The structure and formation of business groups: Evidence from Korean chaebols

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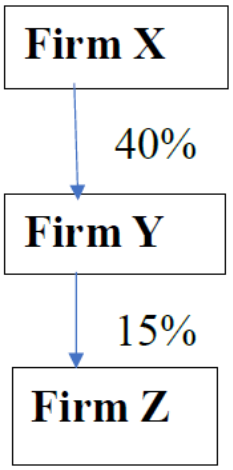
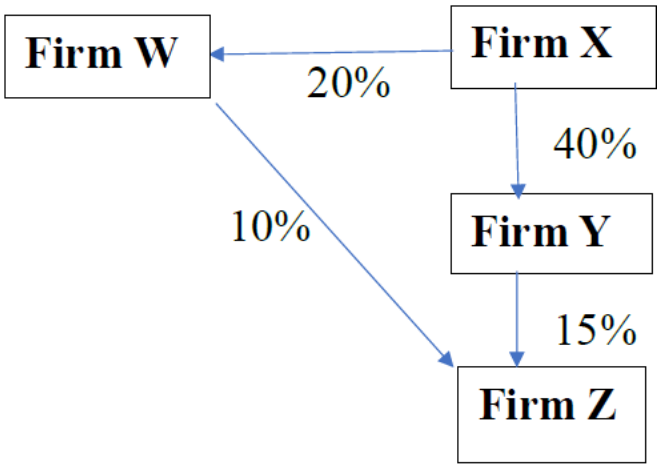
Objective of the Paper

1) Pyramid



Firms X's CF and Control right on Firm Z
CF right= $40\% \times 15\% = 6\%$
Control right= $min(40\%, 15\%) = 15\%$
Deviation=15%−6%=9%

2) Cross-holding



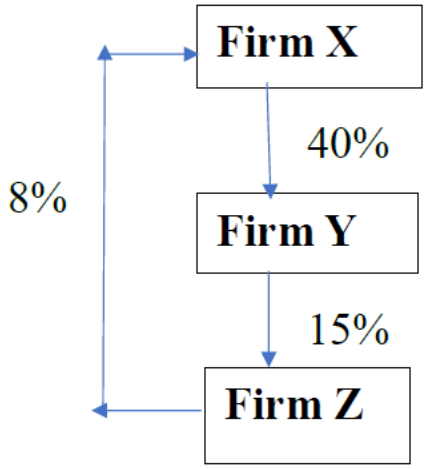
Firms X's CF and Control right on Firm Z

CF right= $(40\% \times 15\%) + (20\% \times 10\%) = 8\%$

Control right= $min(40\%, 15\%) + min\ (20\%, 10\%) = 25\%$

Deviation=25%−8%=17%

3) Circular-holding



Firms X's CF and Control right on Firm Z

CF right= $40\% \times 15\% = 6\%$

Control right= $min(40\%, 15\%) = 15\%$

Deviation$= 15\% - 6\% = 9\%$

Question: How will we measure various BG characteristics variables when the holding structure does not satisfy to be pyramid structure.

How does BG evolve? How firms enter and exits the pyramid structure of the BG?

Common accepted idea is:

Large family-based owners try to control as many firms as possible to enjoy the PBC.

Pyramid structure creates separation on cash flow right and voting right which enable the controlling family to isolate them from the fluctuation of the cash flow variability of the firm they control.

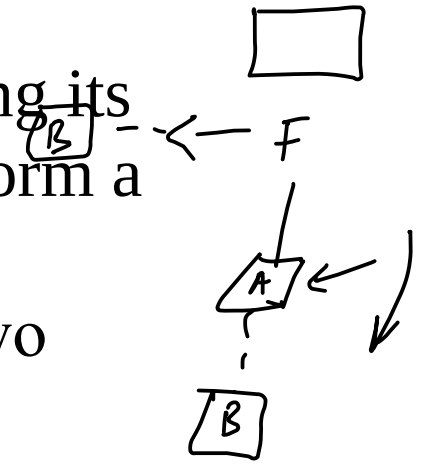
This reduce the risk of controlling the firms but enables the BG to enhance their benefits as they can tunnel firm if firms have positive Cash flow gains.

Pyramidical structure are not generally a universal pattern of holding firms across the world.
Sole objective of holding firms in BG is not due to achieve separation of the CF and voting right.

Almeida and Wolfenzon (2006) argued that the placement of the firms within a BG may be determined by the ease of using if its resource by the controlling family than by separation of CF and voting right.

Suppose a family owns firms A directly.
It decides to set up a new firm B.
It has two choices:

1) Set firm B directly under the family control like firm A.
2) Set firm B under A using its retained earnings and form a pyramidical structure.



The new firm B's value has two components:

a) Private benefit enjoyed by the controlling family
b) NPV shared by all the owners.

Under pyramid structure the NPV of the firms has to be shared by the outside owner of the firms A.

Under the direct ownership the family captures all the NPV benefit

Testable hypothesis:

1. The controlling family places new firms with low pledgeability of cash

flows/assets in pyramids and directly controls firms with high pledgeability.

Pledgeability of Cash flow:
Reported profitability of the firm

Pledgeability of assets:

Asset tangibility ($\frac{PPE}{TA}$)

Collateral ($\frac{PPE+Inventories}{TA}$)

Non-pledgeability of asset ($\frac{Intangibles}{Total\ Assets}$)

Implication: High profitability firms are held directly whereas low profitability firms are held under pyramids.

This implication counters Bertrand, Mehta and Mullinathan (2002) where they found that firms under BG has low profitability due to tunnelling. However, according to Almeid and Wolfenzon it is that low

profitability of the firms causes it to be hold under pyramids.

2. The family places low NPV firms in pyramids and directly controls firms with high NPV.

Using the sample of newly acquired firm in the BG the firms NPV is proxied by acquisition premium.

$$AP = \frac{(Deal\ Price - Market\ Price)}{Market\ Price}$$

Higher the AP higher is the intangibility of the transaction higher is the value of the firms not accommodated in the deal price.

3. since the family places low NPV firms in pyramids, investors should expect low returns from pyramidal investments.

Public group firms that are used by the family to set up and acquire new group

firms should have lower valuations than public group firms that are not used for this purpose

To test the third hypothesis, it is imperative to determine the central firm (a term from social network anlysis) in the group structure.

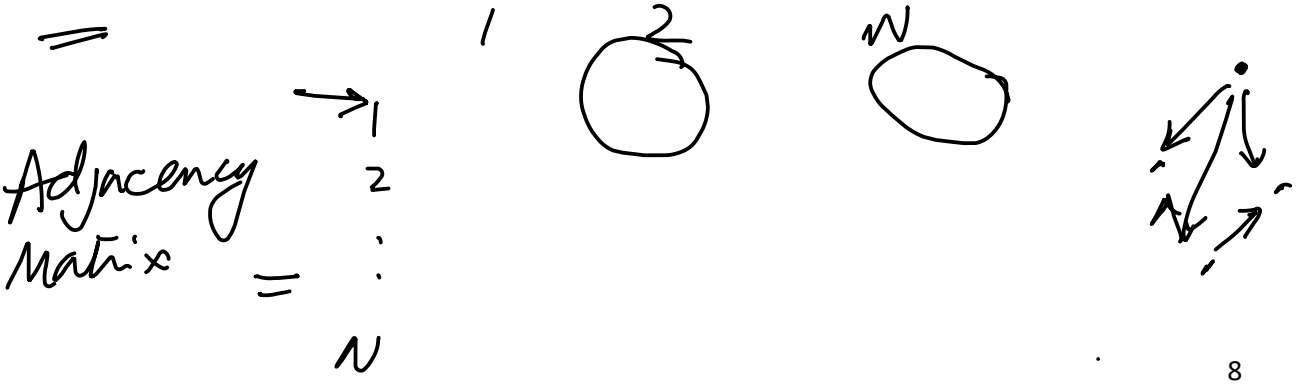
Metrics of the Group Structure:

Consider a BG of N firms where there is cross-holding of share of the firm.

