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Financial constraints and the cash flow sensitivities of external financing: Evidence from Korea

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ABSTRACT

According to pecking order theory, the relationship between internal and external financing is negative because of the cost difference in raising funds. However, what if the role of debt and equity issuance differ in response to the cash flow? To address this, I examine 10,886 firm-year observations in Korea and find several intriguing findings. (1) Debt issuance is negatively related to cash flow as expected, but not for equity issuance. (2) The results are due to firms' intention to issue new equity when their cash flow is positive. (3) Substitution between internal funds and debt is mostly driven by paying off short-term debt. (4) A negative relationship between internal and external financing (debt issuance) exists in the firm-years of positive and increasing cash flow. (5) Regarding financial constraints, pecking order theory is better demonstrated by financially unconstrained firms.

1. Introduction

Research on capital structure has been endlessly disputed in the corporate finance literature. Many theories support and refute one another in searching for an optimal level of capital structure. If market frictions such as taxes or transaction costs do not exist in the marketplace, then the cost difference between internal and external funds can be negligible. Unfortunately, the market is imperfect and there are many forms of market frictions (e.g., Hubbard, 1998; Denis and McKeon, 2012; Faulkender and Petersen, 2006; Kisen, 2009; Lemmon and Zender, 2010; Hovakimian et al., 2001). According to Modigliani and Miller (1958), static trade-off theory (trade-off between benefits and costs of debt) emphasizes tax benefits on interest payments, and thus firms are willing to raise their debt level to a certain point. This theory is refuted by pecking order theory (Myers and Majluf, 1984), which underlines costs associated with information asymmetry and notes that firms prioritize internal financing first and external financing afterwards. The theory additionally explains that with equity issuance, managers tend to issue new equity when price is overvalued, which subsequently raises the information asymmetry costs. Fig. 1 briefly displays three types of financing and costs relative to one another. Debt and equity issuance represent external financing while internal financing signifies the profitability of a firm.

Testing trade-off versus pecking order theory is also an issue in the previous studies (e.g., Shyam-Sunder and Myers, 1999; Fama and French, 2002), for which Fama and French (2002) acknowledge difficulties in confirming one theory is better than the other. Consequently, this paper investigates pecking order theory in testifying a negative relationship between internal (cash flow) and external financing by adopting a method from Almeida and Campello (2010). These authors take Q (market-to-book assets ratio) and firm size (sales) into consideration along with the main explanatory variable, cash flow. To distinguish from previous literature looking into the cash flow sensitivities of investment, they focus on the interplay between internal and external funds. The purpose of this study also conflicts with Almeida and Campello (2010), in the sense that I examine in-depth research on debt and equity issuance

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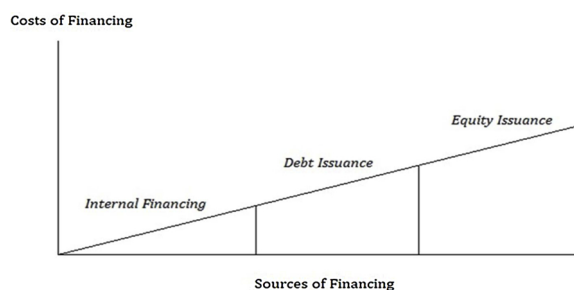


Fig. 1. Pecking order theory.

separately. Additionally, debt issuance is further divided into short- and long-term debt issuance.

The second part of the paper addresses the effects of financial constraints on the sensitivities of cash flow. This topic is pioneered by Fazzari et al. (1988), who investigate the role of financial factors in capital structure and find that financially constrained firms (FCF) have higher investment – cash flow sensitivities than financially unconstrained firms (FUF). This work is later refuted by Kaplan and Zingales (1997) and Cleary (1999), who find even higher sensitivities from FUF. One probable reason is sample selection; for instance, Kaplan and Zingales (1997) use a small subset of Fazzari et al.'s (1988) cohort and find opposite results. As Farre-Mensa and Ljungqvist (2016) test, the measures of financial constraints can also matter in that we already have enough measures such as dividend payout, firm size, bond rating, z-score, KZ-index, HP-index, and so on. However, theoretical reasoning behind the effects of financial constraints on the various uses of cash flow has yet to be answered explicitly in the previous literature.

The remainder of this paper is organized as follows. A literature review regarding the topics of this research is offered in Section 2, and several hypotheses for confirming the substitution between internal and external funds are stated in Section 3. Sample data and methodology are described in Section 4, and the empirical results are presented in Section 5. The effects of financial constraints are analyzed in Section 6, and Section 7 concludes the paper.

2. Literature review

Dispute over the various capital structure theories has a long history in corporate finance. Static trade-off theory is popularized by Modigliani and Miller (1958), who note benefits to raise debt level because of tax concerns. Later, Myers and Majluf (1984) introduce pecking order theory, which practically underlines costs associated with information asymmetry. According to their argument, internal financing (profitability) is preferable to external financing, and in the same context, issuing debt is generally chosen in advance rather than issuing equity because of a cost advantage. Recent studies find even more complicated evidences in respect to debt and equity issuance. For instance, Faff et al. (2016) argue that the sources of financing are not consistent during firms' life-cycle. Equity issuance decreases over time whereas debt issuance increases in the early stage and then falls in the mature stage. Chay et al. (2015) use a quantile regression method in examining financing hierarchy and find supportive evidence for the first rung (internal and external funds) and weak evidence for the second rung (debt and equity) of the pecking order. Elsas et al. (2014) narrow down the observations for large capital expenditures only and insist that external financing depends heavily on managers' attitude in that those firms issue more equity following a sudden upturn in price.

