The current issue and full text archive of this journal is available on Emerald Insight at:
https://www.emerald.com/insight/1743-9132.htm

The firm growth-cash flow sensitivity: do financial constraints matter?

Abdul Rashid
International Institute of Islamic Economics, International Islamic University, Islamabad, Pakistan, and
Mahir Ahmed Hersi
International Institute of Islamic Economics, Islamabad, Pakistan

Received 19 July 2020
Revised 8 February 2021
Accepted 22 April 2021

Abstract

Purpose – The paper examines the differential effect of liquidity constraints on corporate growth using unbalanced panel data for 457 Pakistani firms over the period 2010–2017.

Design/methodology/approach – The study uses the probability of a financial unconstrained index constructed by estimating the endogenous regression model. This approach provides a time-varying measure of financial position for all firm-year observations and takes into account the different degrees of liquidity constraints that a company faces in attaining funds from external markets. It is derived from a multivariate selection equation that simultaneously accounts for all-important features of the underlying company identified in the literature. The cash flow variable has then interacted with various groups of dummy variables for financial constraint, which allows the coefficient of cash flow to vary across firm-year observations in the different liquidity constraint categories. The two-step system-GMM estimator is applied to estimate the main empirical model.

Findings – The results of the study provide evidence of the heterogeneity in firms' growth sensitivity to internal funds, depending on the degree of liquidity constraints. Financing growth through internal funds is found to be essential for both liquidity unconstrained and constrained corporates. However, it is observed that the coefficient of cash flow is greater for firms that do not have access to external financing and it eventually decreases with reductions in the magnitude of liquidity constraints, making the least constrained corporates' growth less responsive to internal funds. The results further indicate that smaller and younger firms show higher responsiveness of growth to internal funds. This finding is mainly attributed to financial market imperfections that make external funding difficult for them.

Practical implications – The results suggest that financially constrained firms should expand their corporate size more than the magnitude of positive income shocks they encounter. The study also suggests important policy implications for liquidity-constrained firms to carefully concentrate on their financing strategies to enhance their growth. By improving the corporate's capacity for production, corporates can achieve a faster effect of a potential positive income shock on their growth.

Originality/value – This paper contributes to the literature by constructing a financial constraint index by running the endogenous regression model. It also contributes by investigating the differential impact of credit

JEL Classification — C23, D82, G32, L25

The authors are thankful to Zainab Jehan for reading first draft of the paper and giving valuable suggestions.

Funding: We did not receive any funding to complete this study.

Compliance with Ethical Standards:

Ethical approval: This article does not contain any studies with human participants or animal performed by any of the authors.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflict of Interest: On behalf of all authors, the corresponding author states that there is no conflict of interest.

Competing interests: The authors declare that they have no competing interests.

International Journal of Managerial Finance
Vol. 18 No. 2, 2022
pp. 317-335

1743-9132
DOI 10.1108/IJMF-07-2020-0379

constraints on firms' growth in Pakistan and how corporate size and age affect firm growth when financial constraints and investment opportunities are controlled.

Keywords Law of proportionate effects, Financial constraints, Growth-cash flow sensitivity, Liquidity constraints, Small firms, Young firms

Paper type Research paper

1. Introduction

Financial constraints are a serious obstacle in promoting a firm's investment and subsequently its growth. Several studies have discussed the effect of liquidity constraints on firms' investment. However, limited papers explored the impact of financial constraints on firm growth (Driver and Muñoz-Bugarin, 2019; Gómez, 2019; Ismail *et al.*, 2010). Financial constraint is defined when liquidity constrained companies encounter a wedge between the financial cost of external and internal financing (Kaplan and Zingales, 1997). Asymmetric information and managerial agency theories are the main drivers of that wedge. Carreira and Silva (2010) describe liquidity constrained firms that face difficulty in acquiring adequate funds from external sources to finance their growth.

The empirical study of Gibrat (1931) is often considered as an empirical benchmark, which states that the growth of a corporation is not related to its size at an earlier stage and that its size distribution is logged normal and remains the same over time. However, a considerable number of studies have criticized on various implications of Gibrat's law. A recent study on the effect of liquidity constraints on plant growth by Markovic and Stemmer (2017) reveals that performance, age and size are the factors that determine and make firms more dependent on internal financing. The authors also find firms' higher reliance on retained earnings. Similarly, Quartey *et al.* (2017) study how capital distress affects corporate growth for small and medium-sized enterprises and show that access to external funds is mainly determined by ownership, firms' export orientation, the strength of legal rights, firm size, the experience of the top manager and depth of credit information. Several other prominent studies have also shown that the degree of capital constraints is higher for firms that do not have access to external funds and eventually declines with reductions is magnitudes of liquidity constraints, making the least constrained companies less responsive to internal funds (Carpenter and Petersen, 2002; Quader, 2017).

A major challenge for researchers is that capital constraints are not directly observable. Prior empirical researches have used different financial constraint measures that have several drawbacks. For instance, Kaplan and Zingales (1997) cast doubts about the validity of the investment-cash flow sensitivity introduced by Fazzari *et al.* (1988) as a measure of liquidity constraints because several unrealistic assumptions. Liquidity constraints do not cause low dividends. Rather, risk-averse management may lead to a low dividend payout ratio (Lins *et al.*, 2010). Investment opportunities bias, which is not captured by Tobin's Q, can reflect investment-cash flow sensitivity (Cummins *et al.*, 2006). Likewise, Hadlock and Pierce (2010) have warned interpreting the results that rely on the KZ index (Kaplan and Zingales, 1997) and the WW index (Whited and Wu, 2006). After estimating an ordered logit model, they find that only two out of the five underlying variables are statistically significant and load with a sign that is consistent with the KZ index accounting variables. In the case of the WW index, only three out of six considered variables are statistically significant and load with a sign that is similar to that of WW index. The use of average Q rather than marginal Q is the major shortcoming of the KZ index. Similarly, a major disadvantage of the Size and Age index is that the model will be incorrectly specified if the non-linear model does not have the goodness of fit (Hadlock and Pierce, 2010) and it is necessary that the index should be economically realistic to remain an effective measure of capital constraints (Silva and Carreira, 2012). Further, a measure of financial constraints through survey-based selfassessment of financial difficulties adopted by Angelini and Generale (2008) can suffer from sampling bias and misreporting whose impact cannot be quantified. Furthermore, this measure only concentrates on the demand side of credit seekers and ignores the role of credit supplier, who is believed to play a critical role in determining creditworthy status in financial markets affected by informational asymmetries.

These aforementioned financial constraint measures with drawbacks motivated us to generate predicted efficiency and financial constraints as an indicator that determines liquidity constraints following Quader and Taylor (2018). This approach classifies firms endogenously according to their liquidity constraint status allowing them to switch to avoid problems of dynamic and static and it is consistent with estimated firm efficiency that simultaneously affects liquidity constraints. Predicted firm efficiency is useful for replacing investment-cash flow sensitivity patterns with a variable that calculates the magnitude of such imperfections by using the stochastic frontier strategy to measure an approximation of a company's corporate efficiency as an inverse proxy of agency cost comparing a company's actual Tobin's Q with its best performing benchmark Q (Habib and Ljungqvist, 2005) and (Nguyen and Swanson, 2009a).

