Ownership Structure and Firm Performance: Evidence from Taiwan

Wanncherng Wang*

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This paper examines the relationship between firm performance and ownership structure for listed and OTC manufacturing firms in Taiwan. By classifying ownership into three categories (managerial owners, institutional owners and the control group), the study addresses two related empirical issues—the commonly examined piecewise and the Granger causality relationships between ownership and performance. The empirical results show that except managerial ownership, there is a positive relationship between ownership and performance. Meanwhile, the piecewise relationship surfaces only for the control group, with the inflection points of 12.5% and 20%. The Granger causality test demonstrates a significant feedback relationship between institutional ownership and performance, consistent with the better expertise of institutional owners in monitoring and investment selection. Firm performance Granger-causes the ownership of the control group and is independent of managerial ownership. As auxiliary tests, this study provides a formal approach to search for inflection points and reconcile different firm performance measures.

Keywords: Firm performance; Ownership structure; Granger causality; piecewise relationship.

1. Introduction

The importance of the impact of ownership structure on firm performance has long been well-recognized since Berle and Means [4]. The well-known agency theory contends that interest misalignment between managers and the absentee owners leads to the deviation of managerial behavior from the maximization of the firm value [16]. A large body of research extends this theory and formulates the impacts of ownership structure on firm performance in various contexts of corporate events such as proxy fights [22], corporate takeovers [11] and anti-takeover [5,1]. While some theories suggest that increased managerial ownership alleviates conflicts between inside managers and outside owners [16], others predict that increased ownership may reduce firm value because of managerial entrenchment. Combining these theories leads to a piecewise relationship

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between ownership and firm performance. For instance, Stulz [26] develops a model in which the market value of the firm first increases, and then decreases in the insider's equity ownership. Similarly, Morck et al. [19] argue that managers respond to two opposing forces and that the relationship between ownership and firm value depends on which force dominates over a particular range of managerial equity ownership. The net effects of the opposing forces vary with the levels of managerial ownership. Empirical evidence of these theories, however, appears to be conflicting.

The issue of corporate governance also invites widespread discussion and research in Taiwan. In exploring this issue, most studies emphasize the impact of the ownership of director board on firm performance in different scenarios. Among others, Chen et al. [6] examine the impact of managerial and institutional ownership on the underpricing of initial public offerings. They find that management and institutional ownership is negatively related to underpricing of IPOs. Chiang [7] focuses on the gap between cash flow rights and control rights to examine the effects of corporate governance on the post-acquisition performance of the target firms. He finds that target firms with the better corporate governance tend to have better performance after acquisition and lower possibility of financial distress. Wen [27] investigates the market reaction to the initial investment announcement conditional on the executive ownership. The empirical results show a significant positive relation between the reaction of the stock market and the concentration of ownership. Overall, most of the studies emphasize the agency costs and predict a linear ownership-performance relation.

Within a different framework, this study attempts to provide evidence on the relationship between ownership structure and firm performance based on a sample of manufacturing companies traded on Taiwan Stock Exchange and Over-the-Counter. In contrast, the current study focuses on the performance-ownership in general and contributes to the literature in the following ways. First, in spite of the importance of the issue, published empirical evidence on this subject is still lacking in Taiwan. The performance of East Asian corporations has been the focus of numerous studies over the last four decades, but the impact of the ownership structure on the performance for the companies in this region remains largely unknown [23,8]. Second, unlike previous US-based studies, which focus on managerial ownership, the current study includes and differentiates ownership among three types of owners—managers, control group (the sum of managers, major stockholders, directors, and supervisors), and institutional owners. Third, although related evidence has been provided from other countries, such as the
US and UK, the results are inconclusive.¹ A potential reason is the
differences in the efficiency levels of managerial labor and stock markets. In
this regard, a great proportion of Taiwanese companies are family-controlled
through pyramid structures and cross-holdings. Thus, one should not expect a
high level of efficiency in the managerial labor market. Meanwhile, if one
expects a higher level of efficiency in the US stock market, then an efficiency
difference in the market for corporate control would be expected between the
US and Taiwan. Without appropriate driving forces from the markets for
managerial labor and corporate control, it is not sure whether a piecewise
relationship between ownership and performance also exists in Taiwan and
what it is like if it does. Fourth, causal relationships between firm
performance and ownership are examined for the three types of
ownership—managers, the control group (the sum of managers, directors,
supervisors and major stockholders), and institutional investors. This
examination considers the possibility that improvement in firm performance
causes increase in ownership and that the differential expertise in investment
may reverse the causal relationship. Finally, one of the major difficulties in
the study of the piece-wise ownership-firm performance is the determination
of the inflection points. The current study provides a systematic approach to
search for the inflection points. In addition, given the conflicting results in
prior studies, the variety in performance measures appears to exacerbate the
discrepancy or confusion in this issue. This paper formally reconciles two
different measures of firm performance—the Tobin’s Q ratio and sales.

Several empirical findings are obtained. Except the managerial
ownership, the other two types of ownership are positively correlated with
firm performance, consistent with the predictions of agency theory. As
predicted, the relationship also depends on the identities of the owners. First,
the empirical results show that managerial ownership is uncorrelated with the
performance of the firm. In contrast, the regression estimation demonstrates
that in the cases of the control group the relationship between ownership and
performance is consistent with the predicted piecewise relation. For
institutional (corporate) ownership, only an empirical linear relation obtains.
The piecewise relation does not hold for this type of ownership. I also
compare the linear relationship for the institutional owners and the individual
(natural) owners. The results show that the institutional ownership is far more
correlated with firm performance than individual ownership, reflecting the
monitoring and advising expertise of the institutional owners.

¹ For instance, Morck et al. [19] found entrenchment occurs in the 5% to 25% ownership range.
McConnell and Servaes [17], however, were unable to replicate Morck et al.’s specific
empirical findings. In addition, the entrenchment ranges also differ among studies (Palia and
Litchtenberg [21], P. 325).
From a different angle, I examine the ownership-performance relation in terms of the Granger-causality. Instead of taking ownership as a driving force for performance as predicted by the agency theory, I conduct Granger causality tests to investigate the possibility that ownership can be driven by anticipated performance as in the real world of investment decisions. The results of Granger causality tests exhibit a sharp contrast among the three types of ownership. The evidence suggests that managerial ownership is independent of the performance of the firm. In contrast, a feedback relationship is observed for the institutional ownership. The Granger causality tests show that the ownership of the control group increases after performance improvement but not the other way around, reflecting investment decisions with the benefit of hindsight.

As sensitivity tests, I use the Tobin's Q as the performance measure and examine its relation to sales both analytically and empirically. Similar results obtain with these two performance measures. Finally, I illustrate an approach to search for the inflection points in the piecewise relationship. The rest of the study is organized as follows. Section 2 provides the theoretical framework of analysis. Section 3 describes data sources and basic statistics of the study sample. Section 4 reports empirical findings. Section 5 provides sensitive tests of different performance measures, reflection points and corrections for price level. Section 6 summarizes and concludes this paper.

