Econ 234C – Corporate Finance Lecture 2: Internal Investment (I)

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Outline

- 1. Organization
- 2. Corporate Investment

1 Organization

- Course number: 234C
- Course time & place: we still have 8-10am, 639 Evans, alternative ...
- EXAM:
 - Regular exam, questions about a model, questions about regression specifications.
 - But: very much geared towards research. I hope to use ideas / examples that either suggest research ideas or build on recent research (with follow up). Think about it as 2 hours being forced to develop research ideas.
 - Exam date: midterm in class; final will be determined later in the term.

- WRDS and other finance data sets:
 - Got a class account.
 - * Username: econ234
 - * Password: CorpFin234C [case-sensitive]
 - Gary Peete will give an introduction to using WRDS and other data sets on 1/30 (about 1 hour).
 - * Any specific requests? (Feel free to email me!)
 - Some encouragement to become a data set activist ...
 - * CRSP/Compustat merged data base
 - * Eventus

- * IRRC will expire this summer!
- * SDC

. . .

- * CapitallQ
- Get names, (tentative) thesis topics, and signatures of other students, ask for an appointment with the chair of your department / with the chair of the appropriate committee (department/UC), find out which professors with similar research interest might be willing to support you (or maybe even contribute some money),
- We have successful examples!

- Class structure:
 - Non-traditional (behavioral, shareholder activism, corporate governance)
 - I also try to deviate from the standard textbook structure, which always (always!) starts from the Modigliani-Miller theorem.
 - Syllabus: I handed out a "still fairly standard syllabus."
 - * Core papers will remain the same, but I might add related recent paper. Will keep reshuffling papers.
 - * Also adding "core questions / topics" of the class.

- Financial Economics Seminar
 - Official Meeting time Th, 12-2pm.
 - Typically: co-organized with another seminar (public, real estate, theory, econometrics, comparative, IO)
 ==> different times & rooms
 - All details are on: http://emlab.berkeley.edu/users/webfac/ malmendier/e235_sp07/e235.shtml

2 Corporate Investment

2.1 A few basics from last class

Baseline model of investment and financing

- Three-periods, firm has existing assets A and s shares outstanding.
- Ass. 1: no debt
 - Ass. 2: zero interest rate
 - t = 0: return function R(I) becomes known to CEO + investors; R defined on $[0, \infty)$, R' > 0, R'' < 0, R'(I) > 1 for some I.
 - t = 1: cash flow C is realized (firm's new net worth A + C); CEO chooses I.
 - $\mathbf{t} = \mathbf{2}$: R(I) realized.

CEO's optimization problem

CEO maximizes shareholder value subject to the financing constraint:

$$\max_{I} \frac{s}{s+s'} (A+R(I))$$

s.t.
$$\frac{s'}{s+s'} \cdot (A+R(I)) = I - C \quad \text{if } I > C$$

 \implies First-order condition: R'(I) = 1.

Question: We are assuming that a CEO (in a world without incentive problems, without asymmetric information) maximizes $s/(s+s') \cdot (A+R(I))$. What does this mean? What alternative assumption would make sense (i.e. is consistent with 'shareholder-vaue maximization')? How does the maximization problem look like now?

Would it make a difference? If so for what?

2.2 Empirical Evidence on Investment

• Much of the empirical evidence on investment evolves around 'investmentcash flow sensitivity' as introduced last class:

$$I_{k,t} = \alpha + \beta C_{k,t} + X'_{k,t} \Gamma + \mu_k + \nu_t + \varepsilon_{k,t}$$

where C is cash-flow of company k in year t, $X_{k,t}$ includes a proxy for investment opportunities $(Q_{k,t})$

- Coefficient β significantly positive
- Theory: Investment should not depend on whether earnings are available. (Firm can borrow at market interest rate.)

• What bigger question are we trying to address here (indirectly)?

• Why don't we ask it directly?

• Can you think of ways of asking directly?

• Can you think of OTHER ways of asking this question indirectly?

Identification of Investment-Cash Flow Sensitivity

- Model: $I_{k,t} = \alpha + \beta C_{k,t} + X'_{k,t} \Gamma + \mu_k + \nu_t + \varepsilon_{k,t}$
- Identification: Need exogenous shock to $C_{k,t}$
 - 1. Unexpected gains from law-suits (Blanchard, Lopez-de-Silanes, Shleifer, *JFE* 1994).
 - 2. Oil price shocks (Lamont, *JF* 1997)
 - 3. Non-linearities in pension fund requirements (Rauh, JF 2006).

Identification using Oil Price Shocks (Lamont, JF 1997)

- Idea:
 - Step 1: exogenous shock to cash flow available to a firm \implies oil price exogenously determined + affects CF of oil firms



Step 2: exogenous shock needs to be orthogonal to investment opportunities (quality of investment projects)
 ⇒ non-oil subsidiaries of oil companies

• **Caveat:** joint hypothesis test with financial frictions + internal capital markets ("corporate socialism")

• Data:

Focus on 1986 oil price decrease.
Argument 1: size of price change: -50%
(from \$26.60/barrel in 12/1985 to \$12.67/barrel in 4/1986).
Argument 2: unanticipated
(What is otherwise the problem?)

