



Bias correction in the estimation of dynamic panel models in corporate finance



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ABSTRACT

Dynamic panel models play an increasingly important role in numerous areas of corporate finance research, and a variety of (biased) estimation methods have been proposed in the literature. The biases inherent in these estimation methods have a material impact on inferences about corporate behavior, especially when the empirical model is misspecified. We propose a bias-corrected global minimum variance (GMV) combined estimation procedure to mitigate this estimation problem. We choose the capital structure speed of adjustment (SOA) setting to illustrate the proposed method using both simulated and actual empirical corporate finance data. The GMV estimator non-trivially reduces bias and hence meaningfully increases the reliability of inferences based on parameter estimates. This method can be readily applied to many other corporate finance contexts.

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1. Introduction

A number of techniques have become increasingly popular in corporate finance research (e.g., dynamic structure modeling and quasi-experimentation). While each of these major new approaches has been shown to provide novel insights, inevitably they all have some form of limitation. Dynamic panel bias,¹ endogeneity issues, empirical model misspecification, and other potential corporate data issues (both separately and in combination) can introduce severe biases into existing baseline estimations, which cast serious doubt over the credibility of the inferences drawn regarding corporate decision making. Despite such issues, inference in corporate finance research is likely to continue to rely heavily on cross-sectional regressions, with dynamic panel models playing an increasingly prominent role (Flannery and Hankins, 2013; Wintoki et al., 2012).

To address the well-known difficulties relating to the identification of parameters in corporate dynamic panel models (e.g., Flannery and Hankins, 2013; Huang and Ritter, 2009), we propose a bias-corrected minimum variance combined estimation procedure. Moreover, we use various statistical specifications to evaluate the performance of this method in an empirically meaningful manner for corporate finance research. Following the lead of several recent studies of corporate finance methodology (e.g., Flannery and Hankins, 2013; Strebulaev and Whited, 2012), we choose capital structure as the research context in which to illustrate our approach. We make this choice, not only because of the prominence and familiarity of capital structure within corporate finance research, but also because of the longstanding and widespread recognition of the challenge of reliably estimating the speed of adjustment (SOA) for leverage in dynamic panel models.² Indeed, capital structure represents a mature research area that can substantially benefit from the bias correction methods that we advocate.

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¹ This type of bias is also known as “short panel bias”.

² See Huang and Ritter (2009) and Flannery and Hankins (2013) for comprehensive comparisons of the most widely used SOA estimators.

While we ground our study in the specific area of SOA estimation, we aim to establish a generally applicable framework and thereby contribute to a broad range of corporate finance studies which share in common inherently dynamic questions, featuring endogenous variables, and that are subject to non-trivial model misspecification. Furthermore, we extend our study to compute a consensus SOA estimate derived from a diverse set of popular extant estimators.

SOA-related research is controversial. The partial adjustment model itself could be misspecified (Chang and Dasgupta, 2009; Hovakimian and Li, 2011; Iliev and Welch, 2010) and thus can spuriously favor the adjustment hypothesis. However, there are also studies supporting the partial adjustment model (e.g., Liu, 2009). Therefore, whether and to what extent firms actually adjust leverage to a target is still an open question, and thus, uncovering the underlying economic force is of primary importance to capital structure researchers (Graham and Leary, 2011).

But, there is no logical reason to dismiss any given research stream, since it is very likely that each and every method can provide some incremental insight despite their respective limitations (Hennessy, 2013). Undeniably, recent advances in corporate finance research, such as dynamic structure modeling and natural experiments, can mitigate endogeneity and causal inference problems. Nevertheless, the existing dynamic modeling literature is primarily theoretical, and the related models have not yet been thoroughly tested (Welch, 2013). Moreover, high-quality, credible natural experiments are extremely difficult to identify in corporate finance (Strebulaev and Whited, 2013). As a consequence, the reduced-form dynamic panel model remains a critically important tool for testing and drawing inferences in corporate finance research.

We contribute to the broader literature by providing a readily implementable alternative method for solving the bias estimation problem in realistic corporate settings. In these contexts, endogenous regressors, unbalanced panels, and the potential misspecification of empirical models collectively are formidable obstacles to many interesting question-driven investigations. Our study is the first to examine the performance of bias-correction methods under various conditions typically encountered in corporate datasets. Our objective is to provide new insights from a different perspective, backed up by meaningful analyses aimed at enhancing the toolkit available to corporate empiricists.

Our paper proceeds as follows. Section 2 briefly reviews SOA estimation in a partial adjustment framework. Section 3 addresses the materiality of bias in the estimated SOA, formulating and applying a general, simulation-based bias correction method as a solution. Section 4 further investigates the proposed method using an actual empirical sample of corporate finance data. Section 5 provides a broader discussion, while Section 6 concludes the paper.

2. Biased estimations in capital structure research: theory and models

2.1. Brief literature overview

The question of how leverage ratios are determined remains elusive three decades after Myers' (1984) AFA presidential address. It is still the most important outstanding question in capital structure literature (Welch, 2013). The three preeminent theories of capital structure are the static trade-off model, the pecking order model, and the more recently popularized market timing model (see Baker and Martin, 2011, for an overview of these theories). Empirical tests of the implications of these theories have spawned numerous papers in the extant literature. While each of these theories has successfully explained several patterns observed in capital structure, they have generally failed to explain much of the observed heterogeneity.

Recent studies have utilized several approaches to address the shortcomings of these traditional models. As Graham and Leary (2011) discuss in their review, different perspectives regarding the nature of these shortcomings have been adopted in these recent empirical studies. In particular, one of the most documented problematic issues in capital structure research relates to SOA inferences. Huang and Ritter (2009) view the estimation of the speed with which firms adjust toward their target leverage levels as the most important issue in capital structure research. Iliev and Welch (2010, p. 2) in recognizing the importance of SOA estimation, state the following regarding the perspective expressed by Huang and Ritter (2009):

The literature is now settled with these starkly different estimates. Even if Huang and Ritter are too optimistic in their assessment of its importance, the SOA is still a readily empirically observable and interpretable statistic that characterizes aggregate corporate capital structure behavior. Its magnitude is of interest not only to many academics, but also to many practitioners and students.

However, no consensus has been reached. Indeed, the literature sends a confused message regarding how best to estimate SOA and the model specification of leverage adjustment behavior. At best, empirical models can only serve as approximations of the underlying “truth”; therefore, all such models can be falsified (Strebulaev and Whited, 2013). Partial adjustment models that account for dynamics represent overly simplified approximations of reality but remain among the most widely accepted reduced-form empirical models in leverage studies. Thus, we purposefully select SOA estimation in a partial adjustment model to illustrate the bias correction method in scenarios involving correctly specified as well as misspecified models.

2.2. Estimation and specification of leverage dynamics

2.2.1. Biased estimation: dynamic panel bias

The partial adjustment model states that corporate financial leverage adjusts towards long-run target leverage, but due to adjustment costs, actual leverage is only partially adjusted toward optimal leverage during each period (Fischer et al., 1989). A

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