Financial Constraints and Investments

Investment, Finance and Asset Prices ECON5068

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Lecture Overview

- Financial Markets and Investment
- Gilchrist and Himmelberg empirical study
- Necessary Reading:
  1. Gilchrist and Himmelberg, 1995, "Evidence on the role of cashflow for investment", Journal of Monetary Economics.

Capital Market Imperfections and Investment

- **The Market for funds:** firms find financing through bonds (traded) banks/private lenders (usually not traded). Funds are supplied by household savings.
- **Capital markets matter:** Results from FHP (1988) indicate that capital market plays an important role in determining the level of investments.
- **Benchmark**: If financial markets were perfect, all firms would have equal (or fair) access to capital.
- A firms's financial structure would then be irrelevant to investment decisions.
- External and internal finance would be perfect substitutes.

Capital Market Imperfections and Investment

- **In reality:** financial markets are far from perfect.
- **Reasons** include transaction costs, agency costs, asymmetric information etc.
- These costs create a **premium** between external and internal finance.
- Firms that are **financially constrained** rely more on internal earnings coming from their cashflows and will find it difficult to get external credit.
- Internal financing is cheap (shadow price) while external financing becomes costly.

Capital Market Imperfections and Investment

- **Important?** Financial/capital market imperfections also have aggregate economy wide consequences.
- **Multiplier**: In the presence of these imperfections, even a small negative shock can be amplified and propogated to the entire economy.
- This is called **Financial Accelerator** mechanism.

$\Rightarrow$ Worsening business conditions tighten borrowing constraints which cut investment further, reducing NPV of the business, which tightens borrowing constraints...

- The results by FHP is evidence for such phenomenon.

Limitations of FHP Study - Role of Cashflow

- The FHP (1988) article was criticized on the basis of **measurement of Q**.
- Tobin's Q or Average Q used by FHP may not properly capture future investment opportunities.
- If Q is mismeasured, then cashflow could impact investment only because it is correlated with the "true" marginal Q that firms' consider when making their investment decisions.

Limitations of FHP Study - Role of Cashflow

- Another problem with the FHP study is related to **how they classify the firms**.
- Firms that are identified as financially constrained are usually newer, smaller and faster growing.
- The stock market is less likely to have information on these firms.
- Thus, Tobin's Q or average Q measured based on the stock market data will not contain enough information about the investment opportunities of these firms.

Limitations of FHP Study - Role of Cashflow

- Furthermore, smaller and younger firms suffer from less bureaucracy and corporate heirarchy.
- **Investment decisions could be made faster and more efficiently**.
- If Tobin's Q is a sufficient statistic for investment, these firms should have high Q coefficients.
- If Tobin's Q does not sufficiently capture investment information, then the coefficient on cash-flow would be higher.

Limitations of FHP Study - Role of Cashflow

- All these limitations are intrinsically related to the **mis-measurement of Q.**
- To properly isolate the role of cashflows, **we need to measure Marginal Q** and not average Q.

Gilchrist and Himmelberg 1995: Fundamental Q

- Gilchrist and Himmelberg (1995) construct a measure of Q that is as **close as possible to the theoretical measurement of Q**, marginal Q.
- They call this **"Fundamental Q"** - defined as the expected discounted stream of marginal profitability.
- Their Fundamental Q is equivalent to Marginal Q.
- Gilchrist and Himmelberg **do not rely on stock market data** to measure Q.

Expressing Marginal Q

- Recall the expression for marginal Q:

$$q_t = \beta \sum_{s=0}^{\infty} \beta^s (1-\delta)^s \mathbb{E}_t \left[\pi_K(\theta_{t+s+1}, K_{t+s+1}) \right] \qquad (1) \qquad (1)$$

- NPV of Expected future marginal profits, over useful lifetime of capital
- Thus, marginal Q essentially is a forecast of future marginal profits.
- We want a data-based counterpart for theoretical object $\mathbb{E}_t(...)$
- GH use the **estimated statistical processes, using firm-level microdata** to predict future profits

GH Methodology

- GH use a **Vector Autoregression (VAR)** to calculate this forecast.
- The forecast from the VAR is based on a set of **observable variables that "fundamentally" determine** and can thus predict future marginal **profits**.
- Hence the name "**Fundamental Q**".

GH Study - Methodology

- **Cash flow** is one of the variables they include in the VAR forecasting exercise.
- In this way, their measurement of Marginal Q will include any information that cash flow has about future profits.
- **Implication** : Any explanatory role for cash flow found in the investment regression can be **attributed to financial constraints**.

GH Study - Methodology

- The investment-Q regression they focus on is the following:

$$(I/K)_{it} = \beta' x_{it} + year_t + firm_i + \omega_{it} \qquad (2) \qquad (2)$$

- x_{it}: vector of fundamentals, $year_t$ captures aggregate shocks every year, common to all firms, and $firm_i$ captures permanent differences in (I/K) between firms.
- Firm fundamentals follow a vector autoregressive (VAR) process:

$$x_{it} = A x_{it-1} + \epsilon_{it} \qquad (3) \qquad (3)$$

- Note: In the original paper, GH also include fixed effects for firm and time in the VAR.

What's a VAR

VAR: vector auto regression: models joint dynamics of a bag of variables:

$$x_{it} = A_1 x_{it-1} + A_2 x_{it-2} + A_3 x_{it-3} + f_i + \tau_t + \varepsilon_{it}$$

dynamics depend only on **own values** (auto) from the **recent past** (regressive)

$$\begin{bmatrix} \pi_{it}/K_{it} \\ S_{it}/K_{it} \end{bmatrix} = \sum_{\ell=1}^{L=3} \mathbf{A}_\ell \begin{bmatrix} (\pi/K)_{it-\ell} \\ (S/K)_{it-\ell} \end{bmatrix} + f_i + \tau_t + \varepsilon_{it} \tag{4}$$

GH use the three year histories of profits- and sales-to-capital ratios.

