Cyclicality of leverage: A study of Indian firms

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Motivation

- Firms' capital structure is determined by both firm-specific factors and macroeconomic conditions.
- Macroeconomic conditions and in particular business cycles, can affect the capital structure of firms both from the demand and the supply side.
  - Firms' demand for debt and equity may change due to capital structure changes induced by a business cycle recession.
  - Supply of debt and equity may change due to changes in capital market conditions triggered by business cycle fluctuations.

How does the state of the economy affect firms' capital structure, in particular their leverage?

Objective

- We do not know much about the determinants of leverage of non-financial firms in India.
- So far we do not know anything about the adjustment of their leverage to macroeconomic booms and busts.
- India is a modern market economy with business cycle fluctuations. We now have business cycle dates (Pandey, et al. 2016).
- Indian firms are highly heterogeneous. Financial constraints are likely to affect their capital structure choice.
  - Do Indian firms financing decisions change over the business cycle?
  - Do firms' leverage ratios vary pro-cyclically (increase during booms) or counter-cyclically (increase during recessions)?

Why is this interesting?

- Exploring this issue may throw light on a specific aspect of firm financing in India.
- It helps to quantify the effects of the main determinants of firms' capital structure.
- This has policy implications in terms of building better financial markets and institutions geared towards improving firms access to formal finance.

Literature: Cyclicality of leverage

- Most of the empirical work on this question has been done for US firms.
- Findings: Not unanimous.
  1. Levy et al (2003): Leverage of financially unconstrained firms varies counter-cyclically (increases during recessions) and pro-cyclically (increases during expansions) for constrained firms.
  2. Halling et al (2016): Leverage is counter-cyclical and there is no difference between financially constrained and unconstrained firms.
  3. Begenau et al (2016): Large firms use equity instead of debt during recessions. Smaller firms use more debt and equity financing during booms and do not substitute external financing sources over the business cycle.

Literature: Role of financial constraints

- Credit channel literature: Gertler and Gilchrist (1993, 1994), Kiyotaki and Moore (1997), Suarez and Sussman (1999).
- Smaller firms or firms facing greater financial constraints find it difficult to borrow following negative shocks to the economy.
- Debt issues of small firms are less sensitive to the business cycle.
- Constrained firms borrow more when collateral values are highest, following high returns in the equity market.

Outline

Sample selection

- We use data on non-financial, non-oil firms from the Prowess (CMIE) database.
- We look at both listed (4074) and unlisted (13928) firms.
- We drop firms with total assets < 0 and net sales < 0.
- We drop 99.9 percentile observations for book leverage (BL=25) and market leverage (ML=65) ratios for listed firms and 95 percentile observations for leverage of unlisted firms.

