Internal Capital Markets in Business Groups

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Abstract

This paper extends a structural model of investment with costly external finance to firms in business groups, derives an empirical regression counterpart, and uses it to test for the existence of internal capital markets in business groups and various characteristics of a group that tend to affect within-group resource allocation. I use a unique firm-level data submitted to Thailand's Ministry of Commerce as a sample in the empirical sections. The results show that corporate ownership, control rights, and within-group intermediaries tend to facilitate the internal capital markets. Corporate laws that protect minority shareholders lead to the less efficient internal capital markets although the effect is indirectly through the smaller cash flow rights and voting rights of controlling shareholders over the listed firms as compared to the non-listed firms. Groups with more member firms that are structured vertically tend to have more efficient internal capital markets while horizontal structure has no effect on within-group resource allocation. Finally, the more industry diversification, the more efficient the internal capital markets in business groups. In sum, the paper provides empirical evidence from firm-level data that the structure of business groups and corporate governance are related to the investment behavior of firms.

JEL Classification: G3, K22, L23

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1 Introduction

"Business groups" are common in many countries, especially in emerging economies. In those economies, the role of collections of legally distinct firms that are tied together and coordinating on

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their actions is important. Linkage between member firms could be formal or informal, and direct or indirect – ranging from a pyramidal holding company structure to cross shareholdings and to common directorates. A number of papers have studied the performance and behavior of firms in business groups. Although several studies conclude that there are internal capital markets within groups, most of those papers follow Hoshi, Kashyap and Scharfstein (1991) approach, which relies on the argument that investment-cash flow sensitivity is positively correlated with liquidity constraint. However, this assumption is criticized by Kaplan and Zingales (1997). Also, the existence of internal capital markets within business groups is implicitly assumed and the approach does not pay much attention to different characteristics across business groups. In this paper, I extend the work in this area of literature in many ways. First, I provide an evidence on the existence of internal capital markets in business groups by using an investment equation derived from a structural model. Instead of focusing on liquidity constraint and investment, the approach used here is based on resource allocation within business groups and is not subject to the Kaplan-Zingales critique. Second, I show that the degree of the efficiency of resource allocation varies across business groups. In other words, a firm's investment behavior does not depend only on whether the firm is a member of any business group, but also on the characteristics of the group to which the firm belongs. Finally, I examine the characteristics of a group that determine the degree of efficiency of within-group resource allocation. The potential characteristics include ownership and control rights of the controlling shareholders, corporate laws and regulations that protect minority shareholders, within-group intermediaries, group's organization structure, and industry diversification.

The idea of the paper is as follow. In a world with perfect capital markets, investment of a firm should depend only on the profitability of the projects of the firm. However, in a real world, external capital markets are imperfect so external funds are more costly than internal finance. This imperfection is natural in emerging economies, where capital markets are not fully developed and firms tend to have credit constraints. As presented in Gilchrist and Himmelberg (1998), the marginal cost of funds determines the firm's discount factor that is used in discounting the stream of marginal future benefits of the current investment. As a result, the firm's investment will also depend on its financial characteristics that determine the cost of fund of the firm, in addition to its profitability. Taking this idea to an empirical implementation, an investment of a stand-alone, non-group firm should depend both on its profitability and its financial determinants. I extend Gilchrist and Himmelberg's work to a business group with more than one firms. Since a group with perfect internal capital markets can freely transfer resources across its member firms, the efficient allocation implies that the marginal costs of funds are equalized across firms within the group; therefore, a group firm's investment should depend only on its group's financial factors and the firm's own profitability– but not on the firm's financial determinants. The empirical prediction is that the investment of a group firm should not depend on its own financial determinants once we include the group-time effects into the regression. The reason is that the group-time effects already

capture the characteristics that determine the common cost of funds of the group.[1]

I gather a unique firm-level data submited to Thailand's Ministry of Commerce. The sample is a panel data of group firms in 1995 and 1996. The data set contains standard items in the balance sheets and the income statements. Therefore, the data provide me with what I need in order to estimate the investment equation, namely investment in fixed assets and cash flow, among other financial characteristics of the firms in the sample. The data also have the information on ownership and board of directors, which allows me to manually construct the groups' network maps, determine the group membership of each firm, and compute ultimate ownership and control rights of the main shareholders. There are 111 groups in the sample, ranging from groups consisting of a few firms to the group with more than 50 member firms.

The empirical results show that corporate ownership, control rights, and within-group intermediaries tend to facilitate the efficient resource allocation. Corporate laws and regulations that protect minority shareholders lead to the less efficient internal capital markets although the effect is indirectly through the fact that controlling shareholders tend to have smaller cash flow rights and voting rights over the listed firms as compared to the non-listed firms. The paper also shows that groups with more member firms that are structured vertically tend to have more efficient internal capital markets while horizontal structure does not seem to affect within-group resource allocation. Finally, the more industry diversification, the more efficient the internal capital markets in business groups. In sum, the paper provides empirical evidence from firm-level data that the structure of business groups and corporate governance are related to the investment behavior of firms.

Market, Business Group and Diversified Firm

What makes business groups different from a collection of firms interacting through external markets; and what makes business groups different from a collection of segments in a diversified firm? The variant of these interesting questions was originally posed by Ronald Coase (1937) seventy years ago on the difference between the firms and the markets. Business groups are an intermediate case. I use Grossman and Hart's (1986) definition of ownership to distinguish activities within a business group from the ones that occur within a firm or in the external markets. Grossman and Hart define ownership as residual control rights over the use of assets of the firms. An owner of a firm has a right to transfer assets across segments of the firms in order to maximize the value of her firm. In effect, this is an establishment of internal capital markets within the firm.[2] Similarly, I define a business group as a collection of legally distinct firms that are partly or wholly owned

[1] This idea is parallel to the study in consumption risk sharing literature. See Cochrane (1991) and Townsend (1994) for example.

[2] However, the fact that the owner has a full right in asset relocation within her firm does not imply that the internal capital market is perfect in a sense that it equates marginal product across projects within the firm. Imperfection can arise, for instance, in the presence of agency problem between the owner and the managers of different segments. See Stein (1997) and Rajan, Servaes and Zingales (2000).

and controlled by an individual (or a group of individuals) that has a right over the use of assets of the member firms. This person has a right to transfer assets across the member firms, hence establishing internal capital markets within a group.[3]

What makes a business group different from a diversified firm is that the right over the use of assets is limited because each member firm in a group is distinct by law. With the existence of costly external finance, I define a within-group efficient resource allocation as the allocation of funds that equalizes the marginal cost of external finance across firms in a group. If the marginal costs are not equal, the controlling shareholder can get higher aggregate profit from transfering funds from the firms with lower marginal costs to the firms with higher marginal costs. Because the composition of shareholders of each member firm of a group could be different, the optimal resource allocation for the controlling shareholder is possibly neither the optimal one for other shareholders nor the efficient one in an economy-wide sense. This conflict of interest between inside, controlling and outside, non-controlling shareholders makes the within-group capital markets imperfect. The degree of imperfection is lower when the controlling shareholder has higher ability to transfer resources between firms in the group. This ability in turn depends on governance and structure of the group as well as corporate laws in the economy. Also, since each member firm in a group is a legally distinct unit, its limited liability and bankruptcy implication are different from a segment of a diversified firm.

This paper has some limitations. First, modeling costly external finance is beyond the scope of the paper. The cost of external finance is simply assumed to be increasing and convex. Second, the main purpose of this paper is not to propose a theory explaining the formation of business groups and I will take the existence of business groups as well as groups' characteristics as given. However, the results from this paper should suggest some ideas on the nature of business groups that motivate future research on endogenous group formation and endogenous group structure. Finally, I define a business group as a collection of firms that is, in some cases, owned and controlled by a group of more than one individual persons. I assume that these persons share the same objective, which is maximizing the aggregate value of the group. In other words, the paper is abstract from conflicts between various controlling shareholders that may share different objectives. This issue is explored in more detail in Bertrand, Johnson, Samphantharak and Schoar (2006).

2 Related Literature

How to allocate funds across projects is a fundamental question in economics. The existing literature looks at two similar but different questions on this issue. The first question is how to allocate funds across firms in the economy, and the second is how to allocate funds across projects within a

[3] Here I use the term "internal capital markets" in a very broad sense. It includes within-group transfers, within-group credit markets, and within-group equity market, among others.

particular firm. In other words, the first question concerns with external capital markets while the second question looks at the internal markets. Stein (2003) offers a more extensive survey of the literature in this field.

2.1 External Capital Markets and Investment

In their seminal paper, Modigliani and Miller (1958) show that, in a world with frictionless perfect capital markets, capital is allocated efficiently in such a way that the marginal product of capital is equated across all projects in the economy. The Q-theory approach, proposed by Tobin (1969) and extended by Hayashi (1982), reformulates the neoclassical theory of investment with the implication that, under perfect capital markets, a firm's investment should depend only on its profitability, as measured by the Q value. A firm's financial characteristics such as capital structure or liquidity should not affect the firm's investment behavior.

However, in a world with frictions such as information asymmetry, internal and external finance are not perfect substitutes. Using funds from external sources is likely to be more costly than using internal funds such as cash flow. For example, Myers and Majluf (1984) and Greenwald, Stiglitz and Weiss (1984) suggest that issuing new equities could be costly to the firm; Stiglitz and Weiss (1981) show that some firms with good investment opportunity cannot get loans to finance their projects.

Studies of the effects of financing constraints on investment can be traced back to Meyer and Kuh (1957) and have been growing since the work by Fazzari, Hubbard and Peterson (1988). The empirical strategy goes as follows. First, sample firms are divided into categories by their degree of credit constraint. The criteria range from dividend payouts (Fazzari, Hubbard and Peterson (1988)) to membership in large industrial groups (Hoshi, Kashyap and Scharfstein (1991) for Japanese *keiretsu*, and Perotti and Gelfer (1998) for Russian Financial-Industrial Groups, among others). Running a regression of a firm's investment on its cash flow and some measures of its future profitability, these studies compare the regression coefficients of the cash flow from different groups of firms. The common finding is that the investment of a firm classified as credit-constrained is more sensitive to cash flow than the one of an unconstrained firm. The argument from this investment-cash flow regression is that a credit-constrained firm has to rely more on its own internal funds; therefore, its investment is more sensitive to the movement of its cash flow.[4] However, this investment-cash flow approach is criticized by Kaplan and Zingales (1997, 2000) that the firms with higher sensitivity of investment to cash flow empirically are not necessary the firms with higher degree of credit constraint.[5]

[4] Hubbard (1998) offers a survey of the literature in this direction.

[5] Kaplan and Zingales (1997) re-categorize low-dividend firms in Fazzari, Hubbard and Peterson's sample according to each firm's annual report and management discussion of liquidity. They find that firms that appear to be financially less constrained have higher investment sensitivity to cash flow than the firms that appear to be more constrained.