Let

$\boldsymbol{f} = [f_1, f_2, \cdots, f_N]'$: Direct stakes by the family on the BG firms

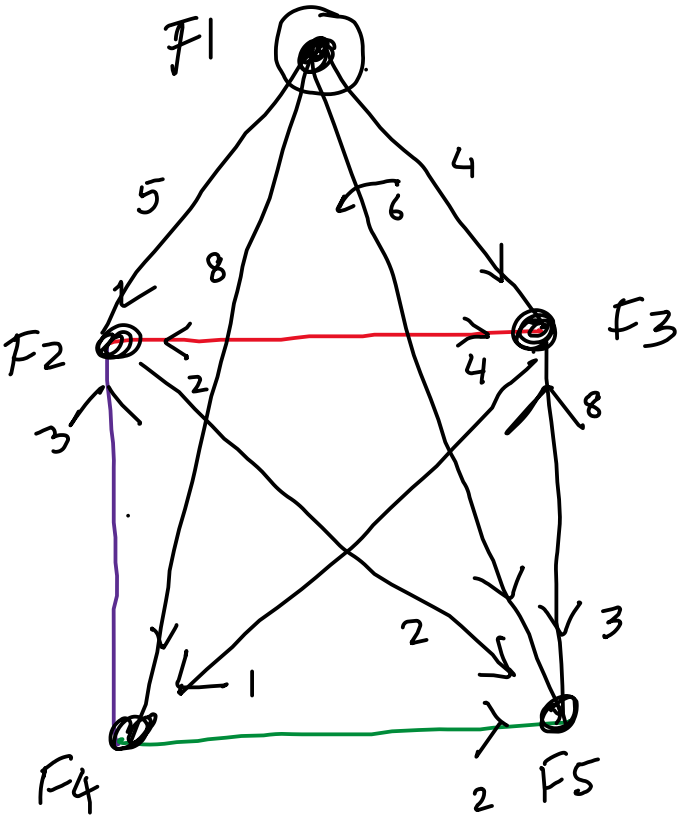
Cross-holding can be expressed as a matrix



$$A = \begin{bmatrix} 0 & s_{12} & \cdots & s_{1N} \\ s_{21} & 0 & \cdots & s_{2N} \\ \vdots & \vdots & \cdots & \vdots \\ s_{N1} & s_{N2} & \cdots & 0 \end{bmatrix}$$

Where s_{ij}: Stake of firm i on firm j.
If $s_{ij} = 8$: this implies that 8% stock of firm j held by firm i

Consider a holding of the following business group



Salient Feature of the above Group Holding.

1) Cross holding is present but small
2) Firm 1 is used to control another firm. In other word Firm 1 is the central firm
3) Within the cross-holding other firms are also central firm like firm 3.
4) Firm 5 is holded by all other firms in the group structure.

Cross-holding matrix A is given by (the values are in the percentage term)

	F1	F2	F3	F4	F5
F1	0	5	4	8	6
F2	0	0	4	0	2
F3	0	2	0	1	3
F4	0	3	0	0	3
F5	0	0	8	0	0

The family has direct holding on each firm given by

$$f = [5 \quad 5 \quad 4 \quad 7 \quad 6]'$$

The objective of this exercise is to follow 1 unit of dividend paid by a firm in the BG how it travels within the group.

Ultimate Cash flow right
Position of the firm in the BG
Centrality measure of each firm
Voting Right

Let firm i pays a dividend of 1 unit

$\boldsymbol{d_i} = [0, 0, \cdots, 1, \cdots, 0]'$ 1 in the i^{th} position.
Suppose the firm 3 in our example gives dividend.

$$d_3 = [0 \quad 0 \quad 1 \quad 0 \quad 0]'$$

Ultimate cash flow right

Let u_i: is defined as the ultimate ownership of the family on the i^{th} firm

Let $\boldsymbol{u} = [u_1, u_2, \cdots, u_N]'$

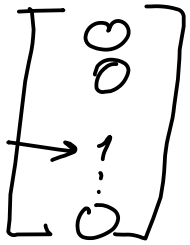
$\boldsymbol{u}$ is traced through the fraction of dividend originally paid by the i^{th} firm that is received by the family.

This ultimate ownership of the family is dependent on two things

1. The direct ownership of the family on the firms
2. Ownership on a firm through other firms in a cross-holding.

To determine the ultimate ownership of the family in the group firm i among each of the N firms.

We determine how a unit dividend by a firm i ultimately reaches to the family owners.



Let d_i unit dividend paid by firm i

The family received directly through its stock ownership= $f_i' d_i$

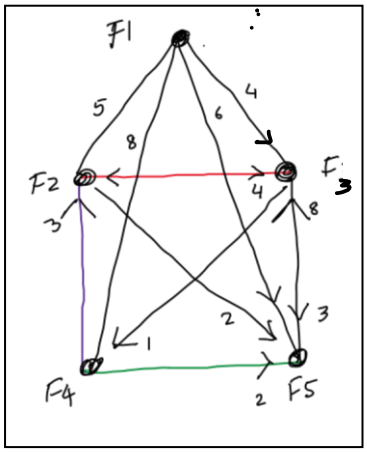
Also, the family receives indirectly the dividend of the firm i from the ownership of another firm.

Other firms that receives dividend from firm i is $A_i d_i$

The ultimate payment from this indirect ownership is $u' A_i d_i$

$$u' d_i = f' d_i + u' A d_i$$
$$u'[I - A] d_i = f' d_i$$
$$u' = f'[I - A]^{-1}$$

Example



$$\begin{bmatrix} 0 & 5 & 4 & 8 & 6 \\ 0 & 0 & 4 & 0 & 2 \\ 0 & 2 & 0 & 1 & 3 \\ 0 & 3 & 0 & 0 & 2 \\ 0 & 0 & 8 & 0 & 0 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 0.04 \\ 0.04 \\ \rightarrow 0 \\ \rightarrow 0 \\ 0.08 \end{bmatrix}$$

$$f'd_i = [.05 \quad .05 \quad .04 \quad .07 \quad .06] \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \\ 0 \end{bmatrix}$$

$$= 0.04$$

$$u_3 = 0.04 + 0.04u_1 + 0.04\,u_2 + 0.08u_5$$

System of Equations

$$u_1 = 0.05$$
$$u_2 = 0.05 + 0.05u_1 + 0.02\,u_3 + 0.03u_4$$
$$u_3 = 0.04 + 0.04u_1 + 0.04\,u_2 + 0.08u_5$$
$$u_4 = 0.07 + 0.08u_1 + 0.01\,u_3$$
$$u_5 = 0.06 + 0.06u_1 + 0.02\,u_2 + 0.03u_3 +$$

Solving the above system of equation we get

$u' = [0.05 \;\; 0.07 \;\; 0.06 \;\; 0.08 \;\; 0.08]$

$\longrightarrow$ 5 5 4 7 6

Position

The Position of a firm i in a group is defined as the distance between family and the firm i in the group.