The research on financial constraints in respect to investment – cash flow sensitivities is first addressed by Fazzari et al. (1988), who realize the importance of financial factors in making investment decisions. They also agree with pecking order theory and that internal funds are preferable to debt or equity. Hoshi et al. (1991) use unique data in Japan and classify those firms into FUF (have close ties to Japanese representative banks) and FCF (do not have close ties to Japanese representative banks). As a result, they find that investment is more sensitive for the latter group, which is in line with Fazzari et al. (1988).

Almeida and Campello (2010) take a different approach by considering an interplay between internal and external funds. Consequently, they observe a highly negative relationship between cash flow and external financing from FUF, yet the results are insignificant for FCF. This finding is confirmed following several robust checks. In investigating the cash flow sensitivities of cash holdings, Almeida et al. (2004) argue that the relationship is significantly positive for FCF because the propensity to hold liquid assets is more urgent for FCF. Denis and Sibilkov (2010) expand on Almeida et al.'s (2004) work by adding that cash holdings are more valuable for FCF, where some of these firms persistently suffer from lack of cash holdings.

3. Hypotheses of the study

In this study, I formulate several testable hypotheses as follows in examining the cash flow sensitivities of various uses of external funds (external financing, debt issuance, short-term debt issuance, long-term debt issuance, and equity issuance).

H1. External financing, which is both debt and equity issuance, is negatively related to cash flow.

H2. Substitution between internal funds and debt is mostly driven by paying-off short-term debt.

H3. Negative relationship between internal (profitability) and external financing is observed more strongly in the firm-years of

positive and increasing cash flow.

H4. Pecking order theory is better demonstrated by financially unconstrained firms.

Pecking order theory signifies a cost advantage in raising funds. Fig. 1 illustrates that internal financing has a cost advantage over external financing and thus is preferred in advance. Almeida and Campello (2010) also find a negative relationship between cash flow and external financing (a mixture of debt and equity issuance), and the results are more definite for FUF. In one of their robustness checks, they classify external financing into debt and equity issuance separately and obtain consistent results. Consequently, I investigate the cash flow sensitivities of overall external financing (itself), debt, and equity issuance in confirming a negative relationship between internal and external financing, which addresses the first hypothesis of this research. Second, debt issuance is further divided into short- and long-term debt issuance, and I examine how firms differ in financing these two sources of funds, if any. I carefully anticipate that the substitution between internal funds and debt is mostly driven by issuing short-term debt owing to its cushiness of raising or lowering. Additionally, I test two different periods, pre-crisis (2001 to 2006) and post-crisis (2010 to 2017), to examine if firms' tendency to issue short- and long-term debt alter over those periods. To allot enough time of the financial crisis, the observations from 2007 to 2009 are eliminated for this particular analysis. The third hypothesis is fairly straightforward. I divide the sample into positive & negative cash flow and increasing & decreasing cash flow. I expect the negative relationship between cash flow and external financing to be more evident in the subsample of positive and increasing cash flow. In other words, firms tend to lower the costly sources of external funds when they are profitable. Finally, the substitution between internal and external funds is tested according to three criteria of financial constraints: firm size, bond rating, and commercial paper (CP) rating. Instead of identifying specific constrained or unconstrained groups, I classify the sample into five groups in an effort to analyze a systematic pattern from Tier 1 (most unconstrained) to Tier 5 (most constrained). Finding a monotonic pattern in all tiers of the three criteria may be difficult, but my expectation is that the interplay is more common in FUF because FCF usually suffer from shortage of funds and are thus prone to refrain from following the ordinary pecking order.

4. Sample data and methodology

The sample period is from 2001 to 2017, and all the financial data are obtained from the *FnGuide* database.¹ I set the time period beginning at 2001 taking into account the following three issues. First, unlike for the US or other developed countries in Europe, the database is insufficient before this time period. Analysis of the bond or CP rating is particularly difficult because of a lack of applicable data. Second, Korea experiences incredible economic growth during the 1970s to mid-1990s, and some of the main economic indices such as inflation rates are unstable then. Third, Korea is directly affected by the Asian currency crisis in 1997, which knocks down the fundamental economy in the meantime. Only the Korea Composite Stock Price Index (KOSPI) firms are observed, and I exclude the financial and utility firms in the sample. Additionally, I discard those firm-years of book value of equity less than zero and asset growth exceeding 100 percent. Observations for missing book value of assets or sales are also eliminated. The final sample contains a total of 10,886 firm-year observations (685 individual firms).

