Financial Constraints and Cash Flow Sensitivity to Investment in Indian Listed Manufacturing Firms

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Abstract The present study is an effort to test the validity of cash flow sensitivity to investment as a measure of financial constraints in Indian manufacturing firms using panel data for 768 listed firms over a period of six years (2010–2016). It also analyses effects of tangibility of assets in alleviating financial constraints. Findings suggest that stand-alone, small and lower debt capacity firms are more cash flow sensitive to investment in comparison to the business group affiliated, large and higher debt capacity firms. Investment for large firms is strongly influenced by capital structure whereas medium-size firms have a mixed effect of financial factors on investment decisions. Further, results for effects of tangibility of assets on easing financial constraint are found significant only in low market capitalization firms.

Keywords Financial constraints · Investment determinants
Market capitalization · Tangible net worth · Ownership classification
Panel data · India

1 Introduction

There is a long-standing debate over the use of cash flow sensitivity as the measure of financial constraints ever since the inception of the literature for financial constraints due to asymmetry in the availability of external finance. The term cash flow sensitivity of investment emerged since the origin of the literature of financial constraints by Fazzari et al. (1988). Cash flow sensitivity of investment refers to the propensity of the firm to save internal funds to meet out the future investment requirements. It is used to capture the effects of financial constraints (see Fazzari et al. 1988; Hoshi et al. 1990; Almeida and Campello 2007). They reported that

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acceptance of an investment project for the financially constrained firm will not only be the function of positive NPV (net present value) but also depend on the availability of internal funds of the firm. However, some results have shown unconstrained firms to exhibit higher cash flow sensitivity than constrained firms (see Kaplan and Zingales 1997; Cleary 1999; Erickson and Whited 2000). Further, Gilchrist and Himmelberg (1995) reported similar cash flow sensitivity to investment for financially constrained and unconstrained firms. Hence, the present study is motivated by the segregated literature over the interpretation of cash flow sensitivity and the fact that there exists a large inconsistency in the rates at which the external finance is available to the Indian firms depending upon the characteristics of the firm such as business group affiliation, tangibility of assets and market capitalization. Also, financial constraints as the research interest are limited largely to the United States and European countries only. The current study will contribute to the literature by reporting relative dependence on internal funds to the Indian listed manufacturing firms that will bring out perspectives for developing economies. It will also strengthen the segregated literature over the use of a proxy for financial constraints along with capturing the effects of pledgeable assets in alleviating the effects of financial constraints.

1.1 Literature Review

The assumption of perfect capital market claims internal and external finance as undifferentiated substitutes to finance investment opportunities (Modigliani and Miller 1958). Also, investment decisions of the firms are independent of their capital structure with the symmetrical availability of financing sources to all the firms. An alternate perspective to the perfect capital market assumption came from the work of Fazzari et al. (1988) refuting internal and external finance as perfect substitutes for investment decisions. They provided empirical evidence for the same using a sample of 422 U.S. manufacturing firms by distinguishing them on the basis of dividend to income ratios. Firms that had least pay-out efficiency were hypothesized as financially constrained[1] and found to be more cash flow sensitive to investment than unconstrained firms. According to this alternate agenda firm's investment will be the function of its financial factors and characteristics of the firm. A financially constrained firm will find it difficult to fund positive NPV (Net Present Value) due to the scarcity of internal funds and costly external finance. Later studies by Devereux and Schiantarelli (1990), Hoshi et al. (1990), Whited (1992), Wang (2003), Almeida et al. (2004), Denis and Sibilkov (2009), Bhaumik et al. (2012) confirmed the findings of Fazzari et al. (1988).

[1]In an imperfect capital market where characteristics of the firm will influence the acceptance of investment opportunities, firms that fail to fund positive NPV projects due to asymmetry between internal and external funds will be called as financially constrained firms.

However, findings of Fazzari et al. (1988) were soon disputed by Kaplan and Zingales (1995) reporting inverse results and inefficiency in the interpretation of results. They reported financially unconstrained firms more cash flow sensitive to investment and questioned cash flow sensitivity of investment as the measure of financial constraints using the 10-k text[2] of 49 U.S. firms. Further, studies by Kadapakkam et al. (1998), Cleary (1999, 2006), Erickson and Whited (2000), Alti (2003) also supported the results of Kaplan and Zingales (1995).