2. Firm Performance and Ownership Structure

I proceed with the derivation of a base specification of performance from the Cobb-Douglas production function [21]. For purposes of exposition, I briefly recap the derivation process and the ownership-performance relationship with the production function. Assuming an index of efficiency that accounts for and gives proper weight to the services of all of the inputs employed by the firm, the index takes the ratio of output to input. That is,

\[ \gamma = \frac{Y}{f(L, K)}, \quad (1) \]

where \( \gamma \) is the efficiency index, \( f(.) \) is the normal output predicted by a production function, \( L \) is the labor input, \( K \) is the capital input and \( Y \) is the actual output. Assuming that \( f(.) \) is a Cobb-Douglas function, or geometrically weighted sum of its arguments, \( f(.) \) can be substituted by eq. (2):

\[ f(L, K) = L^\alpha K^\beta. \quad (2) \]

Then the production function can be rewritten as the product of efficiency index and normal output:
\[ Y = \gamma L^\alpha K^\beta \]  
(3)

Eq. (3) reflects only labor and capital inputs. To incorporate the input efforts of shareowners and macroeconomic factors, the empirical form based on eq. (3) can be rewritten as:

\[
\ln Y_{ijt} = \omega_j + \delta_t + \alpha \ln L_{it} + \beta \ln K_{it} + \theta M_{it} + \varepsilon_t,
\]

(4)

where \( \omega_j \) are the unobserved industry effects, \( \delta_t \) are the year effects, and \( M \) is the ownership. Output \( Y \) is defined as net annual sales, labor \( L \) is defined as the total salary expenses, and capital \( K \) is defined as net property, plan, and equipment. \(^2\)  

\( i, j, \) and \( t \) are indices for firm, industry, and year respectively.

The relationship between managerial ownership and firm performance can be described as follows. First, at the low levels of managerial ownership, managers have incentives to allocate firm resources in their own interests at the expense of outside shareholders. At the same time, the diversion of resources from firm value maximization is also discouraged by the discipline from the markets for managerial labor and corporate control. Second, as their equity ownership further increases, the interests of managers coincide more closely with those of outside shareholders since they bear a substantial portion of the costs of the diversion from firm value maximization. However, at this level of ownership, it is also likely that managers become entrenched and therefore are tempted to overconsumption of perquisites since most of the cost of the perquisites is borne by the outside stockholders. Finally, when their ownership further increases to a sufficiently high level, managers will find that they themselves bear most of the costs, outweighing the benefit of their perquisites. They therefore choose to exert higher levels of effort. All taken together, the relation between ownership and firm performance is predicted to be nonlinear. Since it is impossible, \textit{a priori}, to predict which force will dominate at particular levels of managerial ownership, studies on the ownership-performance relationships generally resort to empirical investigations.

Although prior analyses focus on managerial ownership \cite{21}, the current study contends that the ownership of other stakeholders is also important. An important extension of the present study is to distinguish ownership among three categories of major shareowners—managers, institutional/corporate owners, and the control group (sum of supervisors, \(^2\) While Palia and Lichtenberg \cite{21} uses the unobserved firm effects, this study uses the industry effects to reduce the loss of degrees of freedom. The author also believes that unobserved firm characteristics are more difficult to capture in the form of fixed effects where the number of observations for each firm are limited.
directors, major stockholders and managers). Such a classification is particularly important when corporate control is effected through the pyramidal structure or cross-holdings. Many companies being under family control, it is a common practice that family members are arranged as directors, supervisors and managers. As will be shown in Figure 1, managers on average hold only a minimal proportion of equity ownership. Claessens et al. [8] find that for a high proportion of firms, the top management is related to the family of the controlling shareholder in East Asian countries and that for about 80% of Taiwanese companies in their sample, the CEO, board chairman, or vice-chairman are from the controlling family. Under this circumstance, it is reasonable to consider managers and major stockholders as part of the control group for the purposes of empirical analysis.

Board directors and supervisors play important roles in the corporate governance process. Due to the free-rider’s problem, incentives of a particular shareholder to monitor increases in his/her ownership [3]. This is particularly important for the current study since as the data of ownership structure will show, non-manager stakeholders like directors, supervisors, and major stockholders frequently control the highest level of ownership. In this case, it is in the interests of this group of shareholders to monitor managers. Also as part of their responsibility, they monitor and evaluate managerial performance, decide compensation levels of senior managers, make managerial decisions, and establish connections with other organizations. In so doing, board directors and supervisors in effect play the roles of both management and market discipline and the level of discipline increases in their ownership. On the other hand, directors and supervisors enjoy various types of compensation from the company and are subject to similar agency problems as managers. Consequently, managers, major stockholders, directors and supervisors are combined as a control group and a piece-wise linear relationship between firm performance and ownership are also expected.

Finally, an important aspect of ownership structure is the share holdings of institutional investors. Supporters of institutional holdings contend that institutional investors tend to have more expertise than individual investors in investment selection and monitoring. In addition, institutional investors can also influence firm performance in several ways. For instance, monitoring is particularly enhanced in the presence of a lending relationship where periodic financial reports are required by the banks. On the other hand, a different

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3 Claessens et al. [8] find that large family-controlled firms in Taiwan display a significant wedge between ownership and control and that voting rights frequently exceed cash-flow rights via pyramidal structures and cross-holdings.
strand of thought argues that institutional investors diminish efficiency due to their passivity, myopic goals, or legal constraints. Firm performance can also be negatively influenced as institutional ownership rights are exercised by the representatives. In this regard, the ownership-performance relationship is expected to be less clear, depending on which force dominates. In light of this, this study also considers the relation between firm performance and institutional ownership. Taken together, rather than confining the analysis to managerial ownership, this study analyzes the ownership-performance relation for three major groups of stakeholders—managers, the control group, and institutional investors.

3. The data and basic statistics

3.1 The financial variables

Table 1 Basic statistics

MVE (market value of equity), SALE (Net Sales), FA (fixed assets), TA (total asset), TL (total liabilities), and SALARY (salary) are in thousand of NT dollars. N is the sample size. \( Y = \ln (\text{SALE}) \); \( K = \ln (\text{FA}) \); \( L = \ln (\text{SALARY}) \).