Although most of the empirical research in this field mainly focuses on testing the implication of the theory, there are also some studies that try to estimate the structural model of investment and financial policy. Bond and Meghir (1994) investigate the relationship between investment and cash flow by estimating the Euler equation for optimal capital accumulation in the presence of convex adjustment costs. Gilchrist and Himmelberg (1998) post and try to answer a slightly different question: How much does investment respond to its "fundamental" *versus* "financial" determinants? Their study shows that, in addition to a firm's fundamental profitability, financial factors help explain the investment of firms.

2.2 Internal Capital Markets and Investment

Theoretical ideas about capital markets within a firm date back to Alchian (1969) and Williamson (1975). Alchian's argument on the advantage of internal capital markets is that corporate headquarters have ability in monitoring and information production. However, Gertner, Scharfstein and Stein (1994) argue that Alchian does not give a clear reason why headquarters are better than a bank in a delegated monitoring model of Diamond (1984). Instead, in their opinion, the main distinction between a bank and corporate headquarters is that the headquarters own the business units while the bank does not. Their definition of ownership follows Grossman and Hart (1986) in a sense that it means a residual control rights over the use of assets of the firms.

Examples of empirical studies in this line of research are Lamont (1997) and Shin and Stulz (1998) for conglomerates; and Houston, James and Marcus (1997) for bank holding companies. Their results suggest that there are internal capital markets within a firm, but the markets are not perfect.

2.3 Business Groups

An intermediate case of capital allocation applies to business groups. Most of economics literature on business groups focuses on the characteristics and roles of Japanese *keiretsu*.[6] The traditional findings are that the *keiretsu* firms tend to have lower operating profitability but also lower variance. The results support the idea that there is insurance within the group, but this insurance comes with a cost in terms of lower average profits. Recently, there are studies that challenge the traditional idea of insurance provided by *keiretsu*. See Beason (1998) and Kang and Stulz (2000) for examples.

Khanna and Rivkin (2001) studies the performance of group firms in emerging markets. Their results on profitability, as measured by the rate of returns to asset, of the firms are diverse. Group firms have higher profitability than non-group firms in some countries, while lower or indifferent in other countries. However, in almost all countries in their sample, profit rates of group firms

[6] Hoshi and Kashyap (2001) offer a survay of literature on *Keiretsu*. Khanna and Yafeh (2006) survey literature on business groups across the world.

are closer to one another than to the profit rates of other firms. Khanna and Yafeh (2000) look closer on three channels of risk sharing among business groups. First, they find that there is profit sharing through intra-group trade in some countries, but the magnitude is quite small. Second, they find no evidence supporting that dividend plays a role as shock absorbers. Finally, they find that within-group loans are associated with substantial liquidity smoothing in India.

Lastly, following a series of recent economic crises, many studies have been focusing more on the dark side of business groups. One of the main ideas is that business groups are associated with (legal or illegal) minority shareholder expropriation. The insight stems from Akerlof and Romer's (1993) looting and Johnson, La Porta, Lopez-de-Silanes and Shleifer's (2000) tunneling. Claessens, Djankov, Fan and Lang (1999) take this idea and look at East Asian crisis, while Bertrand, Mehta and Mullainathan (2003) focus on Indian groups.

There are several differences between this study and existing literature. Most of the literatures on business groups focus on the groups performance as measured by profit rates. However, profit rate is not a good variable used for analyzing resource allocation within a group. In production theory, the first-best capital allocation is the allocation that equalizes net marginal product of capital across firms in the group.[7] In principle, we can test the theory of efficient resource allocation directly by comparing the marginal product across firms. However, capital is durable goods so profit rates or rates of return on assets are just a part of a stream of the returns to capital over its lifetime. There are also adjustment costs of capital accumulation. As a result, equalized profit rates or returns on assets at a given date do not imply efficient capital allocation. Looking jointly at investment and its profitability (such as the "Q value" in the neoclassical theory) is preferable. Efficient allocation of capital implies higher investment in a project that has higher profitability.

Although a lot of work on investment and business groups has been done, very few of them really look at the internal capital markets within business groups. The widely cited study is Hoshi, Kashyap and Scharfstein (1991). However, their study is mainly on the relationship between a firm's liquidity constraint and its investment, where the existence of internal capital markets within *keiretsu* are implicitly assumed. Therefore, they focus on comparing the liquidity effect of being in (any) business groups and not being in (any) groups rather than the efficient resource allocation among firms in the same group. The study of interdependence of resource allocation across investment units is more prominent in Lamont (1997) and Shin and Stulz (1998), but their studies look at the allocation of capital within a firm–not across firms within a group. The closest study on resource allocation with in business groups is Almeida and Wolfenzon (2006). They provide theoretical framework for the equilibrium costs of efficient internal capital markets and argue that the presence of business groups in developing countries inhibits the growth of new independent firms because of a lack of finance.

[7] Net of marginal cost of capital.

Looking at internal capital markets across firms within a business group has an advantage over looking at the market within a firm. The data on assets, investment and other financial characteristics are better defined and measured at the firm level than at the segment level, especially when assets such as buildings or machines are commonly used by more than one segments. On the other hand, one would argue that transfers across segments of a firm have less friction than transfers across firms within a group, in particular when the ownership composition of the firms are different. However, the benefit of this imperfection is that it can be used to test for the implications of ownership, control rights, corporate governance, and organization structure on investment. Moreover, this paper also look at other characteristics of the groups that tend to affect efficient resource allocation and empirically test them.

Finally, on the empirical side, most of the existing literature uses data of firms listed in the stock exchanges. However, listed firm data are not appropriate for the study of internal capital markets in business groups. This is because stock exchanges usually impose regulations that prohibit resource transfers between firms and therefore prevents internal capital markets to operate efficiently. This paper uses unique firm-level data that consist both listed and non-listed firms, which allow me to test for the effects of laws and regulations on internal capital markets.

3 Model

The model used in this paper is an investment model with costly external borrowing. This type of model has been extensively used in many studies.[8] For simplicity, the financial friction is not endogenously modeled in this paper. Instead, I assume that if firm i issues a one-period corporate bond $B_{i,t}$ in period t, it has to repay $R_i(B_{i,t})$ in period $t+1$, where $R_i(\cdot)$ is monotonically increasing and weakly convex in $B_{i,t}$, and is continuously differentiable with respect to $B_{i,t}$.

I examine the investment behavior of two extreme types of firms in this section. The first type is the firms that do not belong to any business groups. The problem faced by a stand-alone firm is the same as what was presented in existing literature. In this case, each firm solves its optimization problem individually. The second type of firms is the group firms over which the controlling shareholder has a full control. Since we define a business group as a collection of firms that are controlled by the same controlling shareholder, the controlling shareholder of a group maximizes *her own* aggregate dividend streams from all firms in the group. Since the controlling shareholder controls the group's decision completely, she can make any internal transfers of funds between the firms in her group. These frictionless transfers within group are not likely to occur if the controlling shareholder does not have a full control over all firms in the group. We will discuss the sources of this friction, and empirically test them later in this paper.

[8] Examples are Whited (1992), Hubbard and Kashyap (1992), Jaramillo, Schiantarelli and Weiss (1996), and Gilchrist and Himmelberg (1998).

3.1 Non-Group Firm

The problem of the controlling shareholder of a non-group firm i is to choose the paths of capital stock and debt so as to maximize her expected discounted dividend stream, subject to constraints on nonnegativity of dividends:

$$\max_{\{K_{i,\tau+1},B_{i,\tau}\}_{\tau=t}^{\infty}} D_{i,t} + E_t \sum_{s=1}^{\infty} \beta^s D_{i,t+s}$$

subject to

$$\begin{aligned} D_{i,\tau} &= \Pi_i\left(K_{i,\tau}\right) - I_{i,\tau} - C_i\left(I_{i,\tau}, K_{i,\tau}\right) + B_{i,\tau} - R_i\left(B_{i,\tau-1}\right) \\ K_{i,\tau+1} &= \left(1-\delta_i\right) K_{i,\tau} + I_{i,\tau} \\ D_{i,\tau} &\geq 0 \\ \lim_{\tau\to\infty} B_{i,\tau} &= 0, \end{aligned}$$

for all $\tau \geq t$, where $\Pi_i(\cdot)$ and $C_i(\cdot)$ are the firm's production function and adjustment cost function, respectively; β is a constant discount factor; and δ_i is a constant depreciation rate of capital stock.

Let $\lambda_{i,\tau}$ be a Lagrange multiplier for the nonnegativity-of-dividend constraint in period τ.

Substituting $I_{i,\tau} = K_{i,\tau+1} - \left(1-\delta_i\right) K_{i,\tau}$ into $D_{i,\tau}$,

$$\begin{aligned} D_{i,\tau} &= \Pi_i\left(K_{i,\tau}\right) - \left(K_{i,\tau+1} - \left(1-\delta_i\right) K_{i,\tau}\right) - C_i\left(K_{i,\tau+1} - \left(1-\delta_i\right) K_{i,\tau}, K_{i,\tau}\right) \\ &\quad + B_{i,\tau} - R_i\left(B_{i,\tau-1}\right). \end{aligned}$$

The first-order condition with respect to $K_{i,t+1}$ is

$$\begin{aligned} 0 &= -\left(1+\lambda_{i,t}\right)\left[1 + \frac{\partial C_i\left(K_{i,t}, I_{i,t}\right)}{\partial I_{i,t}}\right] \\ &\quad + E_t\left\{\beta\left(1+\lambda_{i,t+1}\right)\left[\frac{\partial D_{i,t+1}}{\partial K_{i,t+1}} + \left(1-\delta_i\right)\left(1 + \frac{\partial C_i\left(K_{i,t+1}, I_{i,t+1}\right)}{\partial I_{i,t+1}}\right)\right]\right\}. \end{aligned}$$

The Euler equation for investment is

$$1 + \frac{\partial C_i\left(K_{i,t}, I_{i,t}\right)}{\partial I_{i,t}} = E_t\left\{\beta \cdot \frac{1+\lambda_{i,t+1}}{1+\lambda_{i,t}} \cdot \left[\frac{\partial D_{i,t+1}}{\partial K_{i,t+1}} + \left(1-\delta_i\right)\left(1 + \frac{\partial C_i\left(K_{i,t+1}, I_{i,t+1}\right)}{\partial I_{i,t+1}}\right)\right]\right\}. \quad (1)$$

Note that λ_t is the shadow price of the firm's internal funds.

The first-order conditions for borrowing imply

$$E_t\left[\frac{1+\lambda_{i,t+1}}{1+\lambda_{i,t}}\right] \cdot \beta \cdot R_i^{/}\left(B_{i,t}\right) = 1, \quad (2)$$

where $R_i^{/}\left(B_{i,t}\right) \equiv \frac{dR_i(B_{i,t})}{dB_{i,t}}$. Equation (2) can be viewed as an asset pricing equation, where $\beta\frac{1+\lambda_{i,t+1}}{1+\lambda_{i,t}}$ is the effective stochastic discount factor faced by the firm. The equation implies that firm's characteristics that raise the marginal cost of borrowing tend to reduce the expected effective discount factor , $E_t\left[\frac{1+\lambda_{i,t+1}}{1+\lambda_{i,t}}\right]\beta$.