This study attempts to overcome these challenges by using the probability of a financial unconstrained index constructed by running the endogenous regression model as in Quader and Taylor (2018). This approach provides a time-varying measure of financial position for all firm-year observations and considers the different extent of liquidity constraints that a company faces in attaining funds in external markets. It is derived from a multivariate selection equation that simultaneously accounts for all-important features of the company identified the capital structure literature. The cash flow variable has then interacted with various groups of dummy variables for financial constraint, which allows the coefficient of cash flow to vary across firm-year observations in the different liquidity constraint categories without regressing different models on separate sub-samples of companies. This method prevents any endogenous sample selection problem and avoids degree of freedom lose by allowing categories to transit between them (Carpenter and Guariglia, 2008; Guariglia, 2008).

Several studies have extensively explored how capital distress affects corporate investment using the investment-cash flow sensitivity. However, limited studies explored the impact of liquidity constraints on firm growth [1]. This motivated us to examine the effect of financial constraints on corporate growth. This study contributes to the literature by constructing a financial constraint index based on the probability of a firm being financially unconstrained obtained by estimating the endogenous regression model. The study also contributes by examining the differential impact of credit constraints on firms' growth in Pakistan and how corporate size and age affect firm growth when financial constraints and investment opportunities are controlled. Finally, this study answers whether different magnitudes of capital constraints lead to the same growth or differential growth among the firms, and how corporate age and size affect growth after controlling for financial constraints and investment opportunity.

This study is arranged as follows. Section 2 explains financing access to firms listed on the Pakistan Stock Exchange (PXS), section 3 reviews previous studies on the influence of liquidity on corporate growth. Section 4 describes the methods and reports dataset. Section 5 demonstrates and analyzes the key findings. Finally, Section 6 draws some conclusions and presents future research directions and policy implications.

2. Pakistan stock exchange and funding accessibility

The stock market of Pakistan is an essential factor for the country's economic growth and the main poster for the flourishing financial sector. A comparison with several stock markets in developed and emerging countries and under consideration of market liberalization, the microstructure of trading, settlement mechanisms, integration with world markets, and corporate governance, Pakistani stock markets is small in size and comparatively insignificant source of capital mobilization (Iqbal, 2012). A causal relationship between stock market liquidity and macroeconomic variables in Pakistan shows that the interest rate and growth rate of industrial production are cointegrated with stock liquidity (Ali *et al.*, 2018). Substantial correlation between investment performance and equity costs is negative and investors tend to invest in companies that follow high standards of corporate governance as they consider corporate governance to be a significant financial measure (Abbas *et al.*, 2018). Cash flow from operations to sales ratio is an important predictor of financial constraints of firms whereas market ratio cannot be used as liquidity distress predictor except firm size (Waqas and Md-Rus, 2018). It is observed that bigger, more liquid, and less tangible firms are comparatively deploying less debt ratio in Pakistani non-financial firms. However, on average, most debt borrowings are deployed by less liquid and less tangible companies. Conversely, on average, less liquid and less observable companies had the highest debt ratio (Qamar *et al.*, 2016). Recently, Karim and Rashid (2020) have provided evidence of the significant relationship between equity liquidity and Pakistani firms' financial performance and investment decisions, suggesting that the liquidity of stocks is an important factor for achieving higher and sustainable growth objectives of the economy.

3. Literature review

The pecking order theory of Myers and Majluf (1984) conceptually explains that external financial constraints can deteriorate the performance of various corporate companies. The theory specifies that asymmetric information between external financiers and borrowing firms would cause the differential cost of investment for external and internal financing. Unavailable information regarding the financial soundness of borrowing firms and different types of risks associated with their projects cause high costs of capital as the lenders are compensated for moral hazard and expected risk (Akerlof, 1970). In this context, the market mechanism for determining costs of capital does not work properly. It shows the inefficiency of loan prices to achieve capital market clearance, specifically, when there is disequilibrium because the rate of interest is highly influenced by incomplete information regarding the borrower (Stiglitz and Weiss, 1981). Furthermore, the incentives are affected seriously if the borrowers are engaged in risky behavior after borrowing funds. Furthermore, some scholars are also of the view that behavioral changes depend on the terms and conditions set by the lender (Hubbard, 2001). The empirical work of Fazzari *et al.* (1988) is the first study to examine the theory of firm investment by taking into consideration these aspects.

3.1 Classification of firms as financially constrained and unconstrained

The seminal research by Fazzari *et al.* (1988) using US firm-level data classify firms based on dividend payout ratio to explore the investment-cash flow sensitivity across groups of companies. They find that low dividend payers are more probably to be financially constrained and the availability of cash flow affects their level of investment under the presence of capital market imperfections. Kaplan and Zingales (1997) classify firms according to their access to funds using firms' annual reports and internal liquidity statements reported by the managers. They find that companies that seem less liquidity constrained show substantially higher sensitivities than companies that seem more financially restricted. Their findings contradict Fazzari's results and suggest that greater responsiveness to cash flow cannot be interpreted as evidence that firms are financially constrained. Using detailed qualitative data from financial filing, Hadlock and Pierce (2010) categorize firms based on liquidity constraints. Their results questioned the validity of the KZ index while providing mixed evidence as to the validity of other traditional constraint indicators.

3.2 Financial constraints and firm growth

Carpenter and Petersen (2002) predict that a firm's cash flow is causally related to its growth by incorporating liquidity constraints theory with a firm's growth phenomenon. Furthermore, they analyze an unbalanced panel data of US firms and based on the empirical findings propose the "internal finance theory of growth". Similarly, Cummins *et al.* (2006) and Carpenter and Guariglia (2008) further work on the theory. Specifically, the theory explains that the sensitivity of investment to internal funds may not reflect the existence of liquidity distress but it is more likely that the variable of cash flow is a proxy for investment opportunities.

Based on Gibrat's law, recent works extensively analyze the possible implications of a typical Gibrat's model on industrial organizations. Introducing the variable of cash flow as a proxy of liquidity constraints to the law of proportional effect regression, scholars interpret more responsiveness and growth sensitivity to internal funds as a measure to indicate the magnitude of financial constraints. Therefore, a company's growth is restricted by its production facilities and capacity of generating profits. For testing the validity of Gibrat's law in Italy, particularly hospitality services and the industry as a whole, Piergiovanni *et al.* (2003) study the impact of corporate size on corporate growth. Their key findings exhibit that newly established companies show higher growth than the larger ones. In the entire period, a negative correlation between corporate growth and its size does not persist in all the examined business groups. This finding suggests a heterogeneous behavior across industry and thus, puts a question mark on the validity of Gibrat's law.

Rahaman (2011) argues that the impact of capital structure on company growth has quantitative and significant consideration for quoted and unquoted companies in the UK and Ireland. His findings reveal that firms with limitations of outsourcing invest their growth with internal funds but growth-cash flow sensitivity declines when external financing access increases. When a financial constraint is reduced, the company gradually decreases internal financing and starts investing the growth with debt and equity financing as the primary source. Bottazzi *et al.* (2014) examine the impact of capital constraints on corporate dynamics. They find that liquidity constraints diminish average firm growth, cause an inverse relationship in growth patterns, and decrease growth fluctuation dependence on size. They conclude that liquidity constraints cause growth shock distribution, disturbing fast-growing young firms and growth disturbance is serious for slow-growing old firms. An important study by El-hadj and Cooper (2015) examines what determines growth constraints and business activity, using surveillance data collected from Northwestern Myanmar. The results indicate that competition and external financing are the two main factors that contribute to binding constraints. Furthermore, companies that believe access to unofficial lending is the most binding constraint that has roughly 10% less chance to finance their growth. Limited access to market entry is also the main constraint, declining the probability of investment up to approximately fifteen percent.

