calculation computed under different assumptions about the shadow prices μ and Ω. μ is the shadow price of the project financing constraint while Ω is the shadow price of the cash constraint. B^x is tax-exempt debt, B^n is taxable debt, I^x are investment flows for tax-exempt projects, I^n are flows for taxable projects. R_I^x is the marginal return associated with tax-exempt projects, E^o is the initial stock of cash, r^f is the risk-free interest rate, and $(r^f - r^x)$ is the spread between the risk-free and tax-exempt interest rates. Four different matrices are obtained by modeling feasible combinations of positive and zero values for (μ, Ω). Endogenous shifts are indicated on the vertical axis with respect to exogenous shifts indicated on the horizontal axis. Unambiguous positive results are indicated by (+). Unambiguous negative results are indicated by (−). Zero effects are indicated by (0). Ambiguous results are indicated by (?). (·) indicates not applicable. Calculations supporting the summary of results given in this table are available from the authors.

Panel A: Regime 1, Only Project Financing Constraint Binds

Variable	$d\,R_I^x$ [1]	$d\,E^o$	$d\,r^f$ [2]	$d\,(r^f - r^x)$ [3]
$d\,B^x$	+	+	−	+
$d\,B^n$	0	0	0	0
$d\,I^x$	+	+	−	0
$d\,I^n$	0	0	−	+
$d\,\mu$	−	+	+	+
$d\,\Omega$	·	·	·	·

Panel B: Regime 2, Neither Constraint Binds

Variable	$d\,R_I^x$ [1]	$d\,E^o$	$d\,r^f$ [2]	$d\,(r^f - r^x)$ [3]
$d\,B^x$	0	+	0	+
$d\,B^n$	0	0	0	0
$d\,I^x$	+	0	−	0
$d\,I^n$	0	0	−	0
$d\,\mu$	·	·	·	·
$d\,\Omega$	·	·	·	·

Panel C: Regime 3, Only Cash Constraint Binds

Variable	$d\,R_I^x$ [1]	$d\,E^o$	$d\,r^f$ [2]	$d\,(r^f - r^x)$ [3]
$d\,B^x$	+	?	−	+
$d\,B^n$	0	0	0	0
$d\,I^x$	+	+	−	+
$d\,I^n$	−	+	−	+
$d\,\mu$	·	·	·	·
$d\,\Omega$	+	−	−	−

Panel D: Regime 4, Both Constraints Bind

Variable	$d\,R_I^x$ [1]	$d\,E^o$	$d\,r^f$ [2]	$d\,(r^f - r^x)$ [3]
$d\,B^x$	+	+	−	+
$d\,B^n$	−	?	−	−
$d\,I^x$	+	+	−	+
$d\,I^n$	−	+	−	−
$d\,\mu$	−	−	−	+
$d\,\Omega$	+	−	−	+

[1] Refers to increases in R_I^x holding I^x fixed.
[2] Refers to increases in r^f holding constant $(r^f - r^x)$.
[3] Refers to increases in $(r^f - r^x)$ holding constant r^f.

exogenous shifts in the marginal return to investment schedule, R_I^x, b) increases in initial cash, E^o, c) increases in the risk-free rate, r^f (holding the spread between r^f and r^x fixed), and d) increases in the interest rate differential, $(r^f - r^x)$ (holding r^f fixed). In all cases, the comparative statics indicate that increases in the level of exempt investment, $I^{x,t}$, are matched dollar for dollar with increases in tax-exempt-bonds.[11]

[11] The formal expressions that confirm this equality are not given in Table I due to space limitations. They are available from the authors.

The other comparative statics results for regime one include: a) increases in the initial level of cash decrease the risk associated with debt and increase the implicit arbitrage from tax-exempt financing, leading to increases in the level of tax-exempt debt and investment needed to access the arbitrage; b) increases in the spread between the taxable and tax-exempt interest rates have a similar effect; and c) increases in the risk-free rate, holding the spread between taxable and exempt rates fixed, reduce both investment and debt holdings. These results are consistent with the notion that access to the tax-exempt bond market affects real organizational behaviors in this regime. As a result, factors that increase the subsidy realized from tax-exempt debt increase investment flows as well.

B.2. Regime 2: Neither the Project Financing Nor Cash Constraints Bind

Regime two is defined as the regime in which neither constraint binds. It is a natural extension of Regime one in the sense that NP organizations enjoying successive, positive, exogenous shifts in their investment opportunities eventually transition into this regime. Inspection of equation (7c) reveals that no taxable debt is issued, for the same reason given for Regime one: it is unneeded to satisfy the cash flow constraint. On the other hand, equation (7a), with μ set to zero, indicates that tax-exempt debt is issued until the arbitrage on marginal debt is zero. Intuitively, NPs in this regime do not have to constrain their real behaviors to reach their desired leverage position. The set of investment projects they plan, assuming a risk-free rate, r^f, allows them to satisfy the project financing constraint at the point of maximum desired leverage.

The cost of capital for capital projects can be inferred from equations (7b) and (7d). For both exempt and nonexempt projects it is equal to the risk-free rate. Again, this is intuitive. Since exempt projects are not needed at the margin to access desired debt flows, they are not imputed in any of the subsidy associated with tax-exempt debt. Indeed, both types of projects are financed, at the margin, by cash on hand.

These conclusions are confirmed by the comparative statics results given in Panel B of Table I. Here, shifts in the marginal return on investment schedule affect real investment with no corresponding effect on the level of tax-exempt debt. The same holds for shifts in the risk-free interest rate, which depress investment with no effect on tax-exempt debt levels. Conversely, shifts in the level of initial cash or the spread between taxable and tax-exempt rates increase the level of tax-exempt debt with no corresponding effect on the level of investment.

Overall, Regime two is one in which real and financial behaviors are uncoupled. Because investment flows are not needed to attain desired debt levels, factors that influence the level of investment do not affect debt levels, nor vice versa. In this sense, the subsidy NPs receive from the municipal bond market exerts no influence on their real investment behaviors, and merely serves to increase their discretionary income.

B.3. Regime 3: Cash Constraint Binds; Project Financing Constraint Does Not

Assuming investment opportunities improve, nonprofits in Regime two finance additional investment outlays with cash. Where cash is finally exhausted, Ω binds. If μ does not bind simultaneously, then the NP enters Regime three. As in Regimes one and two, no taxable debt is issued in this regime. Although debt is needed to relax the cash constraint, less expensive tax-exempt debt can be issued, so taxable debt markets are not tapped. Conversely, tax-exempt debt is now issued past the optimal arbitrage point where its marginal cost equals the risk-free rate, since it is also needed here to provide cash. Intuitively, organizations in this regime are "cash-poor" in relation to their investment opportunities. Cash balances are driven to zero, and debt is issued in order to access favorable investment opportunities, which would otherwise be foregone.

The marginal cost of capital for both exempt and nonexempt projects alike can be found by combining either equation (7b) or (7d) with (7a) to get,

$$R_I^i - 1 = r^f + \Omega = r^x + r_b(b)(1 - b), \quad i = (x, n). \tag{9}$$

The marginal cost of capital for both types of projects is relatively high, exceeding the risk-free rate and equal to the marginal cost of tax-exempt funds. Given that leverage exceeds the optimum, only relatively high-yield projects are undertaken at the margin. Note that even nonexempt projects are effectively financed at the margin with tax-exempt funds. This is possible, since tax-exempt debt issuance is less than exempt investment outlays. Hence, any increase in nonexempt project outlays are financed by increasing the flow of tax-exempt debt, while nominally designating that marginal debt for inframarginal exempt projects. This frees up cash for the nonexempt projects.

Comparative statics confirm the intuition of a "cash poor" regime. The results in Panel C of Table I indicate that positive shifts in the marginal revenue of investment increase the flow of exempt investment. However, this is financed through a combination of increased tax-exempt bonds and reduced nonexempt project outlays. Conversely, increases in the initial cash level reduce the risk associated with any debt level. This has the effect of reducing the marginal cost of capital, which in turn increases both exempt and nonexempt project outlays. The net effects of overall bond issuance are unsigned however.

Increases in the spread between taxable and tax-exempt rates, holding the risk-free rate fixed, also reduce the cost of capital, increase the flow of tax-exempt bonds, and increase exempt and nonexempt project outlays. Finally, increases in the risk-free rate, holding the spread fixed, have the opposite effect. The cost of capital increases, and the flow of bonds and investment outlays fall.

B.4. Regime 4: Both Project Financing and Cash Constraints Bind

Finally, in Regime four, both the project financing and cash constraints are binding. This regime is similar in most respects to Regime three, in that investment outlays exhaust cash balances, and debt financing must be used to access marginal projects. The primary difference with Regime three is that not all desired debt financing can be obtained from tax-exempt markets. This is because the overall flow of desired debt financing exceeds the level of investment for exempt projects. As a result, taxable debt markets are utilized to provide some portion of the financing needed for nonexempt projects. Intuitively, the relative mix of investment opportunities in Regime four is weighted toward nonexempt projects. This explains why the strategy of financing 100 percent of exempt projects with tax-exempt debt still does not free up enough cash to access all of the desired nonexempt projects.

