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Nexus between Firm Level Investment and Financing Constraint Measures: A Critical Review

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Abstract: This article critically examines recent literature for apparently contradictory findings of FHP and KZ strand theory of investment cash-flow responsiveness, as firm level investment is one of the major drivers of economic growth. The reason for opposite findings of FHP and KZ is: FHP addressed the supply side determinants of external finance, while KZ used the demand side determinants. Recent findings show that investment irreversibility might cause insignificant investment cash-flow sensitivity for constrained firms. Furthermore, recent studies demonstrate that cash-flow volatility does play an important role in determining degree of sensitivity of investment to change in internally generated corporate funds within constrained group of firms. For constrained firms asymmetric information problem is dominated by cash-flow volatility and investment irreversibility varies positively with cash-flow volatility. Financial constraint should be relaxed for constrained firms which have relatively lower degree of volatility in internally generated corporate funds. Increase in cash stock also induces constrained firms to invest more than unconstrained firms.

Keywords: Investment; Cash-flow; Financial constraint; Volatility; Cash stock
JEL Classification: D92, G31, G10

1. Introduction

In case of perfect capital market, a firm's financial structure is irrelevant to investment because external and internal funds are perfect substitutes. If investment is contingent upon availability of internal finance, which has a cost advantage over external finance, external and internal funds are not perfect substitutes.

This article summarizes and highlights the findings of seminal papers in investment cash-flow sensitivity literature. The article begins discussion on findings of Fazzari, *et al*. (1988) which shows that financially constrained firms are more reactionary or more liquidity sensitive, KZ (1997) shows financially healthier firms investment are more responsive to cash-flow. Cleary (1999) concludes that firms with stronger financial position are more liquidity sensitive. Cleary (2006)

introduces the notion of cash-flow volatility and argues that this might be responsible for apparently contradictory findings of FHP and KZ if agency cost problem is dominated by cash-flow volatility. Guariglia, *et al*. (2012) identifies investment irreversibility for less liquidity sensitivity of financially constrained firms. Very recent findings of Mulier, *et al*. (2016) focuses on the movement of the price of external finance as reason of apparently contradictory findings of FHP and KZ, and the main driver of investment cash-flow sensitivity .

This paper tries to explore the link between the findings of Guraglia, *et al*. (2012) and Mulier, *et al*. (2016). How does the investment irreversibility vary with volatility in cash flow for firms with forward looking demand behavior? This paper explores the result of relaxing financing constraint on constrained firms' investment, when they are categorized according to different degrees of cash-flow volatility . Whether the increase in cash holdings induces constrained firms to invest more compare to unconstrained firms? When both constrained and unconstrained firms have same degree of cash-flow volatility , does increase in current cash stock result a large drop in price of external finance for firms that have binding financing constraint?

Section 2 highlights findings of seminal papers in existing literature .Section 3 presents graphical analysis of market for external finance to focus and validate the findings of this review paper. Section 4 reviews recent findings on external finance, FDI and investment in human capital by Claudia, *et al*. (2014) and Popov (2015) respectively. Section 5 concludes .

2. Review of Literature

2.1 Findings of FHP

Fazzari, *et al*. (1988) link conventional models of investment to the recent literature, on capital market imperfections and differential access of individual firms to capital markets. Asymmetric information makes costly for providers of external funds to evaluate firms' quality of investment opportunities. Firms that retain most of their income may have no low source of investment finance , for which the investment should be driven by fluctuation of cash flow. They present test of this hypothesis in the framework of conventional models of 'q', 'neoclassical' and 'accelerator' using the micro data of US manufacturing firms covering period 1970-1984. They found financial effects were generally important across all groups of firms classified by their dividend behavior, but results consistently indicated a substantially greater sensitivity of investment to cash flow and liquidity in firms that retain nearly all of their income. The statistically and economically significant difference was robust to a wide variety of model specifications and estimation techniques.

2.2 Findings of KZ

Kaplan and Zingales (1997) examined sample of low dividend firms of FHP (1988), but their classification scheme was different, unconstrained firms are those with relatively large amount of liquid assets more than necessary to finance the investment in foreseeable future, or where lenders did not restrict from making large dividend payments relative to investment. Financially constrained firms are those which are in violation of debt covenants, and are renegotiating the debt payments. The most financially successful and least constrained firms are those which rely primarily on internally generated corporate funds to invest despite the availability of additional low cost funds and therefore exhibit greater investment cash flow sensitivity. They concluded that investment cash flow sensitivities do not provide useful evidence about the presence of financing constraints.

