A Research on Pecking Order Theory of Financing:
The Case of Korean Manufacturing Firms

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ABSTRACT

This paper empirically tests pecking order theory. Korean listed firms are used as the samples. On the whole we find supportive results for pecking order theory. The fixed effect model on the whole period shows that as pecking order theory suggests that debt ratio decreases as cash flow, ROA, physical assets, and firm size increase. Again, it is shown that corporate debt ratio significantly decreases as cash flow or ROA increases in every sub-sample, which coincides with the prediction of pecking order theory. Corporate debt ratio significantly decreases as physical assets or firm size increases in case of the whole sample, pre-financial crisis period, and the sub-samples by q-ratio, which also supports the prediction of pecking order theory. Statistical significance of the coefficients of physical assets or firm size completely disappears after Korean financial crisis. Perhaps it is because the role of physical assets or firm size as a mitigator of information asymmetry significantly weakens after the financial crisis as Korean financial market becomes more transparent. For small firms only size variable is negatively and significantly related with debt to assets. It seems that size is an important factor for smaller firms in making financing decision.

Keywords: *Pecking order theory, Korean financial crisis, fixed effect model, OLS, q-ratio, size*

1. MOTIVATION

The pecking order model predicts that external debt financing is driven by the internal financial deficit. It is often compared to a static trade-off model, which predicts that each firm adjusts gradually toward an optimal debt ratio. Myers & Majluf [12] proposed that under information asymmetry corporate financing follows certain order if information asymmetry exists in the market. The argument is named 'pecking order theory of financing.' Information asymmetry arises when it is believed that management has superior information about corporate state to potential external investor. The theory insists that firms prefer internal funds to external ones. They are out for external funds only in case internal funds are dried up. Among external funds debt financing is preferred to equity issue. Firms issue equity only when no more debt is available. It is because firms prefer internal funds with lower risk and cost when there exists information asymmetry in the market. Raising external funds by bonds or equity offers

negative signal to the market and firms try to raise eternal funds only when no more internal funds are available. Especially raising external funds by equity transmits information to external investors that the stock price is overpriced.

This paper is interested in empirically testing pecking order theory systematically introduced by Myers and Majluf [12]. Korean listed firms are used as the samples. The data includes a set of panel data by 186 non-financial companies which are continuously listed on the Korean Exchange for the periods of 1980 to 2004. Existing empirical studies on pecking order theory presented in Korea are not frequent and show no consistent results. Most of the extant literatures are anchored on the data from the years before the Korean financial crisis in 1997. Thus we make sub-samples around the occasion of Korean financial crisis. Furthermore we make sub-samples according to q-ratio and firm size. We do this because the occasion of Koreans financial crisis brought about a wide range of structural change in the Korean corporate society, and because it is believed that q-ratio and firm size contain information on firm quality. Firms with greater q-ratio and firm size are exposed less information asymmetry, and thus pecking order theory would work in a different way according to the

magnitude of these variables. In sum, our primary purpose is to examine the theoretical implication of pecking order theory as it is reflected in the financing behavior of Korean listed firms. Especially, our paper is differentiated in the following points. We extend test period. And we construct sub-samples according to the occasion of Korean financial crisis, the magnitude of firm value, and firm size to compare any possible difference between them.

We document that pecking order theory is supported on the whole. The fixed effect regression analysis on the whole period shows that as pecking order theory suggests debt ratio decreases as cash flow, ROA, physical assets, and firm size increase. In every sub-samples of corporate debt ratio very significantly decreases as cash flow or ROA increases, which coincides with the prediction of pecking order theory. Corporate debt ratio significantly decreases as physical assets or firm size increases in case of whole sample, pre-financial crisis period, and the sub-samples by q-ratio, which also supports the prediction of pecking order theory. Non-debt tax shields, however, reveal no significance from all of the regression equations. Section Ⅱ summarizes literature review and formulates testable hypotheses. Section Ⅲ considers research methodology. Section Ⅳ presents the results of empirical analysis. And finally, section Ⅴ shows conclusion and discussion.