<table>
<thead>
<tr>
<th>VAR</th>
<th>N</th>
<th>MEAN</th>
<th>MED</th>
<th>STD</th>
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<th>MAX</th>
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<td>1498016</td>
<td>9081038</td>
<td>7088</td>
<td>133372805</td>
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<tr>
<td>SALE</td>
<td>2565</td>
<td>6194934</td>
<td>2819729</td>
<td>10027201</td>
<td>-2203423</td>
<td>98458902</td>
</tr>
<tr>
<td>TA</td>
<td>2565</td>
<td>10261334</td>
<td>4736343</td>
<td>17356412</td>
<td>343798</td>
<td>203404769</td>
</tr>
<tr>
<td>TL</td>
<td>2565</td>
<td>4395285</td>
<td>1665720</td>
<td>7960016</td>
<td>58680</td>
<td>98267970</td>
</tr>
<tr>
<td>SALARY</td>
<td>2507</td>
<td>1022337</td>
<td>105659</td>
<td>4419544</td>
<td>0</td>
<td>89017312</td>
</tr>
<tr>
<td>MVE</td>
<td>2565</td>
<td>14148609</td>
<td>6954000</td>
<td>26693811</td>
<td>336000</td>
<td>457106000</td>
</tr>
<tr>
<td>Y</td>
<td>2563</td>
<td>14.98</td>
<td>14.85</td>
<td>1.11</td>
<td>8.89</td>
<td>18.41</td>
</tr>
<tr>
<td>K</td>
<td>2565</td>
<td>14.28</td>
<td>14.22</td>
<td>1.23</td>
<td>8.87</td>
<td>18.71</td>
</tr>
<tr>
<td>L</td>
<td>2487</td>
<td>11.89</td>
<td>11.58</td>
<td>1.76</td>
<td>2.77</td>
<td>18.30</td>
</tr>
</tbody>
</table>

The data used in this study include ownership, market value and financial statement variables. All the data are obtained from *Taiwan Economic Journal*. The study sample covers the 1986-1998 period and includes all listed and OTC manufacturing firms in Taiwan. Firm-years must have ownership, price and financial data to be included in the sample. The
criteria creates 2,565 firm-year observations. Table 1 presents the sample descriptive statistics. The average firm in our sample has annual sales of 6.2 billion (NT$), a market value of equity of 14.1 billion, and a book value of total asset of 10.3 billion. Although the sample includes all the listed and OTC manufacturing firms, the median values of fixed assets (FA), sales (SALE), total assets (TA), total liabilities (TL), salary (SALARY), and market value of equity (MVE) are all far below the mean values, indicating a large proportion of small firms in the population. Mean salary accounts for about 16% of mean sales and mean fixed assets is more than 50% of the mean sales. Compared with the sample in Palia and Lichtenberg [21], the sample firms in our study appear more “capital intensive”. Instead of using the number of employees, I use salary expenses to proxy for labor input. Productivity (Y), capital (K) and labor (L) are measured by taking the natural logarithm of sales, fixed assets, and salary expenses.

3.2 Distribution of ownership

In the sections that follow, I will examine the ownership-performance relationship for three different groups of ownership—managers, the control group, and institutional investors. The control group is defined as the sum of directors, supervisors, managers and major stockholders. I sum up these four types of ownership since they are closely related in the exercise of ownership rights. Institutional owners refer to corporate investors and have representatives to exercise their ownership rights. It is generally believed that institutional investors have a special role in corporate control and have better expertise in investment selection and monitoring compared with individual (natural) owners. In the case of individual owners, both shareowners and representatives are the same persons. Figure 1 exhibits the ownership distribution of these four different types of shareowners. As the figure shows, most of the ownership is distributed over the 5% to 70% interval for the control group and individual shareholders. The control group holds a substantial portion of the ownership compared with institutional ownership. Figure 1 also shows that the ownership of managers is negligible. Both statistics suggest that the corporate governance in Taiwan is not effected through managerial ownership. The institutional ownership lies between and certain proportion of the ownership is lower than 2.5%.
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The Control Group

Institutional Owners

Individual owners

Ownership N Mean Std Dev 25th Pctl Median 75th Pctl
Managers 2565 0.01 0.02 0.00 0.00 0.00
Control group 2565 0.30 0.17 0.16 0.28 0.41
Institutional owners 1682 0.18 0.27 0.03 0.10 0.26
Individuals 2301 0.21 0.22 0.08 0.17 0.29

Note: Individual owners refer to those ownership whose owners and nominees (representatives) are the same persons. Institutional owners refers to those ownership whose owners are organizations and whose rights are exercised by their nominees. Cum % is cumulative distribution of ownership percentage.

Figure 1. Ownership distributions for different groups of owners

4. The Empirical Results

4.1 Performance and ownership

As discussed in section 2, managers direct their effort levels according to their ownership levels to maximize their wealth and productivity generally increases in ownership. However, increase in productivity may slow down because of entrenchment and then increases because of interest alignment. These theories suggest a piecewise relation with two inflection points between productivity and ownership.

Based on this premise, I search for two inflection points by the residual of the Cobb-Douglas production function regression and trial-and-error (This issue will be illustrated in further detail later in Section 5.2). The inflection points thus found are 0.125 and 0.2 in the case of the control group. Table 2
Wanncherng Wang reports the results of empirical tests regarding this prediction. I first test how the ownership of managers and the control group affects productivity in linear form. The left-hand side of Panel A reports the ownership-performance relationship for the managerial ownership. The right-hand side presents the results for the control group. As the panel shows, the estimated coefficients of capital and labor are positive and significant (about 0.41 and 0.34 for capital and labor respectively). The estimated coefficients of the right-hand side are about the same. The sum of the two coefficient estimates is less than one. Untabulated results show that the two estimated coefficients are robust to the inclusion or exclusion of industry dummy variables, year dummy variables, or ownership variables. The natural logarithms of fixed asset and salary expense are taken to proxy for capital and labor inputs. This result can therefore be interpreted as the elasticity of substitution between labor and capital inputs being less than one. The result also suggests that a 1% increase in capital (labor) input leads to about a 0.41 (0.34)% increase in sales. In the case of the control group, the estimated coefficient of the ownership percentage is about 0.41 ($P = 0.00$), suggesting a 0.41% average increase in sales as ownership increases 1%. Assuming a linear relation between ownership and performance, the above results indicate that an increase in the ownership of the control group has a positive influence on productivity. These results are consistent with Jensen and Meckling [16] that higher ownership encourages higher levels of managerial and monitoring efforts from the control group. However, as evidenced by the estimated coefficients, the ownership of managers has no significant impact on the firm performance at the conventional significance levels ($a_3 = -0.606; \ P = 0.27$). It is likely that the ownership of managers does not truthfully reflect the nexus of ownership controlled by a related group such as a controlling family. The ownership of the control group appears to better capture the interests of the ownership as an interest entity.

To further investigate the impact of different ownership levels on productivity, I use 12.5%, 20% as the inflection points for the piecewise analysis. The theories predict a lower response coefficient for the 12.5-20% range. As Figure 2 shows, more than 90% of managerial ownership is lower than 2.5%. A piecewise analysis of managerial ownership is thus inapplicable and meaningless. Thus, the piecewise analysis of the managerial ownership is omitted.