2.3 Contribution of Cleary of FHP and KZ strand of literature

Cleary (1999) argued that the major drawback of KZ study is that their sample consists of only 49 firms which are freely high quality. His sample consisted of 1317 of US firms that have complete financial information available for the period 1987-1994. He classified firms into three categories; likely not financially constrained which increase dividends, likely financially constrained which do not change dividend payments and possibly financially constrained which cut dividends. Discriminate analysis uses a number of financial variables which will enable to predict if firms will increase or decrease dividends in subsequent period. The 'z' score is estimated according to following:

$$Z_{FC} = \beta_1 \text{Current} + \beta_2 \text{FC Cov} + \beta_3 \text{ Slack/K} + \beta_4 \text{NI\%} + \beta_5 \text{ Sales growth} + \beta_6 \text{Debt} \quad (1)$$

The largest correlation between Z_{FC} and the NI% (Net Income margin in %) and sales growth suggests that firms tend to increase dividends payments during periods of stable and increasing profits. Using fixed firm and year effects, Cleary (1999) used the following specification:

$$I/K_{it} = \beta_{MB} (M/B)_{it} + \beta_{CF/k} (CF/K)_{it} + \mu_{it} \quad (1a)$$

I represents investment in plant and equipment during period *t*, *K* is the beginning of period book value for net property, plant and equipment; CF represents current period cash flow to the firm as measured by the net income plus depreciation plus change in deferred taxes; and M/B represents the firms' common equity to book ratio based on the previous year's actual market value of common equity to book ratio to proxy for growth opportunities as explained by KZ. This ratio is computed by dividing market value of common equity by the book value of the common equity. Current period cash- flow scaled by *K* (net fixed assets) is used to measure liquidity variable.

Estimations depict firms' investment decisions are more sensitive to liquidity compare to market to book ratio. For all categories of firms the coefficient of cash- flow is larger than that of market to book ratio. The β_{MB} coefficients are not statistically different across three groups and precisely determined. cash-flow coefficients are different and the largest and positive for not financially constrained firms compare to financially constrained and possibly financially constrained firms.

FHP (2000), criticized the findings of KZ (1997) and argued that growing companies invest heavily in both inventories and accounts receivable and they recomputed the median value of cash flow less total investment, they discovered that this figure is negative at seventy fifth percentile for unconstrained firms for KZ which could maintain median total investment from cash stocks for three months and these firms are actually facing financing constraints.

Cleary (2006) made an attempt to resolve these differences by making use of a richer model that examines the interrelationships among some commonly used measures of financial constraint. Firms that are classified as not financially constrained according to financial strength tend to show larger and higher payout ratios; however the relationship is not exceptionally strong except for the US sample.

This study formally examines interactions between different financial constraint measures and determine what firm level characteristics have the greatest impact on investment after controlling for other traits. The study consists of unbalanced panels of firms from 1987-1997 from seven of the world's largest economies, Australia, France, Germany, Canada, Japan, the UK and the US.

Summary statistics confirm that firms reducing their dividends appear to be more financially constrained than those that increase their dividends according to traditional financial ratios. Firms that cut dividends demonstrate lower current ratios, higher debt ratios, lower interest coverage, lower net income margin, lower market to book ratios and lower sales growth than firms that

increase dividends. Summary statistics confirm that NFC firms are more solid than the FC firms, except for Australia, where the ratios are not clearly superior for NFC firms. The following regression equation is estimated:

$$I/K_{it} = \beta_{MB}\,(M/B)_{it} + \beta_{CF/k}\,(CF/K)_{it} + \mu_{it} \qquad (2)$$

The interpretations of all variables are similar to the equation (1) as discussed previously, Cleary (1999).

Firm investment decisions are sensitive to market to book ratio, , but are even more sensitive to cash-flow. The results of the dividend payout group reflect that high payout group is more sensitive to liquidity than low payout group in all the seven countries. Results for the groups formed according to the firm size show that, smaller firms are less liquidity sensitive than larger firms, this result hold for all countries except for the UK. Firms with stronger financial positions are more liquidity sensitive than the firms with weaker financial positions. This result adheres to findings of KZ (1997) and Cleary (1999) in an international setting regarding the impact of the financial health, with lone exception for Australian firms.

In order to account for the interrelationships among the financial constraint measures regressions are run using dummy variables and interactive dummy variables. The CF/K interactive term for high payout firms is positive and precisely determined for total sample of Australian firms indicating higher payout firms are more liquidity sensitive relative to lower payout firms even after controlling for firm size and financial strength. The interactive term for FC dummy variable is negative and statistically significant for all countries except for Germany and Australia.

In most of the cases high payout firms are more cash-flow sensitive for NFC firms except for Japan, where the estimated coefficient is negative for NFC firms and FC firms are more cash-flow sensitive. Larger firms are significantly more cash- flow sensitive in Canada and Germany but in the US estimated coefficient of size interactive dummy for NFC and FC firms are very close and smaller firms are more cash-flow sensitive in Britain. Dividend payout and size effect are weak and in some cases nonexistent for FC firms. The high payout interactive term on full sample is positive and precisely determined in general.