To gain insights into the marginal cost of capital, consider equations (7b) and (7d) under the assumptions that μ and Ω are positive. It is apparent that the marginal cost of capital is smaller for exempt projects, which are financed with tax-exempt debt, compared to nonexempt projects, which are financed with taxable debt. Note, in addition, that the cost for nonexempt projects exceeds the risk-free rate. The cost of capital may be greater or less than the risk-free rate for exempt projects, depending upon the overall leverage level.

Comparative statics, as depicted in Panel D of Table I, indicate that taxable and tax-exempt projects and financing may interact with one another in this regime. For example, factors which increase the marginal return schedule for exempt projects or the spread between the risk-free rate and the tax-exempt rate cause increases in the level of tax-exempt debt and exempt projects. However, the increase in the level of tax-exempt debt increases the marginal cost of taxable debt, leading to reductions in taxable debt levels and nonexempt projects. Conversely, increases in the initial level of cash reduce the marginal cost of both taxable and tax-exempt debt by reducing the overall leverage level. This leads to increases in both taxable and tax-exempt funding and project outlays. The opposite pattern of results holds for increases in the risk-free interest rate, holding the spread between interest rates fixed.

B.5. Graphic Illustration

While space constraints do not permit a graphical depiction of financial behavior in all regimes, a specific example provides some intuitive insight into the comparative statics of the model. Figure 1 provides a graphic depiction of the expressions in equation (7b), illustrating how the marginal cost of capital for exempt projects varies across Regimes one through three. Here, we assume that nonexempt project outlays are held fixed and are less than the initial level of cash, E^o, so that the organization does not encounter Regime four, regardless of its outlays on exempt projects.

Figure 1 illustrates how the NP organization's marginal cost of capital for exempt investment outlays, $(1 + r^f + \Omega - \mu)$ varies as fixed investment outlays, $I^{x,t}$, are increased. The optimal flow of fixed investment is found at the intersection of the marginal revenue of investment curve (curves R_I) with the marginal cost of capital curve (labeled 0123). Thus, Figure 1 depicts the solution to equation (2b) across three different marginal revenues of investment schedules, R_I, holding $I^{n,t}$ fixed at its optimal value. It is clear that the

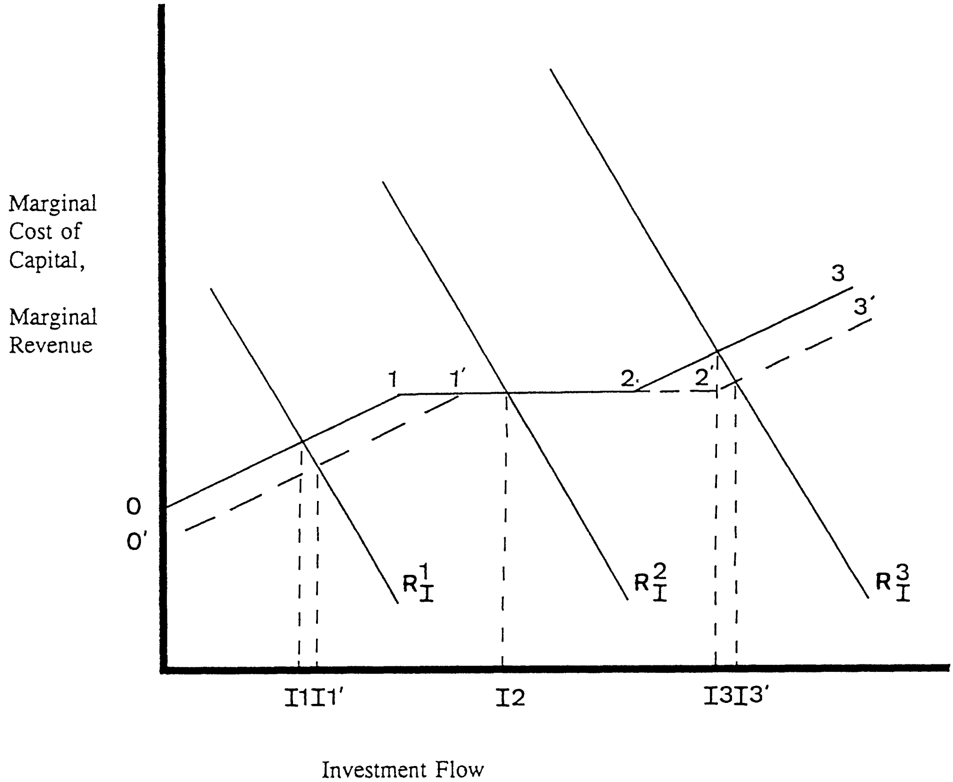

Figure 1. Cost of capital and investment flows under three different financing regimes. This figure indicates the relationship between the nonprofit firm's marginal cost of capital and its level of investment. It also illustrates the comparative statics effects of changes in the yield on tax-exempt debt and total investment flows. I refers to total investment outlays and R_I refers to the marginal return on capital. The marginal cost of capital varies by the nonprofit's financial regime. Reductions in the yield on tax-exempt debt stimulate investment only if either or both of the project financing and cash constraints bind.

marginal cost of capital is increasing at higher levels of outlay and that more and more favorable investment opportunities lead to transitions across the three regimes. Regimes one, two, and three are indicated by the line segments 0–1, 1–2, and 2–3 respectively. Note that the marginal cost of capital slopes upwards in Regimes one and three only, to reflect the fact that the leverage ratio increases with the flow of investment in these regimes.

Using Figure 1, it is also possible to illustrate the comparative statics of a marginal reduction in the cost of tax-exempt debt, r^x, holding the risk-free rate, r^f, fixed.[12] This is done by shifting the marginal cost of capital schedule to reflect variation in the NP's marginal interest costs. The revised schedule is

[12] This is equivalent to an increase in the interest rate spread, $(r^f - r^x)$ holding r^f fixed. For example, any change in tax policy which provides more favorable tax treatment to holders of tax-exempt debt will drive down the yield on tax-exempt bonds and have this effect.

labeled 0′1′2′3′. As shown here, a discrete reduction in the tax-exempt interest rate shifts the marginal cost of capital downward in Regimes one and three while shifting the transition points from one regime to another to the right. The downward shift is intuitive. The rightward shifts, on the other hand, reflect the fact that the optimal mix of debt to equity grows with a reduction in the cost of tax-exempt debt. This, in turn, extends Regime one and shifts the start of Regime three to the right.

The shift in the cost of capital illustrates a key result discussed above. Reductions in the marginal cost of tax-exempt debt do not stimulate investment outlays in Regime two. For example, the shift in the cost of capital increases investment from I1 to I1 in Regime one, but has no effect in Regime two, where investment remains at I2. In Regime three, however, a similar increase from I3 to I3′ occurs.[13]

C. Adjustment Costs and An Empirical Specification

We test our model and its hypotheses by incorporating a partial adjustment mechanism into the single period framework. Our approach is similar in spirit to the ones employed by Taggart (1977), Marsh (1982), Jalilvand and Harris (1984), and others for testing static theories of capital structure and financing behavior. In this approach, the predictions of a static theory are tested by seeing whether changes in the stocks of assets and liabilities are consistent with movement toward a theoretical optimum. Structural representations of these movements, derived from theory, form the specifications for these tests.

Two model refinements are needed to complete the empirical specifications in this case: a) adjustment costs and b) quadratic specifications of the functions for marginal revenue and interest rates. The adjustment costs are added to account for the fact that NPs are not likely to move instantly and completely to the targeted values for debt, and assets implied by the model.[14] For computational convenience, we assume that these costs are quadratic in the net changes in assets or liabilities. Total adjustment costs are written,

$$A^t = \alpha^{B,x}(B^{x,t} - B^{x,0})^2 + \alpha^{B,n}(B^{n,t} - B^{n,0})^2 + \alpha^{K,x}(K^{x,t} - K^{x,0})^2 + \alpha^{K,n}(K^{n,t} - K^{n,0})^2, \quad (10)$$

where A^t are total adjustment costs at time t and the various α are adjustment cost coefficients (no adjustment costs are associated with cash and marketable securities). It is assumed that adjustment costs are netted out of end-of-period profits.

[13] Also, not shown here is an associated increase in the flow of nonexempt investment which would occur if the marginal cost of tax-exempt debt fell in Regime three (see discussion in Section II.*B*.3). This increase will shift the line segment 2′3′ back toward the original segment 23. However, the reduction in marginal capital costs and increase in investment depicted in Figure 2 will still occur.

[14] There are plausible reasons to posit these adjustment costs, including adjustment costs related to administrative costs, etc., as well as informational lags.

Similarly, we apply quadratic specifications to the functions for interest expense, and marginal revenue:

$$(r^x B^{x,t} + r^n B^{n,t}) = \Theta^{B,x} B^{x,t} + \Theta^{B,n} B^{n,t} + \Gamma^B (B^{x,t} + B^{n,t})^2, \tag{11a}$$

$$R^x(K^{x,t}) = \Theta^{K,x} K^{x,t} - \Gamma^{K,x} (K^{x,t})^2, \tag{11b}$$

$$R^n(K^{n,t}) = \Theta^{K,n} K^{n,t} - \Gamma^{K,n} (K^{x,t})^2, \tag{11c}$$

where the Θ and Γ are positive scalars which vary across the equations.