The purpose of this study is to examine the interplay between internal and external funds in Korea. To progress, I adopt a methodology from Almeida and Campello (2010) that considers Tobin's Q and firm size along with cash flow in examining the cash flow sensitivities of external financing. Equations (1) – (5) are the ordinary least squares (OLS) regression model of this study.

$$ExFinance_{i,t} = \alpha_1 Cash\ Flow_{i,t} + \alpha_2 Q_{i,t} + \alpha_3 Size_{i,t} + \Sigma FIRM + \Sigma YEAR + \varepsilon_{i,t} \quad (1)$$

$$\Delta Debt_{i,t} = \alpha_1 Cash\ Flow_{i,t} + \alpha_2 Q_{i,t} + \alpha_3 Size_{i,t} + \Sigma FIRM + \Sigma YEAR + \varepsilon_{i,t} \quad (2)$$

$$\Delta StDebt_{i,t} = \alpha_1 Cash\ Flow_{i,t} + \alpha_2 Q_{i,t} + \alpha_3 Size_{i,t} + \Sigma FIRM + \Sigma YEAR + \varepsilon_{i,t} \quad (3)$$

$$\Delta LtDebt_{i,t} = \alpha_1 Cash\ Flow_{i,t} + \alpha_2 Q_{i,t} + \alpha_3 Size_{i,t} + \Sigma FIRM + \Sigma YEAR + \varepsilon_{i,t} \quad (4)$$

$$EqtIssue_{i,t} = \alpha_1 Cash\ Flow_{i,t} + \alpha_2 Q_{i,t} + \alpha_3 Size_{i,t} + \Sigma FIRM + \Sigma YEAR + \varepsilon_{i,t} \quad (5)$$

Dependent variables are external financing (*ExFinance*), debt issuance ($\Delta Debt$), short-term debt issuance ($\Delta StDebt$), long-term debt issuance ($\Delta LtDebt$), and equity issuance (*EqtIssue*) where external financing is basically a mixture of debt and equity issuance.² *Cash flow*, the main explanatory variable, is the sum of net income, depreciation, and amortization scaled by the beginning-of-the-year book value of assets. *Q* is to capture investment opportunities and is defined as the market value of assets divided by the book value of assets.³ Lastly, *Size* is a natural logarithm of sales. Firm-fixed and year-fixed effects are included, and one-way clustered

¹ *FnGuide* is one of the major institutions in Korea that provides various financial data.

² Refer to Appendix for detailed calculation of each variable.

³ *Q* can be a noisy variable as stated in many previous studies. However, Almeida and Campello (2010) replace *Q* with R&D expenditures in one of their robustness checks and yield consistent results.

Table 1
Descriptive statistics.

	N	Mean	Median	SD	Min.	Q1	Q3	Max.
<i>ExFinance</i>	10,886	0.0123	0.0000	0.1058	-0.3036	-0.0336	0.0445	0.4395
$\Delta Debt$	10,886	0.0016	0.0000	0.0999	-0.3671	-0.0371	0.0354	0.3687
$\Delta StDebt$	10,886	0.0032	0.0000	0.0870	-0.2857	-0.0317	0.0368	0.2982
$\Delta LtDebt$	10,886	-0.0011	0.0000	0.0758	-0.2813	-0.0236	0.0140	0.2906
<i>EqtIssue</i>	10,886	0.0097	0.0000	0.0449	-0.0402	0.0000	0.0000	0.3135
<i>Cash Flow</i>	10,886	0.0632	0.0612	0.0863	-0.2581	0.0261	0.1056	0.3284
Q	10,886	1.2331	0.8437	1.6457	0.2153	0.6420	1.1666	13.3854
Size	10,886	26.2111	26.0280	1.6014	22.5987	25.2180	27.1145	30.6495

Note: The sample contains a total of 10,886 observations in Korea over the period 2001–2017, where financial and utility firms are excluded. Additionally, those firm-years of book value of equity less than zero and asset growth exceeding 100% are also discarded. Refer to Appendix for the definition of each variable.

sandwich estimator corrects the standard errors clustered by firm (Petersen, 2009). All the variables are winsorized at the 1st and 99th percentiles.

5. Empirical results

5.1. Descriptive statistics of each variable

This study looks at 10,886 firm-year observations in Korea from 2001 to 2017 to verify a negative relationship between internal and external financing. To precisely determine the cash flow sensitivities of external financing, I break down external financing (*ExFinance*) into debt ($\Delta Debt$) and equity issuance (*EqIssue*) separately. $\Delta Debt$ is further divided into short- ($\Delta StDebt$) and long-term debt issuance ($\Delta LtDebt$) to look for which portion of debt practically interplays with cash flow. Table 1 summarizes the descriptive statistics of each variable. The mean of *ExFinance* is 0.0123, and the values are 0.0016 and 0.0097 for $\Delta Debt$ and *EqIssue*, respectively.

5.2. Financial substitution between internal and external funds

Section 4 describes the methodology to investigate the cash flow sensitivities of external financing, and the results are provided in Table 2. Columns [1] – [5] are the OLS regression results without firm-fixed effects while columns [6] – [10] are the straight results of Equations (1) – (5). When firm-fixed effects are omitted, the coefficients of cash flow are all negative except $\Delta LtDebt$. The results fairly demonstrate the pecking order when firm-fixed effects are not included because total debt can either be financed by short- or long-term debt. However, when firm-fixed effects are included, which is also the baseline model of Almeida and Campello (2010), the coefficient of *Cash Flow* for *EqIssue* is insignificant at -0.004. This is the punchline in this study allowing for the importance of including firms-fixed effects in the capital structure models. To wit, debt issuance is negatively related to cash flow, as expected, but equity issuance does not follow the ordinary pecking order.

