Risky Investments with Limited Commitment

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A Few Words About Lawrence Klein

The Keynesian Revolution, 1947, MacMillan

It's technical appendix and the section **Mathmatical Models of Keynesian and Classical Economics** were a particular graduate students salvation.

Klein saw the key to understanding the essence of Keynesian Economics as playing out in financial markets. Preferences were a function of money and asset holdings at every date.

CHANGING STRUCTURE OF FINANCE

During the last three decades there have been significant changes in the **organizational structure** of the financial industry.

- Change in NYSE Rules in 1970 allowed public corporations to hold seats on the exchange and resulted in a move away from partnership to corporations.
  - Merrill Lynch went public in 1971
  - Bear Stearns 1984
  - Morgan Stanley 1985
  - Lehman Brothers 1994
  - Goldman Sachs 1999
  - Demise of Traditional Merchant Banks in the UK

Why Did They Change?

"An IPO could give them signficantly greater capital for their proprietary trading."

Charles Ellis, *The Partnership: The Making of Goldman Sachs*, 2008.

DURING THE SAME PERIOD

1. **Increasing innovation and risk taking.**

2. **Increasing size of the financial sector.**

3. **Increasing compensation in the financial sector and greater income inequality.**

4. **Lower stock market valuation of financial institutions.**

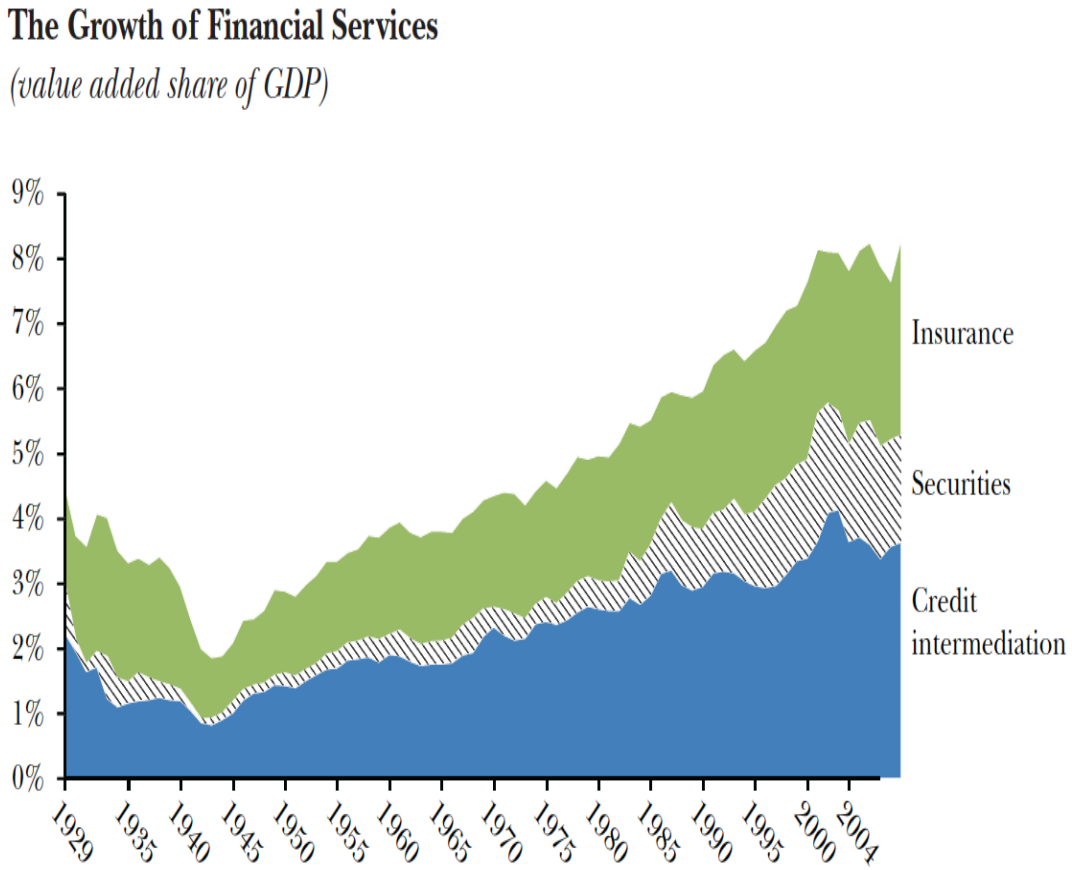
A Larger Financial Sector in US and Elsewhere