Using equations (10) and (11) we can easily derive empirical specifications for the four equations of the basic model. To facilitate this, we incorporate the concepts of debt and asset targets, defined as the desired level of debt and capital stock in the absence of adjustment costs or financing constraints. For example, in the case of exempt and nonexempt capital, the target capital stock equates the marginal return of capital with the risk-free rate. For debt levels, the optimal level of total debt and tax-exempt debt is the point where the tax-exempt arbitrage is fully exploited, holding the level of taxable debt fixed at some level.

We let B^* refer to the optimal level of total debt, $K^{*,x}$ the optimal level of exempt capital, and $K^{*,n}$ the optimal level of nonexempt capital as per these definitions. In addition, we designate β_{ij} as the ith coefficient in the jth equation of the model and let it be positive by convention. Then, the empirical specifications have the following general form,

$$(B^{x,t} - B^{x,0}) + \beta_{11}(B^{n,t} - B^{n,o}) = \beta_{11}(B^{*,t} - B^0) + \beta_{21}(\Omega - \mu), \tag{12a}$$

$$(B^{n,t} - B^{n,0}) + \beta_{12}(B^{x,t} - B^{x,o}) = -\beta_{22} + \beta_{12}(B^{*,t} - B^0) + \beta_{32}\Omega, \tag{12b}$$

$$(K^{x,t} - K^{x,o}) = \beta_{13}(K^{*,x} - K^{x,o}) + \beta_{23}(\mu - \Omega), \tag{12c}$$

$$(K^{n,t} - K^{n,o}) = \beta_{14}(K^{*,n} - K^{n,o}) - \beta_{24}\Omega. \tag{12d}$$

Note the following five properties of equations (12a)–(12d): 1) all debt and capital flows are positive functions of the differences between target and initial values of debt or capital; 2) the cash constraint, Ω, affects both taxable and tax-exempt debt flows positively, and both exempt and nonexempt asset flows negatively, as predicted by theory; 3) the project financing constraint impedes tax-exempt debt, but increases the flow of exempt projects also as predicted by theory; 4) there is a tendency to retire taxable debt holdings, ceteris paribus, as indicated by the negative intercept in equation (12b); and 5) there is an interdependence between taxable and tax-exempt debt flows, as indicated by equations (12a) and (12b). In particular, flows of taxable debt substitute for flows of tax-exempt debt and vice versa. For example, where there is a taxable debt retirement, tax-exempt debt flows exceed those predicted by the initial deviation from the overall debt target alone. This interaction is expected, since within-period debt flows of each type of debt affect the interest rate charged on the other type of debt.

Using equations (12a) and (12b), we can also solve independently for tax-exempt and taxable debt flows. This yields alternative, reduced form versions of the debt equations:

$$(B^{x,t} - B^{x,0}) = \beta_{11} + \beta_{21}(B^{*,t} - B^{0}) - \beta_{31}\mu + \beta_{41}\Omega, \qquad (12a.1)$$

$$(B^{n,t} - B^{n,0}) = -\beta_{12} + \beta_{22}(B^{*,t} - B^{0}) + \beta_{32}\mu + \beta_{42}\Omega. \qquad (12b.1)$$

It is understood that the β^{ij} here differ from the β^{ij} in equations (12a) and (12b). These reduced form specifications still reflect the interdependence between debt flows noted above. For example, the tax-exempt debt equation incorporates a positive intercept to account for the fact that taxable debt is steadily retired, ceteris paribus, so that tax-exempt debt should be steadily added. Likewise, taxable debt flows are now influenced positively by the project financing constraint, μ. For example, a binding project financing constraint reduces the amount of tax-exempt debt issued. This, in turn, reduces the need to retire taxable debt holdings so quickly.

To complete the specification, explicit expressions for Ω and μ are required. It is easily shown that when Ω binds,

$$\Omega = L1 + L2(K^{*,n} - K^{n,0}) - L3(B^{*} - B^{0}) - L4E^{0}, \qquad (13a)$$

where the various L are positive scalars.

Likewise, where μ binds,

$$\mu = M1 + M2(B^{*,x} - B^{x,0}) - M3(K^{*,x} - K^{x,o}),^{15} \qquad (13b)$$

where the M are also positive scalars.

Of course, Ω binds where $I^{n,t}$ equals $(B^{n,t} - B^{n,o}) + E^{0}$. Likewise, μ binds when $B^{x,t} - B^{x,0}$ is equal to $K^{x,t} - K^{x,0}$. Thus, a complete specification of model two includes the expressions for Ω and μ, interacted with dummy variables that indicate whether these constraints are actually binding.

D. Empirical Hypotheses

The specifications given in equations (12) predict the signs of several coefficients that can be used to test the model. We place special emphasis on two resulting hypotheses: 1) debt targeting and 2) the effects of the project financ-

[15] The expression for Ω is derived by noting that when Ω binds, the cash flow identity is

$$(B^{n,t} - B^{n,0}) + E^{0} = (K^{n,t} - K^{n,0}).$$

One can substitute in equations (12b.1) and (12d) for debt and capital and rearrange to solve for Ω in terms of deviations of the various stocks from their theoretical optima.

To solve for μ, note that when μ binds, we have

$$(B^{x,t} - B^{x,0}) = (K^{x,t} - K^{x,0}).$$

Again, substitute in equations (12a.1 and 12c) and solve for μ to get the result.

ing constraint. Both the theory and the specifications predict that debt flows are positively affected by deviations of debt levels from debt targets, holding cash flow requirements constant (see equations (12a.1) and (12b.1)). In our view, this is the most striking parallel between our theory and mainstream theories of capital structure. It implies, for example, that organizations which have adequate cash to finance their planned investments nonetheless acquire tax-exempt debt, providing they are below their overall debt target. This is done, of course, to enjoy an indirect arbitrage. The model also predicts that taxable debt flows respond positively to deviations from the overall debt target. This is due to a combination of adjustment costs and the fact that the marginal costs of taxable debt are lower where the hospital is below its target leverage point. As a result, marginal retirements of taxable debt are smaller (more positive) when total debt is below its overall target.

The second key hypothesis is that the project financing constraint reduces the flow of tax-exempt debt and stimulates the flow of funds expended on exempt capital projects (see equations (12b.1) and (12c)). That is, NP organizations in Regimes one and four acquire less tax-exempt debt than otherwise predicted by their cash needs or current leverage level. They also undertake marginal fixed investment in order to relieve the project financing constraint. In our view, this represents the most striking difference between our theory and mainstream capital structure theory.

The specifications also imply other, ancillary hypotheses of which we take note in our discussion of the empirical results. For example, a positive intercept is predicted in the tax-exempt debt equation, and a negative intercept in the taxable debt equation. This reflects the natural inclination or "inertia" toward retirement of taxable debt and replacement with tax-exempt debt. It also reflects debt-targeting behavior. Likewise, cash flow constraints are hypothesized to increase debt flows and constrain investment flows, ceteris paribus.

III. Data and Methods

Our empirical methodology is designed to test the empirical hypotheses discussed above using a group of 155 NP hospitals in the state of California. Using the system of equations (12a–12d), we examine the coefficients on $(B^* - B^o)$ to test the debt targeting hypotheses and the coefficients for the computed values of μ (see equation (13b)) to test the effects of the project financing constraint on both debt and investment flows. In addition, we interact the key variables in the analysis with measures of hospital size as well as affiliation with a multi-hospital chain. Our rationale here is that first, adjustment costs, marginal revenue, and interest rate functions vary systematically by these two covariates. Larger hospitals, affiliated with chains, may have lower adjustment costs and more elastic marginal revenue schedules due to a wider range of fixed investment opportunities. If so, they should adjust more rapidly to target deviations from debt targets. In addition they may be more inclined to react to the project financing constraint by investing along their relatively flat marginal revenue schedules, rather than curtailing their borrowing. Finally, hospitals affiliated with chains may be able to overcome financing constraints by receiving distributions from their parent organizations. If so, then internal cash flow constraints may have a smaller impact on their patterns of borrowing.[16] These are ancillary hypotheses which are tested as well. While they are specific to the hospital industry, they may have some significance for distinguishing between large and small NP organizations generally.

A. Data and Variables

The primary source of data for this study is the Annual Hospital Disclosure Report collected by the Office of Statewide Health Planning and Development (OSHPD) for the state of California. These reports contain most of the data we need for our tests, including data on flows of profit, debt financing, capital expenditures, and cash holdings. Of particular note is the detailed information provided on specific bond issuances, including issuance and maturity dates, as well as the interest rates on each outstanding hospital bond. This information is used to create aggregate measures of tax-exempt bond holdings, by hospital and year, as described below.

The (OSHPD) data are supplemented with two other sources. Data from the American Hospital Association's (AHA's) annual survey of hospitals is used to identify hospitals belonging to systems (chain hospitals). Likewise, the Survey of Current Business is used to obtain interest rates on short and long term corporate and government bonds.