Since there are multiple chains joining a particular firm to a family, each chain by is weighted by its cash flow

The Chains of dividend flow

In the first round:

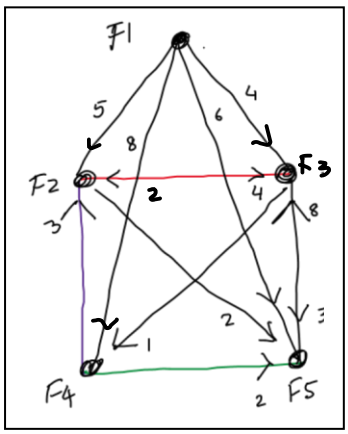
The family receives f_i proportion of dividend since it own Firm 3's stock.
It received $= f'd_i$

$$fd_i = [.05 \quad .05 \quad .04 \quad .07 \quad .06] \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \\ 0 \end{bmatrix}$$

$$= 0.04$$

The other group firms also receive a part of the dividend due its cross holding.

From the above cross holding diagram we know the firm F1, F2 and F5 will receive dividend.



$$\begin{bmatrix} 0 & 5 & 4 & 8 & 6 \\ 0 & 0 & 4 & 0 & 2 \\ 0 & 2 & 0 & 1 & 3 \\ 0 & 3 & 0 & 0 & 2 \\ 0 & 0 & 8 & 0 & 0 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 0.04 \\ 0.04 \\ 0 \\ 0 \\ 0.08 \end{bmatrix}$$

So, in the first round the firms that gets the dividend are $= Ad_i$

If any firms receives a non-operating income as dividend it pays back the dividend to its shareholders as dividends.

In the 2nd Round

In the 1st round all the firms that has stakes in the i^{th} firm will have high cash flow.

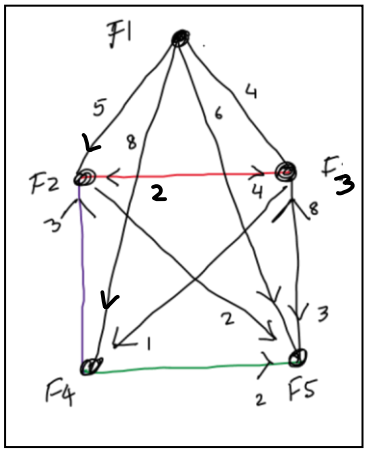
The firms that received dividend in the first round will increase the cash flow for the family firms.

In the example above, F1, F2 and F5 receives dividend and so family's cash flow increase from these firms.

$$fAd_i = \begin{bmatrix} .05 & .05 & .04 & .07 & .06 \end{bmatrix} \begin{bmatrix} 0.04 \\ 0.04 \\ 0 \\ 0 \\ 0.08 \end{bmatrix}$$

$$= \begin{bmatrix} 0.0002 \\ 0.0002 \\ 0 \\ 0 \\ 0.0048 \end{bmatrix}$$

Since F1, F2 and F5 receives dividend, it also increase the cash flow for the inter-locked firms



1st Rnd F2 receives dividend. In the 2nd round F1, F3 and F4 receives some cash flow.

1st Rnd F5 receives dividend In 2nd round all other firms F1, F2, F3 and F4 receives cash flow.

Note F5 does not receives any cashflow in the 2nd round since F5 only owns F3 share and F3 does not pay out in the 2nd round.

The cash flow received by the firms are

$$A(Ad_i) = \begin{bmatrix} 0 & 5 & 4 & 8 & 6 \\ 0 & 0 & 4 & 0 & 2 \\ 0 & 2 & 0 & 1 & 3 \\ 0 & 3 & 0 & 0 & 2 \\ 0 & 0 & 8 & 0 & 0 \end{bmatrix} \begin{bmatrix} 0.04 \\ 0.04 \\ 0 \\ 0 \\ 0.08 \end{bmatrix}$$

$$= \begin{bmatrix} 0.0020 + 0.0048 \\ 0 + 0.0016 \\ 0.0008 + 0.0024 \\ 0.0012 + 0.0016 \\ 0 \end{bmatrix} = \begin{bmatrix} 0.0068 \\ 0.0016 \\ 0.0032 \\ 0.0028 \\ 0 \end{bmatrix}$$

This Chain continues.

After n^{th} round:

The family receives $= fA^{n-1}d_i$

The group firm receives $A^n d_i$

Thus, the chains of the resource flow is given by

$f'd_i$ Family receives directly from firm i .

$f'Ad_i$: Family receives from firm i through chain that contains one intermediate firm

$f'A^2d_i$: Family receives from firm i through chain that contains two intermediate firms.

$$(position_i)P_i = \frac{f'd_i}{u_i}1 + \frac{f'Ad_i}{u_i}.2 + \frac{f'A^2d_i}{u_i}3 + \cdots$$

$$P_i = \frac{1}{u_i} f'(I-A)^{-2}d_i$$---(Position of the ith firm)

Position for all the firms together

$$P = (f'(I-A)^{-2}I)(diag(u)^{-1})$$

Control Rights

In complex group it is difficult to determine the control rights

In empirical literature they have mostly used the weakest link that is the minimum stake along the control chain.

Redefining control rights

Proposition 3. For a given threshold T, the set of firms controlled by the family is given by

$$C(T) = \{i \in N: f_i + \sum_{j \in C(T), j \neq i} s_{ji} \geq T\}$$

Algorithms to find $C(T)$ for a given T

Start with all the firms, $S(0) = N$. In the first stage, we assume that the family controls all the firms and we drop the firms in which the direct and indirect stake of the family is below T.
This procedure generates $S(1)$.

Next, we assume that the family controls only the firms in $S(1)$ and again drop from $S(1)$ the firms in which the direct and indirect stake of the family is below T. This generates $S(2)$.

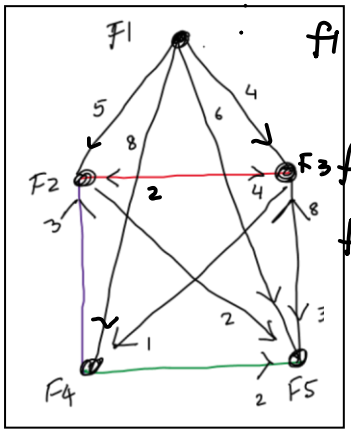
We can repeat this algorithm a number $\#N$ of times to arrive at $S(\#N)$.