3.2 Group with Full Control

Suppose that a firm belongs to a business group. Let's assume that this firm has (at least) two sources of external finance, namely from outside its group and from other firms within the group. The efficient allocation of funds within a group is defined as the allocation that maximizes the total value of the shares owned by the group's controlling shareholder.[9] As we discuss later, this allocation may not be efficient for outside, non-controlling shareholders or the economy as a whole.

Since the controlling shareholder of group firms has full control over the whole within-group loan contracts, we can think that in each period τ she can just choose a *net* group's transfer $t_{i,\tau}$ to each member firm i. Note that transfers could be positive or negative. Indeed, it is possible that they are positive or negative for a particular firm in all periods.

Because a membership of a group and the ability of a group's controlling shareholder to transfer funds within her group are common knowledge, I assume that if firm i issues a one-period corporate bond $B_{i,t}$ in period t to outside-group lenders, it has to repay $R_i\left(B_{i,t}, \mathbf{B}_{I,t}\right)$ in period $t+1$, where $R_i\left(\cdot\right)$ is monotonically increasing and weakly convex in $B_{i,t}$ and each element of $\mathbf{B}_{I,t}$ and is continuously differentiable with respect to $B_{i,t}$ and each element of $\mathbf{B}_{I,t}$, where $\mathbf{B}_{I,t}$ is a vector of borrowing of each firm in group I, $i \in I$.

The controlling shareholder's problem is

$$\max_{\{K_{i,\tau+1}, B_{i,\tau}, t_{i,\tau}\}_{\tau=t}^{\infty}} \sum_{i=1}^{N_I} \theta_i \left[D_{i,t} + E_t \sum_{s=1}^{\infty} \beta^s D_{i,t+s} \right]$$

subject to

$$\begin{aligned}
D_{i,\tau} &= \Pi_i\left(K_{i,\tau}\right) - I_{i,\tau} - C_i\left(I_{i,\tau}, K_{i,\tau}\right) + t_{i,\tau} + B_{i,\tau} - R_i\left(B_{i,\tau-1}, \mathbf{B}_{I,\tau-1}\right) \\
K_{i,\tau+1} &= \left(1-\delta_i\right) K_{i,\tau} + I_{i,\tau} \\
\theta_i D_{i,\tau} &\geq 0 \\
\sum_{i=1}^{N_I} t_{i,\tau} &= 0 \\
\lim_{\tau\to\infty} B_{i,\tau} &= 0,
\end{aligned}$$

for all $\tau \geq t$, where θ_i is the controlling shareholder's share in firm i.

Let $\lambda_{i,\tau}$ denote the Lagrange multiplier of the dividend nonnegativity constraint of firm i, and $\mu_{I,t}$ be the multiplier for the break-even condition of the group's transfers in period τ, respectively. The Euler equation for investment is the same as equation (1).

[9] In this paper, a composition of a group is exogenously given in two levels. First, whether a firm belongs to any group is given. Also, the number of shares of group firms held by the controlling shareholder is also exogenous.

The first-order conditions for external borrowing imply

$$E_t\left[\frac{1+\lambda_{i,t+1}}{1+\lambda_{i,t}}\right]\cdot\beta\cdot\frac{dR_i\left(B_{i,t},\mathbf{B}_{I,\tau}\right)}{dB_{i,t}}=1,\quad\text{for all } i, \tag{3}$$

where $\frac{dR_i\left(B_{i,t},\mathbf{B}_{I,\tau}\right)}{dB_{i,t}}$ is the total derivative of $R_i\left(B_{i,t},\mathbf{B}_{I,\tau}\right)$ with respect to $B_{i,t}$. Again, the effective stochastic discount factor is $\frac{1+\lambda_{i,t+1}}{1+\lambda_{i,t}}\beta$.

Finally, the first-order conditions for internal transfers imply

$$E_t\left[\frac{1+\lambda_{i,t+1}}{1+\lambda_{i,t}}\right]\cdot\beta=E_t\left[\frac{\mu_{t+1}}{\mu_t}\right],\quad\text{for all } i. \tag{4}$$

Since all firms in the group are facing the same shadow price of within-group transfers μ, equation (4) implies that $E_t\left[\frac{1+\lambda_{i,t+1}}{1+\lambda_{i,t}}\right]\beta$ is the same for all firms in the group. This is intuitive because this condition further implies that the marginal cost of external borrowing is equalized across firms within the same group, i.e. $\frac{dR_i\left(B_{i,t},\mathbf{B}_{I,\tau}\right)}{dB_{i,t}}=\frac{1}{E_t\left[\frac{\mu_{I,t+1}}{\mu_{I,t}}\right]}$. Since the controlling shareholder can transfer funds frictionlessly within the group, the optimal borrowing pattern is that all firms in the group borrow until their marginal costs are equal, which is also equal to the group's shadow internal interest rate.

This case illustrates at least two effects of a group membership on firm's behavior. First, there is insurance across firms within a group. Idiosyncratic shocks to a firm's financial indicators such as cash flow, which in turn affect the cost of external funds of the firm, are absorbed by the whole group through within-group transfers. In this extreme case, we would expect to see no effect of firm's financial idiosyncratic shocks on its investment. The second effect is a tunneling effect. The firms with lower costs of external borrowing behave like a credit supplier to the firms with higher costs. This effect could lead to a conflict of interest between controlling and non-controlling shareholders because the "donor" firms do not use that transfers to invest in their own projects. The conflict is minimal when the compositions of shareholders are almost identical for all members of the group. In such case, the group itself is equivalent to a diversified firm, where each member firm is considered as its segment.[10]

As a final remark, the ownership parameters θ_i do not *directly* affect either investment decision or borrowing decision of a particular firm. This is due to the assumptions that firms live forever, and that the fractions of shares held by the controlling shareholder are constant over time. Therefore, they do not distort the investment and borrowing decisions of the firm because the decisions are intertemporal. However, these parameters do *indirectly* affect investment and financing decision of

[10] The only difference is that each production unit in a business group is legally distinct and has its own limited liability.

the firm through the value of μ_t and μ_{t+1},

$$\mu_{I,t} = \frac{\sum_{i=1}^{N_I}\theta_i\left(1+\lambda_{i,t}\right)}{N_I} = \frac{\sum_{i=1}^{N_I}\theta_i\left(1+\lambda_{i,t}\right)}{\sum_{i=1}^{N_I}\theta_i}\cdot\frac{\sum_{i=1}^{N_I}\theta_i}{N_I},$$

$$\mu_{I,t+1} = \frac{\sum_{i=1}^{N_I}E_t\left[\theta_i\left(1+\lambda_{i,t+1}\right)\beta\right]}{N_I} = \frac{\sum_{i=1}^{N_I}E_t\left[\theta_i\left(1+\lambda_{i,t+1}\right)\beta\right]}{\sum_{i=1}^{N_I}\theta_i}\cdot\frac{\sum_{i=1}^{N_I}\theta_i}{N_I}.$$

In other words, the group's shadow price of internal funds as perceived by the controlling shareholder is a product of a weighted average of the member firms' shadow price of internal funds and an average of the shares owned by the controlling shareholder.

3.3 Empirical Strategy

To derive the regression specification, I follow the method used by Gilchrist and Himmelberg (1998). First, I recursively substitute the investment Euler equation (1) to get

$$1+c\left(I_{i,t},K_{i,t}\right)=\beta E_t\sum_{s=1}^{\infty}\beta^{s-1}\left(1-\delta_i\right)^{s-1}\left(\prod_{k=1}^{s}\left(\frac{1+\lambda_{i,t+k}}{1+\lambda_{i,t+k-1}}\right)\right)MPK_{i,t+s}, \tag{5}$$

where $c\left(I_{i,t},K_{i,t}\right)$ is the marginal adjustment cost and $MPK_{i,t}$ is the marginal profit net of adjustment costs, i.e. $MPK_{i,t}\equiv\frac{\partial D(K_t)}{\partial K_t}=\frac{\partial\Pi(K_t)}{\partial K_t}-\frac{\partial C(I_t,K_t)}{\partial K_t}$.

With the assumptions (a) that $\frac{1+\lambda_{i,t+k}}{1+\lambda_{i,t+k-1}}$ linearly depends on firm's financial characteristics $FIN_{i,t+k-1}$ if firm i is a non-group firm, and depends on a group-time financial determinant FIN^J_{t+k-1}, where J is a group index, if firm i is in group J; and (b) that the adjustment cost is quadratic in $\frac{I_{i,t}}{K_{i,t}}$, i.e. its marginal cost is linear in $\frac{I_{i,t}}{K_{i,t}}$. Derivation in the appendix shows that we can linearly approximate equation (5) as

$$\frac{I_{i,t}}{K_{i,t}}=\begin{cases}\alpha_0+f_i+\alpha_1Q^{FIN}_{i,t}+\alpha_3Q^{MPK}_{i,t}+\varepsilon_{i,t}, \text{ if firm } i \text{ is non-group firm}\\ \\ \alpha_0+f_i+\alpha_2^JQ^{FIN,J}_{t}+\alpha_3Q^{MPK}_{i,t}+\varepsilon_{i,t}, \text{ if firm } i \text{ is in group } J\ ,\end{cases} \tag{6}$$

where $Q^{FIN}_{i,t}$ is the present value of financial characteristic that determines the marginal cost of external finance of firm i; $Q^{FIN,J}_{t}$ is the present value of financial characteristic that determines the marginal cost of external finance of member firms in group J; and $Q^{MPK}_{i,t}$ is the present value of the marginal profitability of investment of firm i in period t. This equation shows that, in a presence of imperfect capital markets, a firm's investment depends on its cost of financing ($Q^{FIN}_{i,t}$ or $Q^{FIN,J}_{t}$), in addition to its investment profitability and the firm's fixed effect. Finally, firm i's fixed effect, f_i, is determined by the depreciation rate, δ_i, and the parameters of the firm's specific adjustment cost function, $C_i\left(\cdot\right)$, among others.

To get an implementable regression equation, I rewrite equation (6) as

$$\frac{I_{i,t}}{K_{i,t}} = \alpha_0 + f_i + \alpha_1 Q_{i,t}^{FIN} + \sum_{J=1}^{N} \left(\gamma_{0,t}^{J} d_{i,t}^{J} + \gamma_{1,t}^{J} d_{i,t}^{J} Q_{i,t}^{FIN}\right) + \alpha_3 Q_{i,t}^{MPK} + \varepsilon_{i,t};\ E\left[\varepsilon_{i,t}\right] = 0.$$

where N is the number of groups in the sample and $d_{i,t}^{J}$ is a dummy variable indicating whether firm i is in group J in period t. For a firm in group I, $d_{i,t}^{I} = 1$ and $d_{i,t}^{J} = 0$ for all $J \neq I$. Note that the group-time dummy $d_{i,t}^{I}$ captures the common group's financial factor in period t, $Q_t^{FIN,J}$, through the term $\gamma_{0,t}^{I} d_{i,t}^{I}$. If $Q_{i,t}^{MPK}$ is a true state variable and is correctly measured, then the existence of perfect internal capital markets implies that a group firm's investment decision should be independent of the firm's financial characteristics, after being controlled for its group-time effect, and $\alpha_1 + \gamma_1^J$ should sum to zero.