Donati (2016) explores the effect of capital distress on firm growth in Italy. His results show that small-sized companies in the manufacturing sector have greater responsiveness of growth to internal funds relative to medium-sized companies. He particularly highlights that the responsiveness of growth to cash flows is higher for small companies operating in business services. Quader (2017) explores the differential effect of capital constraints on corporate growth. He finds higher responsiveness of growth to cash funds for most constrained firms and the magnitude of the financial constraints eventually decreases with the external financing access making the least constrained firms less responsive to the cash flow. Moscalu *et al.* (2019) investigate the role of banking markets and how capital constraints and growth of SMEs in Euro-area countries are related. Their findings reveal that liquidity constraints hinder the growth of SMEs and the impact is stronger for perceived financial constraints. Yen *et al.* (2020) explore the impact of credit constraints on agricultural cooperatives' growth in the USA. Their key findings reveal that long-term debt financing and size are positively correlated with cooperative growth, which contradicts Gibrat's law. They conclude that unallocated equity, long-term debt financing, and cash flow are factors of asset growth for cooperatives with small and medium sizes. Ullah (2020) investigates whether corruption and capital constraints affect firm growth with small and medium sizes in 28 Central Asian and Eastern European countries. He finds that liquidity constraints have inversely affected both employment growth and sales growth while corruption does not directly affect growth.

4. Methodology and data

4.1 Model specification

We start the empirical analysis by estimating the following model as in (Quader, 2017) [2].

$$\begin{aligned}\text{Growth}_{it} &= \beta_1 \text{size}_{it-1} + \beta_2 \text{size}^2_{it-1} + \beta_3 \text{age}_{it} \\ &\quad + \beta_4 \text{age}^2_{it} + \beta_5 \text{CF}_{it} + \beta_6 \text{TQ}_{\text{it}} + v_i + I_t + \tau_t + e_{it}\end{aligned} \tag{1}$$

where Growth_{it} is the natural logarithm of the growth of firm i at time t, size_{it}, is the natural logarithm of the size of firm i at time t. We include one period lag of size to make the model dynamic. Age_{it} is the natural logarithm of firm age, TQ_{it} is the Tobin's Q, and v_i, I_t, τ_t and e_{it} allow unobserved firm-specific effects, industry effects, time effects, and error term, respectively, whilst CF_{it} is the cash flow at the beginning of the period calculated as a ratio of cash flow from operation to the total asset. Note, $E(v_i) = 0, E(e_{it}) = 0, E(V_i e_{it}) = 0, E(\tau_t) = 0$, $E(I_t) = 0$ for $i = 1,\ldots, N$ firms and $t = 2,\ldots,T$ years. Also, it is assumed that errors e_{it} are not serially correlated and that the initial conditions size i_1 are predetermined. That is, $E(e_{it}e_{is}) = 0$ for $i = 1,\ldots, N$ and $s \neq t$ and $E(\text{size}_{i1}e_{it}) = 0$ for $i = 1,\ldots, N$ firms, $t = 2,\ldots,T$ years.

To capture the differential effects of liquidity constraints across firms, Eqn (1) is modified and formulated as follows:

$$\begin{aligned}\text{Growth}_{it} &= \beta_1 \text{size}_{it-1} + \beta_2 \text{size}^2_{it-1} + \beta_3 \text{age}_{it} \\ &\quad + \beta_4 \text{age}^2_{it} + \sum_{k=1}^{n} \delta_k (\text{d}k_{it} \times \text{CF}_{it}) + \beta_6 \text{TQ}_{it} + v_i + I_t + \tau_t + e_{it}\end{aligned} \tag{2}$$

where $\text{d}k_{it}$ stands for financial constraint dummy variables for two, three or five categories, which is the estimated probability of financial unconstrained index derived from the endogenous regression model. We analyze empirical results on a firm-year basis rather than firms. Such an approach is adopted by Bond and Meghir (1994), Guariglia and Schiantarelli (1998), Guariglia (2008) and Quader and Taylor (2018).

The first two groups of dummy variables with time-varying, $\text{d}k_{it}$ based on the probability of facing liquidity unconstrained status, is formulated as follows:

First, $\text{d}1_{it}$ is equal to 1, if firm i's probability of having capital unconstrained status in year t, that lies below the second quartile of the distribution of the corresponding likelihood of having liquidity unconstrained status of all firm years, and equal to 0 otherwise. Second, $\text{d}2_{it}$ is equal to 1 if firm i' probability of having capital unconstrained status in year t, that lies above the second quartile of the distribution of the corresponding probability of having liquidity unconstrained status of all firm years, and equal to 0 otherwise.

It is worth noting that these two-category dummies, interacting with cash flow in one equation, will not generate problems of multicollinearity because the sum of these two dummies variables constitute one. $\text{d}1_{it}$ will only identify cash flows of likely liquidity constrained firm-year observations, and $\text{d}2_{it}$ will pick out cash flows of likely liquidity unconstrained firm-year observations. Therefore, cash flows for a specific corporate will only appear once in the equation. Three-category dummy variables of $d11_{it}$, $d12_{it}$ and $d13_{it}$ are formulated by setting firm i is equal to 1 if firm i's likelihood of having liquidity unconstrained status in year t which lies below the first quartile for $d11_{it}$, between first quartile and third quartile for $d12_{it}$ and above the third quartile for $d13_{it}$. And, lastly, the five-category variables $d21_{it}$, $d22_{it}$, $d23_{it}$, $d24_{it}$ and $d25_{it}$ are formulated by setting firm i's likelihood of having liquidity unconstrained status in year t that divides the distribution into five quintiles.

To create the likelihood of facing financially unconstrained status requires estimating investment and selection equations simultaneously through switching regression. The selection equation is coded 1 if a firm's predicted efficiency is greater than the 50th percentile and zero otherwise. Before we estimate the switching regression model, we have to obtain predicted market value efficiency by estimating market value frontier and inefficiency equations simultaneously, using stochastic frontier analysis.

4.1.1 Creating predicted firm efficiency index. We follow the Battese and Coelli (1995) model that uses the parameterization of Battese and Corra (1977). Using the maximum likelihood approach, we estimate simultaneously stochastic frontier and technical inefficiency models. In the model, y_{it} represents the dependent variable of market value, which is the function of explanatory variables, x_{it} is the set of independent variables that determines the frontier location, and ϵ is the disturbance term. The term ϵ is technically described as the difference between inefficiency of the firm (u_{it}) and random variable (v_{it}), which is assumed to be independently and identically distributed.

$$y_{it} = x_{it}\beta + \in \tag{3}$$

and

$$\epsilon_{it} = v_{it} - u_{it} \tag{4}$$

Depending on the explanatory variables and time factor, the frontier can shift from one location to another. Here v_{it} is a random variable that is assumed to be independently and identically distributed, $N(0, \sigma^2)$, and allows estimated errors to identify the location of the frontier and keeps away the outliers to dislocate the frontier. The residual $u_{it} \geq 0$ allows the frontier to be identified by differentiating companies on the frontier $(u_{it} = 0)$ and companies exactly below the frontier $(u_{it} \geq 0)$ and the degree of the residual corresponds to the shortfall of the company's real value from the capacity. By assumption of the stochastic frontier model, $u_{it} \geq 0$ indicates the net inefficiency of a company as a result of misalignment of shareholders' goals that arise from inefficiency factors or agency costs. Cov $(v_{it}, u_{it} = 0)$ states that the disturbance term v_{it} around the frontier and inefficiency of the firm u_{it} are uncorrelated and independent of each other. We simultaneously estimate the stochastic frontier and inefficiency models with appropriate assumptions. Battese and Coelli (1995) postulate the same model using panel data assuming the inefficiency of the firm is found by truncation at zero of $N(m_{it}, \ \sigma^2 u)$.

$$u_{it} = z_{it}\delta \ + w_{it} \tag{5}$$

$$m_{it} = z_{it}\delta \tag{6}$$

where z_{it} is a set of independent variables that decides the inefficiency of the firm and w_{it} denotes an unexplained component of u_{it}. w_{it} is found by truncation of $N(0, \ \sigma^2 u)$ such that the point of truncation is $-z_{it} \ \delta$, i.e. $w_{it} \geq \ z_{it} \ \delta$. δ is a vector of parameters to be predicted. z_{it} may include a set of determinants in the stochastic frontier, assuming inefficiency effects are stochastic. The inefficiency, u_{it} and their factors, z_{it} change over time depending on the company's location in the frontier and this detects conflicts between the managers and stakeholders.