Another point is that the *Cash Flow* of $\Delta LtDebt$ is now significantly negative when firm-fixed effects are included. For this study, I

Table 2
Cash flow sensitivities of external financing.

Dependent Variables:	OLS without firm-fixed effects					OLS with firm-fixed effects				
	<i>ExFinance</i> [1]	$\Delta Debt$ [2]	$\Delta StDebt$ [3]	$\Delta LtDebt$ [4]	<i>EqIssue</i> [5]	<i>ExFinance</i> [6]	$\Delta Debt$ [7]	$\Delta StDebt$ [8]	$\Delta LtDebt$ [9]	<i>EqIssue</i> [10]
<i>Cash Flow</i>	-0.133*** (-7.15)	-0.069*** (-4.09)	-0.047*** (-3.82)	-0.003 (-0.28)	-0.045*** (-3.82)	-0.163*** (-6.63)	-0.149*** (-5.73)	-0.081*** (-4.20)	-0.034* (-1.95)	-0.004 (-0.34)
Q	0.005*** (4.99)	-0.001 (-1.05)	0.000 (-0.75)	0.000 (0.28)	0.005*** (6.47)	0.005** (2.57)	0.001 (0.49)	0.000 (-0.08)	0.001 (1.27)	0.004*** (3.82)
Size	0.000 (0.31)	-0.001*** (-4.45)	-0.000*** (-2.86)	-0.000*** (-4.15)	0.000*** (8.63)	-0.001 (-0.89)	0.001 (0.53)	0.001 (0.57)	0.000 (0.17)	-0.001 (-1.01)
Firm-fixed effects	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	10,886	10,886	10,886	10,886	10,886	10,886	10,886	10,886	10,886	10,886
R-squared	0.0654	0.0514	0.0346	0.0129	0.0938	0.1347	0.1081	0.0672	0.0483	0.2120

Note: The table shows the ordinary least squares (OLS) regression results for the 10,886 firm-year observations in Korea. Dependent variables are *ExFinance*, $\Delta Debt$, $\Delta StDebt$, $\Delta LtDebt$, and *EqIssue*, where firm-fixed effects are omitted in columns [1] – [5] and included in [6] – [10]. One-way clustered sandwich estimator corrects the standard errors clustered by firm. T-statistics are reported in the parenthesis and refer to Appendix for the definition of each variable. ***, **, * indicate statistically significant at the 1%, 5%, and 10% level, respectively.

Table 3
Pre-crisis and post-crisis periods.

Dependent Variables:	Pre-crisis (2001-2006)					Post-crisis (2010-2017)				
	<i>ExFinance</i> [1]	$\Delta Debt$ [2]	$\Delta StDebt$ [3]	$\Delta LtDebt$ [4]	<i>EqtIssue</i> [5]	<i>ExFinance</i> [6]	$\Delta Debt$ [7]	$\Delta StDebt$ [8]	$\Delta LtDebt$ [9]	<i>EqtIssue</i> [10]
<i>Cash Flow</i>	-0.216*** (-4.86)	-0.247*** (-5.61)	-0.083** (-2.52)	-0.102*** (-3.10)	0.043** (2.05)	-0.163*** (-3.75)	-0.158*** (-3.78)	-0.142*** (-4.37)	-0.002 (-0.09)	-0.007 (-0.38)
Q	0.007** (2.17)	0.003 (0.81)	0.001 (0.26)	0.001 (0.71)	0.003** (2.31)	0.003 (0.93)	-0.001 (-0.30)	-0.002 (-1.18)	0.002 (1.05)	0.004** (2.13)
Size	0.001 (0.37)	0.002 (0.43)	0.001 (0.48)	0.000 (0.18)	0.000 (-0.73)	0.100*** (10.06)	0.115*** (11.47)	0.075*** (8.63)	0.037*** (6.86)	-0.011** (-2.33)
Firm-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	4163	4163	4163	4163	4163	5074	5074	5074	5074	5074
R-squared	0.1841	0.1776	0.0828	0.1123	0.2898	0.2494	0.2226	0.1332	0.0873	0.3007

Note: Regression analysis on Equations (1) – (5) are tested separately for pre-crisis period [1] – [5] and post-crisis period [6] – [10]. Firm-fixed and year-fixed effects are included and one-way clustered sandwich estimator corrects the standard errors clustered by firm. ***, **, * indicate statistically significant at the 1%, 5%, and 10% level, respectively.

define short-term debt as the sum of short-term bond, short-term borrowing, current financial liabilities, and current portion of long-term debt. In a similar manner, long-term debt is defined as the sum of long-term bond, long-term borrowing, and non-current financial liabilities. In comparison to $\Delta StDebt$, the *Cash Flow* of $\Delta LtDebt$ is still inferior at -0.034, indicating that the substitution between internal funds and debt is mostly driven by issuing short-term debt.