- Def. oil company: primary or secondary SIC as oil/gas extraction AND \geq 25% of $C_{k,1985}$ form oil/gas extraction.
- Def. non-oil-segment: $\rho(\text{profit, oil price}) \leq 0$.

- Final sample: 26 firms
- Note:
 - * "Extraction of financial or services industry as it is standard"
 - * Concrete examples!
 - * Appendix with full listing, including the *excluded* firms.
- **Results**: Table III ($\Delta = '86 '85$) : 'eye-ball test'

	Company	Segment	$\Delta I/S$	$\Delta CF/S$
1	Amoco Corp	Chemicals	3.46	5.88
2	Atlantic Richfield	Spec & Int. chemicals	2.38	1.97
3	Burlington Northern	Forest products	-1.60	1.55
4	Burlington Northern	Railroad	-6.63	-4.27
5	Canadian Pacific Ltd	Forest products	1.66	1.61
6	Canadian Pacific Ltd	Railroad	-3.40	-1.38
7	Chevron Corp	Chemicals	-1.30	6.05
8	Dekalb Energy Co	Agricultural seed	-2.85	-13.16
9	Du Pont	Ag-Ind. chemicals	-0.67	10.72
10	Du Pont	Biomedical products	0.19	3.08
11	Du Pont	Fibers	1.43	10.77
12	Du Pont	Induscons. products	0.02	-0.65
13	Du Pont	Polymer products	-0.69	3.53
14	Fina Inc	Chemicals	-0.95	9.36
15	Grace (W.R.) & Co	Specialty business	-0.91	0.42
16	Grace (W.R.) & Co	Specialty chemicals	-1.21	-1.01
17	Homestake Mining	Gold	-16.64	12.11
18	Imperial Oil Ltd	Chemicals	0.81	4.08
19	Kerr-McGee Corp	Chemicals	-2.33	5.22
20	Litton Industries	Adv. electronic	2.84	-5.65
21	Litton Industries	Marine engin. & prodtn	-0.32	0.05
22	Mobil Corp	Chemical	-0.40	4.86
23	Mobil Corp	Retail merchandising	-0.88	2.57
24	Nova Corp of Alberta	Petrochemicals	6.92	2.09
25	Occidental Petroleum	Agribusiness	0.40	0.37
26	Occidental Petroleum	Chemicals	-1.19	2.87
27	Phillips Petroleum	Chemicals	0.72	8.65
28	Placer Dome Inc	Mining	-0.43	1.10
29	Royal Dutch/Shell Grp	Chemicals	-1.09	8.52
30	Schlumberger Ltd	Measurement & systems	0.51	0.13
31	Southdown Inc	Cement and concrete	-4.54	-0.29
32	Tenneco Inc	Automotive parts	0.77	1.65
33	Tenneco Inc	Chemical	-1.87	2.34
34	Tenneco Inc	Packaging	-0.72	0.25
35	Tenneco Inc	Shipbuilding	-1.80	-0.00
36	Union Pacific Corp	Transportation	-4.39	6.87
37	Unocal Corp	Chemicals	-2.39	0.44
38	Unocal Corp	Metals	-9.41	-3.42
39	USX Corp	Steel	-1.44	-8.72
40	Zapata Corp	Marine protein	-10.29	16.45
	Average		-146	9 4 9

Table V Change in I/S, 1985–1986

Dependent variable: Δ *I/S*, where I is segment capital expenditure and S is segment sales. Expressed as percentage points. Median: The Z-statistic is the Wilcoxon signed-rank test, which tests the hypothesis that the observations are iid and symmetrically distributed around zero. Number positive: the 2-sided *p*-value is the probability of observing at most this number of positive or negative values, under the null hypothesis that the observations are independent and prob[positive] = 0.5. Industry-adjustment: For each observation of Δ *I/S*, I subtract the median value of Δ *I/S* from a control group of COMPUSTAT segments that were in the same industry, but were owned by companies that did not have an oil extraction segment.