In search of an alternate perspective as the measure of financial constraints Almeida et al. (2004) propose the 'propensity of firms to save cash out of cash flows' (cash-flow sensitivity of cash) as a proxy for liquidity constraints, because only constrained firms will manage liquidity to maximize their value. They tested whether financially constrained firms exhibit high cash-flow sensitivities, while unconstrained firms do not. They found that financially constrained firms have higher propensity to retain cash following negative macroeconomic shocks, while unconstrained firms do not show any such relation. In extension to above, Almeida and Campello (2007) tested the effect of tangibility of assets on investment of the firms. The study used cash flow and asset tangibility multiplier to find out the marginal effect of asset tangibility on cash flow sensitivity to investment. In Indian context, Bhaduri (2005) reported the effects of liberalization on easing financial constraints of the firms. Later, Bhaumik et al. (2012) highlighted significant influence of financial constraints on Indian manufacturing firms. However, there is a dearth of studies in exploring the role of cash flow sensitivity as the valid proxy for measuring financial constraints in the Indian context. Also, to the best of our knowledge, none of the Indian studies has illustrated the role of tangibility of assets in easing financial constraints. The effect of tangibility of assets on alleviating cash flow problems needs to be studied to define the utility of collateral as an enabling factor to access external finance in Indian manufacturing firms. Hence, the current study empirically investigates cash flow sensitivity to investment and effects of asset tangibility along sales, leverage in Indian manufacturing sector to test the validity of above-discussed measures in the Indian context.

2 Model

The amount of external capital required at any time for the financially constrained firm can be given by φ can be the function of the debt capacity and other financial factors of the firm.

$$\varphi = F(\tau, \textit{financial factors}) \ldots \tau \text{ is the debt capacity of the firm}$$

[2]Annual financial report of U.S. companies required by Securities and Exchange Commission highlighting financial performance of firms.

An unconstrained firm can have two scenarios-either amount of internal funds available to the firm (ω) is in excess of current demand π or the availability of external funds satisfies current demand. Suppose π is the funding requirement for the new investment opportunity available.

$\pi < \omega$ *or* $\varphi \notin \tau$ (external funds available irrespective of tangibility of assets)

Borrowing constraints for a financially constrained firm can be given by creditor's liquidation value of the firm (τl).

$$\pi < \tau l$$

Hence, cash flow sensitivity to investment for financially constrained and unconstrained firms according to Almeida and Campello (2007) can be written as

$$\frac{\partial I}{\partial w}(w, \tau) = \frac{1}{1-\tau} \quad \text{for financially constrained firms}$$
$$\frac{\partial I}{\partial w}(w, \tau) = 0 \quad \text{for financially unconstrained firms}$$

The cash flow sensitivity will decrease with the increase in the tangibility of assets to the firm for the financially constrained firm i.e. tangibility will result in easing the financial constraints to the constrained firms while investment for unconstrained firms will be independent of the fluctuations of cash flows. Thus tangibility will be irrelevant to the investment of the financially unconstrained firm.

3 Empirical Estimation Framework

To identify the role of cash flow sensitivity to investment in measuring financial constraints we use sales accelerator model proposed by Abel and Blanchard (1986) which states that increasing firm sales leads to increasing firm investment along with other financial factors. The model is further extended to understand the role of tangibility in influencing cash flow sensitivity to investment in Eq. 1. The interaction term between cash flow and tangibility will highlight the role of tangibility in easing financial constraints for the firms.

$$\left(\frac{I}{K}\right)_{i,t} = \alpha o + \rho\left(\frac{I}{K}\right)_{i,t-1} + \beta_1\left(\frac{\Delta S}{K}\right)_{i,t} + \beta_2\left(\frac{CF}{K}\right)_{i,t} + \beta_3\left(\frac{D}{K}\right)_{i,t} + \beta_4 \text{Ln } tangibility + \beta_5\left(\text{Ln } tangibility_{i,t} \times \left(\frac{CF}{K}\right)_{i,t}\right) + u_{i,t} + e_{i,t} \tag{1}$$

where I represent firm investment (Change in gross fixed assets), S represents a change in firm sales or output as a measure of future profitability and growth opportunities. CF represents the sum of cash flows, net income, depreciation and amortisation, D represents the total borrowings in addition to preference share capital and $u_{i,t}$ represents the idiosyncratic error term. K is the firm's beginning of the period capital stock calculated according to the specification used by Fazzari et al. (1988) highlighted in Eq. 2.