2. LITERATURE REVIEW AND TESTABLE HYPOTHESES

2.1. Literature Review

There are many literatures on pecking order theory. Among them Narayanan [13], Shyam-Sunder and Myers [14], Fama & French [2], and Kwack Seh Young [11] render supportive results. Helwege & Liang [6], Frank & Goyal [4], Yoon Jong In and Kim Hyeong Chul [17], and Yoon Soon Suk [16], however report the other results. Narayanan [13] supports pecking order theory by suggesting that issue of risky debt is more favorable compared to equity issue. Narayanan [13] extends the study of Myers and Majluf [12] by allowing firms to issue risky debt. He shows that debt is attractive to firms with strong growth potential (high-quality firms); even if it is not useful as a signaling device to separate them from firms with negative NPV projects (low-quality firms). He documents that debt financing results in higher than average quality firms and that debt acts as an entry barrier that keeps the worst firms from the market, which improves the pool and therefore improves the efficiency of market valuations. If firms follow the pecking order, then in a regression of net debt issues on the financing deficit, a slope coefficient of one should be observed. Shyam-Sunder and Myers [14] test traditional capital structure models against the alternative of a pecking order model of corporate financing. They find strong support for this prediction in a sample of 157 firms that were traded over the period of 1971 to 1989. They show that their tests reject the pecking order theory against trade-off hypothesis. Chirinko & Singha [1], however, raise a question on the results of Shyam-Sunder and Myers [14] by showing that their test generates

misleading inferences when evaluating plausible patterns of external financing. Their results, coupled with the power problem with the static trade-off model documented by Shyam-Sunder and Myers [14], indicate that their empirical evidence can evaluate neither the pecking order theory nor static trade-off models. Chirinko & Singha [1] conclude that alternative tests are needed that can identify the determinants of capital structure and can discriminate among competing hypotheses. Fama & French [2] find evidence confirming the pecking order model but contradicting the trade-off model. As the pecking order model predicts, short-term variation in investment and earnings is mostly absorbed by debt. Helwege & Liang [6] test the pecking order model of capital structure by examining the financing of firms that went public in 1983 and issued securities in the years of 1984 to 1992. Their results indicate that the probability of obtaining external funds is unrelated to the shortfall in internally generated funds, although firms with cash surpluses avoid external financing. They show that firms having access to the capital markets do not follow the pecking order when choosing the type of security to offer.

Frank & Goyal [4] test pecking order theory of corporate leverage on a broad cross-section of publicly traded American firms for 1971 to 1998. Contrary to pecking order theory, net equity issues track the financing deficit more closely than net debt issues. They use the method of Shyam-Sunder and Myers [14] but obtain a result which does not support pecking order theory contrary to Shyam-Sunder & Myers [15]. They report that financing deficit is less important in explaining net debt issues over time for firms of all sizes.

Kwack Seh Young [10] examines the validity of pecking order theory by analyzing fund raising activities of Korean listed manufacturing firms around the occasion of Korean financial crisis. Using a panel data from 1981 to 2002 he argues that the result as it is supporting pecking order theory. He finds no outstanding difference between pre- and post Korean financial crisis. Yoon Jong In and Kim Hyeong Chul [17] tests pecking order theory and free cash flow hypothesis in investigating the determinants of capital structure in Korea for the periods of 1991 to 1996. Their estimates from a panel data of the non-financial corporations suggest that while the effect of the agency cost seems important, the pecking order is found to be insignificant. Yoon Soon Suk [16] empirically examines whether pecking order theory or the static trade-off theory works well for the Korean firms. The results indicate that pecking order theory fails to explain the financing policies of Korean firms, and that it is required to include not only debt financing variables but also other important financial variables like cash flows. In his test static trade-off theory has a relatively higher explanatory power than pecking order theory for the Korean firms. His results were robust to many sensitivity analyses. Kim Pil Kyu [9] shows that Korean firms rely much more on long-term and short-term debt rather than on equity issues in financing. Net debt issue variable is more closely related to the financing deficit variable. His conclusion is that pecking order theory is not perfect in explaining the recent financing behavior of Korean firms, but it seems to be a useful model compared with static trade-off theory.

2.2. Testable Hypotheses

We draw five testable hypotheses from pecking order theory and related previous researches. They are derived from the theoretical implications of pecking order theory, and are focused on the priority of debt financing to other sources of fund.