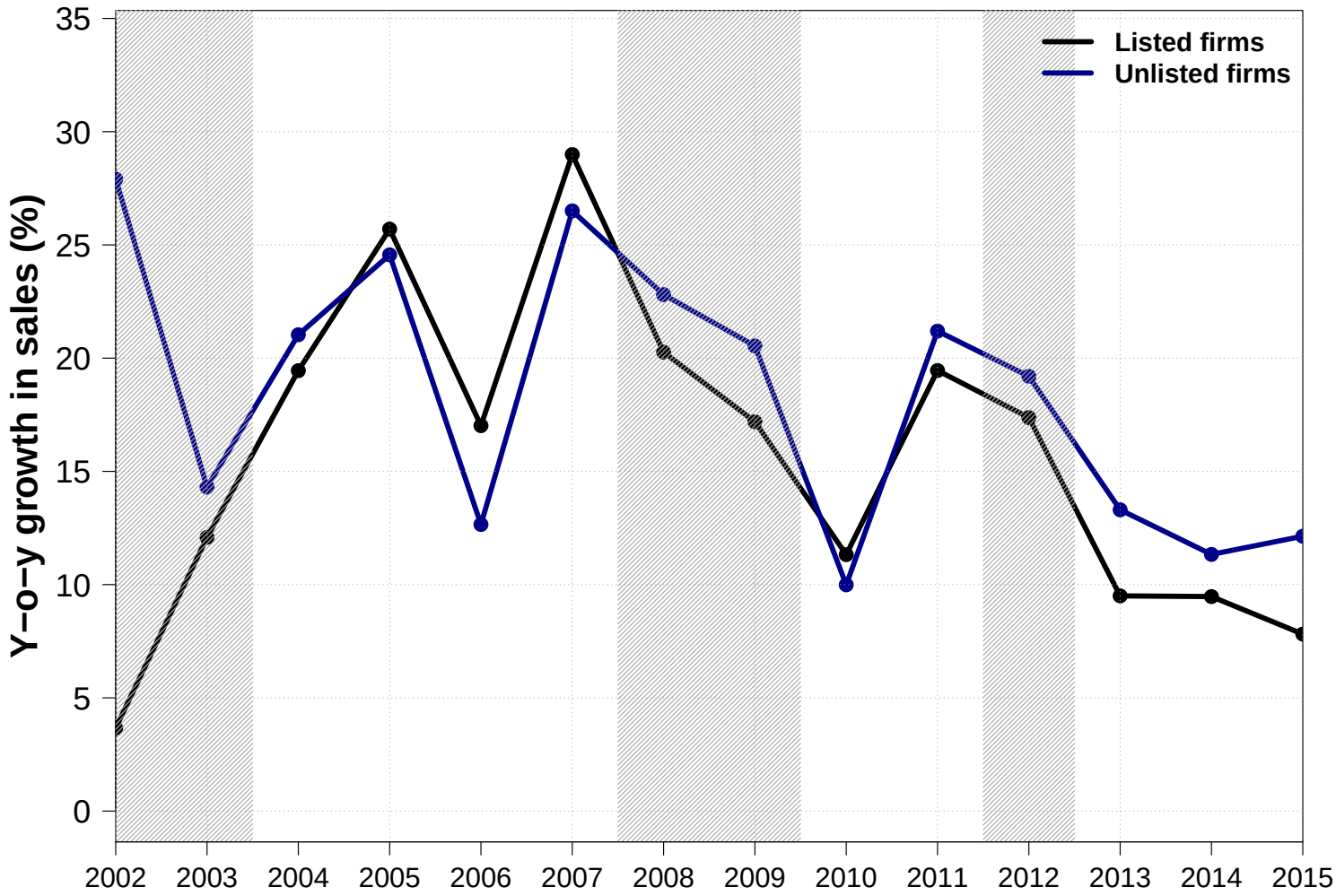
Sample selection

- Sample period: 2001 to 2015.
- Business cycle dates from Pandey et al. (2016).

Table: Business cycle dates

Recession	
Quarters	**Years**
1999Q4 - 2003Q1	2001 - 2003
2007Q2 - 2009Q3	2008 - 2009
2011Q2 - 2012Q4	2012
Expansion	
2003Q1 - 2007Q2	2004 - 2007
2009Q3 - 2011Q2	2010 - 2011
	2013 - 2015

Figure: Growth in (non-finance, non-oil) firms' net sales across business cycles



Measures of leverage

Listed firms

- Book leverage:

$$\frac{\text{Book value of total assets}}{\text{Net worth}}$$

- Market leverage:

$$\frac{\text{Market value of total assets}}{\text{Market capitalisation}}$$

,
where MVTA $=$ Market capitalisation $+$ Total assets $-$ Net worth

Unlisted firms

- Leverage:

$$\frac{\text{Total assets}}{\text{Net worth}}$$

Measures of leverage determinants

- Size:

$$\frac{\text{Net sales + Total assets}}{2}$$

  Positively affects leverage.

- Market-to-book ratio:

$$\frac{\text{Total assets (market value)}}{\text{Total assets (book value)}}$$

  Negatively affects leverage.