Overall the results provide strong evidence that firms with stronger financial positions exhibit more investment cash-flow sensitivity than firms with weaker financial positions even after controlling for size and dividend payout. The impact of firm size is a weaker measurement of financial constraint once the financial strength and dividend payout are controlled for.

Cleary (2006) argued that cash-flow volatility might be responsible for constrained firms to be less sensitive to cash-flow compare to mature established firms. Summary statistics confirm this by using several measures of cash-flow volatility. Where the FC firms have higher and larger values of measurement of the cash-flow volatility across all seven countries. Firms with high cash-flow volatility display low investment cash-flow sensitivity and vice- versa. This may be able to account for apparent contradictory empirical findings if this volatility effect dominates information asymmetry problems that researchers attempt to measure using their financial constraint measures.

2.3.1 Investment Irreversibility and investment cash-flow sensitivity

According to Guariglia *et al*. (2012), firms that face binding constraints on external finance, investment irreversibility may mute the insignificant response of investment to cash-flow. Investment is at least partially irreversible if the sunk cost is greater than resale price of capital. The essence of the work of Abel and Eberly (1994), Bertola and Caballero (1994), Dixit and Pindyck

(1994) among others is that a firm might suspend its present profitable investment projects and wait to get more information rather than to undertake investment under uncertain condition.

Guariglia *et al*. (2010) analyzed 4423 unlisted firms for four transition economies: Bulgaria, Poland, The Czech Republic, and Romania, which are likely to face financial and irreversibility constraint. They estimate investment equations similar to those by Konings, *et al*. (2003) and Scaramozinno (1997), and classify firms according to degrees of investment irreversibility.

Inter-temporal allocation of investment is adversely affected by fixed capital adjustment costs and irreversibility, either by increasing threshold level of profitability or by taking precautionary motive. It is possible that firms might prefer to accumulate cash stock from cash-flow as savings which they might choose to invest in future to avoid the cost associated with external finance.

They estimated following baseline model

$$\frac{I_{it}}{K_{i,t-1}} = \alpha_0 + \alpha_1 \frac{Q_{it}}{K_{i,t-1}} + \alpha_2 \frac{CF_{it}}{K_{i,t-1}} + \varepsilon_{it} \qquad (3)$$

CF_{it} is cash flow, and Q_{it} stands for Tobin's Q. In presence of binding constraint of external finance , it is expected that α_2 is positive and precisely determined , but firms facing irreversibility constraints under uncertainty which might be a situation appropriate to sample countries , two additional models were estimated.

$$\frac{I_{it}}{K_{i,t-1}} = \alpha_0 + \alpha_1 \frac{Q_{it}}{K_{i,t-1}} + \alpha_{21} \frac{CF_{it}}{K_{i,t-1}} * IRR_{it} + \alpha_{22} \frac{CF_{it}}{K_{i,t-1}} * (1 - IRR_{it}) + \varepsilon_{it} \quad (3a)$$

$$\frac{\Delta \text{Cash}_{it}}{\text{TotalAssets}_{i,t-1}} = \beta_0 + \beta_1 \frac{Q_{it}}{\text{TotalAssets}_{i,t-1}} + \beta_2 \frac{CF_{it}}{\text{TotalAssets}_{i,t-1}} + \beta_3 \text{Size}_{it} + \varepsilon_{it} \quad (3b)$$

In model (3a) IRR_{it} is a dummy equal to '1' if firm i faces irreversible constraint and '0' otherwise. In case of high level of capital irreversibility it is expected that α_{21} to be statistically not significant and α_{22} to be significant because investment is non respondent with internally generated corporate funds for firms facing irreversibility constraint.

Model (3b) is included as forward looking firm may opt for accumulating cash from internal funds as a safe guard to protect firm from volatility of market conditions stemming from structural reforms over the sample period instead of investing. In equation (3b), dependent variable is the ratio of cash to total assets which is related to firm's Cash-flow to total assets ratio similar to Almeida, *et al*. (2004). *Size* captures potential economies of scale according to Almeida, *et al*. (2004) and Khurana (2006). Finally model (3c) is estimated which allows the interaction of IRR_i dummy with cash-flow variable in the preceding model.

$$\frac{\Delta \text{Cash}_{it}}{\text{TotalAssets}_{i,t-1}} = \beta_0 + \beta_1 \frac{Q_{it}}{\text{TotalAssets}_{i,t-1}} + \beta_{21} \frac{CF_{it}}{\text{TotalAssets}_{i,t-1}} * IRR_{it} + \beta_{22} \frac{CF_{it}}{\text{TotalAssets}_{i,t-1}} * (1 - IRR_{it}) + \beta_3 \text{Size}_{it} + \eta_{it} \qquad (3c)$$

It is expected that firms with high degrees of irreversibility would exhibit greater and larger sensitivity of cash hoarding to cash-flow compare to firms with lower degrees of irreversibility, so $\beta_{21} > \beta_{22}$.