In Table 3, the sample is divided into pre-crisis (2001 to 2006) and post-crisis (2010 to 2017) periods, and the observations for 2007 to 2009 are omitted. For *ExFinance*, $\Delta Debt$, and $\Delta StDebt$, the results are consistent in both time periods by displaying highly negative coefficients of *Cash Flow*. Interestingly, the coefficient for $\Delta LtDebt$ is negative and significant at the 1 percent level during the pre-crisis period, but drops sharply to -0.002 during the post-crisis period. Thus, average Korean firms suffer from issuing long-term debt after the financial crisis. The overall weakness of $\Delta LtDebt$ in the cross-sectional analysis is presumed from the insignificant results of the post-crisis period, which used to be even higher (in absolute value) than $\Delta StDebt$ before the financial crisis. Another point is that the firm size severely matters during the post-crisis period, expressing positive signs in all sources of external funds except *EqIssue*.

5.3. In-depth analysis on the cash flow sensitivities of external financing

There are firm-years when cash flow is positive (negative), and there are also firm-years when cash flow is increasing (decreasing) compared to the previous year. In Table 4, I test these two scenario of cash flow according to Equations (1) – (5). The total sample is divided into positive (N = 9,393) and negative (N = 1,493) cash flow in Panel A and is divided into increasing (N = 5,398) and decreasing (N = 5,488) cash flow in Panel B. My expectation is that the negative relationship between cash flow and external financing is driven by positive and increasing cash flow since firms tend to curtail the high costs of external funds when they are profitable. Choi and Suh (2017) also find a negative relation when cash flow is non-negative. In Panel A (positive vs. negative), all of *ExFinance*, $\Delta Debt$, $\Delta StDebt$, and $\Delta LtDebt$ meet the expectation by expressing -0.202, -0.295, -0.182, and -0.069, respectively, for positive cash flow. The coefficients are all statistically significant at the 1 percent level. However, *EqIssue* is even positive and significant when cash flow is positive (0.078), meaning that Korean firms issue even more equity when they are profitable. I suppose that this is the reason of the insignificant coefficient in Table 2 when firm-fixed effects are included. In Panel B (increasing vs. decreasing), *ExFinance*, $\Delta Debt$, $\Delta StDebt$, and $\Delta LtDebt$ vehemently support the third hypothesis of this study by showing negative and highly significant coefficients when cash flow is increasing. Furthermore, none of these coefficients of *Cash Flow* are significant for decreasing cash flow in columns [6] – [9]. *EqIssue* remains ambiguous by displaying a negative coefficient when cash flow is decreasing.

5.4. Financial substitution in the non-KOSPI section

KOSPI is the main stock price index in Korea which represents the comprehensive movement of the listed stocks. There is also Korea Securities Dealers Automated Quotation (KOSDAQ), which is similar to the US NASDAQ and exists for small- and medium-sized firms in Korea. Consequently, I investigate if pecking order theory pertains in the KOSDAQ section, and the corresponding results are presented in Table 5. Columns [1] – [5] are the observations for KOSDAQ firms, and they are fairly consistent with the baseline model in Table 2. The only difference concerns $\Delta LtDebt$, where the coefficient is insignificant at 0.011. For the rest, *ExFinance*, $\Delta Debt$, and $\Delta StDebt$ are still negative and significant at the 1 percent level, meaning that the small- and medium-sized firms in Korea indeed show a negative relationship between internal and external financing. But these firms are not actively using long-term debt in relation to their profitability. Columns [6] – [10] are the observations for KOSPI and KOSDAQ combined, and the results are quite equivalent to the KOSDAQ alone. Financial substitution between internal funds and debt is mostly driven by issuing short-term debt for the whole

Table 4
In-depth analysis on the cash flow sensitivities of external financing.

Panel										
Dependent Variables:	Positive cash flow					Negative cash flow				
	<i>ExFinance</i> [1]	Δ <i>Debt</i> [2]	Δ <i>StDebt</i> [3]	Δ <i>LtDebt</i> [4]	<i>EqtIssue</i> [5]	<i>ExFinance</i> [6]	Δ <i>Debt</i> [7]	Δ <i>StDebt</i> [8]	Δ <i>LtDebt</i> [9]	<i>EqtIssue</i> [10]
<i>Cash Flow</i>	-0.202*** (-5.99)	-0.295*** (-9.19)	-0.182*** (-7.33)	-0.069*** (-3.33)	0.078*** (5.45)	-0.160* (-1.69)	0.043 (0.50)	0.030 (0.41)	0.042 (0.72)	-0.152*** (-3.03)
<i>Q</i>	0.007*** (3.49)	0.005*** (2.75)	0.003** (2.01)	0.002** (1.97)	0.002*** (2.59)	0.002 (0.64)	-0.003 (-1.17)	-0.002 (-1.13)	0.000 (-0.01)	0.004** (1.99)
<i>Size</i>	0.002 (0.77)	0.002 (0.76)	0.002 (0.94)	0.000 (0.32)	0.000 (-0.71)	0.006 (0.56)	0.011 (0.74)	0.005 (0.55)	0.005 (0.96)	-0.005 (-1.03)
Firm-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	9393	9393	9393	9393	9393	1493	1493	1493	1493	1493
R-squared	0.1447	0.1507	0.0946	0.0784	0.2052	0.3003	0.2563	0.2297	0.2043	0.4028