$S(\#N)$ satisfies the condition that

$$C(T) = \{i \in N : f_i + \sum_{j \in C(T), j \neq i} s_{ji} \geq T\}$$

Example:

[25 5 4 7 6]



$$\begin{matrix} & & & & \\ f_1 \\ f_2 \\ f_4 \\ & & & & \end{matrix}\begin{bmatrix} 0 & 5 & 4 & 8 & 6 \\ 0 & 0 & 4 & 0 & 2 \\ 0 & 2 & 0 & 1 & 3 \\ 0 & 3 & 0 & 0 & 2 \\ 0 & 0 & 8 & 0 & 0 \end{bmatrix}$$

Direct and indirect control by family on each firm

Firm 1: $f_1 + s_{21} + s_{31} + s_{41} + s_{51} = 25$

Firm 2: $f_2 + s_{12} + s_{32} + s_{42} + s_{52} = 15$

Firm 3: $f_3 + s_{13} + s_{23} + s_{43} + s_{53} = 20$

Firm 4: $f_4 + s_{14} + s_{24} + s_{34} + s_{54} = 16$

Firm 5: $f_5 + s_{15} + s_{25} + s_{35} + s_{45} = 19$

Let's, Chose $T = 25$

Let's, Chose $T = 20$

$S(0) = \{1,2,3,4,5\}$

At $S(1) = \{1, 3\}$

Firm 1: $f_1 + s_{31} = 25$

Firm 3: $f_3 + s_{13} = 8$

$$S(2) = \{1\}$$

Therefore, $C(20) = \{1\}$

Check $C(19) = \{1\}$

Let $T = 16$

$$S(1) = \{1, 3, 4, 5\}$$

Firm 1: $f_1 + s_{31} + s_{41} + s_{51} = 25$

Firm 3: $f_3 + s_{13} + s_{43} + s_{53} = 16$

Firm 4: $f_4 + s_{14} + s_{34} + s_{54} = 16$

Firm 5: $f_5 + s_{15} + s_{35} + s_{45} = 17$

$$S(2) = \{1, 3, 4, 5\}$$

So, $C(16) = \{1, 3, 4, 5\}$

Similarly, it $T = 15$ then

$$C(15) = \{1, 2, 3, 4, 5\}$$

For any firm $i \in N$ the **critical control** threshold is given by

$$CC_i = max\{\acute{T}: \acute{i} \in \overbar{C(T)}\}$$

The critical control threshold is the highest control threshold that is consistent with family control of firm i.

In the above example,

$$CC_1 = 25$$
$$CC_2 = 15$$
$$CC_3 = 16$$
$$CC_4 = 16$$
$$CC_5 = 16$$

Centrality of the firm to control group:

we identify group firms that the controlling family uses to set up and control new firms as the central firm of the group.

$$Central_i = \frac{\sum_{j \neq i}(CC_j - CC_j^{-1})}{\#N - 1}$$

average decrease in CC across all the group firms other than firm i, after we exclude firm i from the group.
The rational of the measure

Centrality Measure of Firm 1

Removing firms 1 from the group the adjacency matrix is

$$\begin{bmatrix} 0 & 4 & 0 & 2 \\ 2 & 0 & 1 & 3 \\ 3 & 0 & 0 & 2 \\ 0 & 8 & 0 & 0 \end{bmatrix}$$

$$CC_2^{-1} = 8$$
$$CC_3^{-1} = 9$$
$$CC_4^{-1} = 8$$
$$CC_5^{-1} = 9$$

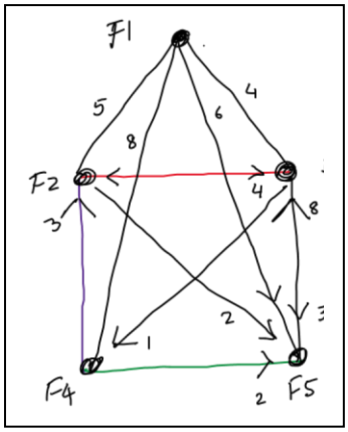
$$Centrality_1 = \frac{1}{4}\left((CC_2 - CC_2^{-1}) + (CC_3 - CC_3^{-1}) + (CC_4 - CC_4^{-1}) + (CC_5 - CC_5^{-1})\right)$$

7 7 8

$$= (15 - 8) + (16 - 9) + (16 - 8) + (16 - 9) = 29$$

$[.25 \quad .05 \quad .04 \quad .07 \quad .06]$

$$Centrality_2 = 0$$
$$Centrality_3 = 5$$
$$Centrality_4 = 5$$
$$Centrality_5 = 7$$



Consistent Voting right:Given a threshold T, the consistent voting rights of the family in firm $i \in C(T)$ are defined as

$$VR_{i(T)} = f_i + \sum_{j \in C(T), j \neq i} s_{ji}$$

Definition 4. We define the aggregate equity stake of firm i in other group firms as

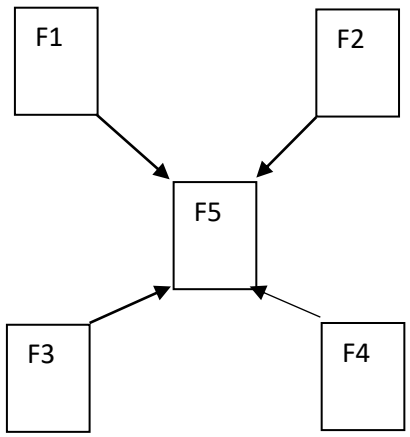
$$Stake_i = \frac{\sum_i s_{ij} E_j}{A_i}$$

Practice:

1.

Consider the following cross holding.

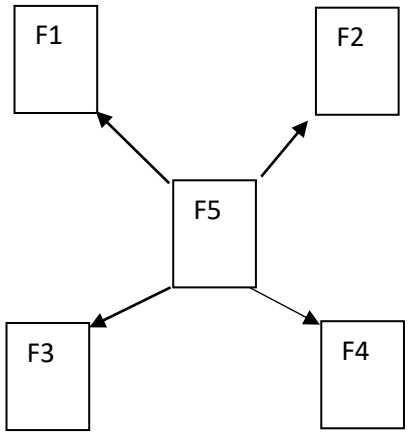
$$f = [8, 10, 12, 9, 15]$$



Determine the centrality of each firms in the cross holding

3. Consider the following cross holding.

$$f = [8, 10, 12, 9, 15]$$

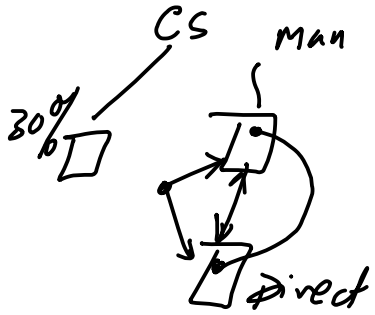


Determine the centrality of each firms in the cross holding

Data:

Korean Chaebol
Financial Data: Korean Listed Companies association (KLCA) and Korean Investors Service (KIS)
Ownership data: Korean Fair-Trade Commission (KFTC)
Business group affiliation is determined by KFTC
They use two criteria

1. Ownership of the controlling shareholders and related person is

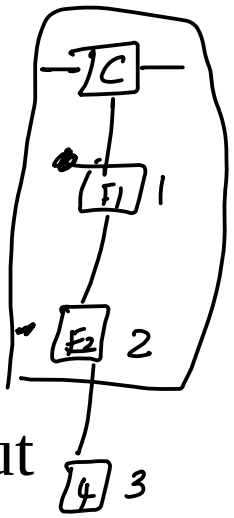


more than 30% excluding the preferred shares

2. Controlling shareholder has controlling influence either through directors' or managers' exchange or through substantial business transaction

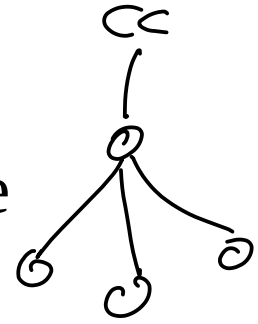
Period: 1998-2004
Includes data only on family-controlled BG
Sample: 3545 firm year observation.