Estimation results suggest that α_2 is precisely determined in model (3) for all sample countries, implying firms has binding financial constraints. All four countries exhibit positive sensitivity of accumulation of cash stock from cash-flow, so $\beta_2 > 0$ in model (3b) as well as the UK. To estimate equation (3a), IRR_i is controlled by variability of Labour to capital ratio (Leahy and Whited 1996), (Drakos and Goulas 2006). Firm i has lower (higher) degree of IRR

constraint if variance of labour to capital ratio is below (above) median value over all industries. As robustness check average depreciation to capital ratio (Chirinko and Schaller, 2009) is the proxy for IRR_i. Firm i has lower (higher) degree of IRR constraint if this ratio falls below (above) median depreciation rate over all industries.

Estimation results suggest that for model (3a) α_{22} is positive and statistically significant for sample countries and it is largest for Bulgaria (1.135). For Romania estimated coefficient is precisely determined at 10% level. Robustness test shows similar result with the largest value of that for Bulgaria. In model (3c), $\beta_{21} > 0$ and precisely determined in all sample countries along with the UK. Estimation results of robustness test when IRR_i is measured by variance of labour to capital ratio and Industry level depreciation rate demonstrate that the coefficient β_{21} in model (3c) is precisely determined for all countries. Finally, in model (3a) and (3c) robustness tests where irreversibility is controlled by I/K confirm that α_{22} and β_{21} are precisely determined for all sample countries.

In transition economies where firms are likely to face binding financing constraints , high degree of irreversibility, might force firms to postpone investment to accumulate cash stock form cash-flow, so in future the firm could relax its liquidity constraint and could use internally available corporate funds to reduce its reliance on external finance which is expensive. Irreversibility constraint may, therefore, be the reason for the lower responsiveness or sensitivity of investment to cash-flow for financially constraint firms. According to Guariglia *et al*. (2012) capital irreversibility may be accounted for insignificant investment cash-flow sensitivity of firms which have liquidity constraint, which makes an attempt to clarify the findings by Kaplan and Zingales (1997), Cleary (1999), and Cummins, *et al*. (2006).

2.3.2 Role of Cash-flow volatility in investment cash-flow sensitivity

To examine the role of cash-flow volatility in investment cash-flow sensitivity literature, Minton *et al*. (2002) demonstrate that this is an important variable in predicting expected cash-flow in future. Boyle and Guthrie (2003) introduced a model where firms with higher level of cash-flow volatility have lower threshold level of Investment and hence the exhibit greater responsiveness of investment to cash-flow. In contrast to this, Cleary (2006) show firms with lower volatility show greater sensitivity of investment to cash-flow. Mulier, *et al*. (2014) tested the error correction model by Bond *et al*. (2003), Mizen and Vermeulen (2005), Guariglia (2008) and Bloom, *et al*. (2007) for unlisted firms for six European economies form 1996 -2008 , they used following model:

$$\frac{I_{it}}{K_{i,t-1}} = \alpha_0 + \alpha_1 \frac{I_{i,t-1}}{K_{i,t-2}} + \alpha_2\left(k_{i,t-2} - s_{i,t-2}\right) + \alpha_3 \Delta s_{it} + \alpha_4 \Delta s_{i,t-1} + \alpha_5 \Delta emp_{i,t-1} + \alpha_6 \frac{CF_{it}}{K_{i,t-1}} + \nu_i + \nu_{jt} + e_{it} \quad (4)$$

As the sample firms are unlisted , to control for possible information content of cash-flow regarding investment opportunities, firm level employment growth was considered based on notion that firms with good investment opportunities will increase their workforce according to Mulier, *et al*. (2014) especially in presence of Cash-flow volatility. Firms with better investment opportunities represented by employment growth invest significantly in all countries except Belgium. Cash-flow coefficients are precisely determined for all countries except Hungary .This manifests the presence of financing constraints which is quite likely because the firms are unlisted.