Panel B.										
Dependent Variables:	Increasing cash flow					Decreasing cash flow				
	<i>ExFinance</i> [1]	Δ <i>Debt</i> [2]	Δ <i>StDebt</i> [3]	Δ <i>LtDebt</i> [4]	<i>EqtIssue</i> [5]	<i>ExFinance</i> [6]	Δ <i>Debt</i> [7]	Δ <i>StDebt</i> [8]	Δ <i>LtDebt</i> [9]	<i>EqtIssue</i> [10]
<i>Cash Flow</i>	-0.222*** (-6.18)	-0.215*** (-5.25)	-0.084** (-2.50)	-0.074*** (-2.87)	0.015 (0.84)	-0.022 (-0.60)	0.037 (1.11)	0.013 (0.51)	0.037 (1.55)	-0.050*** (-2.64)
<i>Q</i>	0.005* (1.88)	0.000 (0.01)	-0.001 (-0.91)	0.001 (0.80)	0.005*** (3.95)	0.004* (1.67)	0.001 (0.43)	0.001 (0.46)	0.001 (0.78)	0.002 (1.40)
<i>Size</i>	0.001 (0.65)	0.002 (0.61)	0.001 (0.61)	0.000 (0.41)	0.000 (-0.57)	0.004 (0.70)	0.006 (0.81)	0.004 (0.84)	0.002 (0.70)	-0.002 (-1.02)
Firm-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	5398	5398	5398	5398	5398	5488	5488	5488	5488	5488
R-squared	0.1886	0.1924	0.1333	0.1325	0.2884	0.2300	0.1911	0.1642	0.1189	0.2492

Note: Regression analysis on Equations (1) – (5) are tested separately for positive & negative cash flow (Panel A) and increasing & decreasing cash flow (Panel B). In Panel A, columns [1] – [5] are the observations for positive cash flow whereas [6] – [10] represent negative cash flow. In Panel B, columns [1] – [5] are the observations for increasing cash flow whereas [6] – [10] represent negative cash flow. ***, **, * indicate statistically significant at the 1%, 5%, and 10% level, respectively.

Table 5
Financial substitution in the KOSDAQ section.

Dependent Variables:	KOSDAQ					KOSPI & KOSDAQ				
	<i>ExFinance</i> [1]	Δ <i>Debt</i> [2]	Δ <i>StDebt</i> [3]	Δ <i>LtDebt</i> [4]	<i>EqtIssue</i> [5]	<i>ExFinance</i> [6]	Δ <i>Debt</i> [7]	Δ <i>StDebt</i> [8]	Δ <i>LtDebt</i> [9]	<i>EqtIssue</i> [10]
<i>Cash Flow</i>	-0.075*** (-3.32)	-0.061*** (-3.89)	-0.070*** (-5.56)	0.011 (1.08)	-0.013 (-0.70)	-0.081*** (-4.62)	-0.073*** (-5.32)	-0.073*** (-6.90)	0.008 (0.88)	-0.007 (-0.50)
<i>Q</i>	0.002* (1.75)	-0.002* (-1.79)	-0.002*** (-2.62)	0.000 (0.25)	0.004*** (3.30)	0.003*** (2.64)	-0.002 (-1.58)	-0.002** (-2.26)	0.000 (0.33)	0.005*** (4.70)
<i>Size</i>	0.001 (0.41)	0.003* (1.73)	0.003 (1.63)	0.000 (-0.38)	-0.002 (-0.68)	-0.002 (-1.51)	0.002 (0.86)	0.002 (1.06)	0.000 (-0.62)	-0.004 (-1.21)
Firm-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	12,323	12,323	12,323	12,323	12,323	21,895	21,895	21,895	21,895	21,895
R-squared	0.2492	0.1208	0.1036	0.0581	0.2970	0.2141	0.1160	0.0932	0.0550	0.2825

Note: Equations (1) – (5) are additionally tested for the KOSDAQ firms in columns [1] – [5] and KOSPI & KOSDAQ firms in columns [6] – [10]. Firm-fixed and year-fixed effects are included and one-way clustered sandwich estimator corrects the standard errors clustered by firm. ***, **, * indicate statistically significant at the 1%, 5%, and 10% level, respectively.

sample as well. The combined sample has a total of 21,895 observations, which do not match the sum of KOSPI (N = 10,886) and KOSDAQ (N = 12,323) because of the cases where the values of *Q* are preposterously high in the KOSDAQ section. I impose another condition for this analysis, which is to drop firm-years where *Q* is greater than 50.

Table 6
Financial constraints: firm size.

Panel A.					
Tiers	Description				
Tier 1	1 st quintile (largest) of the firm size according to book value of assets				
Tier 2	2 nd quintile of the firm size according to book value of assets				
Tier 3	3 rd quintile of the firm size according to book value of assets				
Tier 4	4 th quintile of the firm size according to book value of assets				
Tier 5	5 th quintile (smallest) of the firm size according to book value of assets				