Panel B presents the results for the control group. The regression also includes dummy variables for 14 2-digit industry classifications and 13 years\(^4\)

\(^4\) Year dummy variables are used for the 1986-1998 period, totaling 13 years. Financial data before years before 1986 are unavailable.
to incorporate the effects of industry and time. The estimated coefficients of M1, M2, and M3 are 3.07, -1.11 and 0.34 and significant at the conventional significance levels, consistent with the piecewise relationship prediction. The empirical results corroborate the predicted piecewise and linear relationship for the control group ownership. On the other hand, the managerial ownership is unable to obtain even a significant linear relation.

Table 2. The firm performance and ownership

Panel A. Linear relation

Y (sales), K (capital) and L (labor) are the natural logarithms of sales, fixed assets and salary expenses. Each industry and year gets its own intercept (not reported). PRCT = percentage of common stock owned by directors, supervisors, managers, and major stockholders, $\omega_j =$ industry effects, $\delta_t =$ year effects. The major stockholder is defined to include managers, major stockholders, directors, and supervisors. The linear relation is as follows:

$$ Y_t = \omega_j + \delta_t + a_1 L_t + a_2 K_t + a_3 PRCT_t + \epsilon_t. $$

<table>
<thead>
<tr>
<th></th>
<th>Mangers (N = 2450)</th>
<th>Control group (N=2450)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coeff.</td>
<td>t-value</td>
</tr>
<tr>
<td>$K_t$</td>
<td>0.409***</td>
<td>(29.55)</td>
</tr>
<tr>
<td>$L_t$</td>
<td>0.343***</td>
<td>(29.53)</td>
</tr>
<tr>
<td>PRCT$_t$</td>
<td>-0.606</td>
<td>(-1.10)</td>
</tr>
<tr>
<td>F = 49702; P = 0.00</td>
<td></td>
<td>F = 50191; P = 0.00</td>
</tr>
</tbody>
</table>

Panel B. Piecewise relation for the control group

The piecewise linear specification is specified as follows: $M1 = PRCT$ if $PRCT < 12.5\%$. Or $M1 = 12.5\%$ if $PRCT > 12.5\%$. $M2 = 0$ if $PRCT \leq 12.5\%$. $M2 = PRCT - 12.5\%$ if $12.5\% < PRCT < 20\%$. $M2 = 12.5\%$ if $PRCT > 20\%$. $M3 = 0$ if $PRCT \leq 20$. $M3 = PRCT - 20\%$ if $PRCT > 20\%$. Numbers in the parentheses are t-value.

$$ Y_t = \omega_j + \delta_t + a_1 L_t + a_2 K_t + a_3 M1_t + a_4 M2_t + a_5 M3_t + \epsilon_t. \quad (N=2,450) $$

<table>
<thead>
<tr>
<th></th>
<th>$K_t$</th>
<th>$L_t$</th>
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<th>M2$_t$</th>
<th>M3$_t$</th>
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<tr>
<td>Coeffs</td>
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<td>0.376***</td>
<td>3.074***</td>
<td>-1.109*</td>
<td>0.379***</td>
</tr>
<tr>
<td>t-value</td>
<td>(27.52)</td>
<td>(32.3)</td>
<td>(2.59)</td>
<td>(-1.68)</td>
<td>(3.25)</td>
</tr>
<tr>
<td>F = 45411; P = 0.00</td>
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</table>
4.2 Institutional ownership and firm performance

Table 3. The firm performance and institutional ownership

Panel A. Ownership and performance

The dependent variable, Y, capital, K, and labor, L, are the natural logarithms of sales, fixed assets, and salary expenses. Each industry and year gets its own intercept (not reported). The left-hand side of the panel is the piecewise linear specification of Morck et al. (1988). The quadratic specification is in the right-hand side. The piecewise linear specification is specified as follows:

\[ M1 = \text{PRCT if PRCT < 10%}, \text{Or M1 = 10% if PRCT > 10\%}. M2 = 0 \text{ if PRCT } \leq 10\%. M2 = \text{PRCT - 10\% if 10\% < PRCT < 25\%. M2 = 15\% if PRCT > 25\%}. M3 = 0 \text{ if PRCT } \leq 25\%. M3 = \text{PRCT - 25\% if PRCT > 25\%}. \]

\[ Y_t = \omega_j + \delta_t + \alpha_1 L_t + \alpha_2 K_t + \alpha_3 \text{PRCT}_t + \epsilon_t. \]

\[ Y_t = \omega_j + \delta_t + \alpha_1 L_t + \alpha_2 K_t + \alpha_3 M1_t + \alpha_4 M2_t + \alpha_5 M3_t + \epsilon_t. \]

\[ N=2274 \text{ Fixed effects for 15 industry and 13 Year dummies are not reported.} \]

<table>
<thead>
<tr>
<th></th>
<th>Coeff.</th>
<th>t-value</th>
<th>Coeff.</th>
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<tbody>
<tr>
<td>K_t</td>
<td>0.424***</td>
<td>(31.63)</td>
<td>0.423***</td>
<td>(31.57)</td>
</tr>
<tr>
<td>L_t</td>
<td>0.347***</td>
<td>(31.35)</td>
<td>0.348***</td>
<td>(31.41)</td>
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<tr>
<td>PRCT_t</td>
<td>0.149***</td>
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<tr>
<td>M1_t</td>
<td>0.000</td>
<td>(0.00)</td>
<td></td>
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</tr>
<tr>
<td>M2_t</td>
<td>2.094**</td>
<td>(2.05)</td>
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<tr>
<td>M3_t</td>
<td>0.043</td>
<td>(0.62)</td>
<td></td>
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</table>

\[ F = 44642; \ P = 0.00. \]

Panel B. firm performance and institutional vs. individual ownership

PRCT_A is the institutional ownership. PRCT_B is the individual ownership. Individual ownership refers to ownership whose owner and representative are the same individual. \[ Y_t = \omega_j + \delta_t + \alpha_1 L_t + \alpha_2 K_t + \alpha_3 \text{PRCT}_A_t + \alpha_4 \text{PRCT}_B_t + \epsilon_t. \] (N =2274)

<table>
<thead>
<tr>
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</tr>
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<tr>
<td>K_t</td>
<td>0.421***</td>
<td>(31.23)</td>
<td>0.346***</td>
<td>(31.21)</td>
</tr>
<tr>
<td>L_t</td>
<td>0.156***</td>
<td>(3.00)</td>
<td>0.026</td>
<td>(1.56)</td>
</tr>
</tbody>
</table>

\[ F = 46777; \ P = 0.00; \]

In examining the impact of institutional ownership on firm performance,
I define an institutional investor as a corporate owner. The ownership rights in this case are exercised by representatives. Panel A of Table 3 reports two relationships between firm performance and ownership levels. The left-hand side indicates a linear, positive relation between institutional ownership and firm performance. The coefficient of PRCT is significant at 1% confidence level and indicates a 0.15% increase in sales for a 1% increase in institutional ownership. As in the case of the control group, trial-and-error method is used to search for two potential inflection points—10% and 25%. The estimated coefficients in the right hand side demonstrate a piecewise relationship. As the estimated coefficients show, both the coefficients for the low and high ownership intervals are insignificant at the conventional levels. In contrast, the coefficient for the middle interval is positive and significant ($\alpha_4 = 2.1$, $P$-value = 0.01). This result is exactly the opposite of the theories, suggesting no agency problem with the institutional ownership.5

Panel B compares the relative contribution to firm performance of institutional ownership (PRCT_A) with individual ownership (PRCT_B). As the statistics show, the estimated coefficient of PRCT_A is significant whereas the estimated coefficient of PRCT_B is not (0.16% and 0.03%). The result is consistent with the prediction that institutional investors have better expertise in monitoring or investment selection compared with individual investors.