However, there are several frictions that make internal capital markets imperfect as described in the previous section. To test the extent that each factor affects the within-group resource allocation, I modify equation (7) by using interaction terms between $Q_{i,t}^{FIN}$ and group's characteristics. Finally, we get the following regression specification:

$$\frac{I_{i,t}}{K_{i,t}} = \alpha_0 + f_i + \alpha_1 Q_{i,t}^{FIN} + \sum_{J=1}^{N} \gamma_{0,t}^{J} d_{i,t}^{J} + Q_{i,t}^{FIN}\ \mathbf{X}^{I}\boldsymbol{\eta} + \alpha_3 Q_{i,t}^{MPK} + \varepsilon_{i,t};\ E\left[\varepsilon_{i,t}\right] = 0, \qquad (7)$$

where $\mathbf{X}^{I}$ is a vector of characteristics of group I to which firm i belongs, $i \in I$, and $\boldsymbol{\eta}$ is a corresponding vector of regression coefficients. If an element of $\boldsymbol{\eta}$ has a negative coefficient, the characteristic makes investment less sensitive to the firm's own financial characteristics. On the other hand, if an element of $\boldsymbol{\eta}$ has positive, the characteristic makes investment more sensitive to the firm's own financial characteristics. We expect that the characteristics facilitating the operation of internal capital markets should have negative coefficients, and opposite result for the characteristics that prohibiting the internal capital market. Equation (7) is the regression specification counterpart of the model that I will use in the empirical part of this study.

4 Data

4.1 Corporations in Thailand

Although the study of corporate finance and governance of Thai firms has become more popular after the 1997 Asian financial crisis, the number of literature that solely devotes to the country is still limited. One of the comprehensive studies about the evolution of Thai firms over the past century is Suehiro (1996). Suehiro (2001) also argues that family business was not a major cause of the financial crisis and it would be better to revitalize existing family business to support sustainable growth rather than adopting the model of good governance and scale down the roles of the families. However, Wiwattanakantang, Kali and Charumilind (2006) show that listed firms with ties to banks

and politicians had greater access to long-term debt than firms without such ties. Regarding the investment behavior of firms during the crisis, Osangthammanont (2002) uses different but similar data as the one in this paper for 1995-1999 and finds that firms were more financially constrained after the crisis. Surprisingly, large tradable firms were the most severely affected by the crisis due to their exposure to international financial markets prior to the crisis. Luengnaruemitchai (2003) studies investment response of Thai firms to currency shocks during the Asian financial crisis and finds that there is no strong negative investment response on firms with foreign currency debt. He argues that firms match their foreign currency debt with their stream of foreign income.

Firms in the sample in this study are all listed and largest non-listed firms in Thailand during 1994-1996. There are several reasons why the data from Thailand over that period is a good sample in this study. First, Thailand was an emerging economy that capital markets were not fully developed so external financing was costly. Second, business groups were in essentially every sectors. Third, the data is available for both listed and non-listed firms. Therefore, we can test the effect of corporate laws and regulations that protect minority shareholders on the investment decision of the firms. Finally, we can extend the period of the data set to study the response of groups to shocks during the 1997 economic crisis in the future reseach.

4.2 Data Source

4.2.1 Financial and Ownership Data

All registered firms in Thailand have to submit annual financial statements to the Department of Business Development of the Ministry of Commerce.[11] The documents submitted must be audited by an authorized accounting auditor. The data contain standard aggregate items in the balance sheets and the income statements.[12] The data also have information on ownership and board of directors, which allows me to manually construct the groups' network maps, determine the group membership of each firm, and compute ultimate ownership and control rights of the main shareholders. Other information from the data set includes the registration years of the firms, which give me the age of each firm in my sample. All listed firms are required to submit the same as well as additional data to the Security and Exchange Commission.

The Ministry of Commerce gives a license to the Advanced Research Group Co., Ltd. to compile and publish the data for approximately 2,000 companies annually in a series of the books called *Thailand Company Information* (TCI). The companies in TCI list are relatively large and satisfy

[11] The Department of Business Development was formerly known as the Department of Commercial Registration. Its name was changed in October 2002.

[12] The common aggregate items appearing in the balance sheet and income statement of all firms include cash, total current assets, total fixed assets, total assets, current liability, total liability, income from sales and services, cost of sales and services, interest expense, net profit, among others.

at least one of the following criteria: (1) they had annual turnover more than 200 million Baht;[13] (2) they were one of the leading companies in their industry; or (3) they were listed in the Stock Exchange of Thailand. The numbers of companies and the names of the companies included in the TCI list vary from year to year. There are 2,158 in 1994; 2,278 in 1995; and 2,152 in 1996. There are several cases that the companies in the list changed their names. Moreover, when a company goes public, its registration number at the Department of Business Development changes. I deal with these problems by tracking the registration numbers of all companies in the list and manually recheck with the database at the Department of Business Development whether there were any changes in company names and status over the period of the study. Since we need end-of-previous-year assets in order to compute investment rate, I keep only firms that appear in TCI database for all of the three years from 1994 to 1996 and exclude all firms in financial and real estate sectors from the sample because the interpretation of their financial statements is different from firms in other sectors. Using data on ownership, I determine whether a firm belongs to which business group. I keep only group firms in the sample. I also drop firms that have typo problems in financial statements out of the sample. Finally, my sample consists of 801 observations from 1995 and 1996.

4.2.2 Data on Groups

Groups are defined on ownership and control basis. Firms are in the same group if they are (wholly or partly) owned and managed by the same individual, the same group of individuals such as a family, or a judicial person such the Crown Property Bureau. To identify groups, I first use the information from a book called *Thai Business Groups 2001: A Unique Guide to Who Owns What*. There are 150 groups in the book. The book covers the history of each family business since the time of its founder until recent years. Although the book provides a lot of information about family background, its list of companies affiliated to each family cannot serve the purpose of this study well. For example, since the book uses a very broad definition of business groups, some particular firms are considered as an affiliation to several groups. Some companies are assigned to a family even though the family does not hold significant percentage of shares in the companies when I check with the corresponding ownership data from the Ministry of Commerce.[14] Some families are also connected together that we cannot consider them separately. Finally, there are several groups that were not included in the book due to their small number of member firms, even though each member firm was considered large and important in its industry. Therefore, I focus mainly on the ownership data from the Ministry of Commerce and identify group firms manually by myself, with some helps from the book as sometimes family members do not share the same lastname. In sum, 111 groups are included in the current sample–21 of them are additional to those listed in the

[13] Approximately 8 million US Dollar using 1996 exchange rate, or 5.26 million US Dollar using 2006 exchange rate.

[14] A cut-off criteria for a firm to be considered in a group in this paper is that the controlling shareholder must have at least 10% of control rights over the firm. The method to compute the control rights of the controlling shareholder is presented later in this paper.

Brooker book. Figures 1 and 2 present some examples of groups.

Figure 1 shows examples of simple group structures. The number in a parenthesis indicates the percentage of shares directly held by the family members. An arrow from firm X to firm Y denotes that firm X holds shares of firm Y. The number next to the arrow indicates the percentage of firm Y's shares held by firm X. Figure 1A presents a group that consists of many firms owned by the same family. There are no direct legal connections between the firms themselves. Alternatively, figure 1B shows a group formed by a chain shareholding. Figure 1C is an example of pyramidal structure of business groups with multiple chain shareholdings and a holding company at the vertex. Finally, Figure 1D presents a group with cross shareholdings.

Some business groups have more complex structures than those presented in Figure 1. A group may consist of many chain shareholdings or many firms serving as a vertex of the pyramidal structures. Cross shareholdings or circular shareholdings could be more complex. Figures 2 presents an example of the more complicated group structures. To avoid confusion, all numbers indicating ownership are not shown.

4.3 Data Description and Summary Statistics

4.3.1 Firm Characteristics

There are various legal types of business organizations in Thailand. I do not consider sole proprietor and non-registered partnership in this study since they are not considered as a judicial person under Thai laws. Thai corporate laws allow a company to be registered in only two types: private limited company and public limited company. Shareholders of a private limited company enjoy limited rights or protections under the Civil and Commercial Code B.E. 2468 (A.D. 1925) and its several amendments. On the other hand, a public limited company is governed by a specific law called the Public Limited Company Act B.E. 2535 (A.D. 1992), in addition to the Civil and Commercial Code. The law was drafted with a view to revamp the old Public Limited Company Act B.E. 2521 (A.D. 1978), which was considered obsolete and impractical. The features in the current law that give more protection to minority shareholders are that: A director that benefits from purchases or sales of the company's assets cannot vote for or against the transactions (Section 80); A director is prohibited from operating the same business that competes with the company, unless she announces that she is doing such a business during the shareholder meeting before appointed (Section 86); A director cannot purchase assets from or sell assets to the company, unless the board of directors approves the transaction (Section 87); A director must inform the company whenever she benefits from any contracts made by the company (Section 88); A public limited company cannot lend to (or put a collateral for) its directors or employees (or any business owned more than 50% by its directors or employees), except that the lending is classified as a welfare compensation or it is a business as usual for commercial banks (Section 89).

Under the Stock Exchange of Thailand (SET) rules, each listed companies must be registered as a public limited company. Therefore, listed firms must comply with both the disclosure requirements of the Stock Exchange and the Public Limited Company Act. Examples of the SET's regulations on transactions with related companies are that the company must declare the detail of the transactions to public for low-value transactions; and the company must consult with an independent financial consultant and must get an approval from theshareholder meeting for high-value transactions. Since these law and regulation aim at protecting minority shareholders, they are important factors that create the friction to within-group internal capital markets.

Panel A in Tables 1 summarizes statistics of the firms in the sample. About 24% of the sample were listed in the Stock Exchange of Thailand. The leverage ratio was 2.17% on average. The average age of the firms in 1996 was 20 years.

4.3.2 Group Characteristics

There are 111 groups in the sample. Panel B in Table 1 shows that the number of firms in business groups ranges from two to 51 firms, with the average of 5.84. Note that it is difficult in practice to know exactly how many firms are in each group. In this paper, I scope my analysis on relatively large firms only. Precisely, the number of firms in each group considered here is defined as the number of firms in the group that appeared at least once in the 1993, 1994, 1995 or 1996 TCI lists. Therefore, the number of firms in each group is precisely the number of relatively large firms that belong to the group. The average group age in 1996 was 31.95. The oldest group was 115 years old while the youngest group was 8 years old.