Panel B.					
	<i>ExFinance</i>	Δ <i>Debt</i>	Δ <i>StDebt</i>	Δ <i>LtDebt</i>	<i>EqtIssue</i>
Tier 1	-0.200***	-0.204***	-0.111*	-0.069*	0.009
(N = 2178)	(-3.01)	(-3.00)	(-1.89)	(-1.85)	(0.43)
Tier 2	-0.060	-0.161**	-0.113**	0.011	0.075***
(N = 2177)	(-0.77)	(-2.08)	(-2.07)	(0.23)	(3.49)
Tier 3	-0.232***	-0.265***	-0.135**	-0.066	0.022
(N = 2177)	(-3.36)	(-3.98)	(-2.57)	(-1.26)	(0.84)
Tier 4	-0.106*	-0.145**	-0.040	-0.110**	0.033
(N = 2177)	(-1.82)	(-2.53)	(-0.79)	(-2.59)	(1.20)
Tier 5	-0.152***	-0.103**	-0.029	-0.015	-0.009
(N = 2177)	(-3.02)	(-2.13)	(-0.73)	(-0.45)	(-0.29)

Note: Equations (1) – (5) are tested separately according to firm size. In Panel B, only the coefficients of cash flow are displayed for brevity. ***, **, * indicate statistically significant at the 1%, 5%, and 10% level, respectively.

6. Three criteria of financial constraints

6.1. First criterion: firm size

I rank firm-years in the sample based on their firm size. Book value of assets are used as a proxy for the firm size, which is one of the best-known factors regarding financial constraints (e.g., Fama and French, 2002; Dasgupta et al., 2011; Chang et al., 2014). Instead of dividing firm-years into two specific groups of financially constrained and unconstrained, I classify them into five groups from Tier 1 (largest, most unconstrained) to Tier 5 (smallest, most constrained). For details, refer to Panel A in Table 6. Panel B is the OLS regression results according to Equations (1) – (5). Only the coefficients of *Cash flow* are shown for brevity, and each tier is divided into 2,177 observations. In respect to firm size, the cash flow sensitivities of overall external financing and debt issuance are adequately stable across all tiers, expressing negative coefficients in succession. A key point here is the issuing short-term debt, where the coefficients are significantly negative in Tiers 1 to 3, signifying that the substitution between internal funds and short-term debt is observed in large firms (FUF).

6.2. Second criterion: bond rating

Bond rating is also a well-known factor in regard to financial constraints (e.g., Almeida et al., 2004; Almeida and Campello, 2010; Chang et al., 2014). The Korea Investors Service (KIS), NICE Investors Service (NICE), and Korea Ratings (KR) are three representative rating agencies in Korea, and I employ the most conservative bond ratings from these local agencies. The observations for missing bond ratings are not taken into consideration, and the finalized classification is described in Panel A of Table 7. According to the regression results in Panel B, total debt issuance is related negatively with cash flow in Tiers 1 to 3. Interestingly, the observations for Tiers 1 and 2, which have the best conservative bond ratings in Korea, are capable of issuing long-term debt, whereas those in Tier 3 go hand-in-hand with issuing short-term debt.

6.3. Third criterion: commercial paper (CP) rating

This last criterion is the most conservative CP rating, and in line with the bond rating analysis, I do not include the observations for missing CP ratings. The rating is also obtained from three local agencies in Korea, and I note that the number of observations for CP rating is less than the bond rating in all tiers. As stated in Panel A of Table 8, Tier 1 only represents the CP rating of A1 whereas Tier 5 includes the ratings of C and D. The results in Panel B are appropriately consistent for all uses of external funds except *EqIssue*, which persistently displays ambiguous signs and significance throughout the paper. Ultimately, the negative relationship is concentrated in Tiers 1 and 2, indicating that the interplay between internal and external funds is also strongly observed in FUF for this criterion as well. The negative coefficient of Δ *StDebt* in Tier 5 may be negligible due to its small sample size of only 49 observations.

Table 7
Financial constraints: bond rating.

Panel A.					
Tiers	Description				
Tier 1	Most conservative bond rating of AAA, AA+, AA, AA-				
Tier 2	Most conservative bond rating of A+, A, A-				
Tier 3	Most conservative bond rating of BBB+, BBB, BBB-				
Tier 4	Most conservative bond rating of BB+, BB, BB-, B+, B, B-				
Tier 5	Most conservative bond rating of CCC, CCC-, CC, C, D				

Panel B.					
	<i>ExFinance</i>	Δ <i>Debt</i>	Δ <i>StDebt</i>	Δ <i>LtDebt</i>	<i>EqIssue</i>
Tier 1 (N = 690)	-0.178 (-1.42)	-0.232** (-2.10)	-0.104 (-1.30)	-0.125** (-2.09)	0.043 (1.31)
Tier 2 (N = 1040)	-0.233*** (-2.73)	-0.253*** (-3.17)	-0.098 (-1.36)	-0.152*** (-2.72)	0.007 (0.18)
Tier 3 (N = 992)	-0.181* (-1.85)	-0.163* (-1.83)	-0.171** (-2.56)	0.005 (0.07)	-0.011 (-0.42)
Tier 4 (N = 562)	-0.085 (-0.87)	-0.050 (-0.51)	-0.081 (-0.93)	0.064 (0.71)	-0.039 (-0.75)
Tier 5 (N = 89)	0.103 (0.27)	0.014 (0.03)	0.020 (0.05)	0.122 (0.46)	0.110 (1.54)

Note: Equations (1) – (5) are tested separately according to bond ratings. In Panel B, only the coefficients of cash flow are displayed for brevity. ***, **, * indicate statistically significant at the 1%, 5%, and 10% level, respectively.