4.3 Granger causality test

Although it is important to understand the impact of ownership on firm performance, there is, however, no theory that the relation runs exclusively from ownership to performance. The above analyses focus on the contemporaneous relationship between ownership and firm performance, on the premise that managers decide the levels of their efforts and perquisite consumption based on the size of their ownership. Such a perspective takes ownership as given and does not explain why managers take positions on the firm’s shares. Meanwhile, the observed performance-ownership relationship may not be driven solely by the market discipline, managerial entrenchment or interest convergence. Alternatively, it can be true that informed investors make their ownership decisions in anticipation of firm performance. In this case, if the expectations of the informed investors are on average unbiased, then we will find a Granger causality/precedence of ownership over firm performance.6 On the other hand, we will obtain a reverse causality if

5 I also test several other combinations of inflection points, including the 12.5% and 20%. The results are qualitatively unchanged.

6 Himmelberg et al. [13] find a causal link form ownership to performance although they consider their evidence tentative due to the weakness of the instruments. I assess the possibility
shareowners increase their positions in observing improved performance. Thus, another approach to understanding the ownership-performance relationship is to conduct Granger-causality tests to examine the lead-and-lag or precedence relation between firm performance and ownership. I conduct Granger-causality tests for the three ownership groups, considering the differences in the interests and expertise of different ownership groups. Panel A1 of Table 4 examines whether ownership Granger-causes performance in the case of the control group. The Wald $F$-statistic for the omission of the ownership variable is 1.94 with a $p$-value of 0.16. Thus, the hypothesis seems to be unsupported that the ownership Granger-causes performance in the case of the control group. In contrast, the Wald $F$-statistic in Panel A2 rejects the null hypothesis at the significance level of 6%, suggesting that the control group increase their holdings after they observe improved performance. Panel B focuses on the managerial ownership. As in the case of the control group, the Wald $F$-statistic shows that firm performance precedes the ownership.

Panel C reports the relationship between performance and institutional ownership. The institutional ownership is isolated since institutional investors generally are expected to command better expertise in monitoring and investment selection than other types of shareowners. This suggests somewhat different ownership decisions for the institutional owners. As Panel C1 shows, the Wald $F$-statistic of 6.69 and the corresponding $P$ value of 0.01 suggest a Granger causality from ownership to performance. In Panel C2, the Wald $F$-statistic is 5.03 with a $P$-value of 0.03. As such, the two null hypotheses that describe Granger-causality between the ownership and the firm performance are rejected. The results suggest a feedback relation and are consistent with institutional investors being in a better position in investment selection and monitoring. Institutional investors increase their ownership when they anticipate improvements in the performance of the firm. Alternatively, once an institutional investor increases its ownership, it raises the levels of its efforts in monitoring and advising, therefore improving the performance of the firm.

of a simultaneous relation between ownership and performance and conduct Hausman endogeneity tests for the three groups of shareowners. The resultant statistics categorically reject the existence of a simultaneous relation between ownership and firm performance for the three types of ownership.
Table 4. Granger causality tests

Y (sales), K (capital) and L (labor) are the natural logarithms of sales, fixed assets and salary expenses. Each industry and year gets its own intercept (not reported). PRCT = percentage of common stock owned by directors, supervisors, managers, and major stockholders, \( o_j \) = industry effects, \( \delta_i \) = year effects. Numbers in parentheses are t-values.

A. Ownership of the control group.

A1. Ownership \( \rightarrow \) performance

\[
Y_t = o_j + \delta_i + \alpha_1 L_t + \alpha_2 K_t + \alpha_3 Y_{t-1} + \alpha_4 \text{PRCT}_{t-1} + \varepsilon_t. \quad (N = 2053)
\]

<table>
<thead>
<tr>
<th></th>
<th>( K_t )</th>
<th>( L_t )</th>
<th>( Y_{t-1} )</th>
<th>( \text{PRCT}_{t-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coeff.</td>
<td>0.037***</td>
<td>0.054***</td>
<td>0.886***</td>
<td>0.053***</td>
</tr>
<tr>
<td>t-value</td>
<td>(4.7)</td>
<td>(8.16)</td>
<td>(86.07)</td>
<td>(4.39)</td>
</tr>
</tbody>
</table>

Granger test: Wald \( F \) value = 1.94; \( P \) value = 0.164.

A2. Performance \( \rightarrow \) ownership

\[
\text{PRCT}_t = \beta_1 \text{PRCT}_{t-1} + \beta_2 Y_{t-1} + \varepsilon_t. \quad (N = 2053)
\]

<table>
<thead>
<tr>
<th></th>
<th>( Y_{t-1} )</th>
<th>( \text{PRCT}_{t-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coeff.</td>
<td>0.003*</td>
<td>0.870**</td>
</tr>
<tr>
<td>t-value</td>
<td>(2.78)</td>
<td>(111.61)</td>
</tr>
</tbody>
</table>

Granger test: Wald \( F \) value = 3.62, \( P \) value = 0.06.

B. Managerial ownership.

B1. Ownership \( \rightarrow \) performance

\[
Y_t = o_j + \delta_i + \alpha_1 L_t + \alpha_2 K_t + \alpha_3 Y_{t-1} + \alpha_4 \text{PRCT}_{t-1} + \varepsilon_t. \quad (N = 2053)
\]

<table>
<thead>
<tr>
<th></th>
<th>( K_t )</th>
<th>( L_t )</th>
<th>( Y_{t-1} )</th>
<th>( \text{PRCT}_{t-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coeff.</td>
<td>0.037***</td>
<td>0.053***</td>
<td>0.887***</td>
<td>0.03</td>
</tr>
<tr>
<td>t-value</td>
<td>(4.65)</td>
<td>(8.09)</td>
<td>(86.26)</td>
<td>(0.75)</td>
</tr>
</tbody>
</table>

Granger test: Wald \( F \) value = 0.57, \( P \) value = 0.452.