Definition and calculation of ultimate ownership and control follow La Porta, Lopez-de-Silanes and Shleifer (1999) and Claessens, Djankov and Lang (2000). In case that there is a chain shareholding, I initially compute the ownership along the chain by calculating the product of shares along the chain. The calculation is more complicated if there are more than one chains for each firm. In such case, the ultimate ownership is the sum of the ownership over all chains that can be traced back to the controlling family.[15] Control rights are based on the voting rights the family has. Due to a "one share, one vote" rule, control right is the share the family holds. However, in case of a chain shareholding, control over the voting right of a firm is the smallest share along each chain. The ultimate control is the sum of the controls over all chains.[16] The calculation gets more complex when there is a cross shareholding, where I have to calculate ownership (and control) of multiple

[15] Consider figure 1B as an example. In this case, the families own 51.12% of *Peace Canning (1958) Co. Ltd.*; $9.71 + (0.1091 * 51.12) = 15.40\%$ of *Pattaya Food Industries Co. Ltd.*; and $0.2066 * 15.40 = 3.18\%$ of *Royal Can Industries Co. Ltd.*

[16] Consider figure 1B again. The families control 52.12% of voting rights in *Peace Canning (1958) Co. Ltd.*; $9.71+\min\{52.12, 10.91\} = 20.62\%$ in *Pattaya Food Industries Co. Ltd.*; and $\min\{20.62, 20.66\} = 20.62\%$ in *Royal Can Industries Co. Ltd.*

firms simultaneously.[17] Finally, the group's average ownership (or control) is the average of the ownership (or control) over all firms in the group. It is obvious that chain shareholdings create a discrepancy between ownership and control. On average, a family owned 54% and controlled 58% or the firms.

Not every group has member firms registered as public limited company or listed company in the stock market. The mean number of listed firms in a group is 1.5. Some groups also have intermediaries as member firms. In this paper, intermediaries include commercial banks, finance and securities companies, insurance companies, companies offering financial services (such as credit cards), holding companies, and venture capitalists. About 42% of the groups in this sample have at least one intermediaries as a group member.

To measure industry orientation, industry is classified in 2 levels. The broad classification consists of 8 industries and similar to the 1-digit SIC while the detailed classification has 41 industries and similar to the 2-digit SIC. The sample ranges from groups with no industry diversification to groups with 6 broad industries and 15 detailed industries. The average number of industries in each group is 2.12 for broad classification and 2.94 for detailed classification. Note that most of the firms in the sample were in light manufacturing industry, followed by consumer product, heavy manufacturing, and agriculture. This fact may reflect the industrialization of the country in the previous decades.

5 Empirical Results

The main problem of estimating equation (7) is that it is very unlikely that $Q_{i,t}^{MPK}$ is correctly measured, especially for non-listed firms that we do not have "market" information such as stock prices. Also, it is unclear what the empirical counterpart for $Q_{i,t}^{FIN}$ is.[18] In this paper, I use the average Tobin's Q as proxied by a ratio of market to book values as a measure of firm's fundamental profitability, $Q_{i,t}^{MPK}$, and firm's cash flow normalized by assets at the beginning of the year as a proxy for $Q_{i,t}^{FIN}$. There are several reasons for this choice of variables. First, there are a lot of studies on investment-cash flow sensitivity in the literature. By using the same variables, I can compare my results to them. Second, as Kaplan and Zingales (1997) show, if external finance is costly, then investment is positively correlated to cash flow because cash flow is one of the internal funds available to the firm. Finally, from personal conversations with credit officers of some commercial

[17] Consider figure 1D. Suppose that the family owns x% of *Vee Rubber Co. Ltd.* and y% of *Vee Rubber International Co. Ltd.* We must have that $x = 11.98 + 0.875 * y$ and that $y = 75 + 0.25 * x$. Solving these equations simultanously gives us $x = 99.33$ and $y = 99.83$. In general, this is a fixed-point problem with discount factors less than one. Therefore, the solutions always exist.

[18] To deal with this problem, Gilchrist and Himmelberg (1998) estimate $Q_{i,t}^{MPK}$ and $Q_{i,t}^{FIN}$ from vector autoregression method introduced by Abel-Blanchard (1988). However, their estimates are still not perfect. For example, they ignore the marginal effect of capital on adjustment cost, $\frac{\partial C(I_t, K_t)}{\partial K_t}$, in their MPK.

banks in Thailand, I learn that banks pay a lot of attention to cash flow when they evaluate loan applications.[19]

Market to book ratio is computed as the market value of total equities plus the book value of total liabilities, divided by the book value of total assets, all at the beginning of the year There is a problem to get market to book value as a proxy of $Q_{i,t}^{MPK}$ for each firm because the sample consists of both listed and non-listed firms. Since non-listed firms are not traded in the stock market, we do not observe the price variables of the firms and therefore cannot compute the market value of equities as usual. To deal this problem, I compute the industry average market to book ratio and use it as a proxy for firm's fundamental profitability for all firms in the industry.[20] As some listed firms were in business groups and their stock price may incorporate this fact in addition to the profitability information, I use only data on non-group listed firms when I compute the industry average market to book values.[21]

Because the publicly available financial statements do not have data on depreciation of fixed assets, investment rate is defined as the rate of change in net fixed assets over the year. Corresponding cash flow to fixed assets is defined as cash flow net of depreciation divided by total fixed assets at the beginning of the year. In this paper, this variable is computed as the net profit to fixed assets ratio. Note that using average market to book values and net profit to fixed assets will overestimate the effect of cash flow on investment sensitivity. Instead of interpreting the precise magnitude of the sensitivity itself, I will focus on the effect of group charateristics that increase or decrease the sensitivity and draw qualitative implications from the results.

Tables 2 to 4 present the investment-cash flow sensitivity regressions under various specifications. All of the regressions are OLS and clustered at family level. Variables with interaction terms are demeaned. Columns 1 in Table 2 shows that fixed investment is sensitive to cash flow after controlling for group-year dummies, which capture the common group's financial factor in each year for each group. Although the sensitivity is statistically positively significant, the magnitude is small. A possible explanation is that some business groups have perfect internal capital markets and efficient within-group resource allocation that drive the average sensitivity of firm's own cash flow close to zero. The result is similar when leverage and total assets of the firms are included

[19] Other factors are three-year profits, irregular change in income and cost of production, and credit score. Credit score is computed from 5-year performance, interest coverage, debt-to-equity ratio, ratio of net worth to paid-up capital, and qualitative criteria (such as previous records at the bank, parent company, industry situation, and whether the firm is in the top of its industry).

[20] Equation (11) in the appendix suggests that $Q_{i,t}^{MPK}$ depends on firm i's production function, adjustment cost function, and depreciation rate– which are similar across firms in the same industry. Therefore, industry-average market-to-book value should be a good proxy to some extent.

[21] There is an exception when all listed firms in the industry are group firms. In this case, the industry average is the average over all firms in the industry. However, this exception applies to only one industry in the sample, namely, agricultural product from animals.

in the regression, as shown in column 2. The rest of the empirical exercise considers factors that affect the efficient allocation in a view of controlling shareholders.

Corporate Ownership and Control

In the real world, a controlling shareholder of a group rarely has a full control over the member firms. As discussed earlier, although a business group provides some insurance across firms within the group, it could have tunneling effect as well. Since this tunneling comes with the cost to the outside shareholders of the donor firms, there is a tension between inside, controlling and outside, non-controlling shareholders. We would expect that a group where its controlling shareholder has more control, such as measured by ownership or voting rights, is more likely to have efficient allocation. It is important to note that not only control over a particular firm matters, the control over other firms in the group also affects the operation of internal capital markets. In other words, the fact that a controlling shareholder has full control over a particular firm does not guarantee perfect internal capital market outcomes. To have such outcomes, the controlling shareholder needs to have full control over all other firms in the group as well.

Columns 3 to 5 in Table 2 present the effects of corporate ownership and control on internal capital market in business groups. Group ownership is defined as the simple average of percentage of shares held by the controlling shareholder across all firms in the group. Column 3 shows that the more the controlling shareholder owns the group, the less sensitivity of investment to firm's own cash flow. Column 4 shows that the result is similar when leverage and total assets of the firms are included. The findings suggest that when the controlling shareholder has more ownership over the group, they may have higher ability to transfer resources between firms in the group. This results in a more efficient within-group resource allocation as reflected in the less sensitivity of firm's investment to its own cash flow after controlling for group-year effects.

Ownership as measured by cash flow rights may not capture the ability of the controlling shareholder in controlling the group well, especially when they can exercise extra voting rights. This excess control is generated either by a division from one share, one vote rule or by chain shareholdings as shown in La Porta, Lopez-de-Silanes, Shleifer and Vishny (1999) and Claessens, Djankov, Fan and Lang (1999). Column 5 adds an interaction term between a dummy fro group's excess control and cash flow. The result shows that firms in a group where controlling family has excess voting rights tend to have less investment-cash flow sensitivity. This effect is additional to the effect from the ownership of controlling shareholders over the group. Overall, the findings suggest that groups where controlling shareholders have more ownership and control tend to have more efficient within-group resource allocation or more perfect internal capital markets.

Regulations

Usually corporate laws are designed in order to protect minority shareholders, although the

degree of protection varies by countries and legal systems.[22] Within a country, different types of firms could be governed by different laws, which have different restrictions and requirements on transfers and loans among firms within a group. As discussed earlier, listed firms in Thailand are subject to comply with the Public Company Act and the regulations from the Stock Exchange of Thailand (SET). These regulations tend to protect outside shareholders from being exploited by the inside, controlling shareholders. In effect, groups consisting of many strictly-regulated firms (such as listed firms) are less likely to have efficient internal capital markets because their resource transfers are more difficult. Column 1 in Table 3 includes the number of listed firms in a group as an interaction with firm's own cash flow. The coefficient is positively significant, implying that groups with more listed firms tend to have less efficient within-group resource allocation or less perfect internal capital markets. This result supports the idea that the Public Company Act and the SET's regulations effectively prevent internal transfers in business groups.

However, listed or publicly traded firms usually have more dispersed shareholding. Controlling shareholders tend to hold less percentage of shares in listed firms than in privately held firms. The effect of the number of listed firms in a group on investment-cash flow sensitivity could be driven by the ownership and control rather than the effectiveness of the regulations. Column 2 shows that once we add group ownership and excess control into the regression, the effect from the number of listed firms in the group disappears. The finding suggests that the less efficient resource allocation in business groups with more listed firms comes from the fact that the controlling shareholders of these groups tend to have less ownership and fewer voting rights than those in groups with fewer listed firms. The results do not support the direct effectiveness of the regulations.