To capture the potential cash-flow fluctuation or volatility effect, they consider standard deviation of cash-flow to capital ratio and construct three dummies, i.e. HIGVOL_{it}, MEDVOL_{it}, and LOWVOL_{it}, allow interactive terms with α_6 coefficient in model (4) and estimate the following one:

$$\frac{I_{it}}{K_{i,t-1}} = \alpha_0 + \alpha_1 \frac{I_{it-1}}{K_{it-2}} + \alpha_2 (k_{it-2} - s_{it-2}) + \alpha_3 \Delta s_{it} + \alpha_4 \Delta s_{it-1} + \alpha_5 \Delta emp_{it-1} + \alpha_{6a} \left(\frac{CF_{it}}{K_{it-1}} * LOWVOLit + \alpha 6bCFitKit - 1 * MEDVOLit + \alpha 6cCFitKit - 1 * HIGVOLit + v1 + v2 + v3 + \in it \right. \quad (4a)$$

LOWVOL_{it} is a dummy variable equals to '1' if firm $i's$ standard deviation of cash-flow to capital is among the lowest 25th percentile of its industry in year *t*, and '0' otherwise. HIGVOL_{it} is a dummy variable equals to '1' if firm $i's$ standard deviation of cash-flow to capital is among the highest 25th percentile of its industry in year *t*, and '0' otherwise. MEDVOL_{it} is a dummy variable represents all remaining observations.

Estimation results suggest that investment cash-flow sensitivity decreases with volatility of cash-flow. Estimated α_{6a} is positive and statistically significant and larger than α_{6c}. For Finland and Hungary the α_{6c} is poorly determined for firm years; so the sensitivity is nil. Robustness tests demonstrate similar results where cash-flow is interacted with coefficient of variation of cash-flow as a measurement of volatility. Investment reacts with internally generated corporate funds for lowest volatile group. In fact for high volatile group the sensitivity disappears for all firm years except for Sweden.

2.3.3 The cost of external finance, demand and supply behavior of external finance and investment cash-flow sensitivity

Mulier, *et al*. (2016) allow interaction with financial constraints from recent literature by Campbell *et al*. (2012) and Mulier, *et al*. (2014) in model (4a). They argue investment cash-flow sensitivity is probably stronger for constrained firms with inelastic supply of external finance. Sensitivity is strongest for financially weaker firms with low cash-flow volatility and lowest for financially healthier firms with high cash-flow volatility. Firm size, age and average cash-flow are considered as determinants of supply of external finance. Financially stronger firms have good track records according to Schiantarelli (1996) than weaker firms so asymmetric information problem according to Bernanke *et al*. (1996) does not exist between lender and borrower for financially healthier firms and ,therefore, there supply of external finance is elastic. Increase in size and age is supposed to increase external finance for older and bigger firms Hadlock and Pierce (2010).

Mulier, *et al*. (2016) estimated the following model:

$$\frac{I_{it}}{K_{i,t-1}} = \alpha_0 + \alpha_1 \frac{I_{it-1}}{K_{it-2}} + \alpha_2 (k_{it-2} - s_{it-2}) + \alpha_3 \Delta s_{it} + \alpha_4 \Delta s_{it-1} + \alpha_5 \Delta emp_{it-1} + \alpha_{6a} \left(finconLOW_{it} * \frac{CF_{it}}{K_{it-1}} * LOWVOL_{it} \right) + \alpha_{6b} \left(finconLOW_{it} * CFitKit - 1 * MEDVOLit + \alpha 6cfinconLOWit * CFitKit - 1 * HIGVOLit + \alpha 7afinconHIGHit * CFitKit - 1 * LOWVOLit + \alpha 7bfinconHIGHit * CFitKit - 1 * MEDVOLit + \alpha 7cfinconHIGHit * CFitKit - 1 * HIGVOLit + vi + v2 + vjt + \in it \right. \quad (4b)$$

To represent different degrees of financial constraint $finconLOW_{it}$ is a dummy which equals to '1' if firm i gets a specified score '5' to '6' and '0' otherwise, implying unconstrained supply of external finance. $finconHIGH_{it}$ is a dummy representing firm i has constrained supply. Dummies of financial constraint are allowed to interact with different degrees of cash-flow volatility, measured according to standard deviation of cash-flow to capital ratio. Estimation results suggest that financially constrained firms with low cash-flow volatility exhibit strongest sensitivity of investment; α_{7a} is precisely determined for all countries and Czech republic has the largest value. $\alpha_{7b}$is found to be significant for all sample countries. α_{7c} is significant for Belgium, France and Sweden only. For unconstrained group investment cash-flow sensitivity is stronger for firms with medium volatility for Belgium, France and Sweden. Unconstrained group with low volatility also demonstrate investment cash-flow sensitivity but the magnitude of coefficient $\alpha_{6c}$is smaller. In general the financially constrained group shows greater responsiveness of investment to change in cash-flow compare to unconstrained group. Robustness test where volatility is measured according to coefficient of variation shows similar findings; constrained group exhibits greater sensitivity relative to unconstrained group and investment cash-flow sensitivity reduces as degree of volatility increases.