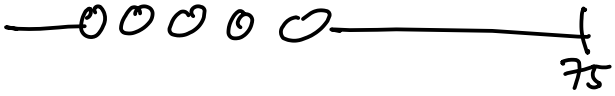
Some observation
Controlling family has 13% of cash flow right of the median firm
The family and the affiliate firms hold 68% of the votes of the median firm
The critical control threshold (CC) of the median firm is 30%.
The median position of the firms is 2.06 implying substantial pyramid structure but



having only one intermediate firm in between.

75^{th} percentile of the centrality measure is zero implying that only few firms are central to the business group. Only few firms are used as central firm to acquire new firm

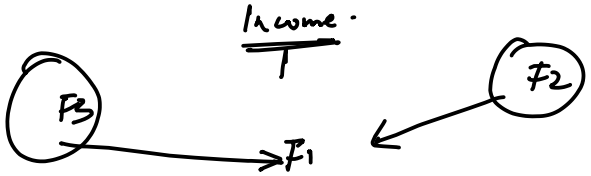




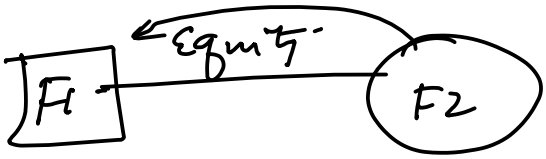
Many firms in the Cheabols are private firms. Median Cheabols are 13 years old with 190 employees.

A typical firm in Chaebol is young and small.

Measure of firm's Profit



$$Affiliate\ Profit = Gain\ from\ holding\ other\ firm's\ equity - Loss\ from\ holding\ other\ firm's\ equity.$$



$$Standalone\ Assets = Total\ asset - Equity\ stock\ of\ other\ firms$$

$$Standalone\ Profitability = \frac{Ordinary\ Income + Int\ Pay - Aff\ Profit}{Stand-alone\ Asset}$$

$$Q = \frac{EV + Book\ value\ of\ liabiliteis}{Book\ value\ of\ the\ assets}$$

Other measures

$$Leverage = \frac{Non\ Current\ Liabilities}{Stand\text{-}alone\ assets}$$

$$Accrual = \frac{|PAT - CF\ from\ Op\ Act|}{Stand-alone\ Assets}$$

$$Tangibility = \frac{PPE}{Stand-alone\ Assets}$$

$$Intangibility = \frac{Intangibile\ assets}{Stand - alone\ Assets}$$

$$Collateral = \frac{PPE + Inventories}{Stand - alone\ Assets}$$

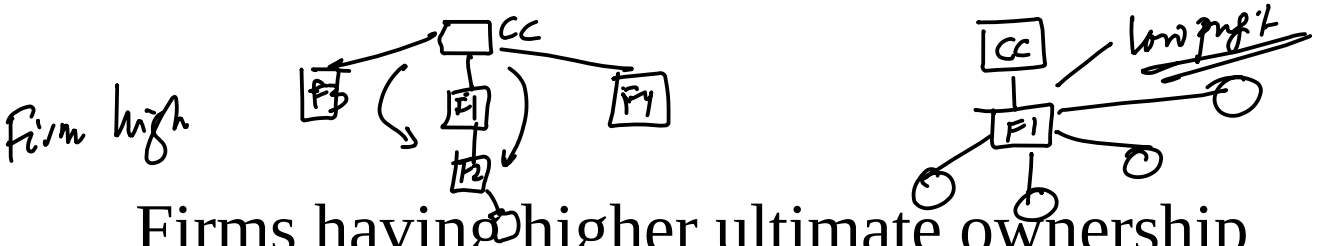
From the acquisition data the NPV of the acquisition

$$Acquisition\ Premium = \frac{Acquisition\ Premium}{BV\ of\ Equity}$$

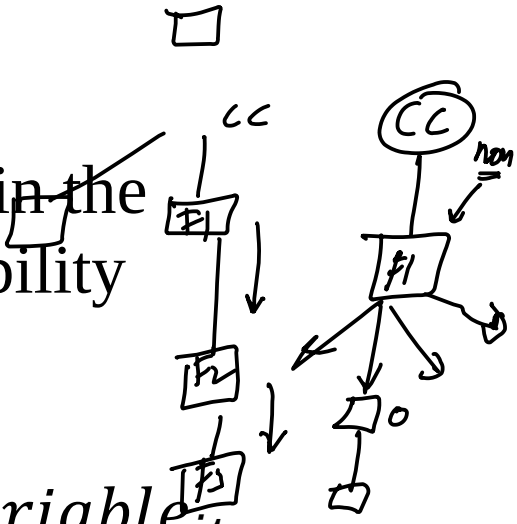
There were 303 acquisition out of which there was data of acquisition premium of 141 acquisition.

$$Acquisition\ Intensity = \frac{\text{sum of the value of equity stakes acquired by each group firm in the acquisition of a new group firm}}{BV\ of\ equity\ of\ acquirer}$$

Hypothesis tested:



Firms having higher ultimate ownership have higher profit (they are kept nearer to the family owner)



Firms used to hold other firms in the business group has less profitability

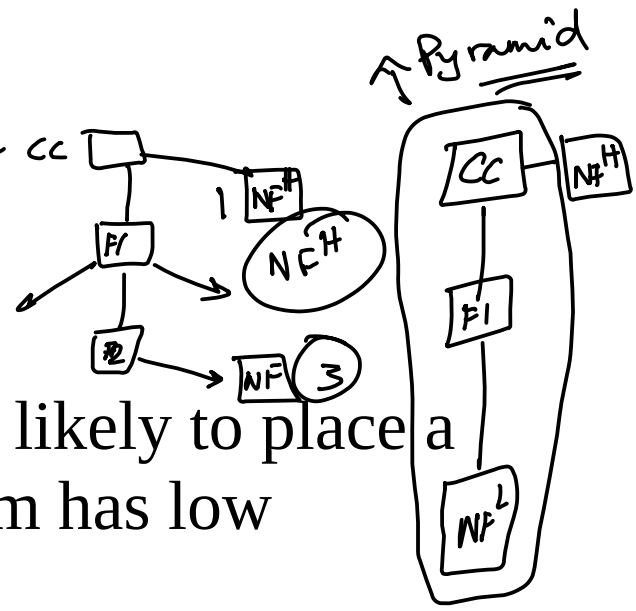
$$SA\ Profitability_{it} = \beta_1 Ownership\ Variable_{it} + \beta Control_{it} + Ind\ FE_j + Year\ FE_t + \epsilon_{it}$$

Ownership Variable:

- Ultimate Ownership
- Separation VR=Voting right-Ult ownership
- Separation CC=CC-Ult ownership