Within-Group Intermediaries

In banking theory, flows of funds across economic units can be facilitated by intermediaries. In the context of business groups, intermediaries include financial intermediaries (commercial banks, finance companies, and insurance companies, among others), as well as firms that act as a vertex of the pyramidal structure of a group such as holding companies. We would expect that a group with these intermediaries is more likely to have more efficient within-group resource allocation. Columns 3 and 4 in Table 3 present the effects of within-group intermediaries on investment-cash flow sensitivity. The results show that groups with intermediaries tend to have lower investment-cash flow sensitivity. This implies that having within-group intermediaries helps the operation of internal capital markets and facilitates within-group resource allocation. The results are robust for both the dummy for groups with intermediaries and the number of within-group intermediaries. Note that this result is similar to the finding in Hoshi, Kashyap and Scharfstein (1991) that intermediaries affect investment-cash flow sensitivity of firms in business groups. The main difference is the economic reasons behind the findings. In their study, firms in a group with financial intermediaries tend to have less liquidity constraint as compared to firms without connection to financial inter-

[22] La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998) have a cross-country survey on this issue.

mediaries. In this paper, however, intermediaries help facilitate resource allocation within a group, given group's aggregate liquidity constraint.

Organization Structure of Business Group

In principle, size of the groups as measured by the number of member firms can have either positive or negative effect on the group's likelihood to have efficient resource allocation. On the one hand, bigger groups are more likely to have more severe within-group information and coordination problems, hence less likely to have perfect internal capital markets. On the other hand, groups with more members are more likely to have alternative ways to transfer resources among themselves, thereby more likely to have efficient resource allocation. For example, suppose that a group has two firms (firm A and firm B), and the controller is prevented to transfer resources explicitly across these two firms. It is unlikely that the group will have efficient internal capital markets. However, if this group has firm A, firm B, and firm C, where firm C does a business with both firm A and firm B. It is possible for the group to transfer resources indirectly between firm A and firm B–through the channel provided by transactions with firm C.

Table 4 shows the effects of the number of firms in a group on investment-cash flow sensitivity. The results are not robust to various specifications although it seems that groups with more member firms may have less efficient within-group resource allocation. In order to check whether the effect is from the number of member firms or the overall size of the group, column 2 includes the interaction term of group's total assets in the regression, which shows no effect on internal capital markets. The results are robust across various specifications (not shown here). If any, the results imply that coordination and information problems may get more severe once the group gets larger in terms of its span of control over multiple units.

Larger number of member firms can come in various forms of organization structure. A group may be very flat and horizontal, where there is only one or few layers of a pyramid but there are many firms located in the same layer. Alternatively, a group could be very vertical, where there is only one but very long chain shareholding. In reality, the structures could be mixed and very complicated as shown earlier. I construct two measures to capture these features. First, I use group width as a proxy for horizontal dimension of the nexus of firms in a business group. It is defined as the maximum number of firms that own a particular firm or the maximum number of firms that are owned by a particular firm, what ever is larger. Second, I use group depth as a proxy for vertical dimension of the group. It is defined as the maximum number of links along chain shareholdings, across all chains in the group. Column 3 shows that horizontal dimension of business groups does not affect the internal capital markets while the result in column 4 suggests that the vertical dimension tends to facilitate the internal capital markets. The result is robust when I include both measures in the regression as shown in column 5. The finding that group depth facilitates within-group resource transfers is not surprising. The result is consistent to what

we found earlier that groups with excess control of the controlling shareholders tend to have more efficient within-group resource allocation. Precisely, the excess control is driven by separation between cash flow rights and voting rights along the vertical chains of pyramidal structure. The result is also consistent with the tunneling hypothesis along the pyramid as tested by Bertrand, Mehta and Mullainathan (2003).

Industry Diversification

Traditional wisdom suggests that industry diversification provides insurance against a group's aggregate shocks, i.e. the more diversified the group, the less volatile the group's aggregate cash flow or profit. However, this argument does not imply how resources are allocated across member firms when the group's aggregate shocks are given. In practice, both industry homogeneity and diversity could facilitate flows of resource across firms. For example, two member firms could trade between themselves on credit, in addition to direct lending or borrowing in cash. This creates one kind of internal credit markets. On one hand, within-group trade could be intra-industry. For example, a frozen chicken firm could buy raw chicken from a chicken farm owned by the same controlling shareholders. On the other hand, trading within group could be inter-industry. For instance, a department store could buy canned food or clothes from its affiliated firms. Therefore, the effect of industry diversification on internal capital markets is unclear.[23] Empirically, columns 6 and 7 in Table 4 show that groups with more industries seem to have more perfect internal capital markets. This is robust for both broad and detailed classifications of industry diversification.

6 Conclusion

This paper tries to answer some interesting questions about business groups: Do business groups have internal capital markets? Do they provide efficient resource allocation? What are the characteristics that determine the tendency to have efficient resource allocation in business groups? The study considers an economy that external capital markets are imperfect and external funds are more costly than internal finance, which is natural in emerging economies where capital market is not fully developed and firms tend to have credit constraints. In this environment, the marginal cost of external funds determines the firm's discount factor that is used in discounting the stream of marginal future benefits of the current investment. As a result, the firm's investment will depend on its financial determinants as well as its fundamental profitability. Since a group with full control can freely transfer resources across its member firms, the efficient allocation in a view of a controlling shareholder implies that the marginal costs of funds are equalized across firms within the group. Therefore, a group firm's investment should depend only on its group's financial factors and the firm's own profitability but not the firm's financial determinants.

[23] Other related examples along this line include (1) transfer of physical capital such as machine between firms that produce similar goods (hence using similar type of machines); (2) transfer pricing by setting the price of product sold to affiliated firms lower than the market price.

With this model, I derive an empirical regression counterpart and use it to test for the existence of internal capital markets in business groups and various characteristics of groups that tend to affect the groups' resource allocation. A unique firm-level data from Thailand's Ministry of Commerce is used as a sample in the empirical sections. The results show that corporate ownership, control rights and within-group intermediaries tend to facilitate the efficient resource allocation. Corporate laws and regulations that protect minority shareholders lead to the less efficient internal capital markets. The effect is indirect through the fact that controlling shareholders tend to have smaller cash flow rights and voting rights over the listed firms. The paper also shows that groups with more member firms that are structured vertically tend to have more efficient internal capital markets while horizontal structure does not seem to affect within-group resource allocation. Finally, the more industry diversification, the more efficient internal capital markets in business groups.

There are some issues that are not considered in detail in this paper. First, group formation and group characteristics are exogenously given in this paper. Second, the paper is also abstract from welfare analysis of the non-controlling shareholders. These issues are important and are waiting for future research. However, the results from this paper should shed some light on the nature of business groups and their structure, which could serve as a starting point to explain why and how business groups are formed.

The main contributions of this paper come in two folds. First, it presents a structural model with an empirical counterpart that can be used to study investment behavior of firms in business groups in the presence of costly external finance. Second, the paper provides empirical evidence from firm-level data that the structure of business groups and corporate governance are related to the investment behavior of firms.

7 Appendix: Derivation of Equation (6)

I follow the method used by Gilchrist and Himmelberg (1998). Denote $\rho_i = \beta(1-\delta_i)$ and $\Lambda_{i,t,t+s} = \prod_{k=1}^{s}\left(\frac{1+\lambda_{i,t+k}}{1+\lambda_{i,t+k-1}}\right)$, we have

$$1 + c(I_{i,t}, K_{i,t}) = \beta\sum_{s=1}^{\infty}\rho_i^{s-1}E_t\left[\Lambda_{i,t,t+s}MPK_{i,t+s}\right].$$

Using a first-order Taylor approximation around $E_t[\Lambda_{i,t,t+s}] \simeq \kappa_1$ and $E_t[MPK_{i,t+s}] \simeq \kappa_2$,

$$\Lambda_{i,t,t+s}MPK_{i,t+s} \simeq \kappa_0 + \kappa_1\Lambda_{i,t,t+s} + \kappa_2 MPK_{i,t,t+s}. \tag{8}$$

Next, we approximate

$$\begin{aligned}
\Lambda_{i,t,t+s} &= \prod_{k=1}^{s}\left(\frac{1+\lambda_{i,t+k}}{1+\lambda_{i,t+k-1}}\right) \\
\Lambda_{i,t,t+s} &= \prod_{k=1}^{s}\left(1+\frac{(1+\lambda_{i,t+k})-(1+\lambda_{i,t+k-1})}{1+\lambda_{i,t+k-1}}\right) \\
\Lambda_{i,t,t+s} &\simeq 1+\sum_{k=1}^{s}\frac{\lambda_{i,t+k}-\lambda_{i,t+k-1}}{1+\lambda_{i,t+k-1}} \\
\Lambda_{i,t,t+s} &\simeq \begin{cases} \phi_0 + \phi_1\sum_{k=1}^{s}FIN_{i,t+k}, \text{ if firm } i \text{ is non-group firm} \\ \phi_0 + \phi_2^J\sum_{k=1}^{s}FIN_{t+k}^J, \text{ if firm } i \text{ is in group } J\ , \end{cases}
\end{aligned} \tag{9}$$

where we assume that $\frac{\lambda_{i,t+k}-\lambda_{i,t+k-1}}{1+\lambda_{i,t+k-1}}$ of firm i linearly depends on firm's financial characteristics $FIN_{i,t+k-1}$ and a group-time financial determinant FIN_{t+k-1}^J, where J is a group index.[24] The two extreme cases presented in the previous section can be viewed as special cases to this approximation. For non-group firms, $\Lambda_{i,t,t+s}$ depends only on individual firm-time financial characteristics. On the other hand, $\Lambda_{i,t,t+s}$ for a firm in a fully controlled group I should depend only on its group-time effect.

Finally, substituting equation (8) into (5), we have

$$\begin{aligned}
1 + c(I_{i,t}, K_{i,t}) &= \beta\sum_{s=1}^{\infty}\rho_i^{s-1}E_t\left[\Lambda_{i,t,t+s}MPK_{i,t+s}\right] \\
1 + c(I_{i,t}, K_{i,t}) &= \beta\sum_{s=1}^{\infty}\rho_i^{s-1}E_t\left[\kappa_0 + \kappa_1\Lambda_{i,t,t+s} + \kappa_2 MPK_{i,t,t+s}\right] \\
1 + c(I_{i,t}, K_{i,t}) &= \kappa_0\beta\sum_{s=1}^{\infty}\rho_i^{s-1} + \kappa_1\beta E_t\left[\sum_{s=1}^{\infty}\rho_i^{s-1}\Lambda_{i,t,t+s}\right] \\
&\quad + \kappa_2\beta E_t\left[\sum_{s=1}^{\infty}\rho_i^{s-1}MPK_{i,t,t+s}\right].
\end{aligned} \tag{10}$$

[24] In theory, this term could depend on any characteristics that determine the cost of external funds. However, financial situation of a firm is one of the most important factors since the data in the firm's balance sheet and income statement, to a big extent, provide information about the default risk of the firm.