4.1.2 Model specification of stochastic frontier. 4.1.2.1 Market Value Frontier Model. Tobin's Q is a proxy of future investment opportunities, which is also called the market value frontier model. A firm can maximize Tobin's Q or market value by adopting efficient financial management. Specifically, the model takes the following form.

$$\begin{aligned}\text{Tobin } Q_{it} &= \beta_0 + \beta_1\text{size}_{it} + \beta_2\text{size}^2_{it} + \beta_3\text{leverage}_{it}\\ &+ \beta_4\text{Capital Exp}_{it} + \beta_5\text{intangible Asset}_{it} + \beta_6\text{dividend}_{it} + \beta_7\text{firm risk}_{it}\\ &+ \beta_8\text{Profit margin}_{it} + \beta_9\text{Asset base}_{it} + f_i + \tau_t + \epsilon_{it}\end{aligned} \quad (7)$$

ϵ_{it} = Composite error term

f_i = Firm specific effect

τ_t = Aggregate time effect

4.1.2.2 Inefficiency model. The following equation of the inefficiency model is estimated simultaneously with equation (7), and the appropriate distributional assumption of the frontier equation applies the same as explained earlier.

$$\begin{aligned}u_{it} &= \delta_0 + \delta_1\text{size}_{it} + \delta_2\text{size}^2_{it} + \delta_3\text{leverage}_{it} + \delta_4\text{firm risk}_{it} + \delta_5\text{age}_{it} + \delta_6\text{age}^2_{it}\\ &+ \delta_7\text{year\_dummy}_{it} + w_{it}\end{aligned} \quad (8)$$

The explanatory variables are selected according to the existing literature. Table 1 describes the variables.

4.1.3 Creating firm-level financial constraint index. Given the assumption of two different investment regimes, regime 1 and regime 2, in the endogenous switching regression model and that the number of the investment regimes is known, the status of structural change is unobservable and regressed with each regime of investment equations. Conditional on the degree of the liquidity constraints, a firm may operate in either regime of investment which is unobservable and the sensitivity of the company's investment to cash flow may be high or low depending on in which regime it operates.

Variable	Description
Market value	It is Tobin's Q expressed as a natural logarithm of Tobin's Q, where Tobin's Q is defined as the market value of assets to book value of assets
Firm size	It is calculated as the natural logarithm of the sales
Leverage	It is long-term borrowings divided by total assets
Capital Expenditure	It is a net increase to property, plant and equipment divided by the total asset
Intangible asset	It is calculated as an intangible asset divided by total assets. It is introduced in the model to capture future growth opportunities
Dividend	The dividend is computed as cash dividend payments divided by total assets. Here, it is used as a proxy for earnings growth. High dividend payouts result in a higher growth rate of earnings
Firm risk	It is defined as the standard deviation of profits before depreciation, interest and tax divided by total assets (Quader and Taylor, 2018)
Profit margin	It is calculated as the operating profits divided by total assets. It represents corporate profitability (Nguyen and Swanson, 2009b; Whited, 1992)
Asset base	It is a natural log of the book value of total assets. It controls for transforming Tobin's Q into a log form
Age	It is the number of years expressed in log form in which a firm is in the business operation

Table 1.
Variable definition

The following switching regression model consists of three equations that are simultaneously estimated [3].

Structural equations

$$I_{1it} = X_{it}\beta_1 + v_{1it} \quad (9)$$

$$I_{2it} = X_{it}\beta_2 + v_{2it} \quad (10)$$

Selection equation

$$y_{it}^* = Z_{it}\alpha + \epsilon_{it} \quad (11)$$

The observed investment, I_{1it}, made by firm i at time t is formulated as follows.

$$I_{it} = I_{1it} \text{ if } y_{it}^* < 0$$

$$I_{it} = I_{2it} \text{ if } y_{it}^* \geq 0$$

$$\text{Cov}(v_{1it}, v_{2it}, \epsilon_{it}) = \begin{pmatrix} \sigma_{11}^2 & \sigma_{12} & \sigma_{1\in} \\ \sigma_{12} & \sigma_{22}^2 & \sigma_{2\in} \\ \sigma_{1\in} & \sigma_{2\in} & 1 \end{pmatrix}$$

4.1.4 Switching regression model. 4.1.4.1 Investment equation. In investment equations, we follow the extended Q theory of investment model developed by Hayashi (1982) to examine the differential behavior of investment across firms in our switching regression model.

$$\text{investment}_{it} = \beta_0 + \beta_1\text{Cash flow}_{it} + \beta_2\text{Fin. Slack}_{it} + \beta_3\text{Tobin}'\text{s}Q_{it} + \beta_4\text{Efficiency}_{it} + f_i + \tau_t + v_{it} \quad (12)$$

$$\text{investment}_{it} = \beta_0 + \beta_1\text{Cash flow}_{it} + \beta_2\text{Fin. Slack}_{it} + \beta_3\text{Tobin}'\text{s}Q_{it} + \beta_4\text{Efficiency}_{it} + \beta_5\text{Tangibility} + f_i + \tau_t + v_{it} \quad (13)$$

4.1.4.2 Selection equation.

$$y_{it}^* = \alpha_0 + \alpha_1\text{Size}_{it} + \alpha_2\text{Age}_{it} + \alpha_3\text{Dividend}_{it}\alpha_4\text{Leverage}_{it} + \alpha_5\text{Tobin}'\text{s}Q_{it} + \alpha_6\text{Financial Slack} + \alpha_7\text{Int.Cov.ratio} + \alpha_8\text{Efficiency}_{it} + \alpha_9\text{Tangibility} + \epsilon_{it} \quad (14)$$

We use switching regression of the maximum likelihood as an econometric estimation to obtain the probability of being financially unconstrained status. Table 2 presents the definition of the variables in investment and selection equations.

4.2 Estimation methods and data

We use system-GMM estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998) to mitigate possible endogeneity problem by using orthogonal deviation and introducing more instruments to improve efficiency and make regressors uncorrelated with the fixed effects. In estimating the firm growth equation, many researchers include lagged growth in the model to check growth persistence. We exclude lagged growth from the model due to the possibility of the presence of inactive firms in the panel because it is not possible to analyze growth persistence for firms that leave from the industry during the observation period (Santarelli *et al.*, 2006). Estimating such a dynamic regression model of firm growth

Table 2.
Description of variables

Variable	Computed as
Investment	Capital expenditure/total asset
Tobin's Q	Market value of assets to book value of assets
Cash Flow	Total cash flow from operating activities/total asset
Financial Slack	(Cash holding + short-term investment)/total asset
Tangibility	Total tangible asset/total asset
Efficiency	Firm efficiency variable is the predicted value of the stochastic frontier of market value
Interest cover ratio	Interest expenses/EBITD
Short-term leverage	Current liability/total asset
Long-term leverage	Non-current liability/total asset
Age	It is the number of years expressed in log form in which a firm is in the business operation
Year dummy	The variable of year in the inefficiency equation is the year dummy and it explains that inefficiency impacts may linearly vary with respect to time

controlling for different possible determinants on a panel of heterogeneous firms may raise omitted variable bias, heteroskedasticity and endogeneity problems (Bond *et al.*, 2001; Roodman, 2009), which makes OLS and the within estimator biased and inconsistent.