1. Value added increased from about 4% of GDP in 1970 to about 8% in 2011.

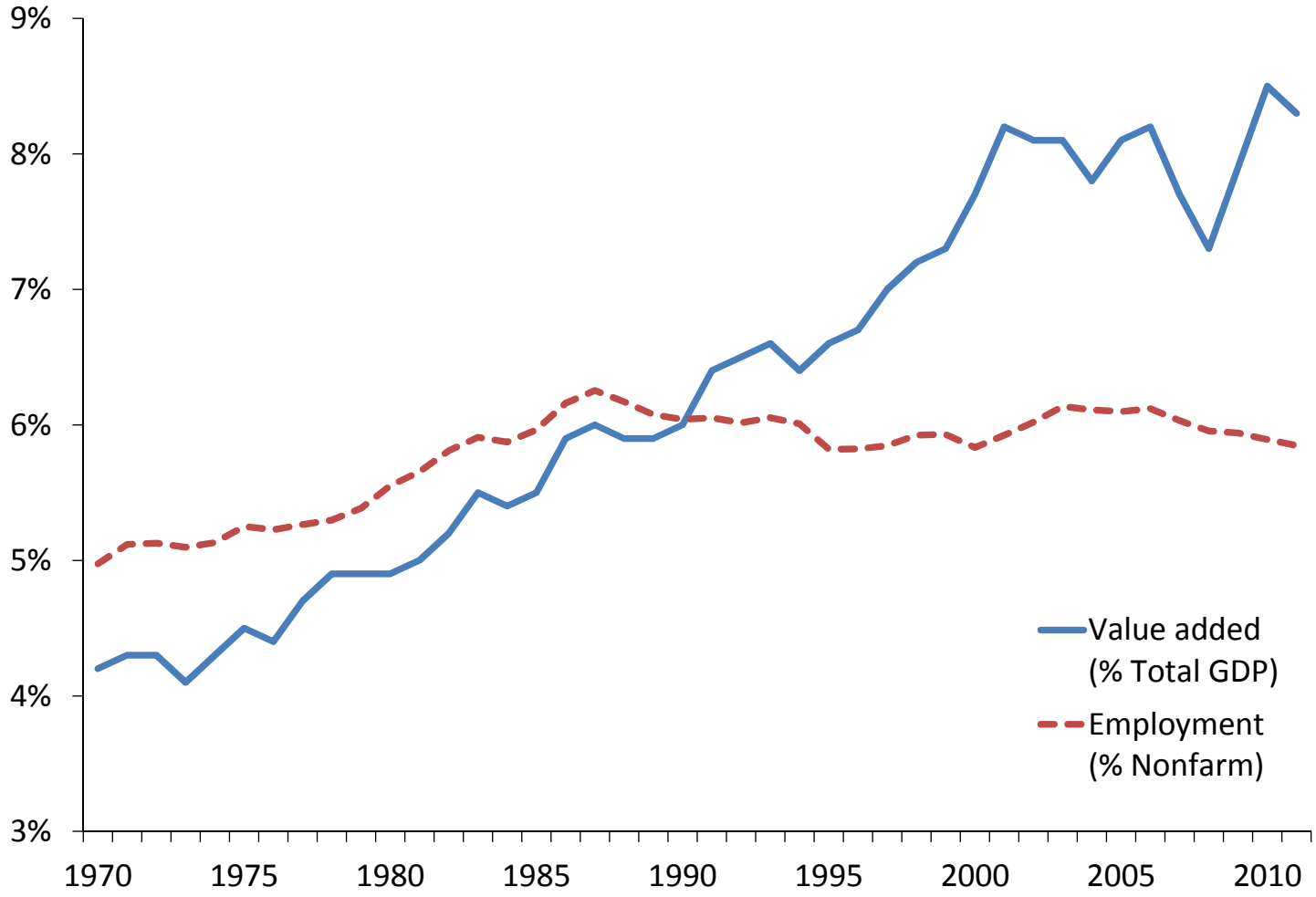
2. Employment increased less, from about 5% in 1970 to about 5% in 2011.