Hypothesis (1): **More internally generated cash flow reduces debt financing.** Internally generated cash flow is preferred to external debt financing according to pecking order theory.

Hypothesis (2): **More profit reduces debt financing.** More profit increases cash flow and the need for external debt financing decreases according to pecking order theory.

Hypothesis (3): **More non-debt tax shield reduces debt financing.** More non-debt tax shield increases available internal cash and thus decreases the need for external debt financing.

Hypothesis (4): **More physical assets reduce debt financing.** More physical assets mitigate information asymmetry, helping firms issue equity, which in turn reduces debt financing.

Hypothesis (5): **Larger firm size reduces debt financing.** Larger firm size mitigates information asymmetry, helping firms issue equity, which in turn reduces debt financing.

Expected signs of the coefficients of the explanatory variables when debt ratio is used as dependent variable under pecking order hypothesis are as follows.

Explanatory variables	Expected sign of the coefficient
CF	–
ROA	–
NDTS(non-debt tax shield)	–
Physical assets (K)	–
Size	–

3. RESEARCH METHODOLOGY

3.1. The Data

In this paper we use a panel data set found in KIS-FAS and KSRI-SD. Our data set are taken from continuously listed non-financial firms at the Korea Exchange from 1980 to 2004 Among them 12 firms without the entry of sales and 11 firms without the entry of total assets are excluded. Again, two firms with operating ROA (operating income among total assets) less than -1 are excluded as outliers. Finally we have 184 sample firms at hand. We construct sub-samples according to the occasion of Korean financial crisis as of 1997, the magnitude of q-ratio and firm size also.

Simple statistics of the sample firm-years are presented in Table 1. Average debt to total assets ratio of the samples is 68.3% with similar median of 69.4%. Cash flow to total assets ratio of the samples is 10.4 on the average. Average non debt tax shield to total assets ratio of the samples is 3.4%. Average ROA is about 7%. Average physical assets to total assets ratio

of the samples is 36.3%. And the average and median of total assets the samples is 541,556 and 137,309 million won each.

Table 1. Simple statistics

Variables	Mean	Median	Stdev.	Maximum	Minimum
D/A	0.683	0.694	0.236	3.448	0.044
CF/A	0.104	0.102	0.078	0.576	-0.735
NDTS	0.034	0.028	0.028	0.268	0.000
ROA	0.070	0.067	0.071	0.549	-0.752
K/A	0.363	0.359	0.173	0.936	0.001
SIZE(log)	20.110	18.738	0.661	24.503	14.519
(Mil. Won)	541,556	137,309	1,845,825	43,816,543	2,020

3.2. Analytical Model and Variables
1) The Panel Regression Model
The panel regression model takes the following form:

$$\left(\frac{D}{TA}\right)_{it} = \beta_0 + \beta_1\left(\frac{CF}{TA}\right)_{it} + \beta_2\left(\frac{NDTS}{TA}\right)_{it} + \beta_3 ROA_{it} + \beta_4\left(\frac{K}{TA}\right)_{it} + \beta_5 SIZE_{it} + u_{it}$$

where, $u_{it} = \eta_i + \mu_t + \varepsilon_{it}$. η_i denotes individual firm effects, while μ_t stands for time effects. ε_{it} expresses pure error terms with i.i.d. and mean zero distribution.

2) OLS model
We construct the OLS model as follows:

$$\left(\frac{D}{TA}\right)_i = \beta_0 + \beta_1\left(\frac{CF}{TA}\right)_i + \beta_2\left(\frac{NDTS}{TA}\right)_i + \beta_3 ROA_{it} + \beta_4\left(\frac{K}{TA}\right)_i + \beta_5 SIZE_i + ID + YD + \varepsilon$$

where, ID represents industry dummies, and YD stands for year dummies. ε represents residual regression terms. We include ID and YD in the OLS model to control the individual firm effects and autocorrelation problem.

D/TA stands for debt ratio (debt/total assets), CF/TA represents cash flow/total assets, and NDTS/TA stands for non-debt tax shield (depreciation/total assets). ROA is return on assets, K/TA stands for physical assets/total assets, and SIZE means natural log of total assets. We normalize debt, cash flow, non-debt tax shield, and physical assets to control for heteroskedasticity problem that may arise from different magnitude of relevant terms.

