Dynamic Performance Measurement

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Dynamic Performance Measurement

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Abstract

This survey advocates the use of dynamic models to examine the incentive properties of commonly used accounting performance metrics. Drawing from recent work in this emerging field, the survey illustrates how one can use tractable multiperiod models to shed light on questions of fundamental interest to accountants. The author first examines the choice of goal congruent performance measures and then explains how the insights obtained from the goal congruent framework can be adapted to second-best contracting in formal agency models. Next, the author builds an analytically tractable multiperiod moral hazard model with a risk averse manager to examine the issue of aggregating accounting and nonaccounting information in constructing optimal performance measures.

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1

Introduction

One of the most fundamental accounting questions relates to alternative performance measures and their ability to align the interests of owners and managers. A number of commonly used managerial performance measures rely on accrual accounting information. Since accrual accounting differs meaningfully from cash accounting only in a multiperiod setting, this survey advocates and illustrates the use of dynamic models to examine the incentive properties of commonly used accounting performance metrics.

Drawing from the recent work in this emerging field, the survey illustrates how one can gainfully employ tractable multiperiod models to shed light on questions of fundamental interest to accountants. For instance, how do the classical accrual accounting concepts such as intertemporal matching of costs and benefits and reliance on realized, or historical, data affect the incentive properties of the resulting accounting information? Though these measurement notions are firmly ingrained in the accounting framework, there has been little formal work on examining the incentive properties of the resulting accounting information.

To address these questions, some papers have adopted the so-called "goal congruent" perspective. Under this perspective, a performance measures is said to be goal congruent if it guides managers toward value maximizing decisions. This approach ignores explicit moral hazard problems and their associated agency costs. Instead, it focuses on identifying performance measures that are robust in the sense that managers have incentives to make value maximizing decisions regardless of their planning horizons, discount rates, or particular compensation rules. The goal congruent perspective has been central to most of the pre-agency work in managerial accounting. See, for instance, Solomons' (1965) pioneering study on divisional performance measurement. The debate about desirable accounting rules has recently resurfaced in connection with so-called value-based management plans, many of which are variants of the familiar residual income concept.[1] The proponents of these plans recommend adjustments to GAAP with the stated objective of obtaining accounting metrics that are more suitable for managerial performance evaluation. For the most part, however, this debate has been lacking in formal criteria for evaluating alternative rules.

To illustrate the choice of goal congruent accounting rules, suppose a firm's manager has superior information about the future returns of a proposed investment project. To ensure that the manager has desirable incentives regardless of his planning horizon, proper accounting rules must reflect value creation in such a manner that the manager does not face any intertemporal tradeoffs when making the investment decision. As a consequence, proper intertemporal matching of revenues and expenses become essential. In particular, robust investment incentives can be created for a broad class of managerial preferences and compensation structures, provided the performance measure is residual income and the depreciation rule is based on the so-called *relative benefit schedule*. The relative benefit rule allocates the initial investment cost across periods in proportion to the intertemporal pattern

[1] Economic Value Added (EVA) is the best known among these value-based management plans. See Stewart (1991) and Ehrbahr and Stewart (1999). Martin and Perry (2000) discuss closely related concepts that have been advocated by other consulting firms. Biddle et al. (1999), Ittner and Larcker (1998), Young and O'Byrne (2000), and Balachandran (2005) provide evidence on the adoption of these plans.

of project revenues (i.e., cash flows). This essentially "annuitize" the project's NPV, and ensures that a profitable project makes a positive contribution to the managerial performance measure in every period. As a consequence, the desired investment incentives hold regardless of the manager's preferences or bonus coefficients. In fact, relative benefit depreciation rule emerges as unique in its ability to deliver robust goal congruent incentives.

This illustrates that while the specific form of matching needed for goal congruence may differ from GAAP, the matching principle of accrual accounting is a fundamentally sound measurement concept. As observed by Solomons (1965) and others, when the project cash flows are constant across periods, the relative benefit depreciation rule coincides with the familiar annuity depreciation method. Stewart (1994) refers to the annuity depreciation method as the "sinking fund" method and advocates it as an alternative to straight line depreciation. It is also worth noting that the annuity depreciation coincides with straight line depreciation when the time value of money is ignored. The time value of money adjustment to GAAP appears necessary in many other instances. For example, in connection with long-term construction projects, goal congruence requires that revenue recognition for a project should reflect the underlying intertemporal pattern of costs incurred toward project completion. To obtain goal congruence, however, the commonly used percentage of completion method needs to be modified so that the estimate of percentage of completion in a given period is based on the ratio of that period's cost to the *discounted* value (rather than the undiscounted value) of the project's total cost.

The study of goal congruent performance measures naturally raises the question whether the corresponding accounting rules also emerge as part of second-best contracts in formal agency models. By definition, the advantage of goal congruence approach is that managerial incentives for investment activities are invariant to the choice of compensation parameters and therefore these parameters can be freely chosen to address other moral hazard problems. At the same time, though, second-best decisions are likely to vary with the underlying agency problem. This would require further adjustments to the performance measures. This raises the obvious concern whether the insights

derived in the goal congruent framework would remain viable when formal agency problems are incorporated, and the desired incentives are derived from unified optimization programs.

This survey discusses that, in many instances, goal congruent performance measures can be modified so that they emerge as part of second-best contracts in formal agency settings. For example, in connection with capital investments, the optimal investment policy entails under investment, since the better informed manager earns informational rents. In order to balance the returns from investment with the required compensation payments to the manager, the principal finds it optimal to curtail investment. Nonetheless, residual income based on the relative benefit depreciation rule remains an optimal performance measure, provided the principal imposes a capital charge rate equal to the firm's *hurdle rate*. This hurdle rate incorporates the compensation cost for the better informed manager and therefore exceeds the firm's cost of capital. This suggests that the earlier characterization of the goal congruent performance measures can be applied to second-best contracting settings in many instances.

This survey does not attempt a comprehensive survey of the extant managerial accounting theory literature. Such a survey is provided in Lambert (2001). Instead, this survey focuses on the work that has examined multiperiod models of accrual accounting. The discussion in this survey draws on Baldenius et al. (2007), Dutta and Reichelstein (2002, 2005a,b), Rogerson (1997), and Reichelstein (1997). Other papers that have examined multiperiod models of accrual accounting include Arya et al. (1999), Baldenius and Reichelstein (2005), Baldenius and Ziv (2003), Bhareket and Mohnen (2007), Bastian (2004), Dutta and Reichelstein (1999), Dutta (2003), Dutta and Zhang (2001), Friedl (2005), Mishra and Vaysman (2004), Pfeiffer and Schneider (2007), Reichelstein (2000), Wagenhofer (2003), and Wei (2004).

The remainder of the survey is organized as follows. The next section examines the choice of goal congruent performance measures for two common transactions: capital investments and multiyear contracts. Section 3 illustrates how the insights obtained from the goal congruent framework can be adapted to second-best contracting in formal agency models. In particular, this section develops an agency model in which a

risk-neutral manager has private information about the profitability of an investment project and also contributes productive effort to enhance the firm's cash flows. Section 4 builds an analytically tractable multi-period moral hazard model with a risk-averse manager. This model is used to examine the issue of aggregating accounting and nonaccounting (specifically, stock market) information in constructing optimal performance measures. Section 5 concludes the survey.

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