A larger size of the financial sector in US

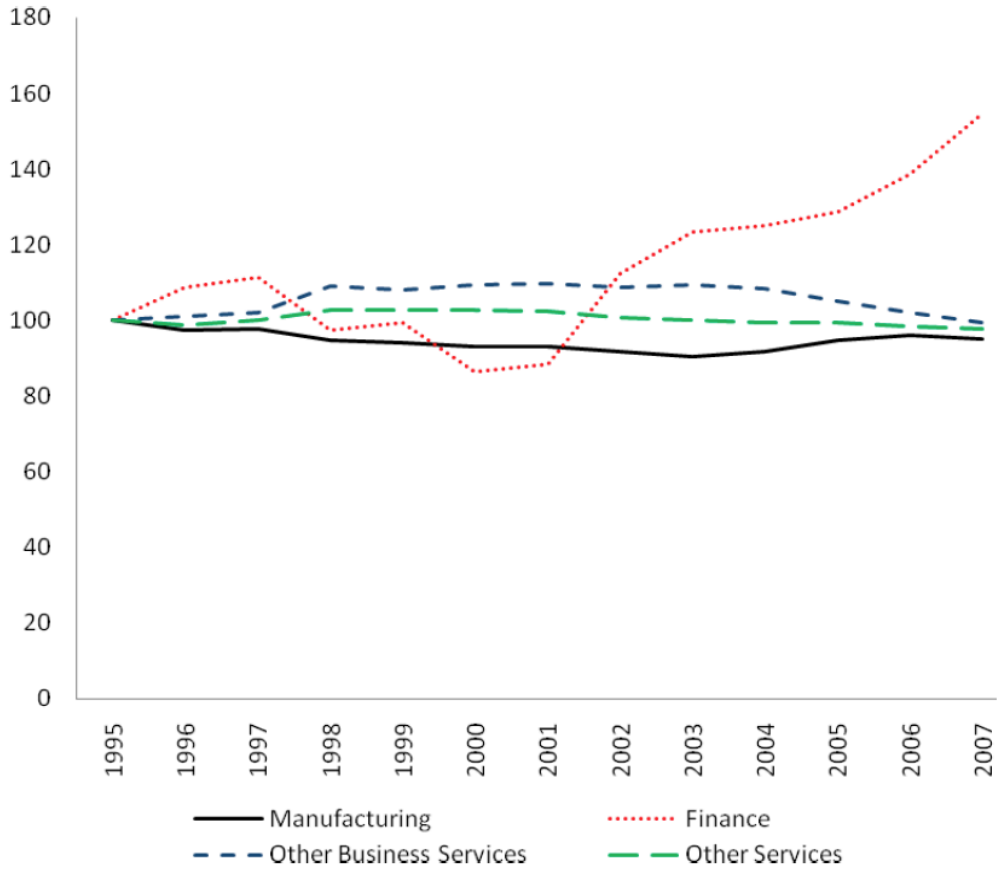
Finance & insurance share of Value Added