The sample is restricted to short term, acute, voluntary hospitals that reported continuously over the cycle 1987–1991.[17] For virtually all hospitals in our sample, this covers hospital fiscal years 1986–1990, the time period of our study. Our final sample consists of 155 hospitals.

The dependent variables in the analysis are the flows of total long-term debt (DBTFLOW), tax-exempt long-term debt (TXEXFLOW), taxable long-term debt (TXBLFLOW), and fixed investment outlays, (INVEST), all in nominal terms. Total long-term debt flows are defined as the first difference of all long-term debt obligations reported on the hospital's balance sheet. The tax-exempt debt flows are computed from the detail data on hospital bond issues.

To compute each hospital's stock of tax-exempt debt, we compare the interest rate at issuance for each hospital bond with the yield on a government bond of the same maturity. All issues whose interest rates are below the interest

[16] The effects of chain membership on hospital financing are, in some ways, analogous to the effects of keiretsu membership on the financial behavior of Japanese firms (Hoshi, Kashyap, and Scharfstein (1991)). Chain membership helps to reduce liquidity constraints, since parent organizations can be a funding source of last resort. Note, however, that chain membership will not generally alleviate the project financing constraint, since funds borrowed by a specific hospital must generally be spent on a qualifying project by the same hospital.

[17] The term "short term acute" refers to mix of patients treated by the hospital. Such hospitals treat patients whose average stay in the hospital is less than a designated threshold. The majority of hospitals in the United States fall into this classification.

rate on government bonds are "flagged" as tax exempt issues.[18] In each year, the outstanding principal on all hospital bonds flagged as tax-exempt is summed to give the hospital's total stock of tax-exempt debt holdings. Flows of tax-exempt debt are then computed as the annual change in hospital tax-exempt debt holdings. Flows of taxable debt are defined as the residual between total and tax-exempt debt flows. Finally, fixed investment outlays are taken from the hospitals' statements of cash flow. Unfortunately we are unable to distinguish between exempt and nonexempt projects in this measure, so that the investment equation actually represents the sum of equations (12c) and (12d). We return to this point in our discussion of the results.

Equations (12) and (13) specify that both debt and capital flows are determined by deviations from debt and capital targets, as well as the shadow prices of the two constraints, μ and Ω. These are the key independent variables used in the analysis (together with the size and chain interactions). Deviations from debt and capital targets make use of the concept of an optimal, unconstrained target value of an asset, liability or flow. Target values, in turn, are based on imperfectly observed market conditions and risk covariates and are, themselves, unobservable. Following the examples of Jalilvand and Harris (1984) as well as Taggart (1977), we develop proxies for targets by applying constant, firm-specific, target ratios to an appropriate exogenous variable in each year. The target ratios, in turn, are measured as the average of the actual ratios over all years other than the year for which the target values are computed.

To illustrate this method, we describe the creation of the debt target for hospital i in year t. We start by computing the average ratio of long term debt holdings to fixed assets for hospital i in all years excluding t. Subsequently, we apply this ratio to the value of fixed assets for hospital i in year t. This yields the targeted value of debt for hospital i in year t.

Using this procedure, we define target ratios for debt to assets, capital to revenues, and cash to assets (this is used to deduce excess cash as discussed below). These are converted into targeted levels of debt (DBTTGT), fixed assets (CAPTGT), and cash (CSHTGT) by hospital and by year. Finally, we create deviations from these targets, also by hospital and year, by deviating the targeted values from their actual lagged values, one year prior. This results in the variables DBTDEV, CAPDEV, and CSHDEV, respectively. We refer these variables as "target flows." Of course, DBTDEV and CAPDEV correspond to $(B^* - B^o)$ and $(K^* - K^o)$ respectively, as given in equation (12). Their expected signs are positive in the debt flow and investment equations.

The shadow price of the cash flow constraint, Ω, makes use of equation (13a) and is equal to CAPDEV, less the sum of both DBTDEV and exogenous cash, E^o. Because our analysis deals with flows over a discrete period (an entire fiscal year), we define exogenous cash (E^o in our theory) to include the sum of

[18] Since government bond yields are always lower than corporate bond yields of the same duration, it is safe to assume that hospital bonds issued at rates lower than the government bond rate are tax-exempt.

surpluses of cash holdings available at the beginning of the year (CSHDEV)[19] as well as operating profits realized during the year (OPCFLOW). Operating profits, in this case, are defined as cash flows reported on the hospital's cash flow statement before (net of) flows of capital, debt, bad debt/charity care, and net additions to cash holding. These profits include, for example, net revenues over expenses before depreciation as well as other sources. We regard these profits as exogenous to the financing decisions modeled here.

According to the model, Ω impacts debt and capital flows only where there is a deficit of available cash with respect to desired cash expenditures (that is, where Ω actually binds). We create a dummy variable defined as one only where (13a) is measured as positive.[20] The dummy variable is interacted with equation (13a) prior to entering it into the debt and investment equations. We refer to the resulting variable as NCFLOW, to indicate that it measures a negative cash flow. Of course, the predicted partial effect of NCFLOW on debt flows is positive (cash flow shortages increase debt flows) and negative on investment (cash flow shortages constrain investment).[21]

Finally, to complete the specification, we also create a variable to measure the shadow price of the project financing constraint, μ, which we refer to as EXCSDCAP. Our measure of μ is referred to as EXCSDCAP since equation (13b) indicates that under the assumed adjustment process, μ is approximately equal to the hospital's "excess debt capacity," the difference between desired debt and capital flows. Because μ only binds where desired debt flows are positive and exceed desired capital flows, excess debt capacity is interacted with two dummy variables. The first is a dummy variable that is coded as one when DBTDEV has a positive value. The second is coded as one where DBTDEV exceeds CAPDEV. EXCSDCAP refers to the fully interacted variable and

[19] Our theory states that all available cash is used for expenditures. However, some cash is needed to fund working capital requirements. Thus, our definition of cash corresponding to E^o in our theory is defined as the excess level of cash over a target cash level.

[20] The definition of Ω given in equation (13a) indicates that Ω starts to bind where net cash flow is negative **conditional** on desired adjustments towards the debt target, $(B^t - B^o)$. Therefore, to define the dummy variable which is used to proxy whether Ω binds, we need to specify, a priori, the hospital's desired adjustment coefficient toward its debt target and add these adjustments to cash flow. We work with a number of different assumed values for this adjustment coefficient with little effect on the qualitative findings. In the results reported here, we assume a value of (0.45) for the adjustment coefficient. That is, we multiply (0.45) times the deviation of current debt from the debt target and add this value to cash flows before assessing whether cash flows are negative. This adjustment parameter is consistent with the estimated adjustment coefficient that comes out of our results.

[21] We estimate some versions of the debt flow equations using the variables OPCFLOW, CSHDEV, and CAPDEV as independent measures of cash flow requirements. Subsequently, however, we estimate restricted versions in which CSHDEV and CAPDEV, net of desired debt flows, are subtracted from OPCFLOW to arrive at the single measure of cash flow need, NCFLOW. The R-squared of the restricted version is virtually identical to the disaggregated version, and we are able to accept this restriction at the 0.01 confidence level (F statistic).

is used in our equations. Its predicted sign is negative in the tax-exempt debt equations and positive in the taxable debt and investment equations.[22]

The other key variables in the analysis include chain affiliation and hospital size. Hospital size (SIZE) is measured by the dollar value of total hospital assets, in tens of millions of dollars. Size may also give the hospital superior access to the bond markets and reduce transaction costs, leading to more systematic debt targeting behavior. Both CHAIN and SIZE are used as interaction variables in the debt flow and investment equations.

Our final specification includes DBTDEV, CAPDEV, NCFLOW, EXCSDCAP, with CHAIN and SIZE used as interactions. Variable definitions, means, and standard deviations are given in Table II.

B. Estimation Issues

Our data comprise a four-year panel of first differences for 155 NP hospitals. A standard approach for estimation with panel data is to use random or fixed effects estimators. However, since the data is already first differenced, the presence of a time-invariant fixed effect is counterintuitive. Moreover, the random and fixed effects estimators make strong assumptions about the nature of the autocorrelation between adjacent observations (Judge et al., (1985)). We experiment with both a fixed effects estimator as well as generalized least squares (GLS) estimators corrected for second order autocorrelation (AR2). We find that the fixed effects estimator fails to eliminate autocorrelation in the data. The AR2 estimator, on the other hand, eradicates the serial correlation. Finally, chi squared tests consistently indicate that fixed effects are not needed (add no explanatory power) conditional on the AR2 correction.[23] For this reason, the estimates reported below are based upon an AR2 correction with no fixed effects included.

Our initial estimates also indicate the presence of heteroscedasticity (HS) as confirmed by White's statistic (White, 1980). We consider several models of the HS and eventually find success with a simple model in which the variance of the disturbance depends upon whether initial debt and capital levels are above or below their target levels. In the debt equations, for example, we weight the data by two separate weights, depending upon whether base period debt is above or below the target level. All results reported below are homoscedastic as measured by White's statistic at the 5 percent confidence level.