B2. Performance \( \rightarrow \) ownership

\[
\text{PRCT}_t = \beta_1 Y_{t-1} + \beta_2 \text{PRCT}_{t-1} + \varepsilon_t. \quad (N = 2503)
\]

<table>
<thead>
<tr>
<th></th>
<th>( Y_{t-1} )</th>
<th>( \text{PRCT}_{t-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coeff.</td>
<td>0.004***</td>
<td>0.868***</td>
</tr>
<tr>
<td>t-value</td>
<td>(3.31)</td>
<td>(108.96)</td>
</tr>
</tbody>
</table>

Granger test: \( F \) value = 40.94, \( P \) value = 0.21.
C. Institutional ownership.
C1. Ownership → performance

\[ Y_t = \omega_j + \delta_{t-1} + \alpha_{1} L_t + \alpha_{2} K_t + \alpha_{3} Y_{t-1} + \alpha_{4} PRCT_{t-1} + \epsilon_t \]  
\( N = 1832 \)

<table>
<thead>
<tr>
<th></th>
<th>K_t</th>
<th>L_t</th>
<th>Y_{t-1}</th>
<th>PRCT_{t-1}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coeff.</td>
<td>0.033***</td>
<td>0.049***</td>
<td>0.9***</td>
<td>0.068***</td>
</tr>
<tr>
<td>t-value</td>
<td>(4.3)</td>
<td>(7.89)</td>
<td>(91.46)</td>
<td>(2.59)</td>
</tr>
</tbody>
</table>

Granger test: \( F \) value = 6.69, \( P \) value = 0.01.

C2. Performance → ownership

\[ PRCT_t = \beta_1 Y_{t-1} + \beta_2 PRCT_{t-1} + \epsilon_t \]  
\( N = 1832 \)

<table>
<thead>
<tr>
<th></th>
<th>Y_{t-1}</th>
<th>PRCT_{t-1}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.005**</td>
<td>0.414***</td>
</tr>
<tr>
<td>t-value</td>
<td>(2.24)</td>
<td>(38.06)</td>
</tr>
</tbody>
</table>

Granger test: \( F \) value = 5.03, \( P \) value = 0.03.

5. Sensitivity Analysis

Most research in the ownership-performance relation uses Tobin’s Q as the performance measure. Depending on the research contexts, several other performance measures are also chosen. They are cumulative abnormal return (Jarrell and Poulsen [14]) returns on equity (Demsetz and Lehn [9]; Denis and Denis [10]), productivity growth measured as change in log of real sales (Nickell, et al. [20]), among others. Whatever the choice of the performance measures is, it is emphasized that performance measures reflect the nature of research issue and that appropriate corresponding independent variables be required. Instead of choosing Tobin’s Q, the current study uses sales as performance measure. The use of this measure has certain advantages even though it is not a direct measure of shareholders’ wealth. First, the Cobb-Douglas production function has been commonly used to characterize the input-output relations. Sales as the firm performance measure therefore are well-founded if the Cobb-Douglas production function reasonably describes the input-output relation of firms in current study sample. I will further discuss below the relation between Tobin’s Q and sales as a measure of firm performance and perform some supplementary tests based on the most commonly-used Tobin’s Q. Second, the measurement of sales is relatively straightforward. Compared with Tobin’s Q, the measurement errors in sales are negligible.
5.1 Reconciliation with alternative measures of firm performance

Tobin’s Q as the measure of performance

Being a common measure of firm performance, Tobin’s Q proxies for how well managers raise the firm value for the given amount of physical assets. A common measurement of the Tobin’s Q takes the following form [12]:

\[ \frac{(S + P + D - I)}{K}, \]

where \( S \) is the market value of common equity, \( P \) and \( D \) are the book value of preferred stocks and debt, \( I \) is the book value of ending inventory, and \( K \) is the gross value of fixed assets.

The problem with the measure of Tobin’s Q is that the values of the items in the ratio are mostly unobservable. Except for common shares, book values are usually used to substitute for the replacement costs of fixed assets and inventory and the market value of debts and preferred stocks. An empirical specification takes the following form [19]:

\[ Q_{ijt} = \alpha_1 + \delta_t + \alpha_2RD_{ijt} + \alpha_3ADV_{ijt} + \alpha_4LTD_{ijt} + \alpha_5RCA_{ijt} + \alpha_6M_{ijt} + \epsilon_{ijt}, \]

where \( Q \) is the Tobin’s Q ratio, \( RD \) is research and development expenses, \( LTD \) is long-term debt, \( RCA \) is the replacement cost of capital assets and \( M \) is the managerial ownership. \( i, j \) and \( t \) indicate firm, industry and time respectively. Like \( Q \), \( RD \) and \( LTD \) are scaled by the book value of total asset.

Table 5 reports the empirical results for the control group. In the right-hand side, the estimated coefficients of research and development expenditures \( (RD) \), advertising expenditures \( (ADV) \), long-term debts \( (LTD) \) are statistically significant and of the same signs as those in Morck, et al. [19]. As the results indicate, \( RD \) and \( ADV \) contribute positively to the Tobin’s Q, partly reflecting the nature of conservative accounting for the two intangible items. The coefficient of long-term debts is significantly negative. These results suggest that the benefits of tax [18], consumption of free cash flows [15] and the signaling argument [24] by debts appear not to materialize. These results are consistent with Morck, et al. [19] but inconsistent with McConnell and Servaes [17].

The lower part of the table presents the results for the relationship between ownership and firm performance. The results show that on average the ownership has significant impact on firm performance \( (\alpha_4 = 10.33, p = 0.01) \) in the monotonic linear form. The right side shows that a piecewise

---

7 We ignore the other ownership groups because of the ‘poor results’ in the previous sections.
relation exists between Tobin’s Q and ownership even though the coefficient of M3 is insignificant.

Table 5. Ownership and performance based on Tobin’s Q--Control group

The dependent variable (Tobin’s Q) is measured as $(S + P + D - I)/K$, where $S$ is the market value of common equity, $P$ and $D$ are the book value of preferred stocks and debt, $I$ is the book value of ending inventory, and $K$ is the gross value of fixed assets. The definition follows from Erickson and Whited (2000). $RD$ is research and development expenses, $LTD$ is long-term debt, $RCA$ is the replacement cost of capital assets and $M$ is the managerial ownership. $i$, $j$ and $t$ indicate firm, industry and time respectively. Like $Q$, $RD$ and $LTD$ are scaled by the book value of total asset. Each industry and year gets its own intercept (not reported). The left-hand side of the panel is the piecewise linear specification of Morck, et al. (1988). The piecewise linear specification is specified as follows: $M1 = PRCT$ if $PRCT < 12.5\%$. Or $M1 = 12.5\%$ if $PRCT > 12.5\%$. $M2 = 0$ if $PRCT \leq 12.5\%$. $M2 = PRCT - 12.5\%$ if $12.5\% < PRCT < 20\%$. $M2 = 7.5\%$ if $PRCT > 20\%$. $M3 = 0$ if $PRCT \leq 20\%$. $M3 = PRCT - 20\%$ if $PRCT > 20\%$. $*: 0.1$ significance level; $**: 0.05$ significance level; $***: 0.01$ significance level.