To prevent possible econometric problems, we first attempted to estimate the dynamic regression with difference-GMM (Arellano and Bond, 1991) but we suspect difference-GMM to suffer from biases of severe finite sample causing the weak instrument due to persistent time series associated with short panels (Blundell and Bond, 1998; Bond *et al.*, 2001). We choose system-GMM as the best estimator that can exploit serious finite sample biases and all econometric problems mentioned earlier. We also assume that variations in firm productivity and financial risk arising from firm access to external financing can be captured by the firm-specific effects in the model controlled by the system-GMM estimator and therefore prevents such biases.

To check whether our model is correctly specified and instruments are valid, we apply Hansen's (1982) J-test to check that the instruments are jointly valid and the structural specification of the model is legitimate. Furthermore, the first difference of the error terms should show no second-order serial correlations (AR(2)) (Arellano and Bond, 1991), which verifies that the error terms of some lagged instrumental variables in the model are serially not correlated to make GMM estimates valid and consistent.

Annual panel dataset for the empirical analysis is obtained from the annual financial reports filed by companies with the "State Bank of Pakistan" and the "Pakistan Stock Exchange (PSX)" over the period 2010–2017. We target all non-financial firms listed at the PSX. We use secondary data with a sample size of 457 firms.

5. Empirical results and discussions

Table 3 presents summary statistics for growth equation variables. With respect to corporate growth rates, the average value is 7.3%. 36-year-old firms grow an average growth rate of 7.3%. This observation signals that most of the corporates in our dataset are middle-aged. The internal liquidity measure of cash flow has an average value of 6.9% and a median of 5%, although 20% of cash flow observations in our dataset are below zero. Firm size is normally distributed with skewness close to zero and kurtosis roughly equal to 3. Furthermore, the mean and median of firm size are identical, ranging from 8 to 20. However, the diversity of corporate size in our sample is signaled by the standard deviation. An average corporate ratio of Tobin's Q is 1.3 which suggests that the market value of the company is more than the replacement cost of its asset since it exceeds one.

5.1 Results for baseline firm growth specification

We start an empirical analysis of the baseline equation reported in Table 4 using various estimating techniques of OLS, fixed effects (FE), difference GMM estimator, and system-GMM estimator. The findings reveal that smaller and younger firms show higher growth but their growth does not show a stable pattern when the capital constraints variable is included in the specification. The sensitivity of growth to internal financing is positive and statistically significant. However, the estimates of pooled OLS are inconsistent and biased because OLS levels do not solve the endogeneity problem caused by a correlation between regressors and the stochastic disturbance. Fixed effects estimator is downward biased while the difference GMM estimator suffers from biases of severe finite sample causing the instruments to be weak due to persistent time series associated with short panels (Blundell and Bond, 2000). To avoid these econometric problems, we analyze system-GMM results throughout our discussions.

In Model 1 of Table 4, a percentage change in corporate size generates a 10.2% decline in corporate growth in the short-run on average holding other variables constant. Size has significant and negative effects on firm growth, indicating that large firms growth slowly. However, the non-linear term of the variable size is positively related to corporate growth. This result is inline with the literature that extensively holds that newly established firms grow more speedily than larger companies. Overall, the observed size impact on growth rejects Gibrat's law, which does not correlate corporate growth and its size. A unit increases in firm age results in an 11% decrease in firm growth in the short-run on average keeping other variables constant. Age is inversely related to corporate growth as predicted by Jovanovic (1982). This inverse effect explains that infant companies have more growth rates than their counterparts when firm size and financial constraints are controlled. Overall, the relationship between corporate age and growth is non-monotonic U-shaped. This finding is consistent with the findings of many studies (Evans, 1987; Huynh and Petrunia, 2010). The reason behind the inverse association is that smaller and younger corporates often have fewer amounts of non-current assets at the post-establishment period. As they invest in inventory production and acquire a new property, plant, and equipment, they grow more sharply than larger and older firms. Old and large firms already have enough fixed assets and they may show small changes in totals assets as they purchase lesser amounts of non-current assets.

The effect of internal funds on corporate growth is positive and statistically significant. As expected, the higher sensitivity of firm growth to internal funds is observed but it does not indicate differential growth between the firms. A percentage increase in internal cash flows enhances firms' growth by 25.4% in the short run, on average, keeping other variables constant at their mean values. In this study, investment opportunities are controlled by including Tobin's Q in the model, and the observed sensitivity of growth to internal financing

	Mean	St. dev	Min	Q1	Median	Q3	Max	Skewness	Kurtosis
Firm growth	0.073	0.279	−3.775	−0.025	0.046	0.157	6.937	6.185	189.075
Size	15.007	1.777	8.211	13.896	14.987	16.174	20.195	−0.083	3.475
Age	36.113	17.514	3	24	32	48	156	1.438	8.652
Tobin Q	1.344	5.785	−13.752	0.618	0.81	1.113	183.75	23.456	637.783
Cash flow	0.069	0.119	−0.649	0.004	0.05	0.121	1.178	1.458	12.601

Table 3. Summary statistics

Table 4.
Results for baseline equation

Firm growth	OLS	FE	Diff-GMM	Sys-GMM
L.Size	−0.213*** (0.0616)	−0.448*** (0.120)	−0.766*** (0.124)	−0.102** (0.0509)
L.Size^2	0.0061*** (0.0021)	0.0007 (0.0042)	0.0108** (0.0043)	0.0030* (0.0016)
Age	−0.0793 (0.153)	−0.981*** (0.265)	−0.884* (0.487)	−0.110* (0.0622)
Age^2	0.0129 (0.0231)	0.225*** (0.0470)	0.126 (0.134)	0.0189* (0.0109)
Cash flow	0.250*** (0.0517)	0.0952* (0.0499)	0.144*** (0.0370)	0.254*** (0.0349)
Tobin Q	0.0199** (0.0093)	−0.00193 (0.0099)	0.0503** (0.0212)	0.0386*** (0.0114)
Constant	2.049*** (0.513)	7.267*** (0.940)		−95.76*** (18.33)
AR(2) *p*-value			0.581	0.464
Hansen *p*-value			0.221	0.228
No. of instruments			59	49
No. of firms		382	347	381
No. of observations	2,273	2,281	1,433	2,245

does not show the existence of financial market imperfections but confirms the existence of growth sensitivity to internal financing that remains significant.

Table 4 reports the predicted results of Eqn (1) using pooled OLS, Fixed Effects, Difference and System GMM. In OLS, a complete set of the year and sector dummies as regressors are estimated along with firm growth variables. A complete set of year dummies is regressed in GMM estimates both as instruments and regressors. Standard errors are in parenthesis; ***, **and* indicate significance at the 1%, 5% and 10%, level, respectively. Numbers correspondent to the Hansen J-tests and AR (2) are the *p*-values of their respective null hypothesis. Based on *p*-values of Hansen J-test, it accepts the null hypothesis of the respective GMM indicating that all instruments are jointly valid which intuitively indicates that the instruments are uncorrelated with the stochastic disturbance. Regarding the *p*-value of AR (2) for both Difference and System GMM, it does not reject the null hypothesis of no second-order serial correlation in the differenced residuals.