- Profit:

$$\frac{\text{PAT}}{\text{Total sales}}$$

  Negatively affects leverage.

- Tangibility:

$$\frac{\text{Net plant and machinery}}{\text{Total assets}}$$

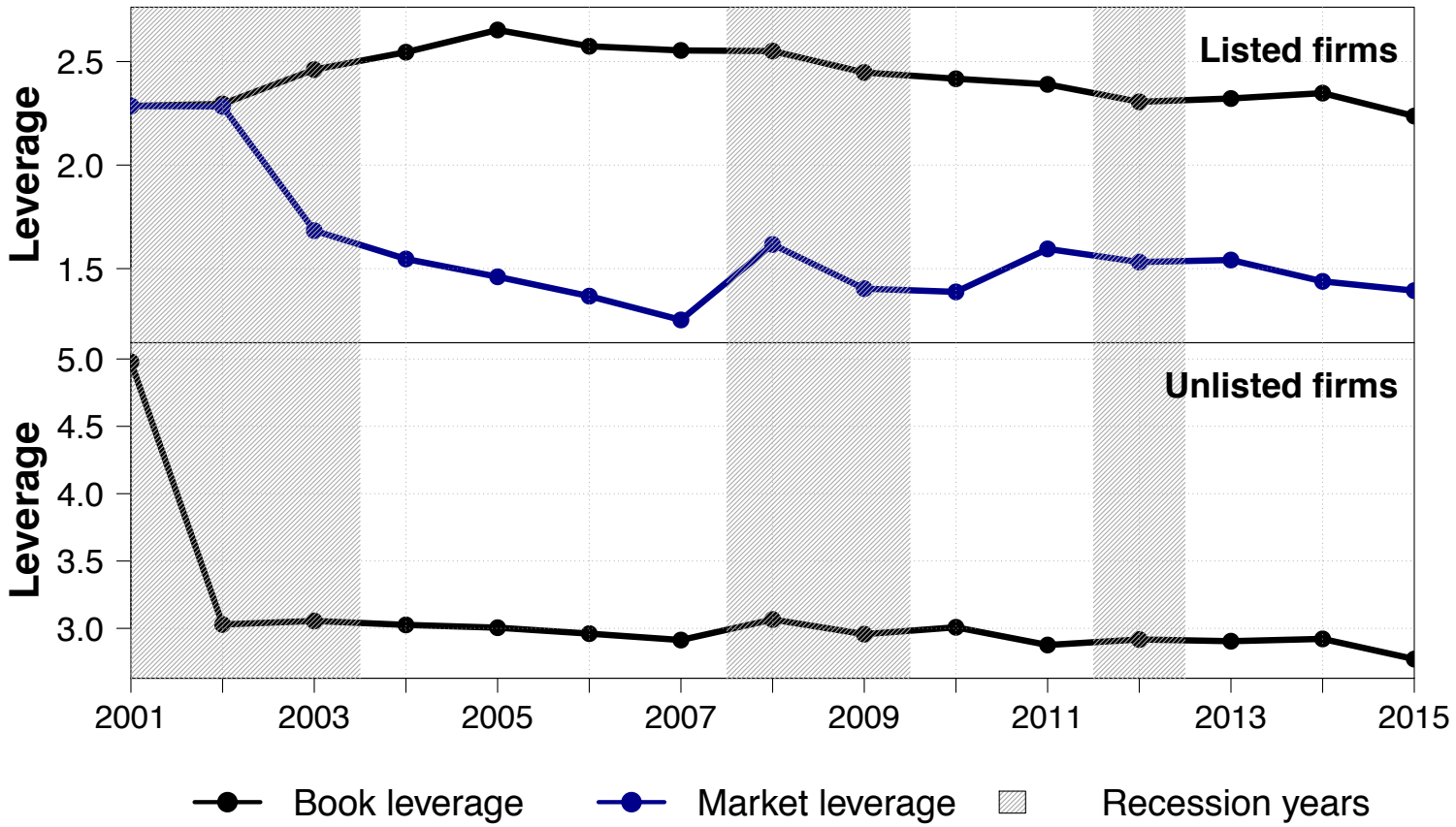
  Positively affects leverage.