	Dependent variable: *Stand-alone profitability*							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Firm age	−0.223	0.074	−0.098	0.125	−0.089	0.118	−0.161	0.110
	(−0.866)	(0.259)	(−0.387)	(0.435)	(−0.354)	(0.411)	(−0.586)	(0.368)
Ln assets	0.008***	0.007**	0.006**	0.006**	0.006**	0.006**	0.008***	0.007**
	(2.824)	(2.216)	(2.319)	(2.165)	(2.244)	(2.184)	(2.795)	(2.170)
Public	−0.002	−0.002	−0.011	−0.010	−0.005	−0.005	−0.002	−0.002
	(−0.314)	(−0.215)	(−1.380)	(−1.269)	(−0.670)	(−0.649)	(−0.214)	(−0.218)
Leverage	−0.053***	−0.050***	−0.052***	−0.049***	−0.052***	−0.049***	−0.053***	−0.050***
	(−4.683)	(−4.052)	(−4.669)	(−4.030)	(−4.711)	(−4.065)	(−4.623)	(−4.018)
Ultimate ownership	0.064***	0.058***					0.067***	0.061***
	(4.132)	(3.173)					(4.242)	(3.298)
Separation VR			−0.020	−0.016				
			(−1.579)	(−1.211)				
Separation CC					−0.040	−0.042		
					(−1.586)	(−1.445)		
Centrality							−0.089**	−0.102**
							(−2.140)	(−2.141)
Cross-shareholdings							0.002	0.007
							(0.286)	(1.122)
Constant	−0.105*	−0.046	−0.064	−0.019	−0.063	−0.017	−0.127**	−0.240***
	(−1.826)	(−0.724)	(−1.113)	(−0.304)	(−1.096)	(−0.277)	(−2.118)	(−3.873)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group fixed effects	No	Yes	No	Yes	No	Yes	No	Yes
Observations	2643	2643	2643	2643	2643	2643	2620	2620
R^2	0.097	0.163	0.086	0.156	0.086	0.157	0.098	0.165

Selection hypothesis:



Controlling family is more likely to place a firm in a pyramid if the firm has low profitability.

The following model was estimated:

$$Position_{it} = \alpha_1 Standalone\ Profit_{it-1} + \Phi Control_{it} + Industry\ FE_j + Year\ FE_t + \epsilon_{it}$$

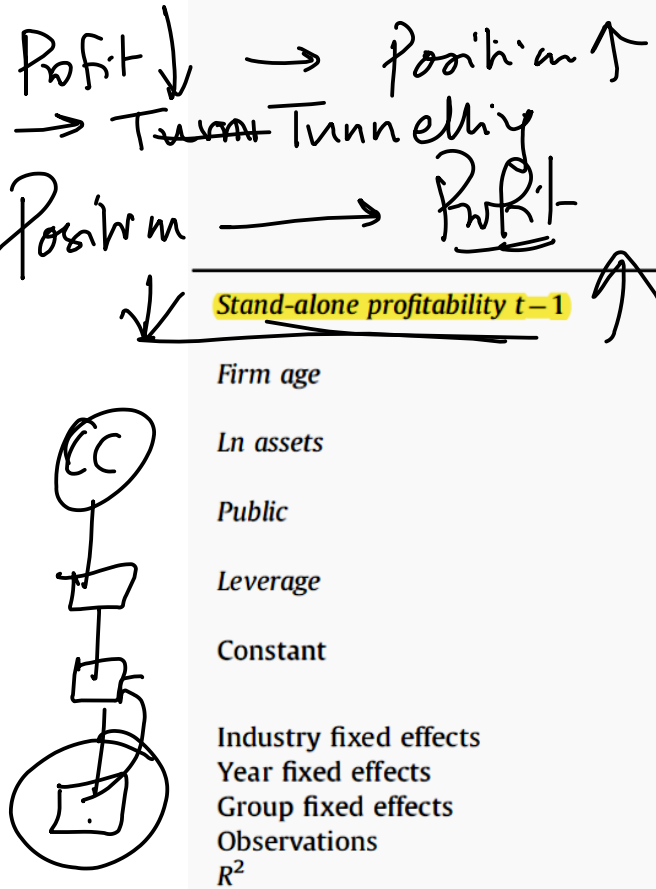
According to the standalone hypothesis

$\alpha_1 < 0$

The standalone hypothesis states that low profitable firm has high position for non-central firm. Tested using sample split by centrality median.

Probability of being in pyramid.

$Pyramid_i$ is 1 if $Position_i > 2$



	Regression model Dependent variable: Position				Probit model Dependent variable: Pyramid	
	All firms		Non-central	Central	Non-central	
	(1)	(2)	(3)	(4)	(5)	(6)
Stand-alone profitability t−1	−0.380**	−0.347**	−0.347**	−0.403	−2.308***	−2.857***
	(−2.567)	(−2.274)	(−2.201)	(−1.293)	(−4.813)	(−5.269)
Firm age	−9.557***	−8.356***	−10.455***	6.674	−32.171***	−36.757***
	(−3.997)	(−3.367)	(−3.379)	(1.399)	(−4.419)	(−4.523)
Ln assets	−0.027	−0.078***	−0.028	−0.070	0.086*	0.019
	(−1.143)	(−3.422)	(−1.118)	(−1.218)	(1.695)	(0.311)
Public	−0.111	−0.072	0.008	−0.387**	−0.039	−0.050
	(−1.309)	(−0.913)	(0.102)	(−2.154)	(−0.188)	(−0.239)
Leverage	−0.123*	−0.147**	−0.169**	−0.112	−0.183	−0.137
	(−1.697)	(−2.010)	(−2.204)	(−0.569)	(−1.300)	(−0.861)
Constant	2.461***	3.021***	1.499*	3.237***	−0.080	0.427
	(3.528)	(3.579)	(1.907)	(2.851)	(−0.0918)	(0.322)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Group fixed effects	No	Yes	Yes	Yes	No	Yes
Observations	2160	2160	1745	396	1386	1325
R^2	0.287	0.455	0.454	0.668	NA	NA

Low profitability of the firms having high positional value can result from tunnelling of the resources by the controlling family.

Alternate test to distinguish between selection any tunnelling hypothesis.

Antecedent of tunnelling hypothesis:

The position of the firm in the BG incentivizes tunnelling. High positional value firm are more likely to be tunnelled.

Antecedent of selection hypothesis

Low profitability of the firms drives the firm down in the BG leading to increase in the positional value.

Test: Annual change in positional value of the firm in BG. If profitability drives change in the positional value then it is likely to selection hypothesis

Test 1

$$Position\ Increase = 1\ if\ Pos_t - Pos_{t-1} > 0.1$$
$$Position\ Decrease = 1\ if\ Pos_t - Pos_{t-1} < -0.1$$

0.1 if 10% of the SD of the position value.

Test 2

A cleaner test is to include those firm that had joined the BG in 1998-2004 and use the profitability of the firm prior to joining the BG.

303 firms joined the BG and of these firms 163 had performance data.

Test if the profitability of the firm prior to joining the BG. If low profitable firm joins a BG and it has higher positional value then the selection hypothesis drives the relationship

Test 3

Test if the new firm's probability to be in a pyramid increase if it has low profitability prior to joining the BG.

	Dependent variable							
	Position increase		*Position decrease*		*Position*			*Pyramid*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Stand-alone profitability t−1	−0.380*	−0.468*	0.317	0.596	−1.709***	−1.591***	−1.717***	−4.279***
	(−1.645)	(−1.915)	(0.989)	(1.565)	(−2.904)	(−2.619)	(−2.722)	(−2.798)
Firm age	−3.967	−3.677	−2.246	1.511	19.044**	22.311**	17.049*	13.673
	(−1.142)	(−0.887)	(−0.615)	(0.386)	(2.105)	(2.358)	(1.739)	(0.770)
Ln assets	0.053*	0.020	0.020	−0.028	−0.002	−0.053	−0.026	0.277**
	(1.814)	(0.611)	(0.719)	(−0.857)	(−0.0234)	(−0.794)	(−0.307)	(2.078)
Public	0.019	0.035	−0.003	−0.074	−0.921***	−0.988***	−0.801***	−1.264*
	(0.158)	(0.280)	(−0.028)	(−0.647)	(−3.795)	(−3.859)	(−3.010)	(−1.898)
Leverage	−0.121	−0.246	0.087	0.107	−0.411	0.137	−0.483	−1.058*
	(−1.030)	(−1.624)	(0.851)	(0.978)	(−1.317)	(0.400)	(−1.563)	(−1.767)
Constant	−1.094**	−0.260	−1.433***	1.045	3.848***	2.857*	5.665***	−3.666
	(−2.133)	(−0.266)	(−2.823)	(0.955)	(2.847)	(1.896)	(4.031)	(−1.556)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group fixed effects	No	Yes	No	Yes	No	Yes	No	No
Firms in sample	All	All	All	All	Additions	Additions	Additions Not owned by chaebol	Additions
Observations	1849	1641	1820	1786	143	143	127	113
R^2	NA	NA	NA	NA	0.531	0.750	0.567	NA

Testing using Pledgeability of resource

Firms having larger pledgeability of asset are nearer to the controlling owner implying lower positional value.