Table 8
Financial constraints: commercial paper (CP) rating.

Panel A.					
Tiers	Description				
Tier 1	Most conservative CP rating of A1				
Tier 2	Most conservative CP rating of A2+, A2, A2-				
Tier 3	Most conservative CP rating of A3+, A3, A3-				
Tier 4	Most conservative CP rating of B+, B, B-				
Tier 5	Most conservative CP rating of C, D				

Panel B.					
	<i>ExFinance</i>	Δ <i>Debt</i>	Δ <i>StDebt</i>	Δ <i>LtDebt</i>	<i>EqIssue</i>
Tier 1 (N = 622)	-0.278** (-2.00)	-0.291** (-2.32)	-0.155* (-1.80)	-0.125* (-1.69)	0.017 (0.60)
Tier 2 (N = 703)	-0.298** (-2.54)	-0.341*** (-3.53)	-0.210** (-2.00)	-0.137* (-1.88)	0.025 (0.41)
Tier 3 (N = 761)	0.018 (0.19)	-0.039 (-0.43)	-0.153 (-1.63)	0.112 (1.42)	0.051* (1.78)
Tier 4 (N = 359)	-0.218* (-1.80)	-0.219* (-1.69)	-0.202 (-1.37)	0.050 (0.36)	0.075 (0.94)
Tier 5 (N = 49)	0.339 (0.58)	0.034 (0.02)	-2.148*** (-3.94)	2.180 (1.25)	0.306 (0.21)

Note: Equations (1) – (5) are tested separately according to CP ratings. In Panel B, only the coefficients of cash flow are displayed for brevity. ***, **, * indicate statistically significant at the 1%, 5%, and 10% level, respectively.

7. Concluding remarks

In this paper, I examine the role of external funds (overall external financing, debt issuance, and equity issuance) in relation to the internal funds (cash flow) by adopting a baseline model from Almeida and Campello (2010). I further break down debt issuance into short- and long-term debt issuance to investigate which portion of debt is practically paying off when firms are profitable. As a result, I find several interesting findings as follows. Debt issuance is negatively related to cash flow as expected, which is not the case for equity issuance. The ambiguous results of equity issuance are caused by firms' tendency to issue new equity when they are profitable. In analyzing the cash flow sensitivities of short- and long-term debt issuance, firms pay off short-term debt in response to their profitability, and long-term debt is difficult to use after the financial crisis. In supporting the third hypothesis, the negative relationship between internal and external financing is mostly observed in the firm-years of positive and increasing cash flow.

The second part of the paper looks into the role of financial constraints on the cash flow sensitivities of external financing. I classify the sample into Tiers 1 (most unconstrained) through 5 (most constrained) according to the three criteria of firm size, bond rating, and CP rating. I do not observe a monotonic pattern in the three analyses, but an overall review is that pecking order theory is better demonstrated by FUF in supporting the argument of Almeida and Campello (2010). The results signify that FCF do not lower the costly sources of external funds when they are profitable.

Can internal and external funds be ‘good’ substitution for each other? Yes, but treating external financing as a mixture of debt and equity issuance should be taken into consideration. Today, many theories regarding equity issuance have become more complicated than ever. For instance, Dierkens (1991) and Faff et al. (2016) insist on the inconsistency of firms’ issuing behavior, and Chay et al. (2015) find weak evidence in the second lung (debt and equity) of the pecking order in examining financing hierarchy. In all likelihood, issuing equity needs to be separated into internal and external equity as Lewellen and Lewellen (2006) emphasize in their paper. Further research will help to identify systematic patterns for the equity issuance.

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Appendix A

Variable definitions.

The codes of *FnGuide* are reported in the parenthesis.

External financing (ExFinance)	Sum of Debt issuance and Equity issuance.
Debt issuance (Δ Debt)	Sum of Short-term debt issuance and Long-term debt issuance.
Short-term debt issuance (Δ StDebt)	Net change (year t-1 to t) of short-term debt which is scaled by beginning-of-the-year book value of assets (1001190010), where short-term debt is [short-term bond (1001181470) + short-term borrowing (1001121700) + current financial liabilities (1001190630) + current portion of long-term debt (1001190620)].
Long-term debt issuance (Δ LtDebt)	Net change (year t-1 to t) of long-term debt which is scaled by beginning-of-the-year book value of assets (1001190010), where long-term debt is [long-term bond (1001190460) + long-term borrowing (1001190470) + non-current financial liabilities (1001190480)].
Equity issuance (EqIssue)	[Capital increase (1001330210) + selling of treasury stocks (1001330260) – capital decrease (1001330550) – repurchase of treasury stocks (1001330600)] / beginning-of-the-year book value of assets (1001190010).
Cash flow	[Net income (1001212450) + depreciation (1001310330) + amortization (1001390020)] / beginning-of-the-year book value of assets (1001190010).
Q	[Book value of assets (1001190010) + market value of equity – book value of equity] / book value of assets (1001190010) where market value of equity is share price (\$430003700) × shares outstanding (\$430001300) and book value of equity is total book equity (1001190380) less book equity of preferred stocks (1001130090).
Size	Natural logarithm of sales (1001210000).

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