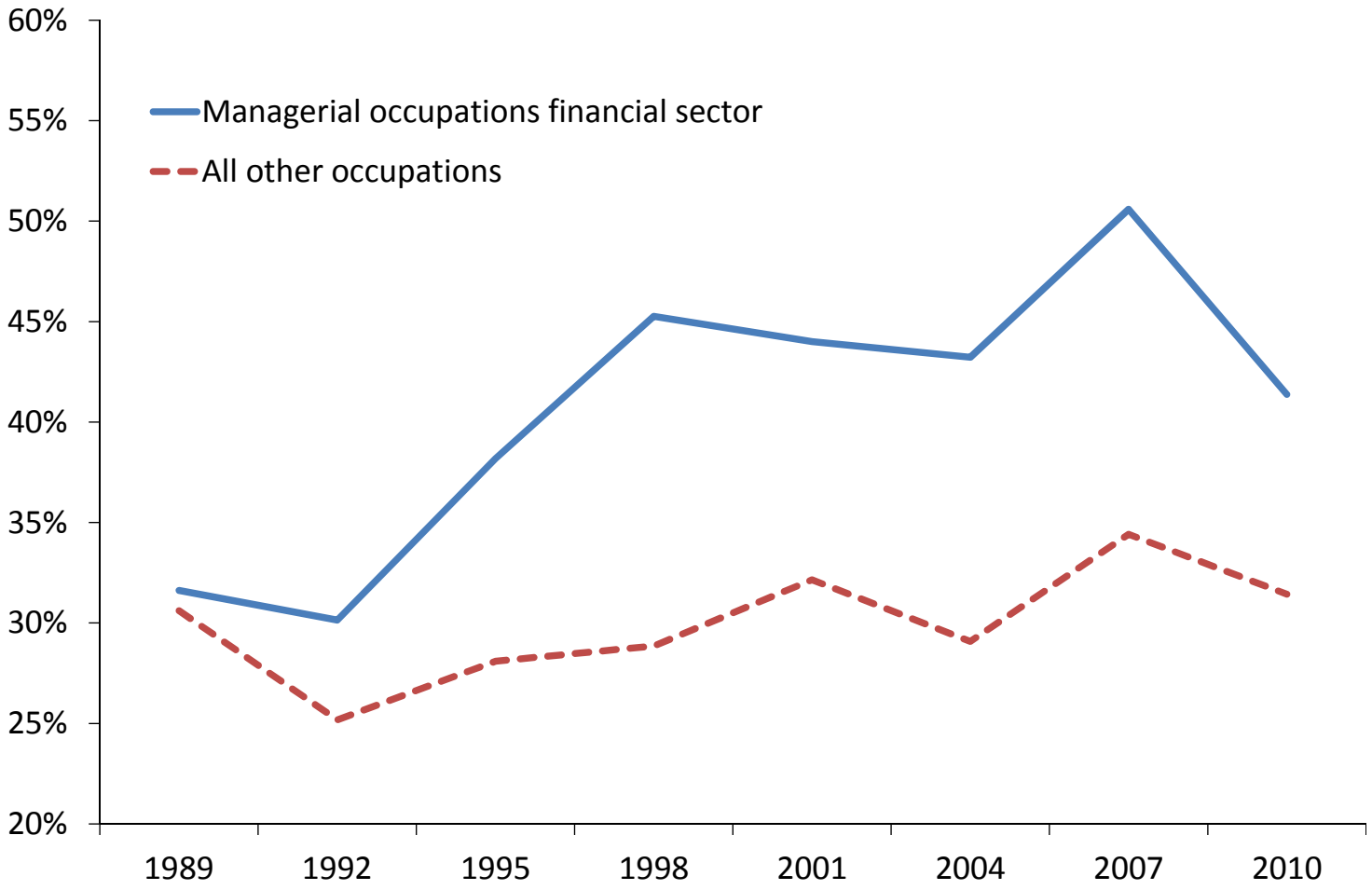
Size of Finance and Insurance



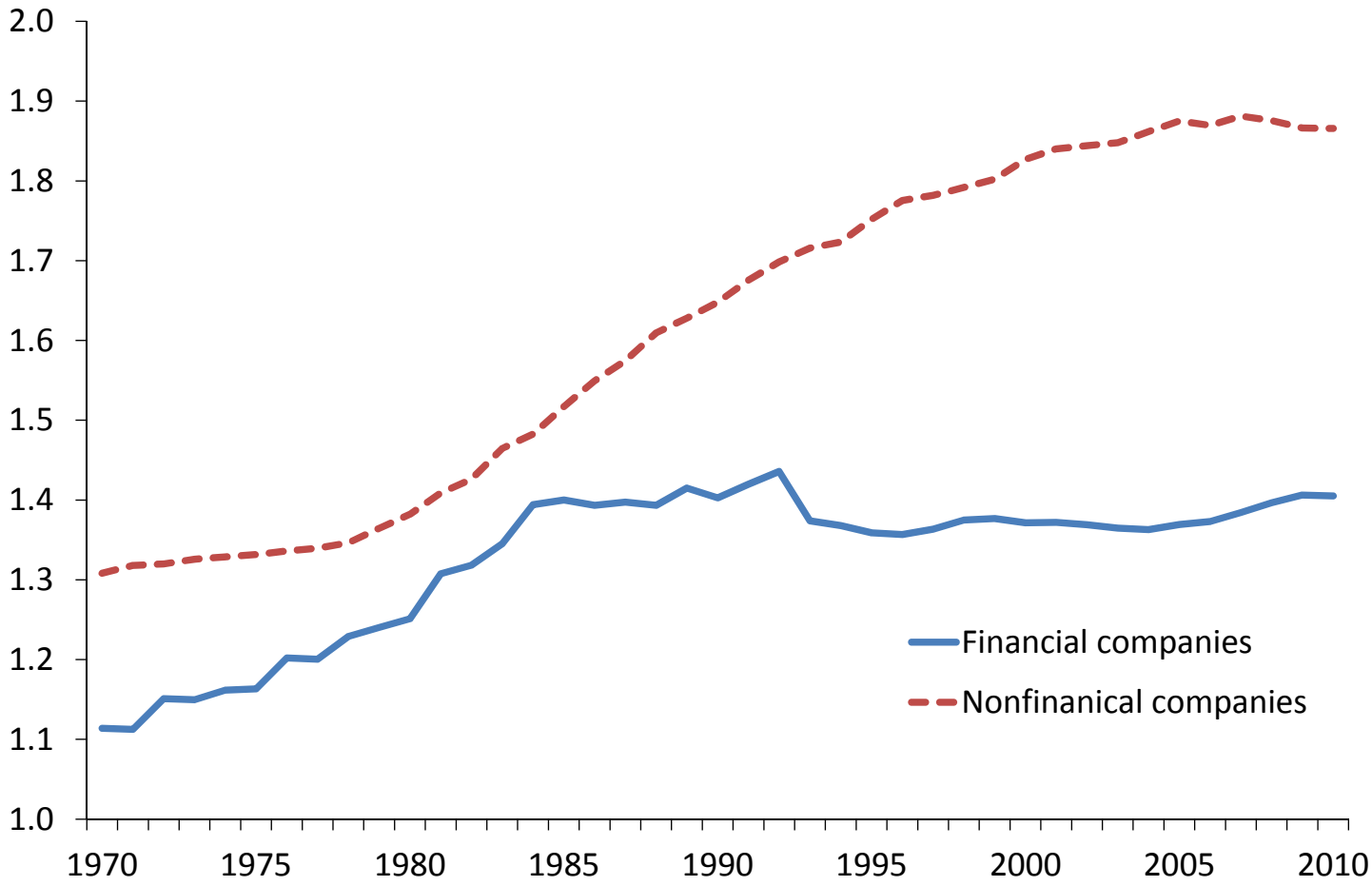
U.K. Value Added per Employee, 1995=100



Income Share of Top 5%



Market to Book Value of Assets



The move away from the partnership & the new financial giants.

In time there was an erosion of the simple principles of the partnership days. Compensation for top managers followed the trend into excess set by other public companies. Competition for talent made recruitment and retention more difficult and thus tilted negotiating power further in favor of stars. You had to pay everyone well because you never knew what next year would bring, and because there was always someone trying to poach your best trained people, whom you didn't want to lose even if they were not superstars. Consequently, bonuses in general became more automatic and less tied to superior performance. Compensation became the industry's largest expense, accounting for about 50% of net revenues.

Roy Smith, former partner of Goldman Sachs, *Wall Street Journal* February 7, 2009.

IN THIS PAPER

- We propose a theory where these facts are a consequence of the change in organizational structure.

- Specifically, we see the organizational changes as having two effects:
  1. Increased competition: The separation of investors and managers enlarged the base of potential investors and increased the demand for and **competition** for managers.
  2. Weakened the commitment of investors: The separation between investors and managers also meant that managers no longer had a **stake** in the firm.

- These effects led to
  - A Larger financial sector.
  - Higher managerial compensation, greater risk-taking and more income inequality.
  - Lower stock market valuation of financial companies.

PRESENTATION PLAN

1. Describe the financial sector in partial equilibrium.

2. Embed the model in general equilibrium.

3. Show the effects of greater *competition* and lower *commitment*.

CENTRAL FEATURES OF THE THEORY

- **Delegation to managers**:
  - Investors need to delegate the choice of risky projects to managers.

- **Innovations and outside value of managers**:
  - Successful projects enhance the outside value of managers.

- **Limited enforcement**:
  - Managers are free to quit and take outside options.
  - The commitment of investors may also be limited.

REMARK

- The modeling of the financial sector could also describe a lot of other sectors like Tech.

- We focus on the financial sector because it is the sector where the organizational changes occured in finite period of time and was accompanied by the significant features we noted.

MANAGERS & INVESTORS

– **Managers providing the human capital:**

* The lifetime utility is

$$E_t \sum_{t=0}^{\infty} \beta^t \Big[u(C_t) - e(\lambda_t) \Big],$$

with $u' > 0, u'' < 0$ and $e' > 0, e'' > 0, e(0) = 0, e(1) = \infty$.

– **Investors providing the capital:**

* Infinite lived with linear utility and residual claimants:

$$E_t \sum_{t=0}^{\infty} \beta^t \left(\beta Y_{t+1} - C_t \right)$$

TIMING OF THE CONTRACT

– Starting period t with h_t, within the period the timing is:

1. λ_t and C_t are chosen and implemented,
2. net output $y(\lambda_t)h_t$ is produced,
3. ε_{t+1} is realised and, therefore, h_{t+1},
4. if there is limited enforcement, the manager decides whether to quit or continue.

THE TECHNOLOGY

- Choice of risky investment projects: $\lambda \in [0,\ 1]$, $0 = \text{minrisk}$, $1 = \text{maxrisk}$.
- Output in period $t+1$:

$$Y_{t+1} = y(\lambda_t) h_t,$$

  where $y' < 0$, $y'' > 0$, $y(1) = 0$.

- The value added of a new project is:

$$i_{t+1} = \lambda_t \varepsilon_{t+1} h_t.$$

- Stochastic human capital accumulation, through successful innovation:

$$h_{t+1} = h_t + i_{t+1} \equiv g(\lambda_t, \varepsilon_{t+1}) h_t \equiv (1 + \lambda_t \varepsilon_{t+1}) h_t,$$

  where $\varepsilon_{t+1} \in \{0, \bar{\varepsilon}\}$, i.i.d. The probability of the good outcome $\bar{\varepsilon}$ is denoted by p.

- Therefore, $E_t h_{t+1} \geq h_t$, with $>$ if $\lambda_t > 0$.