Cash flow is calculated by the sum of net income and depreciation. Pecking order theory predicts that more cash flow lowers the possibility of external financing and consequently will lower debt ratio. Therefore, expect a negative sign of β_1. Non-debt tax shields (NDTS) include depreciation, which will diminish the benefit of debt and thus will lead to negative sign of β_2. Return on assets (ROA) represents profitability. High profitability signals good corporate condition given information asymmetry, which will propel use of debt. Pecking order theory, however, predicts that high profitability will increase cash flow and thus will decrease debt ratio. Thus, we expect a negative sign of β_3. More physical assets among total assets (K/A) will alleviate asset specificity, which will also mitigate information asymmetry and thus accelerate equity issue, while reducing debt issue. Then we expect a negative sign of β_4.

We take natural logarithm on total assets with a view to lowering heteroskedasticity problem of the residuals. Larger firms will raise more funds even though they are less deficient of cash. Those larger firms are likely to raise external funds. Further, according to pecking order theory, larger firms are expected to prefer equity to bond because they are exposed to less information asymmetry. Again, we expect a negative sign of β_5.

3) Estimation by Panel Regression

We perform Hausman's test and F-test. The null hypothesis of Hausman's test is $E(\eta_i | X_{it}) = 0$ and that of F-test is $\eta_i = 0$ and $\mu_t = 0$. η_i represents individual firm effects, while μ_t stands for time effects. Hausman's test aims at checking which type of method is appropriate - fixed effect model or random effect model - for testing $\eta_i = 0$ and $\mu_t = 0$. If the hypothesis of $E(\eta_i | X_{it}) = 0$ is accepted, then estimation by random effect model is desirable because the GLS estimates by it have consistency and efficiency. Otherwise, GLS estimates have inconsistency, so that estimation by fixed effect model is desirable. F-test is interested in testing the appropriateness of fixed effect model, where we interpret that there is fixed effects if the null hypothesis is rejected.

4. RESULTS OF EMPIRICAL TESTS

4.1. Regression on Pooled Samples

We perform correlation analysis between the variables as is shown in Table 2 as a preliminary step. Cash flow to total assets (CF/A), profitability (ROA), physical assets among total assets (K/A), and firm size (SIZE) are all negatively and significantly correlated with debt ratio (D/A). Non-debt tax shields (NDTS) also has the expected negative sign. It, however, shows no statistical significance. Cash flow is positively and significantly correlated with ROA and physical assets. Non-debt tax shields are positively and significantly correlated with ROA but are negatively and significantly correlated with physical assets. Profitability is negatively and significantly correlated with physical assets. It can be interpreted as the result of overinvestment by the sample firms. Physical assets are positively and significantly correlated with firm size. It is natural because firms with more physical assets are probably more mature firms with most of their growth options turned into physical assets. Firm size is positively and insignificantly correlated with cash flow, non-debt tax shields, and profitability.

Table 2. Pearson's correlation coefficients (N = 4,600)

	D/A	CF/A	NDTS	ROA	K/A
CF/A	-0.198***				
NDTS	-0.021	0.049***			
ROA	-0.190***	0.933***	0.054***		
K/A	-0.074***	0.033**	-0.049***	-0.126***	
SIZE	-0.030**	0.012	0.004	0.002	0.062***

***, **, * denote 1%, 5%, 10% level of significance each.

We have to choose proper panel regression model in order to

obtain good estimators. As is shown in Table 3 the null hypothesis (H_0) for Hausman test is strongly rejected with the m value as high as 49.78 and 43.73 each. It shows that we are not sure of the independence between individual firm effects (η_i) and explanatory variables (X_{it}), which implies that estimation by fixed effects model is appropriate instead of random effects model. This kind of statistical diagnosis appears in every sub-period before and after the Korean financial crisis. Model 1 and 2 from Table 4 shows that Hausman m values are 40.18 and 42.12 each before the financial crisis, and model 3 and 4 shows that Hausman m values are 14.50 and 9.39 each after the financial crisis, all of which significantly reject H_0 for Hausman test, supporting estimation by fixed effects model. We, therefore, report only the estimation results by fixed effects model hereafter. Note that the correlation between cash flow (CFA) and ROA is as high as 0.93 for the full sample (Table 2). Thus, we do not put them in the same regression equation but we use them alternatively to avoid multicollinearity problem.

