Structural models and endogeneity in corporate finance: The link between managerial ownership and corporate performance ☆

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ABSTRACT

This paper presents a parsimonious, structural model that isolates primary economic determinants of the level and dispersion of managerial ownership, firm scale, and performance and the empirical associations among them. In particular, variation across firms and through time of estimated productivity parameters for physical assets and managerial input and corresponding variation in optimal compensation contract and firm size combine to deliver the well-known hump-shaped relation between Tobin's Q and managerial ownership. To assess the effectiveness of standard econometric approaches to the endogeneity problem, we apply those remedies to panel data generated from the model. The unfortunate conclusion is that, at least in the ownership–performance context, proxy variables, fixed effects, and instrumental variables do not generally provide reliable solutions to simultaneity bias.

1. Introduction

This paper pursues two interrelated themes. First, we specify and estimate a structural model of the firm in which managerial contract design, firm size, and firm performance are jointly determined in equilibrium. We use numerical methods to calculate the productivity parameters for managerial input and investment that would give rise to the levels of chief executive officer (CEO) ownership and investment observed in the data as optimal choices in our model. The structural model is relatively successful in explaining both (a) the level and dispersion of managerial ownership, firm scale, and performance and (b) the character of the empirical associations among those variables. This suggests that our model captures some of the primary economic determinants of the endogenous equilibrium relation between firm performance and structure. Second, we use our model to evaluate a number of commonly applied econometric approaches to the endogeneity problem. Our unfortunate conclusion is that, in the ownership–performance context, the use of proxy variables, fixed effects, and instrumental variables does not generally provide a reliable solution to simultaneity bias. Overall, the construction of our model and its application to data illustrate how quantitative structural models are likely to be applicable to a spectrum of other empirical questions in corporate finance.

For our analysis we focus on a substantial and consistently active segment of the empirical corporate finance literature, the relation between firm performance and managerial incentives. Important early contributions include Morck, Shleifer, and Vishny (1988) which documents a nonmonotonic relation between Tobin's Q and managerial stock ownership, and McConnell and Servaes (1990), which reports an "inverted-U" or "hump-shaped" relation between Q and managerial ownership. Numerous successors investigate the ownership–performance relation using different data, various measures of performance and ownership structure, and alternative empirical methods.[3]

One common interpretation of the estimated hump shape is that the incentive alignment effects of ownership dominate at low ownership levels, but that high ownership levels facilitate managerial entrenchment.[4] Under this view, shareholders maximize firm value if they can induce managers to own precisely the amount of stock associated with the peak of the performance–ownership relation. In our data the effective ownership from stock and options of the CEO varies from 0.01% to 57.6%, with a standard deviation of 5.7%, and the point at which the maximum of the estimated hump-shaped relationship between Q and effective CEO ownership arises is 20.0%. One obvious possibility is that large transaction costs prevent some firms from moving to the optimum. Based on our estimates of the Q-ownership relation, however, increasing CEO ownership by one standard deviation, from 14.3% to 20.0%, implies an increase in firm value equal to $662 million, on average. Supposing these calculations are representative for the average firm or even just some firms, it seems implausible that the transaction costs of realigning CEO ownership exceed that figure, much less the even greater amounts associated with larger departures of ownership from that which supports maximal Q. Based on this line of reasoning and plausible transaction costs, there is far more variation in observed ownership structure than one would expect.

An alternative interpretation of the data is that the inverted-U pattern represents a value-maximizing relation between two endogenous variables. Under this view, if the empirical specification adequately captures the effects of all relevant exogenous variables, i.e., those structural parameters that jointly drive both ownership and performance, that specification would be unlikely to detect any remaining relation between the jointly determined endogenous variables (Demsetz and Lehn, 1985). One challenge for those who operate in the equilibrium paradigm, in this particular empirical context or any other, is to identify the underlying economic forces that drive what presumably is an equilibrium relation between organization structure and firm performance.

We take up this challenge by specifying and estimating a structural model of the firm. Exogenous parameters specify managerial risk aversion, volatility of cash flow, profit margin, productivity of managerial input, productivity of investment, and how cash flow volatility depends on firm size. The shareholders choose investment (firm size) and ownership (the compensation scheme) of the manager, realizing that the manager chooses input, which cannot be observed by the shareholders. Of course, in the standard agency problem (Mirrlees, 1976; Holmstrom, 1979; and successors) it is the slope of the compensation scheme (i.e., the ex ante sensitivity of managerial wealth to firm performance, or wealth-performance sensitivity (WPS)) that is the primary contractual characteristic that influences the manager's choice of unobservable input. We use data on firm size from Compustat and managerial stock and option ownership from Execucomp to solve for the two model parameters that describe the firm's production function. In particular, for each firm-year observation, we calculate the productivity parameters for managerial input and investment that would give rise to the observed levels of managerial ownership and total assets as optimal choices in our model. We then use these estimated productivity parameters as variables in the model to generate simulated firm-year data on Tobin's Q.

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[3] See Demsetz and Lehn (1985), Cho (1998), Himmelberg, Hubbard, and Palia (1999), Demsetz and Villalonga (2001), Palia (2001), Claessens, Djankov, Fan, and Lang (2002), Lins (2003), Loderer and Martin (1997), Mehran (1995), and Gaver and Gaver (1993), among others. The extent of interest in the performance–ownership relation is shown by Mathiesen (2002), whose dissertation catalogs approximately 100 academic studies on the topic published up through 1999. Also see http://e.viaminvest.com/A5OwnershipStructures/OwPerfStudies/Exhi_1Hypo1to5.asp (accessed April 8, 2011). Many other papers on the specific topic have appeared since 1999. Related contributions include Demsetz (1983), Holderness, Kroszner, and Sheehan (1999), and Smith and Watts (1992).

[4] See Stulz (1988) for a model containing offsetting costs and benefits of managerial ownership. In that model, firm incentive-alignment effects dominate when inside ownership is low but, as managerial ownership increases, these incentive benefits eventually are overtaken on the margin by the cost of an increased managerial ability to pursue non-value-maximizing activities without being disciplined by shareholders.