Technology

– Innovation λ_t enhances human capital

$$h_{t+1} = \left(1 + \lambda_t \varepsilon_{t+1}\right) h_t,$$

where ε_{t+1}= stochastic variable,
but reduces output

$$y_{t+1} = \left(1 - \lambda_t^2\right) h_t$$

– Thus, innovations are costly:

1. **Dis-utility from effort** incurred by the manager: $\alpha \ln(1 - \lambda_t)$
2. **Forgone output** incurred by the firm: $\lambda_t^2 h_t$

Manager's outside value

$$D(h_t, \lambda_t, \varepsilon) = (1 - \rho) \cdot \underline{Q}_{t+1}(h_t) + \rho \cdot \overline{Q}_{t+1}(h_{t+1})$$

ρ = Probability of finding an outside offer after quitting.
$\underline{Q}_{t+1}(h_t)$= Outside value without an offer.
$\underline{Q}_{t+1}(h_{t+1})$= Outside value with an offer.

CONTRACTUAL ENVIRONMENT

1. One-sided limited commitment
   - The investor commits to the contract;
   - The manager does not commit: full control over λ_t and option to quit.

2. Double-sided limited commitment
   - The investor also does not commit. Promises of future payments are not credible.

ONE-SIDED LIMITED COMMITMENT

Q = Manager's value; V = Investor's value; D = Quitting value;

$$V(Q,h) = \max_{\lambda, C, Q(\varepsilon)} \left\{ -C + \beta(1-\lambda^2)h + \beta \mathbb{E} V\Big(Q(\varepsilon), h(\varepsilon)\Big) \right\}$$

subject to

$$Q = \log(C) + \alpha \log(1-\lambda) + \beta \mathbb{E} Q(\varepsilon)$$

$$Q(\varepsilon) \geq D(h, \lambda, \varepsilon), \qquad \text{for all } \varepsilon$$

$$\alpha \log(1-\lambda) + \beta E Q(\varepsilon) \geq \max_{\hat{\lambda}} \left\{ \alpha \log(1-\hat{\lambda}) + \beta E D(h, \hat{\lambda}, \varepsilon) \right\}$$

DOUBLE-SIDED LIMITED COMMITMENT

Q = Manager's value; V = Investor's value; D = Quitting value;

$$V(Q,h) = \max_{C,Q(\varepsilon)} \left\{ -C + \beta(1 - \hat{\lambda}_{max}{}^2)h + \beta \mathbb{E} V\Big(Q(\varepsilon), h(\varepsilon)\Big) \right\}$$

subject to

$$Q = \log(C) + \alpha \log(1 - \hat{\lambda}_{max}) + \beta \mathbb{E} Q(\varepsilon)$$

$$Q(\varepsilon) = D(h, \hat{\lambda}_{max}, \varepsilon), \qquad \text{for all } \varepsilon$$

$$\hat{\lambda}_{max} = \arg\max_{\hat{\lambda}} \left\{ \alpha \log(1 - \hat{\lambda}) + \beta \mathbb{E} D(h, \hat{\lambda}, \varepsilon) \right\}$$

The log case

– Let

$$u(C) - e(\lambda) = \log(C) + \alpha \log(1 - \lambda) = \log(c) + \log(h) + \alpha \log(1 - \lambda).$$

– The manager's value $\overline{Q}_{t+1}(h_{t+1})$ is normalised as:

$$\overline{q} = \overline{Q}_{t+1}(h_{t+1}) - (1 - \beta)^{-1} \log(h_{t+1}),$$

and similarly,

$$\underline{q} = \underline{Q}_{t+1}(h_t) - (1 - \beta)^{-1} \log(h_t),$$

The log case

– Investor's normalised value $v_t = V_t/h_t$ satisfies:

$$v_t = y(\lambda_t) - c_t + \beta E_t g(\lambda_t, \varepsilon_{t+1}) v_{t+1}, .$$

– At the optimal contract, the normalised investor's value satisfies:

$$v'(q) = \mu,$$

where $\tilde{\mu} = \mu h$ is the manager's (Pareto) weight in the recursive contract.