$Q_{ijt} = \omega_j + \delta_t + \alpha_1 RD_{it} + \alpha_2 ADV_{it} + \alpha_3 LTD_{it} + \alpha_4 PRCT_{it} + \alpha_5 M1_{it} + \alpha_6 M2_{it} + \alpha_7 M3_{it} + \epsilon_{ijt}$.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coeff.</th>
<th>t-value</th>
<th>Coeff.</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$RD_{it}$</td>
<td>131.156**</td>
<td>(14.33)</td>
<td>42.000***</td>
<td>(4.63)</td>
</tr>
<tr>
<td>$ADV_{it}$</td>
<td>16.530**</td>
<td>(2.14)</td>
<td>4.441</td>
<td>(0.68)</td>
</tr>
<tr>
<td>$LTD_{it}$</td>
<td>-4.272***</td>
<td>(-3.28)</td>
<td>-4.795***</td>
<td>(-4.33)</td>
</tr>
<tr>
<td>$RCA_{it}$</td>
<td>-2.822***</td>
<td>(-6.71)</td>
<td>-8.781***</td>
<td>(-22.58)</td>
</tr>
<tr>
<td>$PRCT_{it}$</td>
<td>10.332***</td>
<td>(16.92)</td>
<td>115.567***</td>
<td>(33.07)</td>
</tr>
<tr>
<td>$M1_{it}$</td>
<td>-7.200***</td>
<td>(-3.43)</td>
<td>1.346</td>
<td>(1.51)</td>
</tr>
<tr>
<td>$M2_{it}$</td>
<td>1.346</td>
<td>(1.51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$M3_{it}$</td>
<td>1.346</td>
<td>(1.51)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$F = 129.4; \ P = 0.001$  \quad $F = 122.4; \ P = 0.001$.

Reconciliation of Tobin’s Q and sales

Tobin’s Q measures the excess of market value over the replacement cost. Given the piece-wise predictions, the Tobin’s Q in the above analysis reports results similar to those with the measure of sales except that the piecewise relation appears less significant in the case of Tobin’s Q. Then
what is the relation between these two indicators? First, I claim that the two indicators convey the two sides of the same coin—the flow versus the stock concepts for sales and the Q ratio. What follows provides a simple illustration to reconcile the two performance indicators. First, let’s consider the following production function/technology.

Sales = normal sales (characterized by the production function) + excess sales.

Within the framework of Tobin’s Q, a firm earning normal profits is expected to have a Tobin’s Q of one. Similarly, the value of sales can be considered market value of total assets. Normal sales in the first item of the right-hand side can be modeled with the Cobb-Douglas production function. Then the above equation collapses to the Tobin’s Q when we divide both sides by normal sales. In the framework of this study, excess sales are attributable to various factors such as monopoly power, or the managerial ownership as in the current study. Formally, the Tobin’s Q estimated from sales takes the following form:

Tobin’s Q ≅ real sales ÷ normal sales estimated by the Cobb-Douglas production function.

Table 6. Regression of Tobin's Q on QHAT

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coeff.</th>
<th>t-value</th>
<th>F</th>
<th>P-value</th>
<th>Adj. R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERCEP</td>
<td>1.450***</td>
<td>(6.84)</td>
<td>361</td>
<td>0.001</td>
<td>0.14</td>
</tr>
<tr>
<td>QHAT</td>
<td>2.862***</td>
<td>(18.95)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

***: 1% significance level.

---

8 This will be clearer when one values total assets as a multiple of sales.
Based on the above analysis, Table 6 reports the relation between sales and Tobin’s Q in the case of control group. As the regression takes the logarithm of sales, the predicted sales (normal sales) are restored to the original value by taking the exponential of the predicted value. Untabulated results shows that the correlation between normal sales and the estimated replacement costs of capital assets and between firm value minus inventory and actual sales are 0.85 (p-value = 0.001) and 0.79 (p-value = 0.001), suggesting a high correlation between the Tobin’s Q and sales. The result is consistent with my earlier claim that either sales or Tobin’s Q can be used to examine firm performance if the variables of the right hand side are appropriately chosen.

Table 6 reports regression results for the two variables, showing a significant correlation between the two measures. The estimated Tobin’s Q (Qhat) explains about 14% of the Q ratio. From the viewpoint of measurement, the measurement of the market value for fixed assets potentially contains severe measurement errors relative to sales even though market value is supposed to reflect the terminal outcome of all business activity and market forces. However, which indicator is a better performance measure remains an open issue.

5.2 Choice of inflection points

\[ \text{Residual} = \ln Y - (\alpha + \delta + \alpha \ln K + \alpha \ln L) \]

Figure 2. Residual and Ownership
The difficulty in the empirical investigation of the piecewise relationship is to find the two inflection points. This is even more difficult when they are nonexistent. For this issue, I proceed with a regression based on the Cobb-Douglas production in Eq. (4) omitting the ownership variable (M). The unexplained residuals are assumed to be attributable to ownership. The estimated residuals are then classified into 40 groups according to their corresponding ownership. Each group contains ownership with a range of 0.025. For instance, the ownership in the first group is between 0 and 0.025, and so on. The mean residuals of each group are then plotted against the upper bound of their ownership percentage. From Figure 2, four potential inflection points obtain—A (12.5%), B (20%), C (35%) and D (50%). To obtain a piecewise relationship, there are three potential combinations of inflection points—(A, B), (C, D) and (A, D). By trial and error, the (A, B) combination is found to be consistent with the piecewise relations predicted by the theories as presented in Panel B of Table 5.

A complete examination of inflection points demands a full-length paper. The inflection points (12.5% and 20%) in the current study are obtained by trial-and-errors, guided by the distribution of regression residual of the Cobb-Douglas production function. As previous studies show, the inflection points vary across countries and even among different studies. As auxiliary tests, I also test four other combinations of the inflection points obtained from prior studies. Morck et al. [19], Palia and Lichtenberg [21] and McConnel and Servaes [17] provide evidence for the combinations of (0.05, 0.25) and (0.4, 0.5) for the US firms. Short and Keasy [25] find evidence of (0.15, 0.42) in the study of the UK firms. The combination of (0.2, 0.5) is also tested since 0.2 and 0.5 are the cutoffs for equity accounting and consolidated reporting. Table 7 reports the empirical results for these combinations of inflection points. As the evidence shows, the combinations of (0.1, 0.25) and (0.05, 0.25) are both consistent with the piece-wise relationship of ownership and firm performance. The difference from the (0.125, and 0.20) combination is that the coefficients of ownership in (0.125, 0.2) are all significant and the magnitude appears more reasonable—less drastic difference in the magnitude of the three ownership coefficients. The results show a cross-nation difference in the piece-wise relationship between ownership and firm performance.
Table 7. Combinations of inflection points

Numbers in the parenthesis are t-values. *: 10% significance level; **: 5% significance level; ***: 1% significance level. (N= 2450)

