Refinancing, Profitability, and Capital Structure

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The Broad Question

- We want to test the tradeoff theory of capital structure.
- Old and elusive goal.
- New theory-motivated tests with interesting results.

The Conundrum

- We revisit the relationship between profitability and leverage
- Myers (1993):
  - "The most telling evidence against the static trade-off theory is the strong inverse correlation between profitability and financial leverage . . . Higher profits mean more dollars for debt service and more taxable income to shield. They should mean higher target debt ratios."
- Popular and difficult research question
  - E.g. Fama/French (2002), Dudley (2012), Korteweg/Strebulaev (2013), Frank/Goyal (2012)

Agenda

- Derive testable predictions from a class of dynamic trade-off models
- Cross-sectional results
- Time series results
- Robustness

Theoretical Framework

- Dynamic tradeoff theory: firms do not always optimize.
- Main reason: Issuance costs.
- When firms optimize, we should observe positive correlation between profitability and leverage.
- Generic prediction of all versions of dynamic tradeoff theory with (some) fixed costs:
  - Fischer/Heinkel/Zechner (1989), Goldstein/Ju/Leland (2001), Strebulaev (2007), Morellec/Nikolov/Schuerhoff (2012), ...

The Test and the Result

- Identify firms that do large debt for equity swaps.
- They are likely at optimal refinancing points.
- For these firms leverage and profitability are positively correlated.
- The result is not mechanical.

Testing the relationship between profitability and leverage: Problems with previous studies

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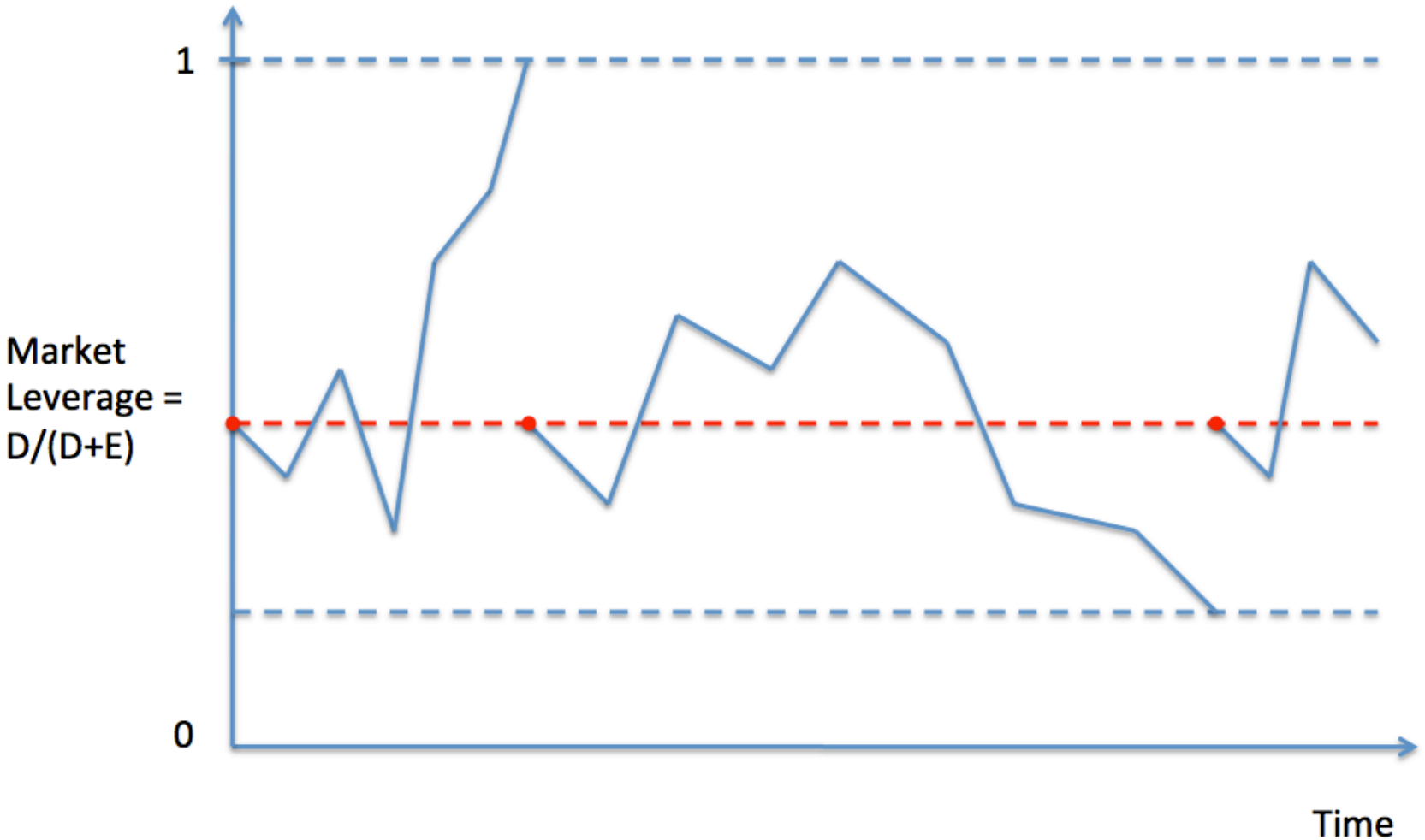