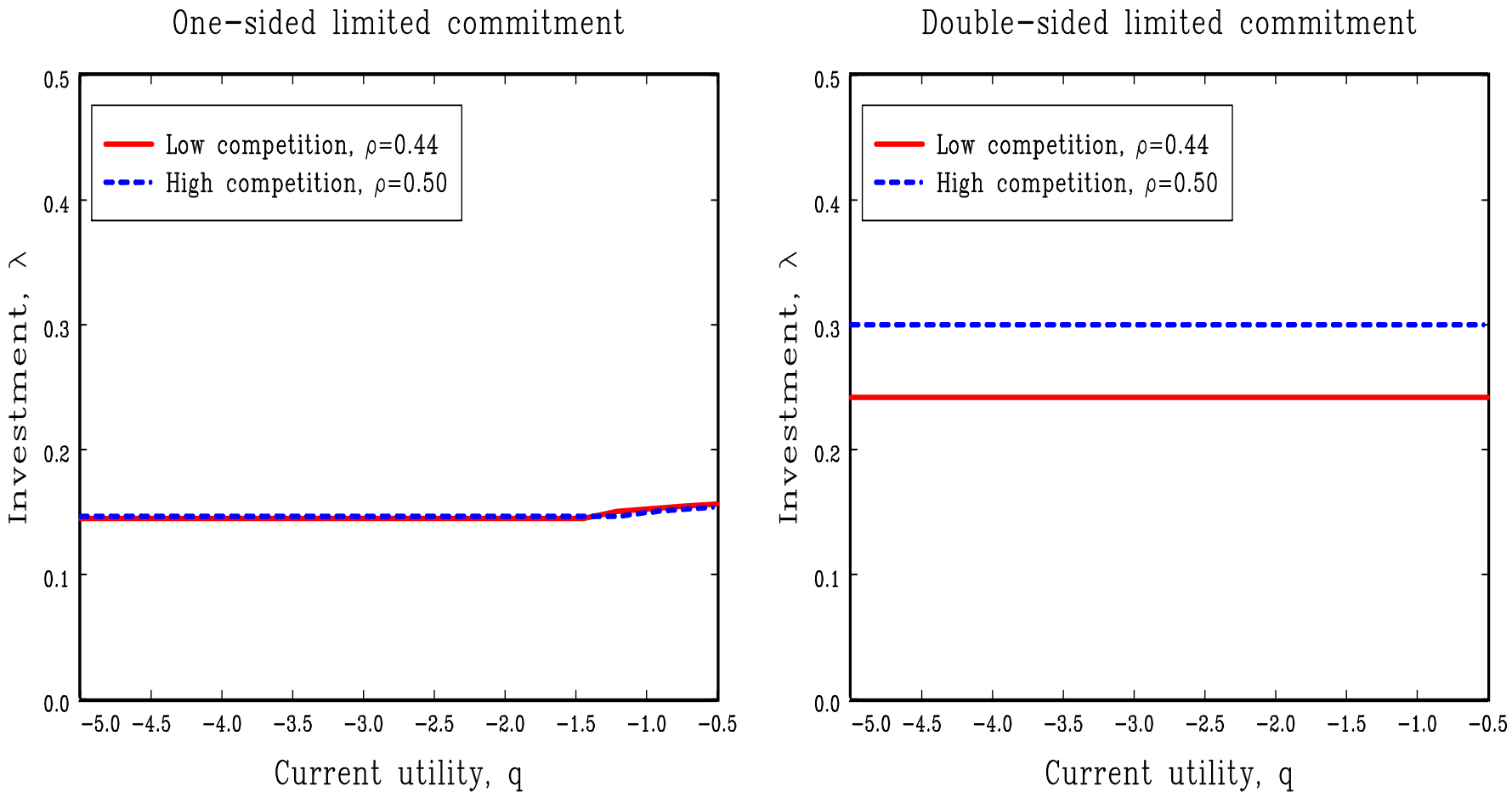
THE EFFECTS OF THE ORGANIZATIONAL CHANGES ON THE FINANCE INDUSTRY

TWO MAIN EFFECTS

1. **Increased competition**
   - In the partial equilibrium model this is captured by an increase in the probability ρ.

2. **Weakened the commitment of investors**
   - This is captured by a shift from one-sided limited commitment to double-sided limited commitment.

Scale of innovation, λ



Two Important Propositions

1. **Proposition 1**

   – With one-sided commitment (Partnership) an increase in competition for managers (an increase in the probability ρ) results in less innovation (λ) when incentive compatibility and enforcement constraints are binding.

2. **Propsition 2**

   – With the shift from one-sided limited commitment to double-sided limited commitment, more competition leads to more innovation.

GENERAL MODEL

MODEL

- Two sectors
  - Financial sector (as described so far)
  - Nonfinancial sector (the rest of the economy)