$$K_{i,t} = \frac{P_t}{P_{t-1}}\left[I_{i,t-1} + K_{i,t-1}\left(1 - \frac{1}{L}\right)\right] \tag{2}$$

where $K_{i,t}$ is the capital stock for the firm i at time t, P_t is the GDP deflator at factor cost for the manufacturing firms taken for the base year 2004–2005. $I_{i,t-1}$ is lagged investment and L is average service life of the firm.

4 Sample Splitting Criteria

To study the effects of financial constraints we require an appropriate splitting criteria to divide the firms into different regimes. By splitting firms into groups with different level of asymmetric information, we can investigate the asymmetric impact of asymmetric information and agency problems on firms with different characteristics. The selection of relevant splitting criteria is also important because cash flow sensitivity of investment is susceptible to the factors used to split the firms according to the literature. Hence it is required to identify the criteria in Indian context that allows us to interpret the availability of internal funds to the firms. We use three criteria to split the firms into financially constrained and unconstrained firms that are as follows:

- Ownership status of the firms.
- Size of firms.
- Debt Capacity of the firms.

The reason for selecting ownership classification as the criteria for splitting the firms is due to the fact that the firms with the group affiliation have easier access to internal funds in comparison to standalone firms. Business groups are particularly effective in dealing with information and contract enforcement problems within the groups. When a firm needs external finance it can obtain funds at a relatively lower cost. Therefore it is expected that firms who have an affiliation with industrial groups will have lower investment cash flow sensitivities than firms who are not part of an industrial group, because of the reduction in information costs for being part of the group and the access to the internal capital group. Moreover, this sample splitting criterion is particularly desirable, because the status of affiliation to industrial groups tends to be fixed, which avoids the problem of endogeneity.

The evidence of investment cash flow sensitivities tends to be quite robust with the affiliation to the industrial group as a sorting criterion. Hoshi et al. (1990), using a dataset from Japan, find that firms that are part of the industrial groups display lower cash-flow sensitivities. Evidence from other countries such as Korea (Shin and Park 1999), Canada (Schaller 1993); Chirinko and Schaller (1995) also found supporting results for the idea that affiliation to industrial groups helps to reduce information asymmetries and to relax financial constraints.

Market capitalization is used as the splitting criteria by taking reference from Lamont et al. (2001) where it is used as the proxy for size. Market capitalization is also used as the proxy for calculating Tobin Q values of the firm in the Kaplan-Zingales index as described in Lamont et al. (2001). Market capitalization of the firm is very important in the as it reflects the liquidity of the stock and also reflects the awareness among the investors about the firm. Similarly, tangible net worth can be seen as the amount of collateral that a firm can use to borrow external funds. Tangibility of assets and debt capacity are the well-known factors in the literature that enables the firm to have easier access to external funds. In a study conducted by Almeida and Campello (2007) reported that asset tangibility increases cash flow sensitivity for financially constrained Firms. Taking reference from the above, we are using tangible net worth as a proxy for pledgeable assets in the Indian context.

5 Data and Methodology

In our study, the data is extracted from CMIE (Centre for Monitoring Indian Economy) Prowess database which is India's largest database for the firm level data of the Indian companies. It constitutes the firm-level data from the annual reports, financial statements and other published reports for the Indian firms. The database has the collection of 26,000 Indian firms across various sectors. Data is extracted for the period of seven years (2009–2015) for all the listed[3] manufacturing firms available in the CMIE database. The final analysis is performed for the period of (2010–2015) as data for 2009 is required only to calculate final variables for the study. The proxy used for the variables have been highlighted in Table 1.

There are a total of 1034 firms across different industries under manufacturing sector. Further, data is cleaned based on various parameters to improve the efficiency and validity of the results. Data is cleaned as under:

1. Firms with missing data for three or more years on investment or capital stock are removed from the analysis.
2. Firms that do not have data on market capitalization or tangible net worth are removed from the analysis. There are two reasons for the above, firstly market capitalization and tangible net worth are used as splitting criteria for the firms

[3]Listed on Bombay stock exchange.