<table>
<thead>
<tr>
<th>Combinations of inflection points</th>
<th>K</th>
<th>L</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Morck et al. (1988) and Palia and Lichtenberg (1999)</td>
<td>(0.05, 0.25)</td>
<td>0.390***</td>
<td>0.376***</td>
<td>17.385***</td>
<td>0.162</td>
</tr>
<tr>
<td></td>
<td>(27.45)</td>
<td>(32.29)</td>
<td>(2.59)</td>
<td>(0.59)</td>
<td>(2.41)</td>
</tr>
<tr>
<td>B. Short and Keasy (1999)</td>
<td>(0.15, 0.42)</td>
<td>0.393***</td>
<td>0.377***</td>
<td>0.769</td>
<td>0.287*</td>
</tr>
<tr>
<td></td>
<td>(27.55)</td>
<td>(32.33)</td>
<td>(1.06)</td>
<td>(1.72)</td>
<td>(0.84)</td>
</tr>
<tr>
<td>C. Equity method (FASB)</td>
<td>(0.20, 0.50)</td>
<td>0.391***</td>
<td>0.377***</td>
<td>0.221</td>
<td>0.315**</td>
</tr>
<tr>
<td></td>
<td>(27.39)</td>
<td>(32.34)</td>
<td>(0.53)</td>
<td>(1.96)</td>
<td>(0.81)</td>
</tr>
<tr>
<td>D. McConnell and Servaes (1990)</td>
<td>(0.40, 0.50)</td>
<td>0.391***</td>
<td>0.377***</td>
<td>0.423***</td>
<td>-0.380</td>
</tr>
<tr>
<td></td>
<td>(27.5)</td>
<td>(32.32)</td>
<td>(2.85)</td>
<td>(-0.70)</td>
<td>(1.37)</td>
</tr>
</tbody>
</table>

5.3 Inclusion of inventory in capital and corrections for price level changes

Aitken and Harrison [2] include material as part of capital investment in an input-output specification and correct for price level changes. The problem with this specification is that capital in the Cobb-Douglas is a ‘fixed investment’. Materials, in contrast, are manufacturing costs, and mostly a current account. They become investment and part of fixed capital if they become inventory. For this reason, instead of using materials, I include the inventory level as part of capital in the empirical model. The correction for price level changes is difficult since the different companies hold different assets and the price indices for the production function are unavailable. For simplicity and as part of sensitivity tests, I use wholesale price index to adjust for changes in price levels. Table 8 reports the results for the control group with inclusion of inventory as part of capital and adjustment for price level. The results show some change in the coefficients of capital (0.39 vs 0.5 for K and K1) and labor (0.33 vs 0.38 for L and L1). The piecewise relation still holds although the coefficients of the ownership slightly change. The insensitivity of the results to the price adjustments is likely due to the relative stability of price level for the sample period. The inclusion of inventory in the capital primarily affects the coefficients of capital and labor, leaving the estimated coefficients of ownership qualitatively unchanged.
Table 8. Inclusion of inventory as capital and correction for price level changes

$$K_1 = \ln((FA + \text{inventory})/\text{wpi}*100); \quad L_1 = \ln(\text{labor}/\text{wpi} *100).$$

<table>
<thead>
<tr>
<th></th>
<th>$K_1$</th>
<th>$L_1$</th>
<th>$M_1$</th>
<th>$M_2$</th>
<th>$M_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coef.</td>
<td>0.504***</td>
<td>0.331***</td>
<td>3.502***</td>
<td>-0.181</td>
<td>0.282***</td>
</tr>
<tr>
<td>t-value</td>
<td>(35.58)</td>
<td>(31.16)</td>
<td>(3.19)</td>
<td>(-0.3)</td>
<td>(2.62)</td>
</tr>
</tbody>
</table>

*: 10% significance level;**: 5% significance level;***: 1% significance level. (N= 2450)

6. Summary and Conclusions

Within the framework of agency and managerial entrenchment theories, this paper tackles several issues regarding the ownership-performance relation based on the evidence from the listed and OTC manufacturing firms in Taiwan. For three types of owners (managers, institutional investors, and the control group), this study examines two main empirical issues—the piecewise and Granger-causality relationship between ownership and firm performance.

Except managerial ownership, ownership is positively correlated with firm performance, consistent with the predictions of agency theory. The empirical results show that the ownership-performance relationship depends on the identities of the owners—managers, the control group (the sum of managers, major stockholders, directors, and supervisors), and institutional owners. First, in the linear regression, the evidence shows that the ownership of control group and institutional investors has positive effects on firm performance while the managerial ownership appears to be irrelevant. There are two potential reasons for the irrelevance of managerial ownership. The managerial ownership reflects only nominal rather than the true equity stake of the managers in the firm. Thus, the mechanism of corporate governance in Taiwan is not effected through equity ownership of managers as predicted by the agency theory. Second, using 12.5% and 20% as the inflection points for the piecewise regression, the estimated coefficients demonstrate that the impact of the control group on the performance appears to be consistent with the piecewise relation predicted by market discipline, managerial entrenchment, and interest convergence. The piecewise relation appears inapplicable for the institutional ownership. Since 90% of managerial ownership is less than 2.5%, we ignore the piecewise analysis of managerial ownership.
The impact of ownership is also compared between the institutional owners and the individual (natural) owners. The empirical results demonstrate a significant difference between the institutional and individual investors, reflecting the monitoring and investment selection expertise of the institutional owners—a 0.15% increase versus an insignificant 0.03% decrease in sales in response to a 1% increase in ownership for the two groups of investors.

Instead of taking ownership as given, we consider the possibility that ownership is influenced by performance. The Granger causality tests provide a sharp contrast among the three types of ownership. The managerial ownership is found to be independent of the performance of the firm. In contrast, a feedback relationship is observed for the institutional ownership. The ownership of the control group lies between and is found to increase after a performance improvement has been observed. These differences are interpreted as expertise differentials in monitoring and investment selections among the three groups.

Our sensitivity tests show that the empirical results are quite robust to an alternative performance measure (the Tobin's Q), correction for price level changes and a different measure of capital investment. A few words of qualifications and opportunities for future research, however, are provided for the empirical results. First, as there is no a priori guide for the turning points of the piecewise relation, a trial and error method is used. In the current study, the evidence reported here is based on the inflection points of 12.5% and 20%. A few sets of turning points from prior studies are also tested. For instance, the commonly used 5% and 25% turning points for a couple of the US based studies are also tried in the current study. The results, however, do not demonstrate a better fitting for our sample. I do not exclude other sets of inflection points that may better explain the performance-ownership relation. Second, the cross-sectional differences in ownership structure complicate the analysis. The ownership of managers and directors can belong to the same or different control groups, entangling the relationship between ownership and performance of firms. Third, the firm or manager characteristics can influence ownership on agency costs. The incentives provided by stock ownership vary with the magnitude and diversification of managers' wealth portfolios. The effort level of managers also varies with their perceived risk of the firm. As a consequence, different companies might have different inflection points.

References