The panel regression results on all samples for whole periods are presented in Table 3. The fixed effect model produces estimators which support pecking order theory. As pecking order theory suggests debt ratio decreases as cash flow, ROA, physical assets, and firm size increase. Non-debt tax shields, however, show the reverse sign and have no significance.

This is the opposite result obtained by Kwak Seh Young [10]. He reports the opposite and significant sign of the coefficient of the size variable. He rationalizes it by saying that firm size is taken as collateral rather than a mitigator of information asymmetry in Korean market. But we do not agree because the sign and significance of size variable in our study is robust either to ROA or cash flow in separate equations while Kwak Seh Young [10] is using ROA considering too high value of correlation coefficient between ROA and cash flow.

Table 3. Testing Pecking Order Theory for All Periods (1980-2004, 4,600 firm-years)

Models / Independent Variables	Dependent variable: total debt divided by total assets			
	Fixed Effect Model		Random Effect Model	
	Model 1	Model 2	Model 1	Model 2
Intercept	0.928***	0.929***	0.868***	0.871***
CFA	-0.181***		-0.220***	
ROA		-0.259***		-0.297***
NDTS	0.048	0.043	0.020	0.015
KA	-0.171***	-0.184***	-0.160***	-0.175***
SIZE	-0.013**	-0.013**	-0.012**	-0.012**
R-Square	0.378	0.380	0.014	0.018
F Value (m Value)	12.97***	13.00***	(49.78***)	(43.73***)

***, **, * denote 1%, 5%, 10% level of significance each.
m Value: Hausman Test for Random Effects
H_0 for Hausman test:

$$E(\eta_i | X_{it}) = 0 \quad \text{(H}_0 \text{ for F-test: } \eta_i = 0, \ \mu_t = 0)$$

4.2. Regression on Sub-samples

1) Regression on Sub-samples before and after the Korean Financial Crisis

Table 4 shows the correlation coefficients between variables before and after the Korean financial crisis.

Table 4. Pearson's correlation coefficients during pre- or post crisis periods

Pre-crisis periods (3,128 firm-years)		Post-crisis periods (1,288 firm-years)					
		D/A	CF/A	NDTS	ROA	K/A	SIZE
	D/A		-0.291***	-0.046*	-0.289***	0.008	-0.018
	CF/A	-0.318***		0.045	0.956***	0.102***	0.001
	NDTS	-0.010	0.056***		0.057**	-0.100***	-0.068**
	ROA	-0.301***	0.906***	0.059***		-0.010	-0.012
	K/A	-0.055***	0.099***	-0.020	-0.116***		0.070**
	SIZE	-0.037**	0.015	0.030*	0.007	0.063***	

***, **, * denote 1%, 5%, 10% level of significance each.

During the pre-crisis periods cash flow to total assets (CF/A), profitability (ROA), physical assets among total assets (K/A), and firm size (SIZE) are all negatively and significantly correlated with debt ratio (D/A), which coincides with the hypothetical expectations. Non-debt tax shields (NDTS) also has the expected negative sign, but it shows no statistical significance.

During the post-crisis periods cash flow to total assets (CF/A) and profitability (ROA) are all negatively and significantly correlated with debt ratio (D/A), which coincides with the hypothetical expectations. Now non-debt tax shields (NDTS) also has the expected negative sign and statistical significance, too. Physical assets among total assets (K/A) and firm size (SIZE), however, lose their statistical significance perfectly. It may imply that the role of physical assets and firm size as an indicator of decreased information asymmetry dwindles away after the financial crisis.

Note that the correlation between cash flow (CFA) and ROA is as high as 0.90 during the pre-crisis periods and as high as 0.95 during the post-crisis periods (Table 4). So that we do not put them in the same regression equation but we use them alternatively to avoid multicollinearity problem.

The panel regression results by fixed effect model on sub-samples for pre- and post-crisis periods are presented in Table 5.