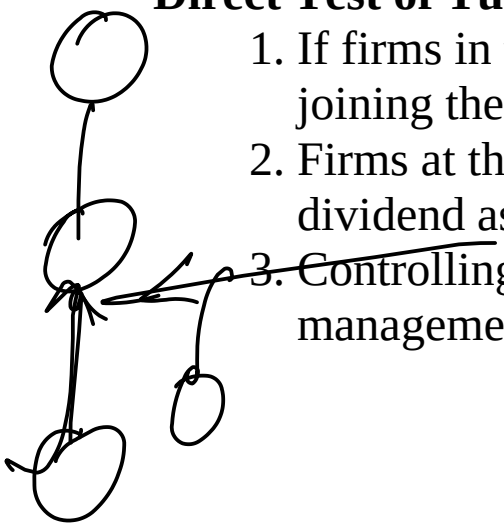
Using the stock (of firm) based proxy of pledgeability prior to joining the BG. The estimation uses only the sample of new firms that joined the BG i.e. 141 of them

The result with the pledgeability **is not conclusive.**

	Dependent variable:					
	Position (1)	*Pyramid* (2)	*Position* (3)	*Pyramid* (4)	*Position* (5)	*Pyramid* (6)
Stand-alone profitability t−1	−1.727***	−4.188***	−1.904***	−2.436	−1.699***	−4.015**
	(−2.785)	(−2.673)	(−2.626)	(−1.562)	(−2.709)	(−2.439)
Tangibility t−1	−0.186	−0.518				
	(−0.578)	(−0.928)				
Collateral t−1			−0.341	−1.798*		
			(−0.663)	(−1.756)		
Intangibles t−1					0.975	0.934
					(1.500)	(0.670)
Firm age	20.209**	16.218	14.936	9.983	20.199*	38.696*
	(2.192)	(0.881)	(1.645)	(0.517)	(1.860)	(1.653)
Ln assets	0.009	0.312**	−0.024	0.504***	−0.012	0.269*
	(0.119)	(2.483)	(−0.263)	(2.763)	(−0.172)	(1.669)
Public	−0.918***	−1.327**	−0.772***	−1.900**	−0.951***	−2.104**
	(−3.792)	(−2.087)	(−2.751)	(−2.492)	(−3.126)	(−2.518)
Leverage	−0.379	−0.970	−0.370	−1.480**	0.125	0.002
	(−1.216)	(−1.544)	(−0.871)	(−2.063)	(0.298)	(0.00165)
Constant	5.081***	−5.344**	2.319	−7.496**	3.522**	−6.155**
	(4.050)	(−2.411)	(1.316)	(−2.458)	(2.420)	(−2.173)
Industry fixed effects	Yes	No	Yes	No	Yes	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Group fixed effects	No	No	No	No	No	No
Observations	141	111	110	71	105	84
R^2	0.538	NA	0.558	NA	0.495	NA

Direct Test of Tunnelling.

1. If firms in the BG are tunnelled then on average after joining the profit should decrease
2. Firms at the bottom of the group are likely to pay less dividend as the cash flow are diverted.
3. Controlling owner is likely to do more accrual management to hide the tunnelling.



	Dependent variable							
	Dividends/ Stand-alone assets	*Accruals*	*Change in stand-alone profits*		*Change in dividends*		*Change in accurals*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	−0.001	0.366***	−0.001	0.379	0.003**	−0.037	0.016	0.377
	(−0.099)	(3.560)	(−0.0247)	(1.033)	(2.456)	(−1.446)	(0.380)	(0.987)
Firm age	−0.077**	−0.054		1.131		−0.153		−4.054
	(−2.376)	(−0.222)		(0.357)		(−1.272)		(−1.224)
Ln assets	0.000	−0.011***		−0.002		0.002		−0.001
	(0.176)	(−4.275)		(−0.171)		(1.331)		(−0.102)
Public	0.003**	−0.002		0.035		0.002		0.015
	(2.410)	(−0.270)		(0.717)		(0.728)		(0.265)
Leverage	−0.003**	0.079***		0.065		−0.002		−0.073
	(−2.427)	(4.573)		(0.778)		(−0.560)		(−0.804)
Stand-alone profitability	0.035***							
	(7.725)							
Position	−0.000	0.001		0.038		0.002		0.006
	(−0.621)	(0.251)		(1.572)		(1.058)		(0.251)
Industry fixed effects	Yes	Yes	No	Yes	No	Yes	No	Yes
Year fixed effects	Yes	Yes	No	Yes	No	Yes	No	Yes
Observations	2643	2629	137	118	138	119	137	119
R^2	0.194	0.108	0.000	0.235	0.000	0.397	0.000	0.372

The result does not show any evidence of tunnelling.

Testing of the hypothesis 2

Firms with high NPV are near to it and low NPV in pyramids.

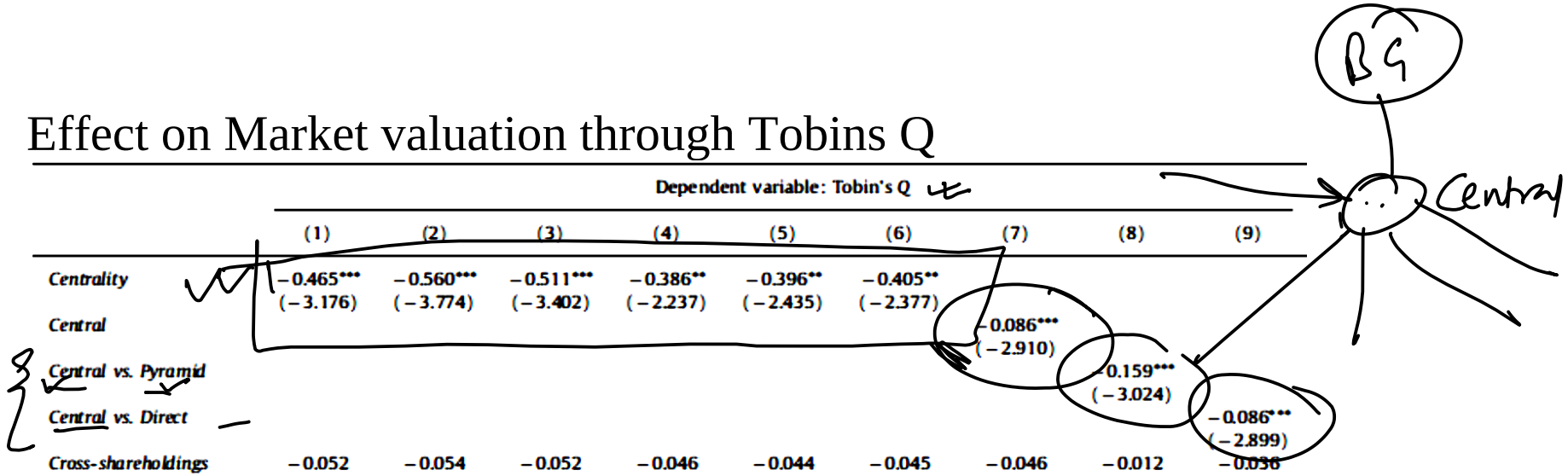
Hg AC ↑ → NPV ↓

High Acquisition premium implies low NPV.