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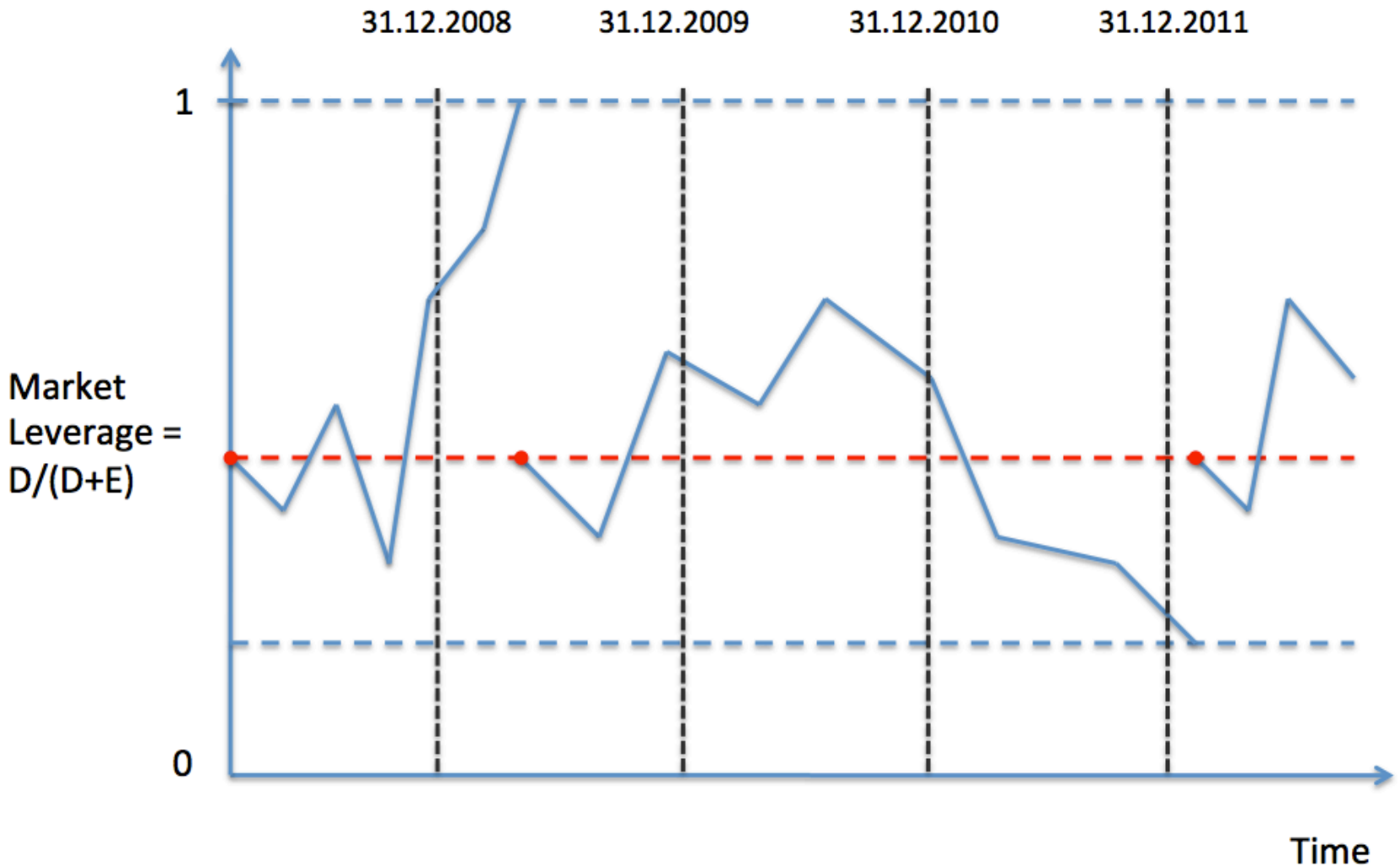