	Raw	Industry-Adjusted		
No. of Observations	40	39		
Mean	-1.46	-1.41		
t-statistic	(2.34)	(2.06)		
<i>p</i> -value	(0.02)	(0.05)		
Median	-0.90	-0.80		
Z-statistic	(2.51)	(2.18)		
<i>p</i> -value	(0.01)	(0.03)		
Number positive	13	12		
<i>p</i> -value	(0.04)	(0.02)		

• Limits:

Mere time-series identification. ⇒ What is the problem? See Table I, Panel A:

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	Panel A: Profit Rates for Lines of Business for FRS Petroleum Companies										
Consolidated	15.3	12.4	7.7	7.4	6.9	5.5	3.0	3.6	7.2	6.4	6.8
Petroleum	19.2	16.6	12.5	11.3	10.4	10.5	5.5	6.2	7.3	6.7	9.5
US Petroleum	17.5	16.1	12.7	10.3	9.4	9.4	3.0	4.9	6.3	5.8	7.9
Oil and Gas Production	20.9	20.2	14.0	11.3	10.8	9.5	0.8	4.1	2.8	2.9	8.5
Refining and Marketing	9.8	4.4	6.0	4.8	0.3	6.5	4.5	2.9	14.7	11.5	5.2
Pipelines	15.1	15.6	20.8	16.6	20.8	15.0	13.2	12.8	9.6	10.2	11.2
Foreign Production	23.0	17.7	11.8	14.1	13.3	13.8	12.8	9.5	9.9	8.7	12.5
Oil and Gas Production	25.1	25.5	17.4	19.6	18.8	20.0	11.6	12.4	9.2	8.9	13.1
Refining and Marketing	26.4	9.0	4.7	7.7	4.5	3.3	16.3	4.7	11.6	8.0	11.2
International Marine	2.4	-1.1	-6.3	-13.2	-14.0	-19.0	5.3	-3.6	6.8	12.4	11.7
Coal	5.6	6.1	4.4	5.0	6.2	4.6	2.7	5.1	6.7	5.0	3.3
Nuclear and Other Energy	-0.7	-6.8	-5.2	0.5	-1.8	-8.4	-0.8	0.5	-2.5	-2.3	1.9
Nonenergy	5.9	3.5	0.6	2.9	4.8	4.2	5.1	12.2	20.3	17.3	7.8

Increase in non-energy profit rate in 1986 supports identification. Explosion in 1987 casts doubt on identification. (Why?)

Other Evidence

• Windfall gains from law-suits (Blanchard, Lopez-de-Silanes, Shleifer, *JFE* 1994).

– Problem: N = 11

• Non-linearities in pension fund requirements (Rauh, JF 2006)



prior credits of \$0.5m.

- Problems
 - manipulation similar to earnings manipulation
 - as with Lamont: investment further before and further after
 - does not exploit discontinuity between funded and underfunded (only within underfunded!)

Broad conclusions from above papers:

- I/CF sensitivity exists
- It remains hard to put a \$\$ amount on it.
- It remains hard to understand generalizability

2.3 Why is Investment Sensitive to Cash Flow?

- Prime hypothesis: financial constraints.
- Cost of external equity finance
 > cost of external debt finance
 > cost of internal finance.
 (Pecking order)



$$I_{k,t} = \alpha + \beta C_{k,t} + X'_{k,t} \Gamma + \mu_k + \nu_t + \varepsilon_{k,t}$$

Fazzari, Hubbard and Petersen (1988) sort on a priori measures of constraint (dividends) and interpret β

Kaplan and Zingales (1997) show that β is not higher for firms that truly appear constrained

Side product: KZ index as a measure of financial constraint.

$$\begin{split} KZ_{it} &= -1.001909 * \frac{CF_{it}}{K_{it-1}} + 0.2826389 * Q_{it} + 3.139193 * Lev_{it} \\ &- 39.3678 * \frac{Dividend_{it}}{K_{it-1}} - 1.314759 * \frac{C_{it}}{K_{it-1}} \end{split}$$

(Other ex-ante measures of financial constraints: age, debt-rating)

Theories relating to I/CF sensitivity

- Asymmetric information
 - Implies underinvestment (external financing more costly than internal financing)
 - Myers and Majluf (1984)
- Manager-shareholder agency problems
 - Tendency to over-invest; (internal resources easier to divert)
 - Jensen and Meckling (1976), Stulz (1990), Hart and Moore (1995)
- Overoptimism/overconfidence
 - Tendency to over-invest; but perceived undervaluation may lead to underinvestment in the case of equity-financing
 - Heaton (2002); Malmendier and Tate (2005)

2.4 Required reading for next class:

- Myers, Stewart and N. Majluf (1984), "Corporate Financing and Investment Decisions when Firms Have Information that Investors Do Not Have," Journal of Financial Economics 13, pp. 187-222.
- Jensen, Michael and William Meckling (1976), "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," Journal of Financial Economics 3, pp. 305-360.
- Jensen, Michael (1986), "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers," American Economic Review 76, pp. 323-329.

Also required:

Familiarize yourself with WRDS (to get something out of the introduction!).

2.5 Take away & Research Ideas

- If your main field is not finance:
 - Clean estimates of the phenomenon
 - Exploring explanations other than financial constraints in areas where financial constraints is the typical explanation
 - Use investment-CF sensitivity where you are 'really' interested in investment quality (as a measure of the 'degree of suboptimality')..
- If your field is finance:
 - My guess: little room for yet another identification / criticism (despite lack of the perfect paper).
 - Direct measures of investment quality?