	Dependent variable: *Position*				
	(1)	(2)	(3)	(4)	(5)
Acquisition premium	0.142**	0.104**	0.115**	0.108**	0.100*
	(2.560)	(2.091)	(2.317)	(1.998)	(1.680)
Stand-alone profitability t−1		−1.033**	−0.981**	−0.924*	−1.330**
		(−2.180)	(−2.097)	(−1.921)	(−2.509)
Firm age		25.758***	27.320***	33.760***	37.106***
		(2.904)	(3.103)	(3.781)	(3.818)
Ln assets		−0.004	0.030	−0.004	−0.011
		(−0.0706)	(0.560)	(−0.0628)	(−0.156)
Public		−1.085***	−1.142***	−1.223***	−1.233***
		(−3.531)	(−3.753)	(−4.089)	(−3.817)
Leverage		0.170	−0.061	0.188	0.461
		(0.440)	(−0.149)	(0.388)	(0.808)
Capital expenditure			0.683	0.924*	1.427**
			(1.476)	(1.884)	(2.203)
Constant	2.477***	2.529***	1.889*	1.988	2.379
	(20.59)	(2.757)	(1.963)	(1.564)	(1.584)
Industry fixed effects	No	No	No	No	Yes
Year fixed effects	No	Yes	Yes	Yes	Yes
Group fixed effects	No	No	No	Yes	Yes
Observations	108	107	106	106	106
R^2	0.058	0.409	0.432	0.652	0.782

Effect on Market valuation through Tobins Q

	Dependent variable: Tobin's Q								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Centrality	−0.465***	−0.560***	−0.511***	−0.386**	−0.396**	−0.405**			
	(−3.176)	(−3.774)	(−3.402)	(−2.237)	(−2.435)	(−2.377)			
Central							−0.086***		
							(−2.910)		
Central vs. Pyramid								−0.159***	
								(−3.024)	
Central vs. Direct									−0.086***
									(−2.899)
Cross-shareholdings	−0.052	−0.054	−0.052	−0.046	−0.044	−0.045	−0.046	−0.012	−0.036
	(−1.597)	(−1.630)	(−1.591)	(−1.107)	(−1.068)	(−1.104)	(−1.442)	(−0.300)	(−1.077)
Firm age	−4.265***	−4.258***	−4.265***	−4.596***	−4.521***	−4.558***	−4.299***	−3.375***	−3.896**
	(−3.694)	(−3.623)	(−3.672)	(−3.393)	(−3.246)	(−3.344)	(−3.663)	(−2.760)	(−2.487)
Size	0.083***	0.087***	0.086***	0.089***	0.090***	0.090***	0.083***	0.111***	0.064***
	(5.841)	(6.398)	(6.380)	(5.346)	(5.369)	(5.354)	(5.736)	(5.586)	(3.960)
Stand-alone profitability	0.259	0.253	0.252	0.342	0.340	0.342	0.282	0.548**	−0.176
	(1.149)	(1.136)	(1.138)	(1.644)	(1.648)	(1.649)	(1.242)	(2.220)	(−0.536)
Capital expenditure	0.418*	0.402*	0.393*	0.330	0.328	0.329	0.426*	0.732**	0.278
	(1.891)	(1.844)	(1.806)	(1.570)	(1.565)	(1.571)	(1.910)	(2.135)	(1.374)
Leverage	0.059	0.068	0.068	0.002	0.001	0.002	0.053	−0.079	0.179
	(0.463)	(0.528)	(0.534)	(0.017)	(0.008)	(0.020)	(0.409)	(−0.648)	(1.224)
Ultimate ownership	−0.114			−0.061			−0.121	−0.051	−0.194**
	(−1.231)			(−0.440)			(−1.283)	(−0.390)	(−1.988)
Separation VR		−0.069			0.030				
		(−0.819)			(0.336)				
Separation CC			−0.215*			0.017			
			(−1.908)			(0.138)			
Constant	−1.429***	−1.103***	−1.101***	−1.573***	−1.597***	−1.581***	−1.436***	−2.126***	−0.907**
	(−3.780)	(−3.002)	(−3.002)	(−3.538)	(−3.545)	(−3.531)	(−3.701)	(−3.927)	(−2.141)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group fixed effects	No	No	No	Yes	Yes	Yes	No	No	No
Observations	807	807	807	807	807	807	807	482	422
R^2	0.426	0.425	0.427	0.527	0.527	0.527	0.425	0.577	0.503



The reason for the negative valuation of the central firm is that the BG owner would use these firm for acquiring other firms.

One need to check the acquisition activities of the central firm compared to other firms.

Defining acquisition intensity:

Sum of the value of equity stakes acquired by each group firm in the event of an acquisition of a new group firm, divided by the book value of the equity of the acquirer

$$Acq\ Int = \frac{\sum_j EV_{ij}^{a}}{BV_i}$$

Next we look at:

1) whether central firm have more acquisition intensity.
2) if central firms undertake more acquisition then what are the market valuation.

	Dependent variable:					
	Acquisition intensity			Tobin's *Q*		
	(1)	(2)	(3)	(4)	(5)	(6)
Central				−0.032	−0.072***	−0.056*
				(−1.262)	(−2.720)	(−1.886)
Acquirer				0.091	0.089*	0.106**
				(1.607)	(1.662)	(2.065)
Central ×Acquirer				−0.101	−0.130*	−0.143*
				(−1.218)	(−1.695)	(−1.958)
Centrality t−1	0.046***	0.029**	0.025*			
	(3.355)	(2.205)	(1.790)			
Firm age		0.079*	0.086*		−4.327***	−4.769***
		(1.835)	(1.719)		(−5.624)	(−5.309)
Ln assets		0.000	0.001			
		(1.406)	(1.273)			
Public		0.002	0.001			
		(1.147)	(0.982)			
Leverage		0.001	0.001		0.049	0.000
		(0.809)	(1.085)		(0.747)	(0.00375)
Cross-shareholdings					−0.046**	−0.042*
					(−2.169)	(−1.699)
Size					0.080***	0.087***
					(8.925)	(8.094)
Stand-alone profitability					0.301**	0.358***
					(2.560)	(2.972)
Capital expenditure					0.423***	0.330**
					(2.898)	(2.301)
Ultimate ownership		−0.000	0.002		−0.132*	−0.064
		(−0.151)	(0.678)		(−1.759)	(−0.650)
Constant	0.003**	−0.008	−0.016*	0.657**	−0.970***	−1.117***
	(2.128)	(−1.311)	(−1.860)	(2.358)	(−2.751)	(−3.004)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Group fixed effects	No	No	Yes	No	No	Yes
Observations	1937	1885	1885	812	803	803
R^2	0.041	0.049	0.068	0.307	0.430	0.532