[22] We note that equations (13a) and (13b), which define Ω and μ indicate that cash and target flows have different linear effects on these shadow prices. We simplify by taking the simple sums and differences of these variables to define these shadow prices. As noted above, this restriction is supported by a number of F tests in which we compare our specification with less restricted versions in which cash and target flows are entered independently. The results of these tests allow us to accept the restrictions applied here.

[23] The tests for inclusion of the fixed effects, conditional on the GLS correction, are based on an asymptotically-distributed chi squared statistic formed from the GLS estimates with and without the fixed effects.

Table II

Variable Definitions, Means, and Standard Deviations

Variable	Definition	Mean	Standard Deviation
DBTFLOW	First difference of total long term debt principal as reported on hospital balance sheet.	2,333,166	10,556,695
TXEXFLOW	First difference of tax-exempt debt principal as computed from debt detail data.	2,433,946	12,555,955
TXBLFLOW	First difference of taxable debt principal; computed as difference between DBTFLOW and TXEXFLOW.	−100,781	9,434,433
INVEST	Hospital fixed investment flows as reported on the statement of cash flows.		
OPCFLOW	Operating cash flow; hospital cash flow before debt issuances and retirements, investment outlays, net additions to cash holdings, and charity care.	8,252,261	13,579,367
CFLOW	(OPCFLOW + (0.45*DBTDEV) − (0.45*CAPDEV) + CSHDEV)	1,440,166	13,577,670
NCFLOW	Negative cash flow; (−1) * CFLOW * Dummy = 1 if (CFLOW < 0)	2,837,956	7,825,096
DBTTGT	Target level of long-term debt; average ratio (across other years) of LTD to net fixed assets (NFA) times current period value of NFA.	24,882,861	36,913,908
DBTDEV	DBTTGT − lagged value of long term debt.	2,800,707	15,521,352
CAPTGT	Targeted level of net fixed assets; average ratio (across other years) of net fixed assets to net patient service revenue times net patient service revenue.	27,149,070	26,735,578
CAPDEV	CAPTGT − lagged value of net fixed assets.	2,268,122	7,840,921
CSHTGT	Targeted level of cash and marketable securities (CSHMS); average ratio (across other years) of CSHMS to total assets times current level of total assets.	10,910,744	17,770,146
CSHDEV	CSHTGT − lagged value of CSHMS	1,066,065	6,003,028
EXCSDCAP	Excess debt capacity; DBTDEV − CAPDEV if DBTDEV > 0 and DBTDEV − CAPDEV > 0. (If DBTDEV < 0 or DBTDEV − CAPDEV < 0, EXCSDCAP is coded as 0.	3,545,594	14,125,874
SIZE	Total assets in tens of millions of dollars.	17.390	1.312
CHAIN	Hospital belongs to multi-hospital system as recorded by AHA annual survey.	0.45	—

Finally, we employ a seemingly unrelated regression (SUR) estimator (Zellner 1962) for some of our results in order to account for the likely covariances which exist among the hospital's various financial flows. For example, it is reasonable to suppose that bond flow and investment flow residuals will be positively correlated. The SUR estimator accounts for such correlations to provide more efficient estimates. In addition, cross-equation restrictions which specify that taxable and tax-exempt debt flows must sum to overall debt flows are also incorporated into the SUR estimators.

We summarize the covariance assumptions employed in our work as follows. For each of the four equations estimated, the disturbance is of the form,

$$\epsilon^{i,t} = v^{i,t} + \rho 1 \epsilon^{i,t-1} + \rho 2 \epsilon^{i,t-2},$$

$$\sigma^2(v^{i,t}) = (\sigma 1)^2, \quad \text{if DBTDEV}^{i,t} > 0,$$

$$= (\sigma 2)^2 \quad \text{if DBTDEV}^{i,t} < 0,$$

where the i denotes hospitals and the t denotes time periods.[24]

The parameters $\rho 1$, $\rho 2$, $\sigma 1$, and $\sigma 2$ are permitted to differ across the four equations. Finally, our SUR estimates also allow for nonzero covariances between the $v^{i,t}$ of different equations for the same i and t.

We use a two-step estimator to obtain all results. In step one, OLS results are used to generate residuals, which are in turn analyzed to estimate the parameters of the covariance matrix. In step two, GLS estimates are obtained using the usual formula. If iterated, our method is equivalent to maximum likelihood. In practice, scalar covariance matrices are obtained with a single iteration.

IV. Empirical Results

Estimates of overall, tax-exempt, and taxable debt flows, as well as fixed investment flows, can be found in Tables III–VI. Table III provides the GLS, single-equation estimates, while Tables IV–VI provide the SUR estimates, incorporating cross-equation restrictions. In addition, the estimated cross-equation covariances utilized in the SUR estimates are listed in Table VII. In discussing the results, we focus our attention on the model's main hypotheses regarding debt-targeting as well as the effects of the project financing constraint. Tables III and IV provide overall tests of these hypotheses and utilize specifications based directly on equations (12) and (13). Tables V and VI are also based on equations (12) and (13), but utilize subsamples confined to observations where debt and capital are above or below their target values. We regard the subsample estimates as important for two reasons: 1) adjustment costs may vary by whether hospitals are above or below their targets, so that subsample estimates may be needed to accurately specify the model; and 2) we wish to verify that debt targeting behaviors persist even when there is **excess** debt capacity, in order to distinguish our theory from simple models of debt rationing.[25] The results from these tables are discussed in sequence.

[24] For the investment equation, $\sigma^2(v^{i,t})$ varies by whether CAPDEV^{i,t} $> <$ 0.

[25] That is, it could be argued that hospitals which exhibit debt targeting behavior where they are above their debt targets are merely being rationed out of debt markets. Our estimates of debt targeting behavior where hospitals are below their debt targets are arguably a better test of our theory.

Table III

GLS Estimates of Debt and Investment Flows: Full Sample

Single-equation regressions of the debt and investment flows of 155 California voluntary nonprofit hospitals. LGCAP is the lagged value of the capital stock. DBTDEV is the deviation from the overall debt target measured at the beginning of the period. CAPDEV is the deviation from the capital target. EXCSDCAP is a measure of excess debt capacity relative to projected capital needs. NCFLOW is the projected cash flow shortage. SIZE measures assets in tens of millions of dollars, while CHAIN represents membership in a hospital system. Reported regressions incorporate corrections for second order autocorrelation and weight observations differently, depending on whether DBTDEV or CAPDEV > < 0. No further evidence of autocorrelation exists as indicated by the regressions of fitted residuals. Homoscedasticity is confirmed by White's statistic.

	Parameter Estimate (Standard Error)			
Explanatory Variables	Total Debt	Tax-Exempt Debt	Taxable Debt	Fixed Investment
INTERCEPT	807,637***	1,545,989***	−651,761*	103,179
	(285,659)	(454,012)	(373,415)	(370,623)
LGCAP	—	—	—	0.168***
				(0.011)
DBTDEV	0.347***	0.217*	0.102	—
	(0.073)	(0.133)	(0.113)	
DBTDEV*SIZE	−0.004	−0.011***	0.012***	—
	(0.003)	(0.004)	(0.004)	
DBTDEV*CHAIN	−0.018	0.127	0.034	—
	(0.064)	(0.127)	(0.110)	
CAPDEV	—	—	—	0.434***
				(0.063)
CAPDEV*SIZE	—	—	—	0.004*
				(0.002)
CAPDEV*CHAIN	—	—	—	−0.078
				(0.059)
EXCSDCAP	−0.379***	−0.451***	0.070	0.133***
	(0.099)	(0.156)	(0.129)	(0.039)
EXCSDCAP*SIZE	0.009***	0.019***	−0.014***	0.0015*
	(0.003)	(0.005)	(0.004)	(0.0009)
EXCSDCAP*CHAIN	0.417***	0.305**	−0.159	−0.062*
	(0.084)	(0.143)	(0.122)	(0.036)
NCFLOW	0.178**	0.324**	0.068	−0.203***
	(0.076)	(0.129)	(0.105)	(0.055)
NCFLOW*SIZE	0.007***	0.006**	−0.007***	0.004***
	(0.002)	(0.003)	(0.002)	(0.001)
NCFLOW*CHAIN	−0.119*	−0.220*	0.175	0.160***
	(0.073)	(0.132)	(0.110)	(0.059)
R^2	0.395	0.338	0.134	0.664
F, DEGREES OF FREEDOM	39.924,610	31.148,610	9.428,610	109.572,609

* Statistically significant at 10 percent level (two-tailed test).
** Statistically significant at 5 percent level (two-tailed test).
*** Statistically significant at 1 percent level (two-tailed test).

