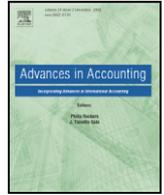




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Assessing self-selection and endogeneity issues in the relation between activity-based costing and performance



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ABSTRACT

Studies investigating the relation between ABC adoption and performance are inconclusive and plagued with econometric problems. This study extends prior research to investigate the association between ABC adoption and four manufacturing plant performance measures (cycle-time improvement, quality improvement, cost improvement, and profitability) and to assess selection bias and the endogenous nature of their relationship. I use the Heckman (1979) model to assess sample selection bias and the Wooldridge (2002) 2SLS-IV approach, to investigate endogeneity. After controlling for sample selection bias and endogeneity, the coefficient of ABC under the Heckman method and ABC_{fit} under the 2SLS-IV method becomes significantly higher compared to the coefficient of ABC under the OLS method. In addition, both the inverse Mills ratio, under the Heckman model, and Hausman F-test, under the Wooldridge 2SLS approach, are positive and significant, confirming the presence of both sample selection bias and endogeneity. Overall, I find that controlling for sample selection bias and endogeneity is essential in properly assessing the significance of ABC-performance association.

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1. Introduction

The relevance of traditional cost accounting has been attacked since the mid-1980s. Khanna (2002) argues that the primary failing of traditional costing systems is the inability to provide useful feedback to understand and allocate overhead costs. Doyle (2002) also suggests that traditional systems have the potential inability to account for the size and diversity of products; for example, a larger or more complex item that may produce more revenue may also consume a larger-than-presumed overhead cost. Brewer, Juras, and Brownlee (2003) argue that these issues have the potential to reduce a company's overall profitability. Thus, activity-based costing (ABC hereafter) has become the accepted remedy for the significant limitations of traditional cost-accounting systems (Mishra & Vaysman, 2001).

The ABC system has been suggested as a key tool for improving business practices in organizations (Anderson, 1995; Cooper & Zmud, 1990; Foster & Swenson, 1997; McGowan & Klammer, 1997; Shields, 1995). The central theme of ABC systems is that their use leads to improved product costing and competitive advantage (Brimson, 1991; Raffish & Turney, 1991), because ABC focuses on costs associated with activities; it thereby allows the evaluation of whether those activities add value, thus providing a means of understanding how to most effectively reduce costs (Cooper & Zmud, 1990; Foster & Swenson, 1997). In addition to these cost reduction benefits, applying ABC gives managers a sound means of monitoring ongoing performance (Player, 1998) and, indeed,

many organizations have found that the pursuit of enhanced performance can best be achieved by implementing ABC systems (Compton, 1996).

Finally, although there is some evidence that previously used measures of ABC success (Krumwiede, 1998; Shields, 1995; Swenson, 1995) are predictors of improvement in financial performance, many other studies find no relationship between ABC adoption and improved firm performance (Bromwich & Bhimani, 1989; Gordon & Silvester, 1999; Innes & Mitchell, 1995; Ittner, Lanen, & Larcker, 2002); and several reservations have been expressed regarding the efficacy of ABC (Innes, Mitchell, & Sinclair, 2000; Malmi, 1997; Morrow & Connolly, 1994).

Some of the conflicting results in the literature may be due to econometric issues. For example, most of the prior studies have used ordinary least square (OLS) methods to assess the association between ABC adoption and firm performance (Gosselin, 2007). Maiga and Jacobs (2008) used structural equation modeling to assess ABC-performance link. However, their study used only ABC-adopting plants in their sample, ignoring non-ABC adopting plants. In addition, they did not assess selection bias or endogeneity issues that may be important because the ABC-performance link may be spurious if sample selection bias and endogeneity of ABC adoption is not controlled. Also, as a result of measurement error, OLS will tend to underestimate the ABC-performance link. In an attempt to link ABC to performance, Ittner et al. (2002) used a two-step residual approach; however, they caution readers of the limitations of their results since they did not match samples of ABC and non-ABC adopters. The research design used in the current study addresses these concerns by using an econometric analysis to better understand sample selection bias and the endogenous nature of the ABC-performance relationship. First, I use the Heckman (1979)

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approach to investigate sample selection bias. Next, I assess the problem of endogeneity, more specifically reverse causality, between ABC and performance.¹ Additionally, this study contributes to the knowledge about the relationship between ABC adoption and plant operational and financial performance.

Results indicate that, overall, ABC adoption is associated with manufacturing plant performance. In addition, the results indicate sample selection bias and endogeneity of ABC adoption. The evidence suggests that the inconclusive results of prior studies on the link between ABC adoption and performance may result from a failure to consider selection bias and endogeneity issues using control and match samples.

This study's main contribution is to highlight the importance of sample selection bias and endogeneity in examining the association between ABC and plant performance. Thus, the difference between OLS estimates of the ABC–performance link and two econometric models, the Heckman model, which addresses sample selection bias, and the Wooldridge 2SLS-IV (two stage least squares–instrumental variables) approach, which addresses the endogenous character of a plant's decision about ABC adoption, are analyzed. The use of different methods not only provides more confidence in statistical findings of the analysis, but also enables a comparison of the magnitude of the ABC–performance association under different estimators. I show that the failure to address sample selection bias and endogeneity affects the inferences made and conclusions drawn by previous studies. Taken together, the findings suggest that future studies on the association between ABC adoption and performance should control for both sample selection bias and endogeneity.