What does the theory predict from a time series perspective?

- According to tradeoff theory, prior to refinancing:
  - Profitability rises
  - Leverage falls
- Same patterns in the data

Aren't You Worried About Endogeneity?

- Less of an issue for our purposes.
- No causal claims.
- What endogenous patterns in the data emerge as predictions of dynamic leverage models?
- Are these patterns present empirically?
- Could they have been generated by other theories?
- Precedents: Leary and Roberts (2005), Whited (2006)

Refinancing Point Definition

- Compustat quarterly: 1984 to 2011
  - Remove utilities and financials
  - Winsorize at 1% and 99% levels
  - Drop negative assets, leverage outside unit interval etc.
- Refinancing point definition
- Each year, a firm is classified as refinancing firm if:
  - Δ Net long-term debt / Assets $> T_d$
  - (Dividends $+$ share repurchases $-$ share issues) / Assets $> T_e$

  with $T_d, T_e \in (0, 1)$.

The Main Prediction

- Leverage is negatively correlated with profitability at non refinancing points.
- Leverage is positively correlated with profitability at refinancing points.

The Regression

- Base case leverage regression

$$L_{it+1} = \alpha_0 + \alpha_1 d_{it+1} + \beta_1 \pi_{it} + \beta_2 d_{it+1} \pi_{it} + \gamma' Z_{it} + \epsilon_{it+1}.$$

  - $d_{it} =$ refinancing dummy
  - $\pi_{it} =$ profitability
  - $Z_{it} =$ controls

- Our main prediction can be written as:
  - $\beta_1 < 0$
  - $\beta_1 + \beta_2 > 0$

Does this specification test what we want? Check by using simulated data

- Simulate economy of 3000 firms over 112 quarters
- Firms differ by profitability, hit by idiosynchratic shocks
- Estimate the following regression:

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	Goldstein-Ju-Leland 2001	Strebulaev 2007
Intercept	0.716^{***}	0.422^{***}
	(0.001)	(0.000)
Profit (β_1)	-5.766^{***}	-0.006^{***}
	(0.052)	(0.000)
Dum	-0.241^{***}	-0.141^{***}
	(0.007)	(0.004)
Dum $\times$ Profit (β_2)	7.339^{***}	0.012^{***}
	(0.262)	(0.002)
Wald ($\beta_1 + \beta_2 = 0$)	0.000	0.000
Adj. R^2	0.04	0.01
Refin. Obs.	11,939	4,456
Total Obs.	333,000	333,000