Table IV

SUR Estimates of Debt and Investment Flows: Full Sample

Seemingly unrelated regression (SUR) of the debt and investment flows of 155 California voluntary nonprofit hospitals. LGCAP is the lagged value of the capital stock. DBTDEV is the deviation from the overall debt target measured at the beginning of the period. CAPDEV is the deviation from the capital target. EXCSDCAP is a measure of excess debt capacity relative to projected capital needs. NCFLOW is the projected cash flow shortage. SIZE measures assets in tens of millions of dollars, while CHAIN represents membership in a hospital system. Reported regressions incorporate corrections for second-order autocorrelation, weight observations differently depending on whether DBTDEV or CAPDEV > < 0 and utilize contemporaneous correlations of the disturbances across equations in order to increase efficiency. Debt equations also incorporate cross-equation restrictions on coefficients. No further evidence of autocorrelation exists, as indicated by the regressions of fitted residuals. Homoscedasticity is confirmed by White's statistic. Reported R^2 is weighted system R^2.

	Parameter Estimate (Standard Error)			
Explanatory Variables	Total Debt	Tax-Exempt Debt	Taxable Debt	Fixed Investment
INTERCEPT	851,437***	1,534,773***	−683,3361*	383,610
	(242,060)	(420,540)	(350,033)	(363,022)
LGCAP	—	—	—	0.159***
				(0.011)
DBTDEV	0.235***	0.171	0.064	—
	(0.059)	(0.119)	(0.105)	
DBTDEV*SIZE	0.000	−0.013***	0.013***	—
	(0.002)	(0.004)	(0.003)	
DBTDEV*CHAIN	0.112**	0.079	0.033	—
	(0.052)	(0.113)	(0.102)	
CAPDEV	—	—	—	0.413***
				(0.061)
CAPDEV*SIZE	—	—	—	0.003*
				(0.002)
CAPDEV*CHAIN	—	—	—	−0.084
				(0.057)
EXCSDCAP	−0.201***	−0.305***	0.104	0.137***
	(0.077)	(0.140)	(0.121)	(0.038)
EXCSDCAP*SIZE	0.002	0.017***	−0.016***	0.001
	(0.002)	(0.004)	(0.004)	(0.001)
EXCSDCAP*CHAIN	0.207***	0.364***	−0.157	−0.058*
	(0.067)	(0.130)	(0.114)	(0.035)
NCFLOW	0.187**	0.082	0.105	−0.198***
	(0.061)	(0.114)	(0.098)	(0.054)
NCFLOW*SIZE	0.006***	0.014***	−0.008***	0.004***
	(0.002)	(0.003)	(0.0025)	(0.001)
NCFLOW*CHAIN	−0.147***	−0.231**	0.084	0.137**
	(0.057)	(0.117)	(0.102)	(0.058)
SYSTEM R^2	0.419	0.419	0.419	0.419
SYSTEM DEGREES OF FREEDOM	2439	2439	2439	2439

* Statistically significant at 10 percent level (two-tailed test).
** Statistically significant at 5 percent level (two-tailed test).
*** Statistically significant at 1 percent level (two-tailed test).

Table V

SUR Estimates of Debt and Investment Flows: Debt and Capital Below Target Levels

Seemingly unrelated regression (SUR) of the debt and investment flows of 155 California voluntary nonprofit hospitals. LGCAP is the lagged value of the capital stock. DBTDEV is the deviation from the overall debt target measured at the beginning of the period. CAPDEV is the deviation from the capital target. EXCSDCAP is a measure of excess debt capacity relative to projected capital needs. NCFLOW is the projected cash flow shortage. SIZE measures assets in tens of millions of dollars, while CHAIN represents membership in a hospital system. Reported regressions incorporate corrections for second-order autocorrelation, weight observations differently, according to whether DBTDEV or CAPDEV > < 0 and utilize contemporaneous correlations of the disturbances across equations in order to increase efficiency. Debt equations also incorporate cross-equation restrictions on their coefficients. No further evidence of autocorrelation exists as indicated by regressions of fitted residuals. Homoscedasticity is confirmed by White's statistic. Reported R^2 is weighted system R^2. All reported coefficient estimates are for variables interacted with dummy to indicate that either CAPDEV or DBTDEV > 0. The remaining coefficient estimates for these regressions (for variables interacted with DBTDEV or CAPDEV < 0) are given in Table VI.

	Parameter Estimate (Standard Error)			
Explanatory Variables	Total Debt	Tax-Exempt Debt	Taxable Debt	Fixed Investment
INTERCEPT	583,766	500,314	83,453	1,001,395
	(438,687)	(595,302)	(470,907)	(671,364)
LGCAP	—	—	—	0.169***
				(0.017)
DBTDEV	0.182***	0.586***	−0.404**	—
	(0.139)	(0.195)	(0.165)	
DBTDEV*SIZE	0.006	−0.010**	0.016***	—
	(0.004)	(0.005)	(0.004)	
DBTDEV*CHAIN	0.397	0.034	0.362**	—
	(0.137)	(0.189)	(0.162)	
CAPDEV	—	—	—	0.209*
				(0.109)
CAPDEV*SIZE	—	—	—	0.007*
				(0.004)
CAPDEV*CHAIN	—	—	—	0.005
				(0.083)
EXCSDCAP	−0.169	−0.620***	0.451***	0.297***
	(0.145)	(0.202)	(0.170)	(0.061)
EXCSDCAP*SIZE	−0.002	0.015***	−0.018***	0.001
	(0.004)	(0.006)	(0.004)	(0.001)
EXCSDCAP*CHAIN	−0.172***	0.221	−0.393**	−0.260***
	(0.144)	(0.199)	(0.169)	(0.067)
NCFLOW	0.363***	0.098	0.265**	−0.295***
	(0.110)	(0.151)	(0.125)	(0.087)
NCFLOW*SIZE	0.007***	0.015***	−0.008***	0.009***
	(0.003)	(0.003)	(0.002)	(0.003)
NCFLOW*CHAIN	−0.078	0.216	−0.138	0.211***
	(0.121)	(0.165)	(0.139)	(0.082)
SYSTEM R^2	0.431	0.431	0.431	0.431
SYSTEM DEGREES OF FREEDOM	2427	2427	2427	2427

* Statistically significant at 10 percent level (two-tailed test).
** Statistically significant at 5 percent level (two-tailed test).
*** Statistically significant at 1 percent level (two-tailed test).

Table VI

SUR Estimates of Debt and Investment Flows: Debt and Capital Above Target Levels

Seemingly unrelated regression (SUR) of the debt and investment flows of 155 California voluntary nonprofit hospitals. LGCAP is the lagged value of the capital stock. DBTDEV is the deviation from the overall debt target measured at the beginning of the period. CAPDEV is the deviation from the capital target. EXCSDCAP is a measure of excess debt capacity relative to projected fixed capital needs. NCFLOW is the projected cash flow shortage. SIZE measures assets in tens of millions of dollars, while CHAIN represents membership in a hospital system. Reported regressions incorporate corrections for second order autocorrelation, weight observations differently, according to whether DBTDEV or CAPDEV > < 0 and utilize contemporaneous correlations of the disturbances across equations in order to increase efficiency. Debt equations also incorporate cross-equation restrictions on their coefficients. No further evidence of autocorrelation exists as indicated by regressions of fitted residuals. Homoscedasticity is confirmed by White's statistic. Reported R^2 is weighted system R^2. All reported coefficients are for variables interacted with dummy to indicate that CAPDEV or DBTDEV < 0. The remaining coefficients for these regressions (for variables interacted with DBTDEV or CAPDEV > 0) are given in Table V.

	Parameter Estimate (Standard Error)			
Explanatory Variables	Total Debt	Tax-Exempt Debt	Taxable Debt	Fixed Investment
INTERCEPT	875,691***	966,013**	−90,322	786,405
	(338,219)	(480,433)	(477,373)	(493,712)
LGCAP	—	—	—	0.150***
				(0.016)
DBTDEV	0.111	−0.078	0.189	—
	(0.093)	(0.156)	(0.157)	
DBTDEV*SIZE	0.005	−0.027***	0.032**	—
	(0.004)	(0.006)	(0.006)	
DBTDEV*CHAIN	0.134*	0.320**	−0.186***	—
	(0.075)	(0.144)	(0.139)	
CAPDEV	—	—	—	0.698***
				(0.088)
CAPDEV*SIZE	—	—	—	−0.013***
				(0.002)
CAPDEV*CHAIN	—	—	—	−0.300***
				(0.074)
NCFLOW	0.089	0.561**	−0.471**	0.083
	(0.134)	(0.227)	(0.231)	(0.106)
NCFLOW*SIZE	0.006	−0.053***	0.058**	−0.005***
	(0.006)	(0.012)	(0.011)	(0.002)
NCFLOW*CHAIN	−0.142	0.054	−0.196	−0.025
	(0.091)	(0.160)	(0.161)	(0.116)
SYSTEM R^2	0.431	0.431	0.431	0.431
SYSTEM DEGREES OF FREEDOM	2427	2427	2427	2427

* Statistically significant at 10 percent level (two-tailed test).
** Statistically significant at 5 percent level (two-tailed test).
*** Statistically significant at 1 percent level (two-tailed test).

Table VII

Cross-Equation Correlations For SUR Estimates

Estimated cross-equation correlations from the seemingly unrelated regressions. Panel A provides results from the overall regression. Panel B provides results from the regression where all coefficients are interacted with dummy variables that indicate whether capital or debt is above or below its target value.