Table 1 Variables and proxy used

Variable	Proxy used
Investment	Gross fixed assets additions − Gross fixed assets deductions for the year (in millions)
Change in sales	$Sales_n - Sales_{n-1}$ (in millions)
Cash flow	Profit after tax + Depreciation + Amortisation for the year
Debt	Total borrowings + preference share capital
Replacement value of capital stock	Gross fixed assets subject to the specification used by Fazzari et al. (1988), Athey and Laumas (1994), Bhaduri (2005)
GDP implicit price deflator	RBI data on GDP implicit price deflator for manufacturing firms subject to the base year 2004–2005
Average service life of the firm	16 years (Bhaduri 2005)
Size	Market capitalization
Debt capacity	Tangible net worth (Net worth − Intangible net worth)

Table 2 Summary of observations

Variable	Observations	Mean (in millions)	Std. Dev. (in millions)	Min (in millions)	Max (in millions)
Investment	4608	1736.121	9822.773	−157,600	270,749.3
Debt	4312	11,243.2	48,965.9	0	976,200
Change in sales	4608	3265.547	32,669.8	−604,880	811,410
Cash flow	4608	2777.313	14,533.43	−58,394	365,270
Capital stock	4608	16,023.14	85,102.73	−353.728	2,060,185
Tangible net-worth	4608	14,345.93	983.3293	−11,886.6	1,813,910

into various groups. Secondly, firms without data on market capitalization might be delisted or cease to exist. Also in some cases, CMIE does not drop the firms that cease to exist from the database.

3. Firms with negative tangible net worth are removed from the analysis because of the deficit on the asset side. The firms facing this condition will face negative influence on financing opportunities and will experience shrunken business growth. Hence dropping these firms will remove biasness in the results.
4. Firms that are merged into some other firms are removed from the analysis.

The application of above filters reduced the number of firms to 768 in total for which summary statistics are provided in Table 2. There are total 27,352 observations for five variables calculated for six years. The cleaned data is then bifurcated on the basis of the splitting criteria chosen for the study. Firstly, the firms are divided on the basis of business group affiliation that divides the data into 423 business group associated and 345 standalone firms.

Secondly, firms are divided on the basis of market capitalization which is taken as the proxy for size according to which the firms are divided into three groups in the order of high to low market capitalization viz. HMC (High market capitalization), MMC (Medium market capitalization) and LMC (low market capitalization) with 256 firms in each of the groups. Finally, third criteria for the division of firms is on the basis of tangible net worth taken as the proxy for debt capacity. Firms are divided into three groups in the order of high to low tangible net worth viz. HTNW (High tangible net worth), MTNW (Medium tangible net worth) and LTNW (Low tangible net worth) with 256 firms in each of the groups. Tangible net worth is taken as the criteria for splitting the firms according to debt capacity as well as a proxy for tangibility of assets in the analysis. Another important restriction that we applied to the data is prohibiting the firms to change the group to which they belong over the period of analysis i.e. firm belonging to LMC group will not be changed to MMC or HMC with time. Similarly, for other two criteria firms will not be allowed to shift the group. The study is confined to the period of only six years which lowers the chance for the firms to change regimes. Hence, to this particular study, we did not find significant need of applying sample selection model to enable firms to change the regime from financially constrained or unconstrained firms or vice versa.

Finally, each group is analysed using the GMM (Generalized Method of Moments) for the first order[4] and second order[5] as specified by Arellano and Bond (1991) using dynamic panel data model. The proposed sales accelerator model can be considered as a dynamic panel data equation where a lag of dependent variable along with other variables is taken as an independent variable to check out cash flow sensitivity of investment. The advantage of using GMM is the efficient results which it brings by taking the unobserved heterogeneity into account by estimating first order equation. Further second order GMM can be used to better the result of first order estimates due to the asymptotic efficient estimates. Also, endogeneity problems are taken care of by using a lag of dependent variable as instruments. We allowed maximum one lag of dependent variable to be used as instruments in most of the groups except few which used more instruments for the analysis. The autoregression of order AR (2) is used in the analysis. To find out that model is appropriate robustness checks are performed using Arellano and Bond (1991) test for autocorrelation (H_0-no autocorrelation) and Sargan test (1958) for the validity of over identifying restrictions (H_0-over identifying restrictions are valid). The results are reported after checking for any lacunas in the model. The final results are reported according to GMM second order considering the efficiency that it brings to the estimates.