Then, substitute (9) into (10)

$$
\begin{aligned}
1+c\left(I_{i,t},K_{i,t}\right) &= \kappa_0\beta\sum_{s=1}^{\infty}\rho_i^{s-1}+\kappa_1\beta E_t\left[\sum_{s=1}^{\infty}\rho_i^{s-1}\Lambda_{i,t,t+s}\right]+\kappa_2\beta E_t\left[\sum_{s=1}^{\infty}\rho_i^{s-1}MPK_{i,t,t+s}\right] \\
1+c\left(I_{i,t},K_{i,t}\right) &= \begin{cases} \kappa_0\beta\sum_{s=1}^{\infty}\rho_i^{s-1}+\kappa_1\beta E_t\left[\sum_{s=1}^{\infty}\rho_i^{s-1}\left(\phi_0+\phi_1\sum_{k=1}^{s}FIN_{i,t+k-1}\right)\right] \\ +\kappa_2\beta E_t\left[\sum_{s=1}^{\infty}\rho_i^{s-1}MPK_{i,t,t+s}\right], \text{ if firm } i \text{ is non-group firm} \\ \kappa_0\beta\sum_{s=1}^{\infty}\rho_i^{s-1}+\kappa_1\beta E_t\left[\sum_{s=1}^{\infty}\rho_i^{s-1}\left(\phi_0+\phi_2^J\sum_{k=1}^{s}FIN_{t+k-1}^J\right)\right] \\ +\kappa_2\beta E_t\left[\sum_{s=1}^{\infty}\rho_i^{s-1}MPK_{i,t,t+s}\right], \text{ if firm } i \text{ is in group } J. \end{cases} \\
1+c\left(I_{i,t},K_{i,t}\right) &= \begin{cases} \left(\kappa_0+\kappa_1\phi_0\right)\beta\sum_{s=1}^{\infty}\rho_i^{s-1}+\kappa_1\phi_1\beta E_t\left[\sum_{s=1}^{\infty}\sum_{k=1}^{s}\rho_i^{s-1}FIN_{i,t+k-1}\right] \\ +\kappa_2\beta E_t\left[\sum_{s=1}^{\infty}\rho_i^{s-1}MPK_{i,t,t+s}\right], \text{ if firm } i \text{ is non-group firm} \\ \left(\kappa_0+\kappa_1\phi_0\right)\beta\sum_{s=1}^{\infty}\rho_i^{s-1}+\kappa_1\phi_2^J\beta E_t\left[\sum_{s=1}^{\infty}\sum_{k=1}^{s}\rho_i^{s-1}FIN_{t+k-1}^J\right] \\ +\kappa_2\beta E_t\left[\sum_{s=1}^{\infty}\rho_i^{s-1}MPK_{i,t,t+s}\right], \text{ if firm } i \text{ is in group } J. \end{cases} \\
1+c\left(I_{i,t},K_{i,t}\right) &= \begin{cases} \tilde{f}_i+\tilde{\alpha}_1Q_{i,t}^{FIN}+\tilde{\alpha}_3Q_{i,t}^{MPK}, \text{ if firm } i \text{ is non-group firm} \\ \tilde{f}_i+\tilde{\alpha}_2^{J}Q_t^{FIN,J}+\tilde{\alpha}_3Q_{i,t}^{MPK}, \text{ if firm } i \text{ is in group } J\ . \end{cases} \qquad (11)
\end{aligned}
$$

If the adjustment cost is quadratic in $\frac{I_{i,t}}{K_{i,t}}$, then its marginal cost is linear in $\frac{I_{i,t}}{K_{i,t}}$. Equation (11) can be rewritten as

$$
\frac{I_{i,t}}{K_{i,t}}=\begin{cases} \alpha_0+f_i+\alpha_1Q_{i,t}^{FIN}+\alpha_3Q_{i,t}^{MPK}+\varepsilon_{i,t}, \text{ if firm } i \text{ is non-group firm} \\ \alpha_0+f_i+\alpha_2^JQ_t^{FIN,J}+\alpha_3Q_{i,t}^{MPK}+\varepsilon_{i,t}, \text{ if firm } i \text{ is in group } J\ , \end{cases} \qquad (12)
$$

where $Q_{i,t}^{FIN}$ is the present value of financial characteristic that determine the marginal cost of external finance of firm i; $Q_t^{FIN,J}$ is the present value of financial characteristic that determine the marginal cost of external finance of member firms in group J; and $Q_{i,t}^{MPK}$ is the present value of the marginal profitability of investment of firm i in period t. Finally, $\varepsilon_{i,t}$ is the stochastic component of the adjustment costs and other disturbances that are not captured by $Q_{i,t}^{FIN}$, $Q_t^{FIN,J}$, and $Q_{i,t}^{MPK}$.

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Figure 1 Examples of Simple Ownership Structure in Business Groups

Numbers in parentheses are the percentage of ownership directly held by the family. The arrow from firm X to firm Y denotes that firm X holds shares in firm Y. The number next to the arrow represent the percentage of firm Y's shares owned by firm X. Figure 1A is a business group where all member firms are legally independent and directly owned by a family. Figure 1B presents a simple vertical ownership along a chain shareholding. Figure 1C shows a simple pyramidal structure with a holding company at the top. Figure 1D is an example of a cross shareholding.

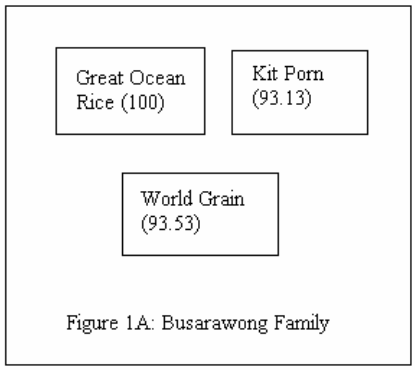

Figure 1A: Busarawong Family

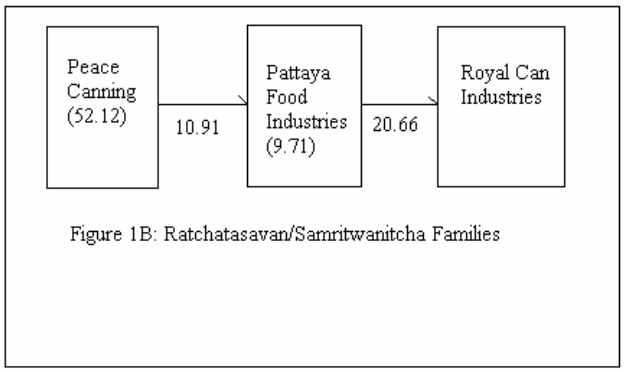

Figure 1B: Ratchatasavan/Samritwanitcha Families

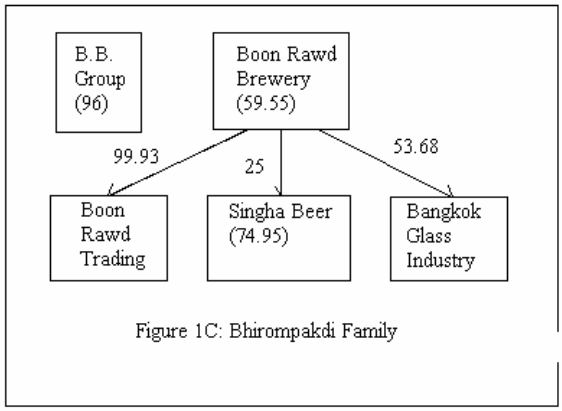

Figure 1C: Bhirompakdi Family

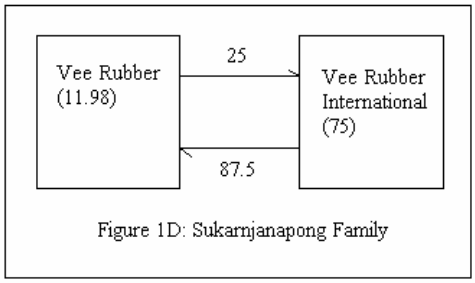

Figure 1D: Sukarnjanapong Family

Figure 2 Example of Complicated Ownership Structure in Business Groups

The arrow from firm X to firm Y denotes that firm X holds shares in firm Y. The numbers for percentage of shares held directly by the family and indirectly through chain shareholdings are not reported.

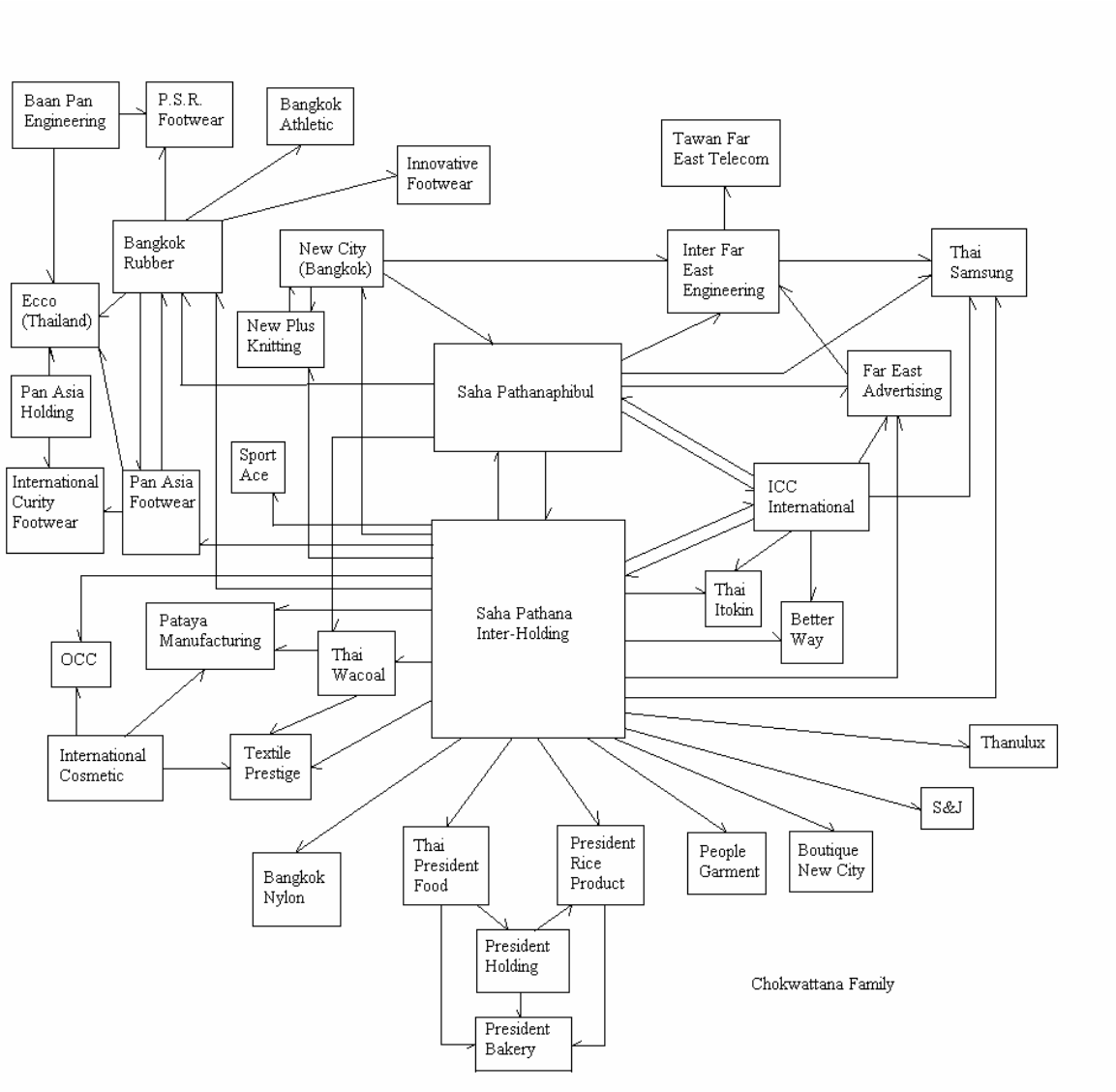

Table 1 Summary Statistics

Panel A presents summary statistics at the firm level. The sample is pooled panel data for 1995 and 1996. Listed in SET is the dummy variable that equals to one if the firm is listed in the Stock Exchange of Thailand in 1996, and equals zero otherwise. Fixed asset is the value plant, property, machines and land at the beginning of the year in million baht. Total asset is the firm's total assets at the beginning of the year in million baht. Leverage is the percentage of total liabilities to total assets at the beginning of the year. Net profit is the firm's net profit during the given year in million baht. Fixed investment is computed as fixed assets at the end of the year minus fixed assets at the beginning of the year, divided by fixed assets at the beginning of the year. Cash flows to fixed assets is computed as net profits divided by fixed assets at the beginning of the year. Both fixed investment and cash flow to fixed assets are in percentage. Age is the age of the firm in 1996. Industry Q is computed as industry average of market to book ratios at the beginning of the year across non-group firms in the 2-digit industry.