- Capex:

$$\frac{\text{Change in gross fixed assets}}{\text{Total assets}}$$

  Positively affects leverage.

Figure: Aggregate leverage ratios of firms across business cycles



Summary Statistics

All firm-year observations

Table: Summary statistics of listed firms

Variables	Min	Max	Mean	Median	Std	Obs
Book leverage	0.05	21.19	2.94	2.33	2.22	37954
Market leverage	1.00	42.58	4.38	2.35	5.37	37954
Size	0.05	1418375.55	7157.54	723.98	36455.95	37954
Profit	0.00	5553.00	0.75	0.04	38.56	37954
Tangibility	0.00	4.14	0.39	0.41	0.24	37954
Capex	-22.51	1.91	0.04	0.02	0.24	37954
Market to book	-0.00	7.94	1.05	0.81	1.02	37954

Table: Summary statistics of unlisted firms

Variables	Min	Max	Mean	Median	Std	Obs
Leverage	0.00	36.00	3.89	2.58	4.34	86735
Size	0.05	840277.70	2000.73	178.20	13971.39	86735
Profit	0.00	35240.89	1.39	0.04	146.55	86735
Tangibility	-0.00	2.00	0.34	0.32	0.29	86735
Capex	-1713.00	24.50	-0.03	0.02	10.98	86735

Expansion & recession firm-year observations

Table: Summary statistics of listed firms

	Expansion			Recession			Rec - Exp
Variables	**Mean**	**Median**	**Obs**	**Mean**	**Median**	**Obs**	**Mean diff**
Book leverage	2.97	2.34	23488	2.90	2.31	14466	-0.07^{***}
Market leverage	3.70	2.11	23488	5.52	2.99	14466	1.82^{***}
Size	7989.49	799.0	23488	5806.72	614.42	14466	-2182.77^{***}
Profit	0.78	0.05	23488	0.70	0.04	14466	-0.08
Tangibility	0.38	0.40	23488	0.39	0.41	14466	0.01^{***}
Capex	0.04	0.02	23488	0.05	0.02	14466	0.01^{***}
Market to book	1.15	0.85	23488	0.89	0.75	14466	-0.27^{***}

Table: Summary statistics of unlisted firms

	Expansion			Recession			Rec - Exp
Variables	**Mean**	**Median**	**Obs**	**Mean**	**Median**	**Obs**	**Mean diff**
Book leverage	3.86	2.55	55195	3.93	2.64	31540	0.06
Size	2134.54	175.00	55195	1766.57	183.25	31540	-367.96^{***}
Profit	1.81	0.04	55195	0.66	0.03	31540	-1.15
Tangibility	0.33	0.32	55195	0.34	0.32	31540	0.00
Capex	-0.00	0.02	55195	-0.06	0.02	31540	-0.06

Financial constraints of firms

Summary Statistics

- Cyclicality of firms' leverage may depend on the financial constraints faced by firms.
- A firm is considered more financially constrained as the wedge between its internal and external cost of funds increases.
- We use measures of financial constraints proposed by Fazzari and Petersen (1993), and Kaplan and Zingales (1995).
    1. Size: Small firms face asymmetric information problems and have less access to external funds than large firms.
    2. Dividend payout: Low-dividend firms are the most likely to face financial constraints
    3. Cash levels: Firms with higher cash are considered more financially constrained.