- Once you have $(\hat{\mathbf{A}}, \hat{f}, \hat{\tau})$ you can predict $x_{it+1}, x_{it+2}, \ldots, x_{it+h}$
- **VAR is a statistical model to learn from past dynamics to make future predictions**

GH Study - Methodology

- The forecast of future fundamentals x conditional on current values is then given by the conditional expectation:

$$E[x_{it+s}|x_{it}] = A^s x_{it} \tag{5}$$

- where $s > 0$ is the period that is forecasted.
- The **conditional expectation** can be approximated by the **forecast**.
- GH use the **full stream of expected marginal profits** to approximate q[1]

[1] $F_{it} = c'(I - \lambda\hat{A})^{-1}x_{it} = c'x_{it} + \lambda c'\hat{A}x_{it} + \lambda^2 c'\hat{A}^2 x_{it} + ... = \hat{\pi}_{it} + \lambda\hat{\pi}_{it+1} + \lambda^2\hat{\pi}_{it+2} + \lambda^3\hat{\pi}_{it+3}$

GH Study - Methodology

- They then forecast marginal q based on these fundamentals x and rewrite the regression equation as:

$$(I/K)_{it} = \frac{1}{\alpha}[\phi(A)]x_{it} + year_t + firm_i + error_{it} \tag{6}$$

- α: coefficient related to the adjustment cost, and $\phi(A)$ is a function A in VAR equation that is obtained from the **forecasting exercise** (respecting a fixed discount factor $\beta(1-\delta)) = 0.8$)

$$(I/K)_{it} = [Q_{it}^{forecast}(data|given : \beta, \delta, r)] + year_t + firm_i + error_{it} \tag{7}$$

GH Study - Methodology

$$\text{Fundamental Q} = [\phi(A)]x_{it} \tag{8}$$

- **Fundamental Q** is a function of firm fundamentals, and is the data equivalent to theoretical marginal Q.

GH Study - Data

Data :

1. The widely used **Compustat** Database, All U.S. Listed Firms.
2. Time period is 1979-1989
3. Firms belong to the **Manufacturing** Sector.
4. Two fundamental variables in x_{it} - **Profit and Sales to Capital Ratios.**

Sample Splitting : Firms are grouped based on their

1. **Dividend** Payout
2. **Size** - measured by Capital or Assets
3. **Bond Rating** (think Moody's, S&P et al)
4. Access to **commercial paper** market (v short term, no collateral, only highest rated firms).

GH Study - Estimation

- They estimate two regression equations focusing on the investment-Q relation.
- First regression is without the cashflow variable.
- Second regression augments the first one with cashflow as an explanatory variable.

Tobin's Q vs Fundamental Q: No Cashflow

Sample	N	**Tobin's** Q	Fundamental Q		Difference
		$1/\alpha$	$1/\alpha$	Adjusted	Wald test
		(s.e.)	(s.e.)	std. error	(p-value)
Full sample	428	0.050***	0.183***		0.634
		(0.015)	(0.034)	[0.118]	
Constrained subsamples					
Small firms	106	0.076***	0.177***		0.029**
		(0.019)	(0.013)	[0.091]	
Low dividend	106	0.079***	0.272***		0.113
		(0.013)	(0.057)	[0.074]	
No CP rating	249	0.066***	0.170***		0.037**
		(0.016)	(0.038)	[0.104]	
No bond rating	291	0.072***	0.211***		0.060*
		(0.016)	(0.038)	[0.111]	
No CP or bond rating	234	0.074***	0.182***		0.020**
		(0.015)	(0.039)	[0.103]	

GH Study - Results

Results regarding Q:

1. Parameter estimate on fundamental Q is much larger
2. Implies smaller adjustment costs - closer to realistic levels (adjustment spells of a few years, not decades)

GH T2: Excess Sensitivity Tests

Sample	N	Tobin Model		GH Fundamental model	
		Q	*Cash*	*Q*	*Cash*
		(s.e.)	(s.e.)	(s.e.)	(s.e.)
Full sample	428	0.033**	0.242***	0.085	0.170*
		(0.016)	(0.038)	(0.097)	(0.091)
Constrained subsamples					
Small firms	106	0.056***	0.203***	0.069	0.173**
		(0.020)	(0.045)	(0.083)	(0.071)
Low dividend	106	0.063***	0.101**	0.228***	0.118*
		(0.014)	(0.040)	(0.064)	(0.063)
No CP rating	249	0.039**	0.245***	0.044	0.250***
		(0.018)	(0.041)	(0.085)	(0.071)
No bond rating	291	0.049***	0.214***	0.120	0.144*
		(0.018)	(0.043)	(0.098)	(0.081)
No CP or bond rating	234	0.046***	0.236***	0.059	0.237***
		(0.017)	(0.041)	(0.083)	(0.070)

GH Study - Results

Results regarding sensitivity of investment to cash flow:

1. Cashflow adds **additional explanatory power** to the investment equation.
2. The effect of cash flow on investment is **greater for constrained firms** than for unconstrained firms.
3. Using **Tobin's Q tends to overstate the sensitivity** of investment to cash flow for unconstrained firms but not for constrained firms.
4. **FQ** has **economically meaningful impact on (I/K)** but estimates are noisier.
5. Results suggest **Cashflow important for investment** even after properly accounting for fundamentals – **financial constraints** at work.