Results in the Cross-Section

	(1)	(2)	(3)	(4)
Intercept	-0.014	0.061^{***}	0.141^{*}	0.019
	(0.073)	(0.020)	(0.086)	(0.162)
Profit	-0.262^{***}	-0.171^{***}	-0.310^{***}	-0.339^{***}
	(0.037)	(0.036)	(0.036)	(0.032)
Dum	-0.174^{***}	-0.149^{***}	-0.163^{***}	-0.054^{***}
	(0.018)	(0.018)	(0.017)	(0.015)
Dum $\times$ Profit	1.628^{***}	1.484^{***}	1.467^{***}	0.696^{***}
	(0.250)	(0.239)	(0.234)	(0.214)
Risk	-0.004	-0.003	0.004	-0.060^{**}
	(0.007)	(0.007)	(0.007)	(0.027)
Size	0.035^{***}	0.006^{**}	0.028^{***}	0.041^{***}
	(0.002)	(0.002)	(0.002)	(0.004)
MTB	-0.031^{***}	-0.027^{***}	-0.021^{***}	0.007^{***}
	(0.002)	(0.002)	(0.002)	(0.002)
TA	0.416^{***}	0.371^{***}	0.459^{***}	0.578^{***}
	(0.016)	(0.015)	(0.022)	(0.028)
Rating		0.184^{***}		
		(0.009)		
HHI		0.096^{***}		
		(0.017)		
ILev		0.109^{***}		
		(0.004)		
Wald $(\beta_1 + \beta_2 = 0)$	0.000	0.000	0.000	0.098
Quarter FE	yes	yes	yes	yes
Industry FE	no	no	yes	no
Firm FE	no	no	no	yes
Adj. R^2	0.17	0.21	0.22	0.05
Refin. Obs.	1583	1569	1569	1583
Total Obs.	194051	191015	191015	194051

Results are robust to different symmetric thresholds

	(1)	(2)	(3)	(4)	(5)	(6)
	$T_d = 0.09$ $T_e = 0.09$	$T_d = 0.08$ $T_e = 0.08$	$T_d = 0.07$ $T_e = 0.07$	$T_d = 0.06$ $T_e = 0.06$	$T_d = 0.04$ $T_e = 0.04$	$T_d = 0.03$ $T_e = 0.03$
Profit	-0.261^{***}	-0.261^{***}	-0.261^{***}	-0.262^{***}	-0.261^{***}	-0.261^{***}
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
Dum $\times$ Profit	0.947^{***}	0.869^{***}	0.986^{***}	1.374^{***}	1.603^{***}	
	(0.126)	(0.178)	(0.232)	(0.316)	(0.224)	(0.189)
Controls	yes	yes	yes	yes	yes	yes
Wald	0.000	0.000	0.002	0.000	0.000	0.000
Quarter FE	yes	yes	yes	yes	yes	yes
Adj. R^2	0.17	0.17	0.17	0.17	0.17	0.17
Refin. Obs.	17	37	126	837	2281	3636
Total Obs.	194051	194051	194051	194051	194051	194051

Results are robust to asymmetric thresholds

	(1)	(2)	(3)	(4)	(5)	(6)
	$T_d = 0.05$ $T_e = 0.07$	$T_d = 0.03$ $T_e = 0.07$	$T_d = 0.07$ $T_e = 0.05$	$T_d = 0.03$ $T_e = 0.05$	$T_d = 0.07$ $T_e = 0.03$	$T_d = 0.05$ $T_e = 0.03$
Profit	-0.261^{***}	-0.261^{***}	-0.263^{***}	-0.261^{***}	-0.266^{***}	-0.263^{***}
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
Dum $\times$ Profit	1.039^{***}	1.147^{***}	1.663^{***}	1.621^{***}	1.592^{***}	1.534^{***}
	(0.227)	(0.232)	(0.269)	(0.231)	(0.223)	(0.208)
Controls	yes	yes	yes	yes	yes	yes
Wald	0.001	0.000	0.000	0.000	0.000	0.000
Quarter FE	yes	yes	yes	yes	yes	yes
Adj. R^2	0.17	0.17	0.17	0.17	0.17	0.17
Refin. Obs.	163	197	1167	2003	1825	2597
Total Obs.	194051	194051	194051	194051	194051	194051

Predicted Patterns in the Time Series

- During sequence of positive cash flow shocks
- If the firm's financing policy is driven by dynamic tradeoff theory
  - operating cash flows will increase
  - market leverage ratio will decrease for some time
  - eventually, the firm will adjust its leverage ratio upwards