Quartiles by size

Mean of variables of listed firms by size quartiles

Table: Size quartile averages for listed firms

	Expansion			
Variables	**Q1**	**Q2**	**Q3**	**Q4**
Book leverage	2.10	3.04	3.33	3.29
Market leverage	2.48	4.32	4.35	3.20
	Recession			
Book leverage	2.12	3.02	3.21	3.25
Market leverage	3.97	7.17	6.37	4.00
Rec- Exp: Mean diff of BL	0.02	-0.03	-0.13^{*}	-0.05
Rec- Exp: Mean diff of ML	1.50^{***}	2.84^{***}	2.02^{***}	0.81^{***}

Mean of variables of unlisted firms by size quartiles

Table: Size quartile averages for unlisted firms

	Expansion			
Variables	**Q1**	**Q2**	**Q3**	**Q4**
Leverage	2.92	3.73	4.14	4.48
	Recession			
Leverage	3.05	3.64	4.14	4.63
Rec- Exp: Mean diff	0.13	-0.09	0.00	0.15**

Quartiles by dividend payout

Mean of variables of listed firms by dividend quartiles

Table: Dividend quartile averages for listed firms

	Expansion			
Variables	**Q1**	**Q2**	**Q3**	**Q4**
Book leverage	3.24	3.07	2.87	2.76
Market leverage	3.55	2.94	2.57	2.84
	Recession			
Book leverage	3.15	2.93	2.78	2.76
Market leverage	4.52	4.49	3.91	4.86
Rec- Exp: Mean diff of BL	-0.09	-0.14^{*}	-0.10	-0.01
Rec- Exp: Mean diff of ML	0.97^{***}	1.56^{***}	1.34^{***}	2.02^{***}

Quartiles by cash levels

Mean of variables of listed firms by cash quartiles

Table: Cash quartile averages for listed firms

	Expansion			
Variables	**Q1**	**Q2**	**Q3**	**Q4**
Book leverage	2.08	3.00	3.32	3.37
Market leverage	2.50	4.13	4.37	3.33
	Recession			
Book leverage	2.15	2.93	3.23	3.28
Market leverage	3.62	7.01	6.49	4.16
Rec- Exp: Mean diff of BL	0.06	-0.07	-0.09^{**}	-0.09^{**}
Rec- Exp: Mean diff of ML	1.12^{***}	2.88^{***}	2.12^{*}	0.82^{*}

Mean of variables of unlisted firms by cash quartiles

Table: Cash quartile averages for unlisted firms

	Expansion			
Variables	**Q1**	**Q2**	**Q3**	**Q4**
Leverage	2.92	3.67	4.15	4.54
	Recession			
Leverage	3.08	3.67	4.12	4.64
Rec- Exp: Mean diff	0.16**	0.00	-0.03	0.09

Preliminary regression results

Refinancing sample

- Refinancing sample: Firms that exhibit substantial leverage adjustments during the sample period. We use this sample to estimate the effect of business cycle on leverage ratios.
- **Change in debt**: Change in total debt from (t-1) to t.
- **Change in equity**: Change in total equity from (t-1) to t.
- **Change in capital structure**: Sum of changes in debt and in equity.
- A firm-year observation defined as a refinancing observation if we observe a **change in capital structure** $>$ 5% **of last period's total assets**.

Refinancing sample

Table: Refinancing sample

	Listed firms	**Unlisted firms**
Total firm-year obs.	21966	45837
	In percentage	
Changed_only_debt	31.4	100
Debt_increase	62.5	61.5
Debt_decrease	36.8	38.5
Changed_only_equity	0	0
Equity_increase	89.4	0
Equity_decrease	10.3	0
Changed_equity_and_debt	98.9	0

Contemporaneous and direct effect of recession on leverage

$$LR_{i,t} = \beta_0 + \beta_1 REC + \beta_2 X_{i,t-1} + f_i + \epsilon_{i,t} \quad (1)$$

- $LR_{i,t}$: leverage ratio of firm i at time t.
- REC: Dummy variable $= 1(0)$ when there is a recession (expansion) in year t.
- $X_{i,t-1} =$ (size, proft, tangibility, capex, MTB).
- β_1: Direct effect of recession on leverage.