Panel B presents summary statistics at the group level. Number of fims is the number firms included in Thailand Company Information database between 1993-1996 that belong to the group. Group age is the maximum age across firms in the group. Group ownership is the average of family's cash flow right across firms in the group in 1996. Group control is the average of family voting rights in the group in 1996. Both group ownership and control are in percentage. Number of listed firms is the number of firms in the group that are listed in the Stock Exchange of Thailand in 1996. Number of financial institutions is the number of financial institutions that belong to the group in 1996. Number of broad industries is the group's number of industries closedly defined to 1-digit SIC. Number of detailed industries is the group's number of industries closedly defined to 2-digit SIC. Group width is the maximum number of firms in the group that own a particular firm in the same group. Group depth is the number of maximum chains along the group's pyramids. Groups with complicated cross shareholdings are dropped out when group width and group depth are calculated, resulting in the smaller numbers of observations.

Variable	Number of Observations	Mean	Std. Dev.	Min	Max
		Panel A: Firm Level			
Listed in SET	803	0.24	0.42	0	1
Fixed assets, million baht	803	878	3083	0.08	45231
Total assets, million baht	803	2728	6334	16.19	70418
Leverage, %	803	2.17	29.33	0	623
Net profit, million baht	803	2.73	6.33	0.02	70
Investment in fixed assets, %	803	25.63	86.86	-97.34	808.50
Cash flow to fixed assets, %	803	19.22	2395.28	-63063.64	18427.57
Age	803	20.07	12.16	2	106
Industry Q	803	1.53	0.38	0.86	2.60
		Panel B: Group Level			
Number of firm	111	5.84	7.88	2	51
Group age	111	30.95	16.59	8	115
Group ownership, %	111	54.41	25.77	6.12	100
Group control, %	111	58.31	23.30	14.95	100
Number of listed firms	111	1.50	2.67	0	18
Number of within-group intermediaries	111	0.42	1.78	0	15
Number of broad industries	111	2.12	1.33	1	6
Number of detailed industries	111	2.94	2.77	1	19
Group width	58	2.93	3.29	0	15
Group depth	58	1.73	1.37	0	6

Table 2 Corporate Ownership, Corporate Control and Internal Capital Markets in Business Groups

Dependent variable is investment in fixed assets, computed as fixed assets at the end of the year minus fixed assets at the beginning of the year, divided by fixed assets at the beginning of the year, in percentage. Cash flow to fixed assets is defined as net profits divided by fixed assets at the beginning of the year, in percentage. Group ownership is the average of family's cash flow right across firms in the group in 1996. Dummy for group's excess control equals to one if group's voting rights over member firms exceed group's cash flow rights in 1996. Industry Q is computed as industry average of market to book ratios at the beginning of the year across non-group firms in the 2-digit industry. All regressions are OLS, clustered at family level. Variables with interaction terms are demeaned. Robust standard errors are in parentheses. All regressions include firm age, year dummies and a constant (not reported). * indicates statistic significance at 10%; ** indicates statistic significance at 5%; and *** indicates statistic significance at 1%.

	Dependent Variable: Investment in fixed assets				
	(1)	(2)	(3)	(4)	(5)
Cash flow to fixed assets	0.001	0.001	0.015	0.016	0.028
	(0.001)**	(0.001)*	(0.007)**	(0.007)**	(0.007)***
Group ownership x cash flow to fixed assets			-0.001	-0.001	-0.001
			(0.000)**	(0.000)**	(0.000)**
Dummy for group's excess control x cash flow to fixed assets					-0.035
					(0.006)***
Industry Q	18.405	18.088	18.676	18.365	14.611
	(13.050)	(13.133)	(12.898)	(12.962)	(12.878)
Leverage		0.113		0.109	0.108
		(0.056)**		(0.060)*	(0.061)*
Total assets		0.000		0.000	0.000
		(0.000)***		(0.000)***	(0.000)***
Group-Year Dummies	Included	Included	Included	Included	Included
Observations	803	803	803	803	803
R-squared	0.41	0.43	0.41	0.43	0.45

Table 3 Regulation, Financial Institutions and Internal Capital Markets in Business Groups

Dependent variable is investment in fixed assets, computed as fixed assets at the end of the year minus fixed assets at the beginning of the year, divided by fixed assets at the beginning of the year, in percentage. Cash flow to fixed assets is defined as net profits divided by fixed assets at the beginning of the year, in percentage. Group ownership is the average of family's cash flow right across firms in the group in 1996. Dummy for group's excess control equals to one if group's voting rights over member firms exceed group's cash flow rights in 1996. Number of listed firms is the number of firms in the group that are listed in the Stock Exchange of Thailand in 1996. Dummy for group with intermediariess equals to one if there is at least one intermediaries belonging to the group and zero otherwise. Number of intermediaries is the number of intermediaries that belong to the group in 1996. Intermediaries include commercial banks, finance companies, insurance companies and holding companies. Industry Q is computed as industry average of market to book ratios at the beginning of the year across non-group firms in the 2-digit industry. All regressions are OLS, clustered at family level. Variables with interaction terms are demeaned. Robust standard errors are in parentheses. All regressions include firm age, year dummies and a constant (not reported). * indicates statistic significance at 10%; ** indicates statistic significance at 5%; and *** indicates statistic significance at 1%.

	Dependent Variable: Investment in fixed assets			
	(1)	(2)	(3)	(4)
Cash flow to fixed assets	0.006	0.032	0.032	0.031
	(0.002)***	(0.008)***	(0.008)***	(0.008)***
Group ownership x cash flow to fixed assets		-0.001	-0.001	-0.001
		(0.000)**	(0.000)**	(0.000)*
Dummy for group's excess control x cash flow to fixed assets		-0.036	-0.035	-0.036
		(0.006)***	(0.006)***	(0.006)***
Number of listed firms in group x cash flow to fixed assets	0.002	-0.002	-0.002	-0.000
	(0.001)**	(0.002)	(0.001)	(0.002)
Dummy for group with intermediaries x cash flow to fixed assets			-0.004	
			(0.001)***	
Number of intermediaries in group x cash flow to fixed assets				-0.002
				(0.001)***
Industry Q	17.907	14.926	13.758	13.831
	(13.110)	(12.810)	(12.960)	(12.910)
Leverage	0.111	0.108	0.108	0.106
	(0.059)*	(0.060)*	(0.060)*	(0.062)*
Total assets	0.000	0.000	0.000	0.000
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Group-Year Dummies	Included	Included	Included	Included
Observations	803	803	803	803
R-squared	0.43	0.45	0.45	0.45

Table 4 Size, Industry Diversification, Organization Structure and Internal Capital Markets in Business Groups

Dependent variable is investment in fixed assets, computed as fixed assets at the end of the year minus fixed assets at the beginning of the year, divided by fixed assets at the beginning of the year, in percentage. Cash flow to fixed assets is defined as net profits divided by fixed assets at the beginning of the year, in percentage. Number of fims in group is the number firms included in Thailand Company Information database between 1993-1996 that belong to the group. Group's total assets are the sum of total assets across firms in a group in a particular year, in thousand baht. Number of broad industries is the group's number of industries closedly defined to 1-digit SIC. Number of detailed industries is the group's number of industries closedly defined to 2-digit SIC. Group width is the maximum number of firms in the group that own a particular firm in the same group. Group depth is the number of maximum chains along the group's pyramids. Industry Q is computed as industry average of market to book ratios at the beginning of the year across non-group firms in the 2-digit industry. All regressions are OLS, clustered at family level. Robust standard errors are in parentheses. Variables with interaction terms are demeaned. All regressions include firm age, year dummies and a constant (not reported). * indicates statistic significance at 10%; ** indicates statistic significance at 5%; and *** indicates statistic significance at 1%. Groups with complicated cross shareholdings are dropped out when group width and group depth are calculated, resulting in the smaller numbers of observations.

	Dependent Variable: Investment in fixed assets						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cash flow to fixed asset	0.004	0.005	0.012	0.039	0.036	0.006	0.027
	(0.002)*	(0.009)	(0.030)	(0.007)***	(0.006)***	(0.002)***	(0.004)***
Number of firms in group x cash flow to fixed assets	0.000	0.001	0.003	0.003	-0.001	0.001	0.004
	(0.000)	(0.002)	(0.010)	(0.001)***	(0.003)	(0.000)**	(0.001)***
Group's total assets x cash flow to fixed assets		-0.000					
		(0.000)					
Group width x cash flow to fixed assets			-0.003		0.008		
			(0.014)		(0.005)		
Group depth x cash flow to fixed assets				-0.013	-0.014		
				(0.003)***	(0.002)***		
Number of broad industries in group x cash flow to fixed assets						-0.003	
						(0.001)***	
Number of detailed industries in group x cash flow to fixed assets							-0.011
							(0.002)***
Industry Q	18.509	18.653	23.425	25.396	25.801	16.301	20.622
	(13.009)	(13.016)	(14.087)*	(13.897)*	(13.859)*	(13.028)	(12.524)
Total assets	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)***	(0.000)***	(0.000)**	(0.000)***	(0.000)**	(0.000)***	(0.000)***
Leverage	0.109	0.109	0.008	-0.027	-0.024	0.110	0.104
	(0.060)*	(0.061)*	(0.076)	(0.023)	(0.019)	(0.060)*	(0.067)
Group-Year Dummies	Included	Included	Included	Included	Included	Included	Included
Observations	803	803	478	478	478	803	803
R-squared	0.43	0.43	0.47	0.48	0.49	0.43	0.44