3. Market for External Finance , Cash-flow Volatility, Role of Cash–stock and Investment Cash Flow Sensitivity

3.1 Access to external finance and investment cash-flow sensitivity of constrained firms

Graphically we examine the impact of relaxing financing constraint on investment cash-flow sensitivity for constrained firms with different degrees of cash-flow volatility in following diagram. We assume the firm's demand for external finance is forward looking. There are two broad categories of firms according to fluctuation in current cash-flow; High volatile and low volatile.

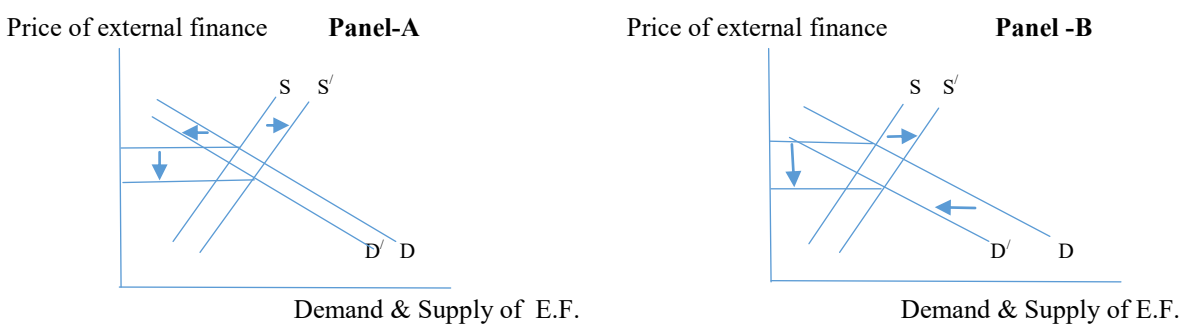

Figure 1. Constrained firms of high volatility (Panel-A), and of low volatility (Panel-B)

We assume current cash-flow rises by same amount for both groups, so downward sloping demand function shifts to the left to a larger extent for low volatile group and price of external finance drops substantially relative to high volatile group. Upward sloping supply function which is steeper shifts to right for both categories of constrained firms to the same extent because we assume greater access to institutional finance/external finance for both groups to equal extent. The important policy implication is: more institutional or external finance should be available for constrained firms with low cash-flow volatility. Because of large drop in equilibrium interest rate,

these firms are expected to invest more. Although these firms are suffering from financing constraint, they are "potentially good firms" with greater profit generating capacity in future. So financially constrained firms which have relatively lower degree of cash-flow fluctuation are expected to reduce their reliance on external finance in future.

Proof:

Demand function for external finance: $Q_{ef}^{d} = \alpha - \beta P_{ef}$

Supply function for external finance: $Q_{ef}^{s} = \lambda + \delta P_{ef}$

Solving for equilibrium P_{ef}:

In equilibrium, $Q_{ef}^{d} = Q_{ef}^{s} = Q$. By equating right sides of demand and supply equations and solving for equilibrium price of external finance, we get $P_{ef}^{*} = \frac{\alpha-\lambda}{\delta+\beta}$. It is required that $\alpha > \lambda$. Increase in current cash-flow induces the downward sloping demand curve to shift leftward. Increase in availability of external finance will induce upward sloping supply curve to shift rightward.

Demand equation: $Q_{ef}^{d} = \alpha^{*} - \beta P_{ef}$

Supply equation: $Q_{ef}^{s} = \lambda^{*} + \delta P_{ef}$.

Solving for new equilibrium Price of external finance we similarly find $P_{ef}^{*} = \frac{\alpha^{*}-\lambda^{*}}{\delta+\beta}$. Differential of equilibrium price P_{ef}^{*} for constrained firms with high cash-flow volatility would be: $\frac{\alpha-\lambda}{\delta+\beta} - \frac{\alpha^{*}-\lambda^{*}}{\delta+\beta} = \frac{(\alpha-\alpha^{*})+(\lambda^{*}-\lambda)}{\delta+\beta}$.

For low volatile group, demand function shifts to a greater extent towards left and greater availability of external finance induces supply curve to shift rightward.

Demand function: $Q_{ef}^{d} = \alpha^{**} - \beta P_{ef}$

Supply equation keeps the same: $Q_{ef}^{s} = \lambda^{*} + \delta P_{ef}$

New Equilibrium Price of external finance is $P_{ef}^{**} = \frac{\alpha^{**}-\lambda^{*}}{\delta+\beta}$. Similarly, differential of equilibrium price P_{ef}^{*} for constrained firms with low cash-flow volatility is $\frac{\alpha-\lambda}{\delta+\beta} - \frac{\alpha^{**}-\lambda^{*}}{\delta+\beta} = \frac{(\alpha-\alpha^{**})+(\lambda^{*}-\lambda)}{\delta+\beta}$. Since $\alpha^{**} < \alpha^{*}$, differential of equilibrium price for low volatile group is larger than that of high volatile group. Interest rate falls substantially for those constrained firms which have lower degree of cash- flow volatility.