Equation	Total Debt	Tax-Exempt Debt	Taxable Debt	Investment
Panel A: Results for Overall Debt and Investment Flows*				
Total Debt	1	0.461	0.224	0.245
Tax-Exempt Debt	—	1	−0.685	0.175
Taxable Debt	—	—	1	−0.025
Investment	—	—	—	1
Panel B: Results for Divided Sample Debt and Investment Flows**				
Total Debt	1	0.366	0.255	0.188
Tax-Exempt Debt	—	1	−0.718	0.135
Taxable Debt	—	—	1	−0.023
Investment	—	—	—	1

* Refers to results in Table IV.
** Refers to results in Tables V and VI.

A. Results for Overall Debt and Fixed Investment Flows

We consider, first, the results in Tables III and IV, where the adjustments are constrained to be the same both above and below debt and capital targets. We focus our discussion on the SUR results of Table IV, since these are arguably the most efficient estimates and since they do not differ appreciably from the results given in Table III. Two aspects of the Table IV results support the debt-targeting hypothesis. First, the positive, significant intercept (approximately \$1.5 million) in the tax-exempt debt equation and the negative, significant intercept (approximately −\$0.7 million) in the taxable debt equation suggest that hospitals attempt to substitute tax-exempt for taxable debt, even where the overall debt level is at its target value. This is predicted by our theory and, as noted earlier, is an efficient means of optimizing the hospital's capital structure.

Second, overall (total) debt flows are calibrated to the difference between the debt target and the base period debt level. Chain hospitals reduce the deviation between actual and target values by 35 cents on the dollar in any given period. The comparable figure for freestanding hospitals is 23.5 cents. These effects are statistically significant for both groups of hospitals. In addition, if one considers mid-sized hospitals, holding \$50 million in total assets, (to account for the size interaction), both tax-exempt and taxable debt flows respond positively to deviations in the overall debt target. A single dollar of DBTDEV induces 10–20 cents of taxable as well as tax-exempt debt flow. Chain and freestanding hospitals are similar in this regard. Statistically speaking, the effects of DBTDEV on debt flows are significant for chain hospitals only, however.[26] Note, in addition, that the 10–20 cents in positive taxable debt flow merely offsets some of the negative taxable debt flow, which is indicated in the intercept of the taxable debt equation.

Two results that are not directly predicted by our theory are 1) that larger hospitals are less likely to access tax-exempt markets in response to excess debt capacity (negative size interact with DBTDEV), and 2) that chain hospitals do more overall debt targeting. We have no ready explanation for the former result, but suspect that the chain result may reflect more sophisticated management practices by these hospitals.

Table IV also provides support for the predicted effects of the project financing constraint on debt and capital flows. For freestanding hospitals in particular we find, as predicted, that the project financing constraint (EXCSDCAP): a) constrains tax-exempt debt flows, b) does not constrain taxable debt flows, and c) encourages fixed investment flows, since the marginal cost of capital is reduced where this constraint binds.[27] Results (a) and (c) are statistically significant. The constraining effect on tax-exempt debt flows is substantial for freestanding hospitals. The results suggest, for example, that a mid-sized freestanding hospital that is a dollar below its debt target (DBTDEV = \$1) but at its capital target (CAPDEV = 0, EXCSDCAP = \$1), will issue no tax-exempt debt.

These effects are significantly different for chain hospitals. By adding the coefficients for EXCSDCAP with its interaction with CHAIN, we find that the project financing constraint: a) does not constrain tax-exempt debt acquisition, b) still has little net effect on taxable debt acquisition, and c) has a positive, modest effect on fixed investment outlays. These results are consistent with the notion that chain hospitals can find ways to evade the project financing constraint. In part, this is accomplished by increasing investment outlays. We return to this point in our summary discussion.

The other results in Table IV are also broadly consistent with our theory. The cash constraint takes on its predicted effect in all of the equations. Cash shortages stimulate overall debt flows by 20 cents per dollar of cash deficiency in freestanding hospitals. However, chain hospitals place a much smaller reliance upon debt markets to make up shortages, as reflected by a 15 cent offset to the freestanding estimate. Conversely, cash flow shortages constrain investment flows by 20 cents per dollar of shortage in freestanding hospitals.

[26] In order to test statistical significance, we form a chi squared statistic against the null hypothesis that the expression (DBTDEV + DBTDEV*CHAIN + 5*DBTDEV*SIZE) is equal to zero (for freestanding hospitals, DBTDEV*CHAIN is omitted. Using the covariance matrix of our estimates, we compute the statistic and reject the null hypothesis (10 percent significance level) for chain hospitals in both the tax-exempt and taxable debt equations.

[27] Note that the effect of EXCSDCAP on investment flows is biased downward by the fact that our measure of investment combines both exempt projects (which **are** affected by EXCSDCAP) and nonexempt projects (which are unaffected by EXCSDCAP). Since most hospital projects fall into the exempt category, however, the measured coefficient should be similar to the true effect of EXCSDCAP on exempt investment flows.

However, the effect is again much smaller in chain hospitals who presumably can access financing from their parent organizations to carry out projects.

Finally, the covariances between the $v^{i,t}$ are indicated in Table VII. Positive correlations are observed between investment and total or tax-exempt debt issuance, while a negative correlation exists between taxable and tax-exempt debt issuance.

B. Results Where Debt and Capital Are Below Target Levels

Regressions of debt and investment flows where initial values are below target levels are given in Table V (only SUR results are reported here since single-equation results are quite similar). These results provide a more rigorous test of firm-initiated debt-targeting behavior. Hospitals above their target values may be constrained, through debt rationing, to reduce debt levels towards their target levels. However, hospitals below their targets presumably have the latitude to maintain or increase their debt levels.

Turning to Table V, our results continue to support the hypothesis of debt targeting, particularly for tax-exempt debt flows. However, there are significant differences compared to Table IV. First, the intercepts for all three debt equations are now statistically insignificant. Conversely, the magnitudes of DBTDEV are substantially higher than before, falling in the range of 50–60 cents on the dollar for the tax-exempt flows of mid-sized hospitals. Compared to the overall results, these findings indicate that, where debt is below its target level, deviations from the debt target are the best predictors of tax-exempt debt flows and that the simple inertia to add tax-exempt debt and retire taxable debt is less relevant. This shift in the results suggests that: a) the effects of leverage on the marginal cost of financing are greater below debt targets, and/or b) the adjustment costs associated with closing the gap with the debt target are less substantial when adding rather than retiring debt. Both explanations would help to account for the differences from the overall results.

For taxable debt flows, note that the negative intercept in Table IV disappears. For freestanding hospitals, the negative intercept is replaced, in some sense, by a negative, significant 40 cent coefficient for DBTDEV. The negative sign technically contradicts our theory, which argues that there should be an inertia (hence the negative intercept) to retire taxable debt, mitigated to some degree by a positive offset where initial debt is below its debt target. The results here suggest, instead, that sizable deviations from the debt target are the necessary spur to simultaneously add tax-exempt debt and retire taxable debt. Such behavior, while technically suboptimal, at least permits greater additions of tax-exempt debt in cases where tax-exempt debt is added. Note that in chain hospitals there is neither an inertia to retire taxable debt nor a debt targeting effect.

The overall results on debt targeting indicate that mid-sized freestanding hospitals issue total debt of about 20 cents for each dollar of debt deviation, with a comparable figure of about 60 cents for chain hospitals. While both chain and freestanding hospitals target tax-exempt debt flows, the major difference lies in the fact that freestanding hospitals retire taxable debt when tax-exempt debt is issued, and hence engage in less overall debt targeting.

The predicted effects of the project financing constraint are also supported by these results. For mid-sized, freestanding hospitals, each dollar of excess debt capacity (DBTDEV-CAPDEV) fully offsets a dollar of DBTDEV in the determination of debt flows. For example, a freestanding hospital at its capital target (CAPDEV = 0) but below its debt target, will issue no debt, ceteris paribus. However, the same hospital, if a member of a chain, will issue approximately 20 cents of tax-exempt debt. This suggests, as before, that chain hospitals are able to find ways to evade the project financing constraint, either through project investment or other means.

In the taxable debt equations, the large positive coefficient for freestanding hospitals essentially offsets the large negative coefficient for DBTDEV, indicating that taxable debt is not retired where there is excess debt capacity. This is consistent with our prediction and with the fact that there is little tax-exempt debt issued in this regime as well. For chain hospitals, the net effect of EXCSDCAP (EXCSDCAP plus the interaction) is close to zero. Coupled with the chain results for DBTDEV, this also suggests that chain hospitals do not retire taxable debt where there is excess debt capacity.

Finally, note that the project financing constraint influences the investment flows of freestanding hospitals positively, as predicted. A dollar of excess debt capacity has a 30 cent effect on the investment flows of these hospitals. There is no analogous effect for chain hospitals, however. This is surprising, since chain hospitals seem able to avoid the project financing constraint in their tax-exempt debt issuances. Since incremental investment flows are the means to relax the project financing constraint, a role for EXCSDCAP in the investment flows of chain hospitals seems necessary.