Table 5. Fixed Effects Model for Pre- or Post- Crisis Periods

Test Periods & Models / Independent Variables	Dependent variable: total debt divided by total assets			
	Pre-Crisis Periods (1994-1996)		Post-Crisis Periods (1998-2004)	
	Model 1	Model 2	Model 1	Model 2
Intercept	0.890***	0.888***	0.874***	0.882***
CFA	-0.311***		-0.595***	
ROA		-0.325***		-0.725***
NDTS	0.080	0.0760	-0.253	-0.237
KA	-0.099***	-0.115***	0.101	0.085
SIZE	-0.009**	-0.008**	-0.004	-0.005
R-Square	0.609	0.608	0.543	0.549
F Value	20.86***	20.89***	5.95***	6.18***

***, **, * denote 1%, 5%, 10% level of significance each.

H0 for F-test: $\eta_i = 0$, $\mu_t = 0$

For the pre-crisis period the estimators of cash flow, ROA, physical assets, and firm size support pecking order theory significantly. For the post-crisis period, however, the estimators of physical assets and firm size fail to keep the statistical significance. It may imply that the role of physical assets and firm size as an indicator of relaxed information asymmetry

fades away around the event of the Korean financial crisis. Size variable takes the opposite and significant sign during the pre-crisis period to Kwak Seh Young [10], and loses significance completely for the post-crisis period, the latter of which coincides with Kwak Seh Young [10] but with different sign.

2) Regression on Sub-samples according to market valuation

We construct second sub-samples according to firm value maximization behavior. Firms with q≥1 (q<1) are classified as value maximizing (non-value maximizing) firms. We do this for several reasons. First, value maximizing firms are more apt at managing funds. They have control over internal or external funds because it is less probable that they are in financial distress. Therefore it is not unreasonable that they have pecking order theory be more easily manifested. Non-value maximizing firms are expected to take the other angle.

Table 6 shows the correlation coefficients between variables for firms with q≥1 or q<1. For firms with q≥1, which are considered to be value maximizing firms, cash flow to total assets (CF/A), profitability (ROA), and physical assets among total assets (K/A) are all negatively and significantly correlated with debt ratio (D/A), which coincides with the hypothetical expectations. Firm size (SIZE) shows no significant correlation with debt ratio. This is because we guess that value maximizing firms, whose stock prices are high enough, are less exposed to information asymmetry and thus are less dependent on firm size for ease of information asymmetry. Non-debt tax shields (NDTS) also has the expected negative sign, but it shows no statistical significance. For firms with q<1, which are considered to be non-value maximizing firms, cash flow to total assets and profitability are never significantly correlated with debt ratio. It means that pecking order theory does not work well in case of value maximizing firms.

Table 6. Pearson's correlation coefficients according to the magnitude of q-ratio

		Firms with q<1 (3,275 firm-years)					
		D/A	CF/A	NDTS	ROA	K/A	SIZE
Firms with q≥1 (1,325 firm-years)	D/A		-0.021	-0.013	0.003	-0.165***	-0.036**
	CF/A	-0.387***		0.065***	0.921***	-0.042**	-0.017
	NDTS	-0.020	0.017		0.073***	-0.049***	0.002
	ROA	-0.378***	0.951***	0.018		-0.216***	-0.029*
	K/A	0.116***	0.161***	-0.053*	0.013		0.058***
	SIZE	-0.024	0.067**	0.007	0.059**	0.073***	

***, **, * denote 1%, 5%, 10% level of significance each.

Why? They do not have necessary control over internal or external funds because it is more probable that they are in financial distress. Thus it is possible that they cannot have pecking order theory be manifested in their firm.

Note that the correlation between cash flow(CFA) and ROA is as high as 0.951 for firms with q≥1 (1,325 firms) and 0.921 for firms with q<1 (3,275 firms) (table 8).

We practice OLS on the sub-samples of firms with q≥1 or q<1. It is because the samples included are different according to years according to the magnitude of q-ratio. Table 7 shows the OLS regression results on the sub-samples of firms with q≥1 or q<1. For Firms with q≥1, which are considered to be value maximizing firms, cash flow to total assets (CF/A), profitability (ROA), physical assets among total assets (K/A) and firm size (SIZE) are all negatively and significantly related to debt ratio (D/A), which coincides with the hypothetical expectations.