The remainder of this paper is organized as follows. Section 2 gives an overview of the related literature suggesting the relevance of ABC systems to firm performance. Section 3 develops the research methods and describes the sample and data. Section 4 presents the primary findings. Finally, Section 5 summarizes and concludes the study.

2. Related literature

The benefits and costs of ABC adoption have been suggested, studied, and tested in numerous research papers. Benefits suggested include efficiency gains related to reducing or eliminating non-value-added activities and illuminating where re-engineering of processes, including quality initiatives and product re-design, can enhance performance.

When an entity implements ABC, its entire operation is scrutinized in great detail, its performance is analyzed, and its employees are encouraged to suggest improvements (Kaplan & Cooper, 1998). As a result, ABC can assist in identifying activities that cause non-value-added time and provide information needed to minimize other delays in the value-creation process (Borthick & Roth, 1995; Kaplan, 1992). Ittner et al. (2002) found that ABC use is positively related to improvement in cycle time; thus, ABC can be viewed as an “enabler” to support the development of cost-effective product designs and manufacturing processes. For example, with accountants providing important inputs into product design and development decisions, ABC attempts to mirror the manufacturing process, so that engineers and production managers can easily see how design changes will affect costs (Swenson, 1998). Prior studies suggest that the information provided by ABC can allow managers to reduce costs by designing products and processes that consume fewer activity resources, increasing the efficiency of existing activities, and eliminating activities that do not add value to customers (Gunasekaran & Sarhadi, 1998; Ittner et al., 2002).

ABC also serves as a useful information system to support effective decision-making processes related to quality initiatives (Gupta & Galloway, 2003). The information provided by ABC can help identify the drivers of quality problems and quality benefits (Armitage &

Russell, 1993; Carolfi, 1996) by highlighting the quality-related non-value-added activities, which can therefore facilitate quality improvement (Cooper et al., 1992; Ittner, 1999; Ittner et al., 2002). For example, Jorgenson and Enkerlin (1992) describe how ABC information helped Hewlett–Packard product teams simulate and improve quality early in the product-design phase. Ittner et al. (2002) found that ABC use is positively related to higher quality levels.

Proposals for management implementation of innovations, such as ABC, suggest that an improvement in financial performance will necessarily follow. In the case of ABC, a hypothesized direct relationship with plant profitability is compelling because of the substantially improved association of costs with individual products and services, with customers, and with suppliers. With new and better intelligence, management can more accurately determine product margins, customer profitability, supplier profitability, etc., which should lead to a more profitable mix of products, customers and suppliers. Thus, a direct association between ABC adoption and plant profitability has been hypothesized numerous times in the extant literature. Overall, advocates argue that ABC provides a means of enhancing profitability because it provides companies with a powerful tool for improving profitability (Carolfi, 1996; Cooper & Kaplan, 1991; Plowman, 2001). Findings by Rafiq and Garg (2002) suggest that there is a strong relationship between ABC implementation and profitability. Many other studies, however, are unable to find the relationship between ABC use and superior firm performance as conjectured (Bromwich & Bhimani, 1989; Gordon & Silvester, 1999; Innes & Mitchell, 1995; Ittner et al., 2002). This dichotomy of findings in the literature warrants further investigation on the relation between ABC and business performance.

3. Research methods

3.1. Sample

Data for this research was drawn from a survey of manufacturing plants across the United States. The initial sample consists of 2403 manufacturing that have adopted ABC obtained from Maiga and Jacobs (2008). In addition, a random sample of 2500 manufacturing plants was drawn from *Industry Week's* Annual Census of Manufacturers without a priori knowledge of whether plants have adopted ABC or not (excluding the initial sample obtained from Maiga & Jacobs, 2008).

Copies of the questionnaire were mailed to plant managers and operating managers with self-addressed envelopes for returning the completed questionnaire directly to the researchers. The questionnaires were then to be completed by the plant manager or operating manager. To reduce possible desirability bias, I promised to keep all individual responses completely confidential, and confirmed that the analyses would be restricted to an aggregate level, preventing the identification of any individual or organization. Within the first three weeks, I received 1205 responses. To increase the response rate, I sent follow-up letters and another copy of the questionnaire to those who had not responded. The second mailing resulted in 106 responding plants. Of the total 1311 responses, 45 were incomplete. Next, I elected to match at a given industry level (SIC 20 through SIC 39) by selecting the control firm (non-ABC plants) with number of employees closest to the number of employees of the adopting firm.² The matching procedure yielded 538 ABC adopters and 538 non-ABC adopters.

Non-response bias is always a concern in survey research. Thus, I tested for statistical differences in the responses between the early and late waves of survey respondents, with the last wave of surveys received considered representative of non-respondents (Armstrong & Overton, 1977). T-tests are performed to compare the mean scores of the early and late responses. There were no statistically significant differences between the early and late respondents, providing some

¹ Reverse causality leads to ABC being correlated with the true (but unobserved) error term of the structural equation, resulting in inconsistent OLS parameter estimates (Wooldridge, 2002).

² A specification was made that the number of employees of the control plant must lie within 70% to 130% of the ABC plant.

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