3.2 Impact of Increase in cash stock on investment cash-flow sensitivity for constrained and unconstrained firms:

Assuming both constrained and unconstrained firms have same degree of cash-flow volatility, we present the analysis in the following diagram:

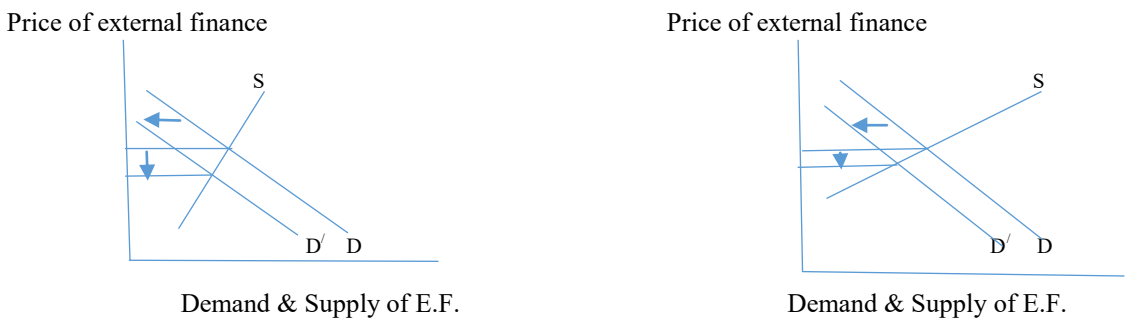

Figure 2. Shifts of constrained firms (Left) and unconstrained firms (Right)

As we see in above diagram ,downward sloping demand function shifts to the left to same extent for both group of firms as we assume increase in current cash stock to equal extent as increase in current cash holdings reduces the demand for external finance at given interest rate. The fall in equilibrium interest rate is larger for firms that are facing financial constraint in panel A because of relatively inelastic supply curve compare to firms that are not facing financing constraint. We could conclude that if both groups have same degree of cash-flow volatility, increase in cash stock induces the constrained firms to invest more than unconstrained firms. So constrained firms are found to be more liquidity sensitive when cash holding rises. This finding is similar to Denis & Sibilkov (2009).

Proof: The demand and supply functions of Constrained Firms are

DD function: $Q_{ef}^{d} = a - bP_{ef}$

SS function: $Q_{ef}^{s} = c + dP_{ef}$, solving for market-clearing price of external finance induces $P_{ef} = \frac{a-c}{b+d}$

For Unconstrained Firms,

DD function keeps the same as before: $Q_{ef}^{d} = a - bP_{ef}$

SS function varies to: $Q_{ef}^{s} = c^{*} + d^{*}P_{ef}$, here $d^{*} < d$.

Equilibrium price of external finance is $P_{ef} = \frac{a-c^{*}}{b+d^{*}}$. Increase in current cash holdings reduces demand for external finance for both groups, assuming same degree of cash- flow volatility for both groups.

The equilibrium price differential for constrained group:

DD function varies to $Q_{ef}^{d} = a^{*} - bP_{ef}$, and supply function remains the same as before. The new market-clearing price is $P_{ef} = \frac{a^{*}-c}{b+d}$. Equilibrium price differential is: $\frac{a \quad -c}{b+d} - \frac{a^{*}-c}{b+d} = \frac{a-a^{*}}{b+d}$.

For unconstrained group:

Demand function is $Q_{ef}^{d} = a - bP_{ef}$, and Supply function is $Q_{ef}^{s} = c^{*} + d^{*}P_{ef}$ now.

Increase in current cash holdings reduces the demand for external finance so demand curve shifts to the left. Since the degree of cash- flow volatility is same across two groups the demand curve shifts to the same extent as constrained group. We need to solve the following two equations:

(1) Demand function: $Q_{ef}^{d} = a^{*} - bP_{ef}$; and (2) Supply function: $Q_{ef}^{s} = c^{*} + d^{*}P_{ef}$, with the new equilibrium price of external finance $P_{ef}^{**} = \frac{a^{*}-c^{*}}{d^{*}+b}$. The equilibrium price differential is: $\frac{a-c^{*}}{b+d^{*}} - \frac{a^{*}-c^{*}}{b+d^{*}} = \frac{a-a^{*}}{b+d^{*}}$.

Since $d^{*} > d$. The upward sloping supply curve is flatter for unconstrained firms. We find that $\frac{a-a^{*}}{b+d} > \frac{a-a^{*}}{b+d^{*}}$.

Because demand curve is downward sloping which implies ‘ b’ is negative, and we have $d > d^{*}$. Equilibrium price differential for constrained firms is greater than that of unconstrained firms.