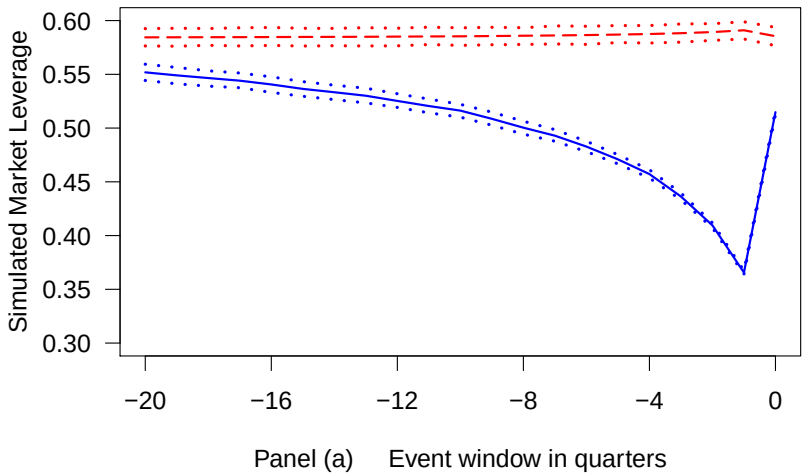
We generate patterns in simulated data

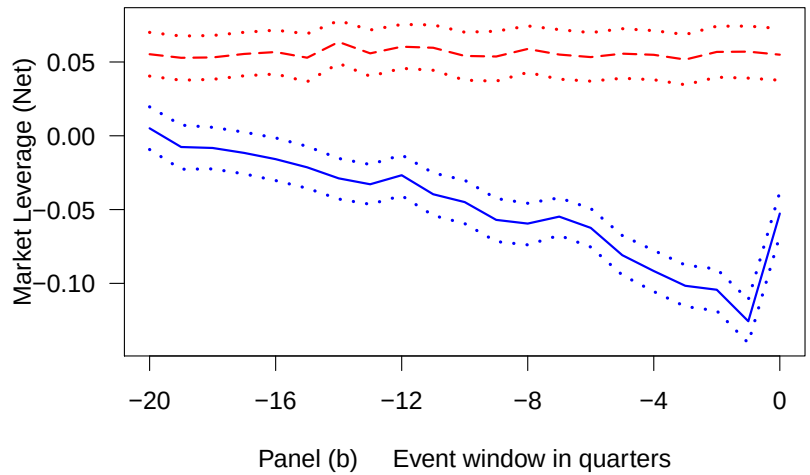
- 150 quarters and 3000 firms.
- Divide each quarter into refinancing and non refinancing groups.
- Trace leverage and profitability back 20 quarters.
- Repeat for each quarter.
- Average the paths for each groups.