The other covariates in these regressions perform as expected. The cash flow constraint again has a positive influence on debt flows and a negative influence on investment flows. Chain hospitals are more likely to rely on tax-exempt markets for these purposes compared to freestanding hospitals. Likewise, the cash flow constraint has little effect on the investment flows of chain hospitals. The effects of lagged capital on capital flows are similar to Table IV. Note, however, that the coefficient for CAPDEV is substantially smaller here than in Table IV. Hospitals are slower to make up deficits from their fixed capital targets where capital is below the target, compared to where capital is above the target. Finally, Table VII again provides the matrix of covariances across the four equations for the SUR estimates. The pattern of correlations is similar to that found in Table IV.

C. Results Where Debt and Capital Are Above Target Levels

Results where debt and capital exceed their target values, given in Table VI, are expected to differ from our prior results to the extent that: a) adjustment costs differ for the process of reducing debt and capital stocks, b) the marginal costs of deviating from target values differs as well, and c) there are possible instances of capital rationing. Note that there are no results associated with the project financing constraint here, since desired debt flows are for the most part negative.

With this in mind, we review the SUR findings in Table VI regarding the issue of debt targeting. As in the overall results (Table IV), there is a positive and significant intercept for tax-exempt debt and a negative (albeit insignificant) intercept for taxable debt. Thus, for hospitals above their targets, there is a tendency to acquire tax-exempt debt and a smaller tendency to reduce taxable debt. This is consistent with theory.

Theory also predicts a positive coefficient for DBTDEV. That is, negative values for DBTDEV (target minus actual) should mitigate the tendency to acquire tax-exempt debt and further reduce taxable debt holdings. This is only partially supported by the results here. For tax-exempt debt, mid-sized chain hospitals exhibit a modest, positive effect for DBTDEV, (about 10 cents), while mid-sized freestanding hospitals show a surprising negative overall effect for DBTDEV on the order of 20 cents. For taxable debt, both chain and freestanding hospitals exhibit a positive debt targeting effect, although the result is substantially higher in freestanding hospitals (about 34 cents compared to 16 cents). All effects are statistically significant.

This pattern of results suggests that freestanding hospitals substitute taxable debt retirements for tax-exempt debt retirements when overall debt is above its target value. Chain hospitals behave more in accordance to the original theory. The differences in these behaviors may reflect the ways in which debt rationing, adjustment costs, and the marginal costs of debt differ between freestanding and chain hospitals operating above their targets values.

The effects of CAPDEV on investment remain positive and significant. The magnitudes are generally higher than the findings below the target. This suggests that adjustment of the capital stock downward (by simply failing to replace depreciated stock) may be less costly than adjustments upwards. Finally, the cash flow constraint has little net effect on overall debt issuance or investment flows. There is a strong positive effect on tax-exempt debt issuance, however, for some smaller hospitals (the effect largely goes away for mid-sized and larger hospitals). Conversely, cash flow deficits reduce taxable debt holdings in smaller hospitals and have little effect on the taxable debt holdings of larger hospitals. For smaller hospitals, this pattern of results suggests that cash flow deficits are a spur both to acquire tax-exempt debt and to simultaneously refund taxable debt. As previously noted, this behavior is not predicted by our theory. However, the refunding of taxable debt does permit larger issuances of tax-exempt debt.

V. Conclusion

The empirical results provide strong support for the theoretical model. The most compelling evidence in support of the debt targeting and project financing hypotheses, in our view, comes from the following three results: 1) both freestanding and chain hospitals target their stock of tax-exempt debt, even where existing debt is below its optimal level and cash balances are adequate to finance proposed outlays; 2) the project financing constraint constrains the acquisition of tax-exempt debt, but has little effect on the acquisition of taxable debt; and 3) the project financing constraint stimulates the investment flows of freestanding hospitals. In addition, we consistently find that overall debt levels are sensitive to deviations from the debt target and that both cash flow and deviations from the capital target have plausible (predicted) effects on debt and capital flows.

On the other hand, our model does not account for 1) the fact that intercepts in the debt equations vary in their magnitudes and significance levels across the various estimates, and 2) that in Table IV, taxable debt flows respond negatively to deviations from the debt target. Even in the latter case, however, the negative coefficient for DBTDEV predicts that NP hospitals retire taxable debt as they add tax-exempt debt, which is consistent with the general thrust of our model.

One additional puzzling aspect of our findings is related to predicted chain hospital behavior in the region where the project financing rule binds. Our Table IV results suggest that, where the project financing constraint binds, (EXCSDCAP $>$ 0) increments in DBTDEV lead to additional tax-exempt borrowings (coefficients for DBTDEV + EXCSDCAP $>$ 0) and yet do not lead to incremental investment flows (coefficient for EXCSDCAP in investment equation is equal to zero for chain hospitals). This is inconsistent with the behavior needed to continue to satisfy the project financing constraint. The ways in which chain hospitals may be able to evade the project financing constraint may be the subject of future inquiry. For now, we speculate that investment flows by other hospitals in the system may be used to satisfy the project financing rule in these cases.

Overall, we regard our results, both theoretical and empirical, as an initial step toward understanding the capital structure and financing behavior of large NP entities. We have highlighted the defining institutional features of the NP form in order to develop a framework for analysis. Future work may explore the roles of agency and bankruptcy and perhaps donations in order to enrich and extend this framework.

REFERENCES

Altman, Edward, 1984, A further empirical investigation of the bankruptcy cost question, *Journal of Finance* 39, 1067–1089.

Barnea, A., R. Haugen, and L. Senbet, 1980, A rationale for debt maturity structure and call provisions in the agency theoretic framework, *Journal of Finance* 35, 1223–1234.

DeAngelo, H., and R. Masulis, 1980, Optimal capital structure under corporate taxation, *Journal of Financial Economics* 8, 5–29.

Edwards, Steven, ed., 1992, *The Issuer's Guide to Tax-Exempt Finance* (Global Financial Press, Philadelphia).

Fama, Eugene F., and Michael Jensen, 1983a, Separation of ownership and control, *Journal of Law and Economics* 26, 301–325.

Fama, Eugene F., and Michael Jensen, 1983b, Agency problems and residual claims, *Journal of Law and Economics* 26, 327–349.

Fama, Eugene F., and Michael Jensen, 1985, Organizational forms and investment decisions, *Journal of Financial Economics* 14, 101–119.

Grossman, Michael, F. Goldman, S. Nesbitt, and P. Mobilia, 1993, Determinants of interest rates on tax-exempt hospital bonds, *Journal of Health Economics* 12, 385–410.

Harris, Milton, and A. Raviv, 1991, The theory of capital structure, *Journal of Finance* 46, 297–355.

Hoshi, T., A. Kashyap, and D. Scharfstein, 1991, Corporate structure, liquidity, and investment: Evidence from Japanese industrial groups, *Quarterly Journal of Economics* 106, 33–60.

Jalilvand, Abolhassan, and R. Harris, 1984, Corporate behavior in adjusting to capital structure and dividend targets: An econometric study, *Journal of Finance* 39, 127–145.

Jensen, Michael, and W. Meckling, 1976, Theory of the firm: Managerial behavior, agency costs, and capital structure, *Journal of Financial Economics* 3, 305–360.

Judge, G., W. Griffiths, R. C. Hill, H. Lütkepohl, and T. Lee, 1985, *The Theory and Practice of Econometrics* (Wiley and Sons, New York).

Kraus, A., and R. Litzenberger, 1973, A state-preference model of optimal financial leverage, *Journal of Finance* 28, 911–922.

Marsh, P., 1982, The choice between equity and debt: An empirical study, *Journal of Finance* 37, 121–144.

Miller, Merton, 1977, Debt and taxes, *Journal of Finance* 32, 261–276.

Myers, Stewart, 1977, Determinants of corporate borrowing, *Journal of Financial Economics* 5, 147–175.

Myers, Stewart, and N. Majluf, 1984, Corporate financing and investment decisions when firms have information that investors do not have, *Journal of Financial Economics* 13, 187–221.

Sloan, F. A., T. J. Hoerger, M. A. Morrisey, and M. Hassan, 1990, The demise of hospital philanthropy, *Economic Inquiry* 28, 725–743.

Taggart, R. A., 1977, A model of corporate financing decisions, *Journal of Finance* 32, 1467–1484.

Wedig, Gerard J., 1994, Risk, leverage, donations, and dividends-in-kind: A theory of nonprofit financial behavior, *International Review of Economics and Finance* 3, 257–278.

Wedig, Gerard J., F. Sloan, M. Hassan, and M. Morrisey, 1988, Capital structure, ownership and capital payment policy: The case of hospitals, *The Journal of Finance* 43, 21–40.

White, Halbert, 1980, A heteroscedasticity-consistent covariance matrix estimator and a direct test for heteroscedasticity, *Econometrica* 48, 817–838.

Zellner, A., 1962, An efficient method for estimating seemingly unrelated regressions and tests of aggregation bias, *Journal of the American Statistical Association* 57, 348–368.