4. Financial Constraint , Foreign Direct Investment and Investment in Human Capital

4.1 Financing constraint and foreign direct investment

Claudia, *et al*. (2014) examined the importance of financing constraint for firms who are willing to enter foreign markets. They analyzed a detailed data set of German domestic and multinational firms and found financial frictions restrict firms foreign investment decisions. These firms need external finance because these firms are most likely to expand and are productive. Firms with lower level of internally generated corporate funds, lower productivity, higher leverage, higher fixed cost are not substantially affected by financing constraint because they are less likely to invest abroad. Their findings suggest, high productivity is a necessary but not a sufficient condition for entry into the foreign market.

4.2 Financing constraints and firm investment in human capital

The existing literature has focused much on the effect of financing constraint on corporate investment which is the process of accumulation of physical capital. Becker (1964) first gave emphasis on the availability of credit constraints in the provision of human capital. Popov (2015) examined the impact of financing constraint on firm investment in human capital. He analyzed 2005 business and enterprise performance survey data base on 9,655 firms from 27 emerging markets. Findings demonstrate that financial constraints do hinder the provision of firm level training. Limited access to bank finance, lack of access to equity capital and stringent collateral requirements impede firm’s investment in on-the-job training for its employees. Especially, the SME’s are affected which have greater reliance on external finance. Firms are able to invest more in formal training in countries with well developed credit market. Financing constraint accompanied by inadequate investment in human capital reduces firms’ productivity & efficiency. According to Bronwyn *et al*. (2016), European small and younger firms’ R&D investment is severely affected by financing constraints than larger firms because of small firms’ limited access to external finance, and this might be pronounced in case of longer macroeconomic recession and demand uncertainty. Similar findings Alvarez *et al*.(2015) were obtained for Chilean firms, where financial constraints are more severe for micro and small firms and this creates hindrance for innovation and R&D.

5. Concluding Remarks

The recent findings of Mulier, *et al*. (2016) give emphasis on the price of external finance , which plays an important role in determining the investment cash-flow sensitivity debate. FHP focused on variables that focus on supply of external finance; while the KZ focused on demand of external finance. So FHP and KZ used different proxies to measure the financing constraints. Investment cash-flow responsiveness varies with the degree of cash-flow volatility within the constrained group. Low volatile group exhibit greater sensitivity and high volatile group demonstrate lower responsiveness. Probably FHP focused on firms that have restricted supply of external finance with relatively low volatility and KZ considered firms that are actually facing limited supply of external finance with high cash-flow volatility.

Guariglia, *et al*. (2012) pointed out capital irreversibility as an important factor behind the low investment cash-flow sensitivity for constrained firms. These firms actually have steeper supply curve of external finance; increase in current cash-flow induces the leftward shift of downward sloping demand function of external finance and hence fall in interest rate; so does price of capital; but firms postpone current investment because of high cash-flow volatility . Because of greater fluctuation in current cash-flow, a forward looking firm does not have the incentive to alter its expectation regarding future cash-flow, so downward sloping demand curve shifts leftward to a little extent. As a result the price of external finance does not fall substantially to induce firms to increase its current investment. They adopt "wait and see" policy and prefer the accumulation of cash stock instead and exhibit lower cash-flow sensitivity. The degree of investment irreversibility varies in positive direction with volatility effect within the constrained group of firms.

Price of external finance is affected by cash-flow volatility , which affects the demand in market for external finance; that causes different investment cash-flow sensitivities for firms facing financing constraint. For constrained group of firms which are forward looking; the agency cost is dominated by volatility of cash-flow. This adheres to the prediction by Cleary (2006).

The contribution of this review paper is that it explores the link between findings by Guariglia, *et al*. (2012) and Mulier, *et al*. (2016). Firms which have forward looking demand behavior, investment irreversibility accompanied by high level of volatility in cash-flow are actually less liquidity sensitive. Irreversibility varies in positive direction with cash-flow volatility. Firms that have lower degree of investment irreversibility as well as low volatility in cash-flow are actually more liquidity sensitive.

Forward looking constrained firms with lower degree of cash-flow volatility would invest in greater extent today because of substantial drop in the price of external finance compare to high volatile group. This paper argues that institutional or external finance should be available in greater extent for those constrained firms which have comparatively lower degree of cash-flow fluctuation. Our analysis finds that increase in cash holdings induces the constrained firms to invest more . When both constrained and unconstrained firms have same degree of cash-flow volatility, increase in current cash-stock results a large drop in the price of external finance for firms that have binding financing constraint and such firms become more liquidity sensitive. With help of firm level data, appropriate baseline models should be introduced and developed, so that the claim of this paper could be examined and tested empirically.

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