Model 1

Table: Contemporaneous, direct effect of recession

	Listed firms		Unlisted firms
Variables	**Book leverage**	**Market leverage**	**Book leverage**
Constant	4.08***	3.60***	3.96***
	(0.41)	(1.33)	(1.45)
Rec dummy	0.00	0.35***	0.11***
	(0.02)	(0.09)	(0.02)
Size	0.00***	0.00***	-0.00***
	(0.00)	(0.00)	(0.00
Profit	-0.08***	-0.04	-0.00
	(0.00)	(0.05)	(0.00)
Tangibility	0.32**	-1.2***	0.16
	(0.12)	(0.42)	(0.12)
Capex	0.49***	0.55	1.12***
	(0.13)	(0.41)	(0.12)
MTB	-0.06**	-0.37***	-
	(0.01)	(0.06)	-
Firm-years	15127	15127	30881
Firms	2857	2857	7715
Adj. R squared	0.63	0.56	0.74

Lagged and indirect effect of recession on leverage

$$LR_{i,t} = \beta_0 + \beta_1 REC + \beta_2 X_{i,t-1} + \beta_3 X_{i,t-1} * REC + f_i + \epsilon_{i,t} \quad (2)$$

- $LR_{i,t}$: leverage ratio of firm i at time t.
- REC: Dummy variable $= 1(0)$ when there is a recession (expansion) in year (t-1).
- $X_{i,t-1} =$ (size, proft, tangibility, capex, MTB).
- β_3: Indirect effect of recession on leverage.

Model 2

Table: Lagged, direct effect of recession

	Listed firms		Unlisted firms
Variables	**Book leverage**	**Market leverage**	**Book leverage**
Constant	4.03***	3.80**	3.96***
	(0.41)	(1.33)	(1.45)
Rec dummy	-0.04*	0.09	-0.04**
	(0.02)	(0.07)	(0.02)
Size	0.00**	0.00***	-0.00***
	(0.00)	(0.00)	(0.00)
Profit	-0.08***	-0.04	-0.00
	(0.00)	(0.05)	(0.00)
Tangibility	0.33**	-1.20**	0.16
	(0.12)	(0.42)	(0.12)
Capex	0.49***	0.51	1.14***
	(0.13)	(0.41)	(0.12)
MTB	-0.06***	-0.40***	-
	(0.01)	(0.06)	-
Firm-years	15127	15127	30881
Firms	2857	2857	7715
Adj. R squared	0.63	0.56	0.75

Model 3

Table: Lagged, indirect effect of recession

	Listed firms		Unlisted firms
Variables	**Book leverage**	**Market leverage**	**Book leverage**
Constant	4.06***	3.88***	3.93
	(0.41)	(1.34)	(1.45)
Rec dummy	-0.14**	-0.06	0.04
	(0.06)	(0.22)	(0.05)
Size	0.00**	0.00***	-0.00**
	(0.00)	(0.00)	(0.00)
Profit	-0.09***	-0.07	-0.00
	(0.01)	(0.07)	(0.00)
Tangibility	0.29**	-1.52***	0.21***
	(0.13)	(0.45)	(0.13)
Capex	0.56***	0.89**	1.32
	(0.15)	(0.49)	(0.16)
MTB	-0.08***	-0.37***	-
	(0.02)	(0.06)	-
Size*rec	0.00	0.00	0.00
	(0.00)	(0.00)	0.00
Profit*rec	0.07***	0.05	-0.01
	(0.02)	(0.10)	(0.01)
Tang*rec	0.11	0.87**	-0.13**
	(0.12)	(0.39)	(0.11)
Capex*rec	-0.22	-1.18	-0.42
	(0.25)	(0.83)	(0.23)
MTB*rec	0.04*	-0.14	-
	(0.02)	(0.08)	-
Firm-years	15127	15127	30881
Firms	2857	2857	7715
Adj. R squared	0.63	0.56	0.74

Conclusion

- While book leverage is consistently pro-cyclical, market leverage is counter-cyclical.
- Next step: further explore the effect of financial constraints and improve on the estimation methodology to better identify the effect of business cycles on leverage.

Thank You