Table 7. OLS Regression for All Periods (1980-2004) on Firms with q≥1 or else

Test Periods & Models Independent Variables	Dependent variable: total debt divided by total assets			
	q≥1		q<1	
	Model 1	Model 2	Model 1	Model 2
Intercept	0.714***	0.750***	0.646***	0.655***
CFA	-0.980***		-0.447***	
ROA		-0.951***		-0.460***
NDTS	-0.041	-0.067	0.100	0.080
KA	0.218***	0.162***	-0.050**	-0.076***
SIZE	-0.021**	-0.023**	-0.008**	-0.009**
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Adjusted R-Square	0.362	0.352	0.350	0.348
F Value	14.95***	14.35***	33.75***	33.40***
Number of Obs.	1,325	1,325	3,275	3,275

***, **, * denote 1%, 5%, 10% level of significance each.

Now non-debt tax shields (NDTS) also have the expected negative sign but without statistical significance. It may imply that the role of physical assets and firm size as an indicator of decreased information asymmetry dwindles away after the financial crisis. For firms with q<1 the regression results are similar, which is different from the correlation analysis shown in Table 6.

3) Regression on Sub-samples according to firm size

According to pecking order theory, financing behavior is driven by adverse selection costs. The theory should perform best among firms that face particularly severe adverse selection problems (Frank and Goyal [4]). Following the same line of reasoning small firms will not behave according to the pecking order (Frank and Goyal [4]). It is natural to guess that large firms, which usually have longer history and are better established, would suffer more heavily from information asymmetry. So, we construct a third sub-samples according to firm size. Firms whose size is larger (smaller) than median of the sample are classified as large (small) firms. Large firms usually have longer history and better reputation with more stable cash flow and capability to manage funds. Therefore it is plausible that pecking order theory more easily works in large firms. Small firms are usually growing ones, are more easily exposed to lack of liquidity, and thus they are less expected to follow pecking order theory in funding.

Table 8 shows the correlation coefficients between variables for firms with Size≥median or Size<median. For firms with Size≥median, which are classified as large firms, cash flow to total assets (CF/A), non-debt tax shield (NDTS), profitability (ROA), and physical assets among total assets (K/A) are all negatively and significantly correlated with debt ratio (D/A), which coincides with the hypothetical expectations. Firm size (SIZE), however, shows no significant correlation with debt ratio. This is because we guess that large firms are less exposed to information asymmetry and thus are less dependent on firm size for debt capital issue. For firms with Size<median, which are classified as small firms, SIZE variable is also significantly correlated with debt ratio, but NDTS is not. Correlation analysis gives us a hint that firm size works as if it contains some information on pecking order theory.

Table 8. Pearson's correlation coefficients according to firm size

Firms with Size≥ Median (2,301 firm -years)		Firms with Size<Median (2,299 firm-years)					
		D/A	CF/A	NDTS	ROA	K/A	SIZE
	D/A		-0.261***	0.008	-0.272***	-0.066***	-0.055***
	CF/A	-0.122***		0.010	0.936***	0.047**	-0.026
	NDTS	-0.038*	0.092***		0.036*	-0.049**	0.027
	ROA	-0.090***	0.931***	0.076***		-0.109***	-0.014
	K/A	-0.079***	0.015	-0.045**	-0.147***		-0.013
	SIZE	0.028	0.002	0.066***	-0.030	0.045**	

***, **, * denote 1%, 5%, 10% level of significance each.

Note that the correlation between cash flow (CFA) and ROA is as high as 0.931 for large firms (2,391 firms) and 0.936 for small firms (2,299 firms). So that we do not put them in the same regression equation but we use them alternatively in order to avoid multicollinearity problem.

Table 9 shows the OLS regression results on the sub-samples of firms with Size≥median or Size<median. For Firms with Size≥median, which are considered to be large firms, cash flow to total assets (CF/A), profitability (ROA), and physical assets among total assets (K/A) are negatively and significantly related to debt ratio (D/A), which coincides with the hypothetical expectations. Size variable does not show any statistical significance. Non-debt tax shields have the expected negative sign but do not have statistical significance. For firms with Size<median, which are considered to be small firms, however, size variable is negatively and significantly related with debt to assets. It seems that size is an important factor for smaller firms in making financing decision. That is, smaller firms take more benefit from the fact that it is relatively larger in a market where information asymmetry exists.