[4]One step estimator.

[5]Two step estimator.

6 Findings and Discussion

The findings are reported in accordance with the splitting criteria (ownership group, size and debt capacity) used for the analysis. The model is reported significant and appropriate for all the groups on which analysis is performed. The results for group firms suggest sales and debt are positively significant while cash flow is negatively significant in first-order GMM analysis. In second-order analysis lagged investment is also found significant along with the above variables. The results from non-group firms found that cash flow is the only significant variable in both first order and second order analysis. This shows that firms without business group affiliation are more cash flow sensitive to investment in comparison to group affiliated firms. Further, a negative coefficient for cash flows for group firms suggests surplus cash flows that are much larger than investment opportunities available with these firms. Also, sales and capital structure are found to be key determinants that influence investment in group affiliated firms.

Further, robustness checks are performed using Arellano and Bond (1991) (also called AR (1) and AR (2) tests) and Sargan test (1958) for testing autocorrelation suggests that there is no autocorrelation in the model. AR (1) and AR (2) test represents the null hypotheses (H_0-zero autocorrelation) in first differenced errors for the first order and second order respectively. The *p* values reported for AR (1) and AR (2) are 0.1812 and 0.1630 which precludes us from rejecting the null hypothesis for group firms. Similarly, panel for standalone firms has reported no evidence for appropriateness of the model. Also, Sargan test fails to provide any evidence for autocorrelation with *p*-value 0.4215 and 0.1981 for a group affiliated and standalone firms respectively (Table 3).

The results according to size (market capitalization) report highest cash flow sensitivity to investment with coefficients[6] (1.5162) and (0.6363) for cash flows are reported for LMC firms. All other variables other than cash flow reported insignificant relationship for the same. Further, MMC firms report negative cash flow sensitivity to investment with a coefficient (−0.1258) in the first order and positive for second order (−0.1795). Sales, debt and lagged investment are also found significant to investment along with cash flows for the MMC firms. However, HMC firms report the insignificant relation between cash flows and investment. Debt is found as the most important determinant that positively influences investment along with marginal positive impact from sales in first order. While, Second order analysis denied the significant influence of sales but reported negative influence (−0.0037) of lagged investment on the HMC firms' investment. Tests for checking validity reject null hypotheses to provide evidence for no autocorrelation in the model.[7] Above findings suggest that cash flow sensitivity to investment is

[6]First order and second order respectively.

[7]LMC-MA1 (0.0087), MA2 (0.2990), Sargan (0.2495).
MMC-MA1 (0.0310), MA2 (0.1877), Sargan (0.9287).
HMC-MA1 (0.2157), MA2 (0.8173), Sargan (0.1763).

Table 3 Results (ownership structure)

$\left(\frac{I}{K}\right)_{i,t}$ (dependent variable)	Group firms		Non-group firms	
	GMM 1 order (Coef.)	GMM 2 order (Coef.)	GMM 1 order (Coef.)	GMM 2 order (Coef.)
Lagged investment	−0.005	−0.004***	−0.046	0.026
Change in sales	0.288***	0.289***	0.001	0.001
Cash flows	−0.472***	−0.478***	0.211***	0.180**
Debt	0.699***	0.687***	0.001	0.001
Tangible net worth	−0.00688	−0.01444**	0.00476	0.006577
Cash flows* Tangible net worth	0.021803	0.04987***	−0.00684	−0.00999
Constant	−0.524***	−0.540***	0.118***	0.102***

*, **, *** Significant at 90, 95 and 99% confidence intervals respectively

Table 4 Results size (market capitalization)