5.2 Differential impacts of cash flow on corporate growth

The results for the differential impacts of international financing on firm growth are presented in Table 5. We run different specifications. The variable of interest is the interaction term of cash flow with two, three, and five category dummies to capture higher responsiveness of growth to cash funds. The predicted value of cash flow for the most liquidity distressed group whose percentile lies below the median of 50, corresponding to the distribution of the forecasted probability of being unconstrained liquidity status, is positive and statistically significant. The observed sensitivity of growth rate to internal funds indicates that a percentage increase in the cash flow variable is associated with a 24.3% rise in corporate growth in the short run. As anticipated, the second class in Model 1 with a financial unconstrained index above the 50th percentile exhibits lower value than first class but still positive (21.6%) growth-cash flow sensitivity. This lower response of growth to cash flow explains that firms belonging to this class are privileged firms accessing outsource

	Model 1	Model 2	Model 3
L.size	−0.150* (0.0883)	−0.284*** (0.0781)	−0.363*** (0.104)
L.size^2	0.0051* (0.0027)	0.0089*** (0.0024)	0.0111*** (0.0033)
Age	−0.585*** (0.113)	−0.861*** (0.236)	−0.832** (0.332)
Age^2	0.0959*** (0.0190)	0.144*** (0.0342)	0.138*** (0.0490)
Cf × d1(<50th *p*)	0.243*** (0.0222)		
Cf × d2(>50th *p*)	0.216** (0.109)		
Cf × d11(<25th *p*)		0.704*** (0.0903)	
Cf × d12(25th *p* – 75th *p*)		0.479*** (0.0605)	
Cf × d13(>75th *p*)		0.425** (0.181)	
Cf × d21(<20th *p*)			1.070*** (0.131)
Cf × d22(20th *p* – 40th *p*)			0.935*** (0.0879)
Cf × d23(40th *p* – 60th *p*)			0.602*** (0.0825)
Cf × d24(60th *p* – 80th *p*)			0.415*** (0.158)
Cf × d25(>80th *p*)			0.177 (0.219)
Tobin Q	0.0442*** (0.0123)	0.0715*** (0.00799)	0.0749*** (0.0186)
Constant	64.94*** (13.41)	65.30*** (10.77)	−0.594 (20.73)
AR (2) *p*-value	0.855	0.990	0.572
Hansen *p*-value	0.284	0.312	0.918
No. of instruments	53	57	47
No. of firms	343	343	323
No. of observations	990	989	741

Table 5. Results for extended model

financing which subsequently minimizes internal fund reliance on growth. To test whether statistically, the estimated coefficient of both groups of firms differs we apply the Wald test. As we can see from Table 6, the *p*-value along with the test provides strong evidence confirming the estimated coefficient are quite different statistically. This finding confirms the heterogeneity insensitivity of growth to internal funds between both groups of firms.

In Model 2, the impact of internal funds on corporate growth with the predicted index falling below the 25th percentile of the distribution is 70.4%, and gradually declining thereafter to 47.9% for middle 50% and then further decreases to 42.5% for above 75th percentile. The respective null hypothesis of the equivalent growth-cash flow sensitivity of this category is also rejected as the respective *p*-value of the Wald test is close to zero. These findings confirm that the responsiveness of firm growth to cash flow is higher for firms that do not have access to external financing. Said differently, the sensitivity of growth to internal funds significantly decreases with declines in liquidity constraints.

When five-category dummies of financial constraints are incorporated in the third model and more variations in growth sensitivity to internal funds are observed. However, the estimates are in line with the first two models. Moving from most to least liquidity constrained categories in the third model, the impact of internal funds on growth declines monotonically with an estimated coefficient of cash flow that displays the highest value of 1.07 and lowest value of 0.177 showing how growth cash flow sensitivity intensifies with the magnitude of firms' financial constraints. In other words, internal cash flow is positively associated with asset growth for most financially constrained firms showing more sensitivity, but positive and less sensitive to the least financially constrained firms. All three models show that the most liquidity constrained firms have higher sensitivity of growth to internal funds that may lead to growth problems because of severe asymmetric information. These results support the differential cost between internal and external financing. Table 6 reports the *p*-value of the Wald test for testing the equality of the estimated coefficient in each model. The *p*-values provide strong evidence of the significant differences between the estimated coefficients of cash flow at a different level of financial constraints. The statistical significance of the difference between the estimated coefficients of interaction term of cash flow with the dummies of degrees of liquidity constraints confirms the presence of heterogeneity in growth-cash flow sensitivity depending on the degree of financial constraint. The more severe the financial constraint, the higher the sensitivity of firm growth to cash flow.

Table 5 shows the differential effect of internal financing on corporate growth across liquidity unconstrained and constrained corporate years, separated with the probability of being liquidity unconstrained status with the least constrained group as probably to be most financially constrained. Model 1 is estimated with a growth equation whose cash flow variable has interacted with two dummy variables that are below and above the second quartile. Model 2 is estimated with three dummy variables whose first dummy is below the

Hypothesis	Model 1 *p*-value	Model 2 *p*-value	Model 3 *p*-value
Cf*d1 = Cf*d2	0.0000		
Cf*d11 = Cf*d12		0.0000	
Cf*d12 = Cf*d13		0.0000	
Cf*d21 = Cf*d22			0.0000
Cf*d22 = Cf*d23			0.0000
Cf*d23 = Cf*d24			0.0000
Cf*d24 = Cf*d25			0.0286

Table 6.
Wald test

first quartile and the second is between the first and third quartiles while the third is above the third quartile. Model 3 is estimated with five dummy variables whose interval is 20. Here "*d*" represents dummies generated by the likelihood of being unconstrained status. Table 6 shows the *p*-values of Hansen J and AR (2) tests according to their respective null hypothesis. The observed *p*-values of AR (2) for both Difference and System GMM do not reject the null hypothesis of the absence of second-order autocorrelation in the differenced stochastic disturbances. The estimated *p*-value of Hansen J does not reject the null hypothesis that all instruments are jointly valid which implies that the instruments are uncorrelated with stochastic disturbance.

Table 6 shows the Wald test to check the hypothesis that the impact of internal financing on company growth is the same across company year observations with two different liquidity constraint statuses. Based on the observed *p*-value, we reject the null hypothesis that equates the impact of internal funds on firm growth across corporate year observations. This implies that cash flow interacted with different dummy variables are not simultaneously equal to zero and introducing these dummy variables in the regression contribute to effective improvement of the model fit.

Accessibility of longer-term borrowing makes firms less sensitive to cash flows. Thus, firms with external financing access and their credit line is assumed to be caused by factors that are less likely related to the current liquidity such as stock performance, firm relationship with the bank and longer-term credit records (Pál and Kozhan, 2009).

$$0 \quad \frac{d\text{Growth}}{d\text{Cash flow}} \leq 1 + \gamma$$

where γ is the value of collateral security of the company by every extra unit of internal funds used investment financing, allowing companies with financial distress to collect debts from the capital market to finance growth and consequently develop a growth-cash flow relationship greater than one-to-one. The magnified effect (value of γ) of the companies with limited access to get external funds will be high. In contrast to that, less financially constrained companies show a low value of the magnified effect. According to Model 3, $\gamma = 0.07$, which is the value of collateral security for the firm-year observations in five category dummies allowing them to get more leverage which will have a multiplier effect on their firm growth by each additional unit of internal financing (Carpenter and Petersen, 2002). The multiplier effect for the most constrained group (<20th percentile) in Model 3 is 107% of the extra unit of cash flow earned for the first quintile group, while the multiplier effect for the least constrained group, (>80th percentile) in Model 3, is 17.7%. This empirical work evidence that the financial distress of corporates severely affects the growth of many small and young corporates even size, age, and investment opportunities are controlled.