5. CONCLUSION AND DISCUSSION

Pecking order theory of financing predicts that external debt financing is driven by the internal financial deficit. Myers & Majluf [13] proposed that under information asymmetry corporate financing follows certain order if information asymmetry exists in the market. This paper empirically tests pecking order theory. Korean listed non-financial firms are used as the samples. We build sub-samples according to the occasion of Korean financial crisis in 1997, the magnitude of firm value (q-ratio), and firm size.

Conforming to Narayanan [13], Shyam-Sunder and Myers [14], Fama & French [2], and Kwack Seh Young [10], we find supportive results for pecking order theory for the most part. That is to say more internal cash (cash flow [hypothesis 1] and profitability [hypothesis 2]), more physical assets [hypothesis 4], and bigger size [hypothesis [5] are significantly and negatively related with decrease of debt issue. But non-debt tax shields do not show any significance. Sub-samples show minutely different results, but cash flow [hypothesis 1] and profitability [hypothesis 2] are significantly and negatively related with decrease of debt issue in every sub-sample. Corporate debt ratio also significantly decreases in both pre- and post-financial crisis period and the sub-samples by q-ratio, which also supports the prediction of pecking order theory. The results are summarized in Table 10.

See to it that statistical significance of the coefficients of physical assets or firm size completely disappears after Korean financial crisis. How can it be interpreted? Perhaps it is because the role of physical assets or firm size as a mitigator of information asymmetry significantly weakens after the financial crisis as Korean financial market becomes more transparent.

Table 9. OLS Regression for All Periods (1980-2004) on Firms According to Size

Test Periods & Models / Independent Variables	Dependent variable: total debt divided by total assets			
	Size≥median		Size<median	
	Model 1	Model 2	Model 1	Model 2
Intercept	0.486***	0.501***	0.989***	0.999***
CFA	-0.504***		-1.050***	
ROA		-0.445***		-1.153***
NDTS	-0.171	-0.228	0.106	0.118
KA	0.067**	0.046*	0.003	-0.065**
SIZE	0.009	0.009	-0.056***	-0.055***
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Adjusted R-Square	0.336	0.329	0.303	0.308
F Value	23.00***	22.29***	19.56***	19.94***
Number of Obs.	2,301	2,301	2,299	2,299

***, **, * denote 1%, 5%, 10% level of significance each.

Table 10. Summary of the Test Results

Explanatory variables	Expected signs	Test results (Dependent variable: total debt divided by total assets)						
		Fixed Effect Model			OLS Regression			
		Whole samples	Before Korean Financial Crisis	After Korean Financial Crisis	$q \geq 1$	$q < 1$	Size$\geq$ median	Size< median
Cash flow		(***)	(***)	(***)	(***)	(***)	(***)	(***)
ROA		(***)	(***)	(***)	(***)	(***)	(***)	(***)
Non-debt Tax Shield		insigni-ficant	insigni-ficant	insigni-ficant	insigni-ficant	insigni-ficant	insigni-ficant	insigni-ficant
Physical assets		(***)	(***)	insigni-ficant	(***)	(***) (** with ROA)	(**) (* with ROA)	(**) (nil with CFA)
Size		(**)	(**)	insigni-ficant	(**)	(**)	insigni-ficant	(***)

***, **, * denote 1%, 5%, 10% level of significance each.
Cash flow and ROA are separately put into the regression model because of too big correlation.

Physical assets lose much of its statistical significance in case it is regressed together with ROA. Physical assets lose all of its statistical significance in case it is regressed together with cash flow for small firms. Size variable does not show any statistical significance for large firms. For small firms, however, size variable is negatively and significantly related with debt to assets. It seems that size is an important factor for smaller firms in making financing decision because they face more serious information asymmetry problem in the market.

We show that the theoretical implications are generally supported in the test. The theoretical implication that firms are out for external funds only in case internal funds are dried up, and that there exists information asymmetry in the market implies that firms had better retain their cash position healthier in order to avoid any penalty by the market. The result that more physical assets and bigger size reduce debt financing because of easier equity issue implies that firms will benefit building up alliances which have size up effect.

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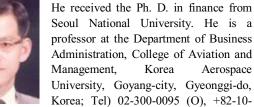
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