$\left(\frac{I}{K}\right)_{i,t}$ (dependent variable)	Large firm size		Medium firm size		Small firm size	
	GMM 1 order (Coef.)	GMM 2 order (Coef.)	GMM 1 order (Coef.)	GMM 2 order (Coef.)	GMM 1 order (Coef.)	GMM 2 order (Coef.)
Lagged investment	−0.003	−0.003***	−0.148***	−0.123**	−0.012	−0.004
Change in sales	0.040***	0.009	0.072***	0.092***	0.001	0.001
Cash flows	−0.067	0.106	−0.111***	−0.149***	0.818***	1.079***
Debt	1.428***	1.470***	0.231***	0.286***	0.004	0.002
Tangible net worth	0.018497	0.004607	−0.00938	−0.01699	0.010599	0.001224
Cash flows* Tangible net worth	−0.01715	−0.00083	0.021954	0.047649	−0.326***	−0.06371
Constant	−1.171***	−0.908***	−0.110***	−0.160***	0.044	0.009

*, **, *** Significant at 90, 95 and 99% confidence intervals respectively

inversely proportional to the size of the firm i.e. smaller the firm higher will be the cash flow sensitivity to investment for the firms (Table 4).

Similarly, results by splitting the firms by Debt capacity (tangible net worth) imitates the results from division according to size. LTNW firms report the significant positive influence of cash flows on investment while, all other variables reported insignificant relationship for the same. MTNW firms reported significant positive relationship for all the variables except cash flows which report negative influence on the investment. Further, HTNW firms report a significant relationship between cash flows and investment in first order but the results from second-order

Table 5 Results tangible net worth (debt capacity)

$\left(\frac{I}{K}\right)_{i,t}$ (dependent variable)	High debt capacity		Medium debt capacity		Low debt capacity	
	GMM 1 order (Coef.)	GMM 2 order (Coef.)	GMM 1 order (Coef.)	GMM 2 order (Coef.)	GMM 1 order (Coef.)	GMM 2 order (Coef.)
Lagged investment	−0.011	0.036	−0.003	−0.004***	−0.008	−0.001
Change in sales	0.007**	0.001	0.270***	0.275***	0.002	0.001
Cash flows	0.143***	0.054	−0.824***	−0.652***	0.107***	0.120***
Debt	0.177***	0.049	0.736***	0.752***	0.004	0.003
Tangible net worth	0.000691	0.00037	−0.02134	0.017962	−0.01166	−0.00304
Cash flows* Tangible net worth	0.029257	0.005811	0.036817*	−0.03022	−0.01641	−0.00105
Constant	−0.140***	0.057	−0.414***	−0.399***	0.149***	0.136***

*, **, *** Significant at 90, 95 and 99% confidence intervals respectively

estimates denies any significant relationship for the same. Sales and debt are also found significant in first order but not in second-order analysis. The model reports no autocorrelation for robustness checks in the analysis.[8] Hence we can say that cash flow sensitivity to investment reduces with the increase in debt capacity of the firms (Table 5).

7 Conclusions

The study explores the investment behaviour pursuant to characteristics of the firms and to analyse the effect of tangibility of assets in alleviating financial constraints. The results report significant firm factors to investment by splitting the firms through a priori splitting criteria for the firms according to business group affiliation, market capitalization and tangible net worth. Standalone firms are found to be more cash flow sensitive to investment in comparison to group affiliated firms highlighting their strong dependence and scarcity of internal funds for investment decisions. Cash flow is found to be the only significant factor while taking investment decisions for the standalone firms whereas sales and capital structure are found crucial for investment decisions for group affiliated firms. The results from

[8]LTNW-AR 1 (0.0066), AR 2 (0.9225), Sargan (0.6458).
MTNW-AR 1 (0.2304), AR 2 (0.2902), Sargan (0.3126).
HTNW-AR 1 (0.2464), AR 2 (0.7519), Sargan (0.3353).

splitting the firms according to market capitalization and tangible net worth reveal a higher degree of cash flow sensitivity for firms with lower market capitalization and tangibility of assets. The results verify cash flow sensitivity as the proxy for financial constraints and are in line with the results of Fazzari et al. (1988). Findings of the study also suggest that medium market capitalization firms have mixed effects of all the variables for investment decisions as all the variables report significant relationship for the investment decisions. The results for effects of tangibility of assets on easing financial constraint are found significant only in low market capitalization firms. The results suggest that tangibility of assets does not play a significant role in accessing external finance for most of the firms. The study has a limitation of using only listed firms that restrict the scope of the study to the listed firms only. Future research can be conducted using a larger sample of non-listed firms and compare the discrepancies in the behaviour of listed and non-listed firms in terms of financial constraints.

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