6. Conclusion

The results of the study suggest non-monotonic U-shaped relation of firm size and age with growth, which is inline with the existing literature. Using the constructed financial constraint index, we find a considerable heterogeneity in growth sensitivity to internal funds among the firms conditional on the degree of financial constraints. Financing growth through internal cash flow on growth is found to be significant for firms that have limited access to external financing. The magnitude of estimated cash flow is greater for most constrained firms and eventually decreases with a decline of the degree of financial constraints, making the least constrained firms less sensitive to cash flow. Severe asymmetric information related problems are more likely to cause the growth-cash flow sensitivity for constrained firms. They can expand their size to some extent by using debt financing rather than internal financing that creates growth-cash flow sensitivity. These significant variations in the sensitivity of growth to cash flow are consistent with the view that liquidity constraints are significantly attributed by imperfections of capital markets. Our findings also suggest that the presence of capital market imperfection causes greater sensitivity of growth to internal funds for smaller and younger firms.

With regard to policy implications, it has been observed that small and young firms have growth challenges associated with limited access to external financing. To deal with these challenges, policymakers may set strategic plans and regulations that may improve financial institutions and business environment, which subsequently help more financially constrained firms to finance external sources and make their growth less dependent on internal financing. Another important implication is that creditors should provide signals to external investors about the actual status of the business by enhancing organizational performance and by reducing agency disputes, making optimal operational, funding and investment decisions. The study also suggests important policy implications for liquidity-constrained firms. Specifically, they should carefully concentrate on their financing plans to enhance their growth. By improving the capacity for production, corporate firms can attain a faster and favorable effect of potential positive income shocks, which will, in turn, help achieve their higher growth targets.

Notes

1. With respect to for Pakistan, the literature is concentrated on the relationship between liquidity constraints and investment but has been very limited in investigating the impact of liquidity constraints on corporate growth. Furthermore, most of the studies on liquidity constraints conducted in Pakistan use the sensitivity of cash flow as an indicator of the degree of capital constraints. But the study uses the probability of financial unconstrained index derived from estimating the switching regression model as a gauge to measure liquidity constraints to find how liquidity constraints affect corporate growth.
2. In the econometric specification, linear and non-linear terms of company age and size are included in basic and extended models to capture possible non-linearity and linearity in the size-growth and age-growth relationships to capture productivity difference and age dependence. Productivity variations across the companies are captured by the company size, which does not make the company growth conditional on age (Hopenhayn, 1992). The sign of estimated age changes from negative to positive around the age of 7 and 8 for all specifications (Huynh and Petrunia, 2010). To investigate the effect of capital constraints on company dynamics, we consider the multivariate regression model by estimating initially baseline regression for a dynamic model of firm growth:
3. Eqns (9) and (10) are the structural equations that explain the investment behavior of corporates in the different regimes. Eqn (11) is the selection equation that determines a corporate's propensity of being in the first or the second investment regime. X_{it} are the independent variables for corporate investment and Z_{it} are the factors that determine a corporate's probability of being in one or the other investment regime at a time t. v_{1it}, v_{2it} and ϵ_{it} are disturbance.

References

Abbas, N., Ahmed, H., Malik, Q.A. and Waheed, A.J.P.A.R. (2018). Impact of investment efficiency on cost of equity: an empirical study on shariah and non shariah compliance firms listed on Pakistan Stock Exchange. Vol. 2 No. 3, pp. 307-322.

Akerlof, G. (1970), "The market for 'lemons': asymmetrical information and market behavior", *Quarterly Journal of Economics*, Vol. 83 No. 3, pp. 488-500.

Ali, S.S., Mubeen, M. and Hussain, A. (2018), "Prediction of stock performance by using logistic regression model: evidence from Pakistan stock exchange (PSX)", *Paper Presented at the Patron of the Conference*.

Angelini, P. and Generale, A. (2008), "On the evolution of firm size distributions", *American Economic Review*, Vol. 98 No. 1, pp. 426-438.

Arellano, M. and Bond, S. (1991), "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations", *The Review of Economic Studies*, Vol. 58 No. 2, pp. 277-297.

Arellano, M. and Bover, O. (1995), "Another look at the instrumental variable estimation of error-components models", *Journal of Econometrics*, Vol. 68 No. 1, pp. 29-51.

Battese, G.E. and Coelli, T.J. (1995), "A model for technical inefficiency effects in a stochastic Frontier production function for panel data", *Empirical Economics*, Vol. 20 No. 2, pp. 325-332.

Battese, G.E. and Corra, G.S. (1977), "Estimation of a production Frontier model: with application to the pastoral zone of Eastern Australia", *Australian Journal of Agricultural Economics*, Vol. 21 No. 3, pp. 169-179.

Blundell, R. and Bond, S. (1998), "Initial conditions and moment restrictions in dynamic panel data models", *Journal of Econometrics*, Vol. 87 No. 1, pp. 115-143.

Blundell, R. and Bond, S. (2000), "GMM estimation with persistent panel data: an application to production functions", *Econometric Reviews*, Vol. 19 No. 3, pp. 321-340.

Bond, S. and Meghir, C. (1994), "Dynamic investment models and the firm's financial policy", *The Review of Economic Studies*, Vol. 61 No. 2, pp. 197-222.

Bond, S.R., Hoeffler, A. and Temple, J.R. (2001), "GMM estimation of empirical growth models", available at: SSRN 290522.

Bottazzi, G., Secchi, A. and Tamagni, F. (2014), "Financial constraints and firm dynamics", *Small Business Economics*, Vol. 42 No. 1, pp. 99-116.

Carpenter, R.E. and Guariglia, A. (2008), "Cash flow, investment, and investment opportunities: new tests using UK panel data", *Journal of Banking and Finance*, Vol. 32 No. 9, pp. 1894-1906.

Carpenter, R.E. and Petersen, B.C. (2002), "Is the growth of small firms constrained by internal finance?", *The Review of Economics and Statistics*, Vol. 84 No. 2, pp. 298-309.

Carreira, C. and Silva, F. (2010), "NO deep pockets: some stylized empirical results on firms'financial constraints", *Journal of Economic Surveys*, Vol. 24 No. 4, pp. 731-753.

Cummins, J.G., Hassett, K.A. and Oliner, S.D. (2006), "Investment behavior, observable expectations, and internal funds", *American Economic Review*, Vol. 96 No. 3, pp. 796-810.

Donati, C. (2016), "Firm growth and liquidity constraints: evidence from the manufacturing and service sectors in Italy", *Applied Economics*, Vol. 48 No. 20, pp. 1881-1892.

Driver, C. and Muñoz-Bugarin, J. (2019), "Financial constraints on investment: effects of firm size and the financial crisis", *Research in International Business and Finance*, Vol. 47, pp. 441-457.

El-hadj, M.B. and Cooper, G. (2015), "Constraints to the growth of small firms in Northwest Myanmar", *Journal of Asian Economics*, Vol. 39, pp. 108-125.

Evans, D.S. (1987), "The relationship between firm growth, size, and age: estimates for 100 manufacturing industries", *The Journal of Industrial Economics*, pp. 567-581.

Fazzari, S., Hubbard, R.G. and Petersen, B.C. (1988), "Financing constraints and corporate investment", *Brookings Papers on Economic Activity*, Vol. 1, pp. 41-195.