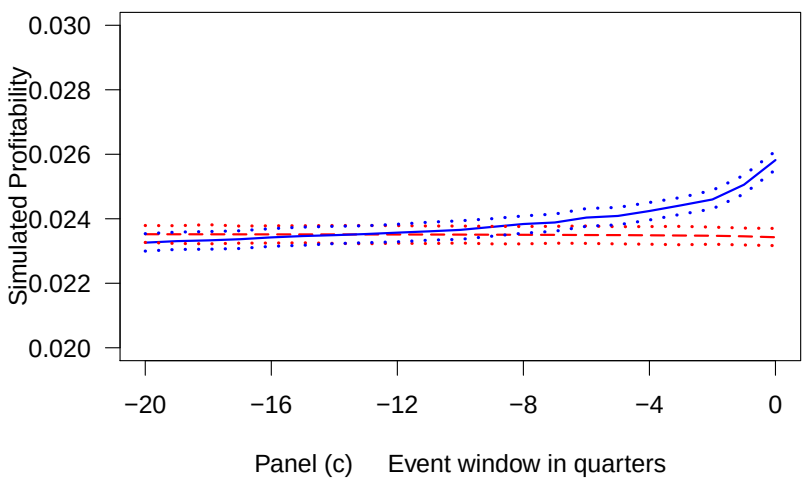
We generate patterns in real data

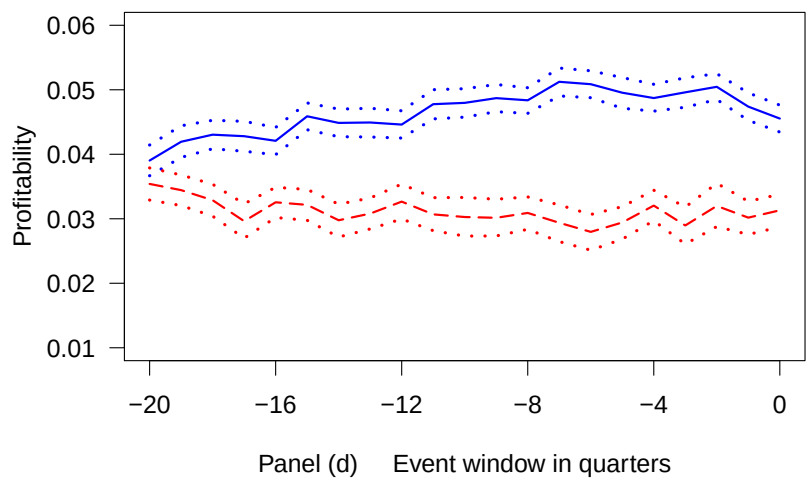
- In each year isolate refinancing firms.
- Trace leverage, profitability, and payouts back 20 quarters.
- Match each refinancing firm with a non-refinancing firm in event quarter -20.
- Average as in the simulated data.

Net Market Leverage and Profitability

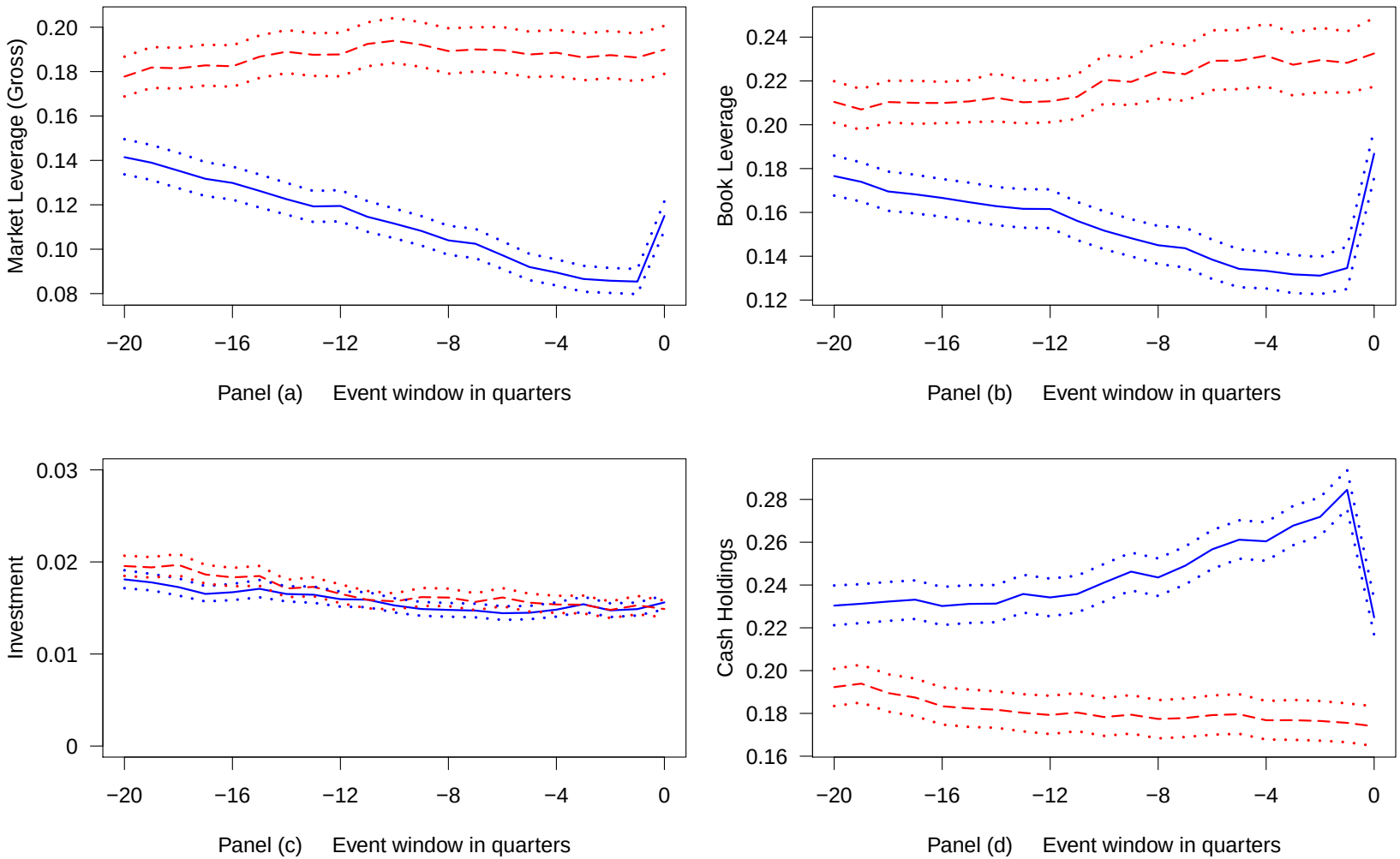








Gross Market Leverage, Book Leverage, Investment, and Cash Holdings



Change in profitability can predict rebalancings: Logit regressions

	4 Quart.	Marg. Eff.	12 Quart.	Marg. Eff.	16 Quart.	Marg. Eff.	20 Quart.
Intercept	-5.896^{***}		-5.870^{***}		-5.879^{***}		-5.859^{***}
	(0.090)		(0.090)		(0.090)		(0.091)
Δ (Profit)	5.095^{***}	0.041	5.371^{***}	0.043	5.576^{***}	0.045	5.776^{***}
	(0.400)		(0.405)		(0.387)		(0.392)
Profit	9.466^{***}	0.075	9.017^{***}	0.072	8.751^{***}	0.070	8.352^{***}
	(0.465)		(0.480)		(0.465)		(0.467)
Risk	-0.180	-0.001	-0.076	-0.001	-0.105	-0.001	-0.129
	(0.144)		(0.134)		(0.138)		(0.144)
Size	0.150^{***}	0.001	0.147^{***}	0.001	0.149^{***}	0.001	0.146^{***}
	(0.012)		(0.013)		(0.013)		(0.013)
MTB	0.166^{***}	0.001	0.175^{***}	0.001	0.180^{***}	0.001	0.183^{***}
	(0.012)		(0.012)		(0.012)		(0.012)
TA	-1.554^{***}	-0.012	-1.568^{***}	-0.013	-1.551^{***}	-0.012	-1.497^{***}
	(0.136)		(0.137)		(0.138)		(0.139)
T_d	0.05		0.05		0.05		0.05
T_e	0.05		0.05		0.05		0.05
McFadden's R^2	0.62		0.63		0.63		0.64
Refin. Obs.	1583		1558		1548		1511
Total Obs.	194683		191110		189837		183371

More Robustness

- Results not driven by investment spikes
  - Dudley (2012)
- Results robust to different measures of leverage
- Results not driven by oversampling of certain firms
- Findings not likely to be diven by market timing
  - Baker and Wurgler (2002)
- Results not driven by mechanical mean reversion in leverage
  - Chen and Zhao (2007), Chang and Dasgupta (2009)

Results Summary

- Analyze relationship between leverage and profitability
- Mechanical negative relationship between rebalancings
- Positive relationship at rebalancing points
- Empirical and simulated patterns very similar

Conclusion

- Dynamic tradeoff theories with exogenous investment explain significant fraction of financial rebalancings
- Firms with higher profitability really want higher leverage ratios
- However, smaller interim adjustments cannot be explained
- Conclude that tradeoff theory useful to understand major financial restructurings unaccompanied by changes in investment opportunities