Gibrat, R. (1931), *Les inegalites economiques*, Librairie du Recueil Sirey, Paris.

Gómez, M.G.P. (2019), "Credit constraints, firm investment and employment: evidence from survey data", *Journal of Banking and Finance*, Vol. 99, pp. 121-141.

Guariglia, A. (2008), "Internal financial constraints, external financial constraints, and investment choice: evidence from a panel of UK firms", *Journal of Banking and Finance*, Vol. 32 No. 9, pp. 1795-1809.

Guariglia, A. and Schiantarelli, F. (1998), "Production smoothing, firms' heterogeneity, and financial constraints: evidence from a panel of UK firms", *Oxford Economic Papers*, Vol. 50 No. 1, pp. 63-78.

Habib, M.A. and Ljungqvist, A. (2005), "Firm value and managerial incentives: a stochastic Frontier approach", *The Journal of Business*, Vol. 78 No. 6, pp. 2053-2094.

Hadlock, C.J. and Pierce, J.R. (2010), "New evidence on measuring financial constraints: moving beyond the KZ index", *The Review of Financial Studies*, Vol. 23 No. 5, pp. 1909-1940.

Hansen, L.P. (1982), "Large sample properties of generalized method of moments estimators", *Econometrica*, Vol. 50 No. 4, pp. 1029-1054.

Hayashi, F. (1982), "Tobin's marginal q and average q: a neoclassical interpretation", *Econometrica: Journal of the Econometric Society*, Vol. 50 No. 1, pp. 213-224.

Hopenhayn, H.A. (1992), "Entry, exit, and firm dynamics in long run equilibrium", *Econometrica*, Vol. 60 No. 5, pp. 1127-1150.

Hubbard, R.G. (2001), "Capital-market imperfections, investment, and the monetary transmission mechanism", *Investing Today for the World of Tomorrow*, Springer, pp. 165-194.

Huynh, K.P. and Petrunia, R.J. (2010), "Age effects, leverage and firm growth", *Journal of Economic Dynamics and Control*, Vol. 34 No. 5, pp. 1003-1013.

Iqbal, J. (2012), "Stock market in Pakistan: an overview", *Journal of Emerging Market Finance*, Vol. 11 No. 1, pp. 61-91.

Ismail, M.A., Ibrahim, M.H., Yusoff, M. and Zainal, M.P. (2010), "Financial constraints and firm investment in Malaysia: an investigation of investment-cash flow relationship", *International Journal of Economics and Management*, Vol. 4 No. 1, pp. 29-44.

Jovanovic, B. (1982), "Selection and the evolution of industry", *Econometrica: Journal of the Econometric Society*, Vol. 50 No. 3, pp. 649-670.

Kaplan, S.N. and Zingales, L. (1997), "Do investment-cash flow sensitivities provide useful measures of financing constraints?", *Quarterly Journal of Economics*, Vol. 112 No. 1, pp. 169-215.

Karim, M. and Rashid, A. (2020), "Equity liquidity, firm investment and financial performance: an assessment of the role of financial development", *Business Review*, Vol. 15 No. 2, pp. 51-74.

Lins, K.V., Servaes, H. and Tufano, P. (2010), "What drives corporate liquidity? An international survey of cash holdings and lines of credit", *Journal of Financial Economics*, Vol. 98 No. 1, pp. 160-176.

Markovic, M. and Stemmer, M. (2017), "Firm growth dynamics and financial constraints: evidence from Serbian firms", available at: https://halshs.archives-ouvertes.fr/halshs-01489222/.

Moscalu, M., Girardone, C. and Calabrese, R. (2020), "SMEs' growth under financing constraints and banking markets integration in the euro area", *Journal of Small Business Management*, Vol. 58 No. 4, pp. 707-746.

Myers, S.C. and Majluf, N.S. (1984), "Corporate financing and investment decisions when firms have information that investors do not have", *Journal of Financial Economics*, Vol. 13 No. 2, pp. 187-221.

Nguyen, G.X. and Swanson, P.E. (2009a), "Firm characteristics, relative efficiency, and equity returns", *Journal of Financial and Quantitative Analysis*, Vol. 44 No. 1, pp. 213-236.

Nguyen, G.X. and Swanson, P.E. (2009b), "Firm characteristics, relative efficiency, and equity returns", *Journal of Financial and Quantitative Analysis*, Vol. 44 No. 1, pp. 213-236.

Pál, R. and Kozhan, R. (2009), "Firms' investment under financial constraints: a euro area investigation", *Applied Financial Economics*, Vol. 19 No. 20, pp. 1611-1624.

Piergiovanni, R., Santarelli, E., Klomp, L. and Thurik, A.R. (2003), "Gibrat's Law and the firm size/firm growth relationship in Italian small scale services", *Revue D'Économie Industrielle*, Vol. 102 No. 1, pp. 69-82.

Qamar, M.A.J., Farooq, U., Afzal, H. and Akhtar, W. (2016), "Determinants of Debt financing and their moderating role to leverage-performance relation: an Emerging Market Review", *International Journal of Economics and Finance*, Vol. 8 No. 5, p. 300.

Quader, S.M. (2017), "Differential effect of liquidity constraints on firm growth", *Review of Financial Economics*, Vol. 32, pp. 20-29.

Quader, S.M. and Taylor, K. (2018), "Corporate efficiency, credit status and investment", *The European Journal of Finance*, Vol. 24 No. 6, pp. 439-457.

Quartey, P., Turkson, E., Abor, J.Y. and Iddrisu, A.M. (2017), "Financing the growth of SMEs in Africa: what are the contraints to SME financing within ECOWAS?", *Review of Development Finance*, Vol. 7 No. 1, pp. 18-28.

Rahaman, M.M. (2011), "Access to financing and firm growth", *Journal of Banking and Finance*, Vol. 35 No. 3, pp. 709-723.

Roodman, D. (2009), "How to do xtabond2: an introduction to difference and system GMM in Stata", *STATA Journal*, Vol. 9 No. 1, pp. 86-136.

Santarelli, E., Klomp, L. and Thurik, A.R. (2006), "Gibrat's law: an overview of the empirical literature", *Entrepreneurship, Growth, and Innovation*, Springer, pp. 41-73.

Silva, F. and Carreira, C. (2012), "Measuring firms financial constraints: a rough guide", *Notas Económicas*, Vol. 36 No. 2, pp. 23-46.

Stiglitz, J.E. and Weiss, A. (1981), "Credit rationing in markets with imperfect information", *The American Economic Review*, Vol. 71 No. 3, pp. 393-410.

Ullah, B. (2020), "Financial constraints, corruption, and SME growth in transition economies", *The Quarterly Review of Economics and Finance*, Vol. 75, pp. 120-132.

Waqas, H. and Md-Rus, R (2018), "Predicting financial distress: Importance of accounting and firm-specific market variables for Pakistan's listed firms", *Cogent Economics and Finance*, Vol. 6 No. 1, pp. 1-16.

Whited, T.M. (1992), "Debt, liquidity constraints, and corporate investment: evidence from panel data", *The Journal of Finance*, Vol. 47 No. 4, pp. 1425-1460.

Whited, T.M. and Wu, G. (2006), "Financial constraints risk", *The Review of Financial Studies*, Vol. 19 No. 2, pp. 531-559.

Yen, M.F., Miranda, M. and Katchova, A. (2020), "The effects of capital constraints on the growth of agricultural cooperatives", *Agricultural Economics*, Vol. 66 No. 1, pp. 27-33.

Corresponding author
Abdul Rashid can be contacted at: abdulrashid@iiu.edu.pk