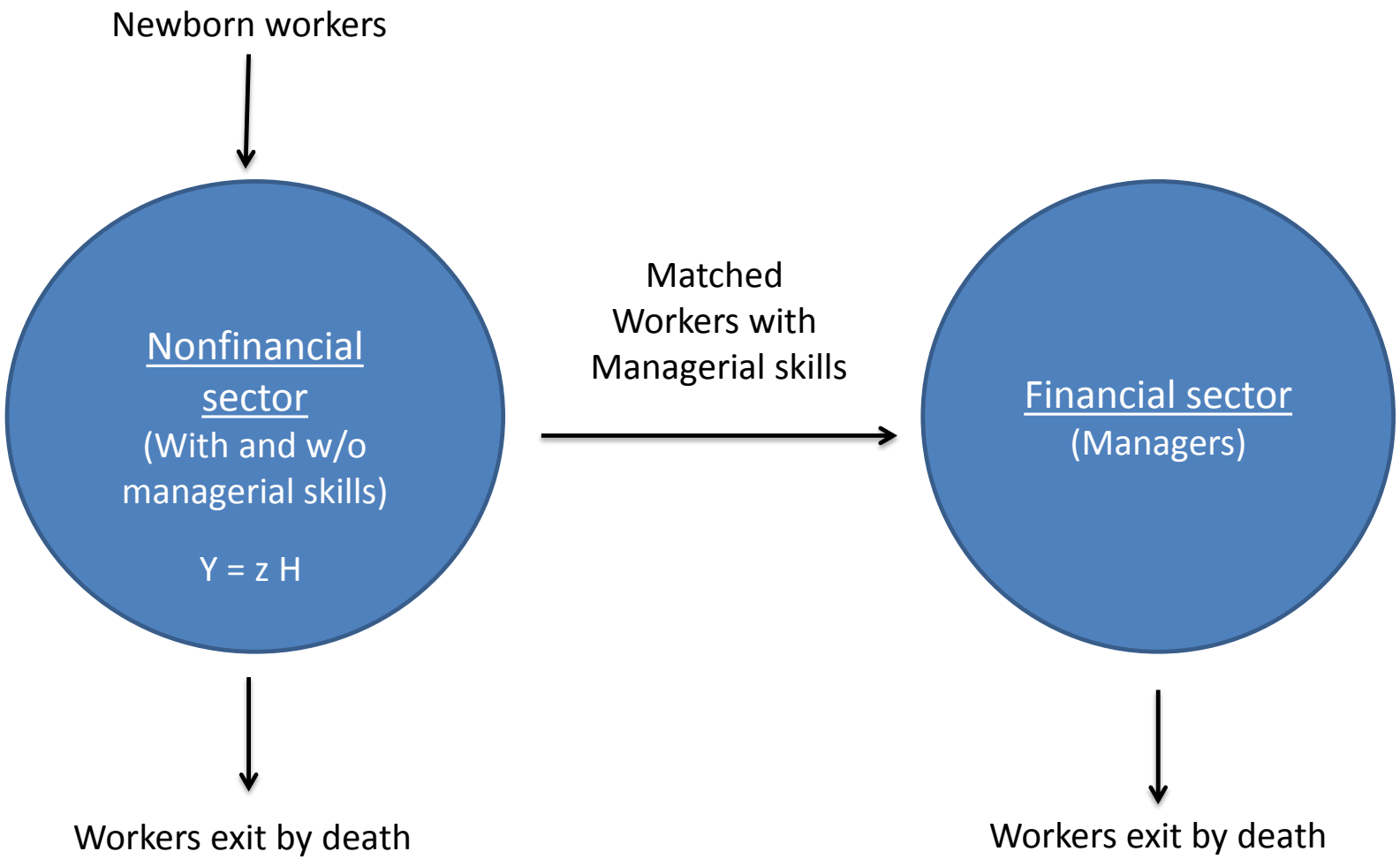
- Two types of agents that die with probability ω:
  - Investors (mass 1)
  - Workers (mass 1)

- Occupation
  - A fraction ψ of workers have the managerial skills and can find occupation in the financial sector (as already described).
  - Workers that are not employed in the financial sector find occupation in the nonfinancial sector and produce

$$Y = zN,$$

N=Number of workers employed in the nonfinancial sector.

General Model



Financial sector

- Firms are created by investors at cost τh_t.

- New firms become productive only if matched with searching managers:

$$m_t = A I_t^{\eta} S_t^{1-\eta}$$

I_t= New firms (vacancies)
$S_t = \psi N_t$= Workers searching for financial occupation
$\phi_t = \frac{m_t}{I_t}$= Filling probability
$\rho_t = \frac{m_t}{M_t}$= Job finding probability

- Free entry condition

$$\phi_t \overline{V}_t = \tau h_t$$

Manager's outside value

– Bargaining determines the initial conditions of the contract:

$$\left\{\overline{Q}_t, \overline{V}_t\right\} = \arg\max_{Q_t, V_t} \left\{ V_t^{\eta} \cdot (Q_t - \underline{Q}_t)^{1-\eta} \right\}$$

– Value employment nonfinancial sector

$$\underline{Q}_t = \ln(z h_{t-1}) + (1 - \rho_{t+1}) \cdot \underline{Q}_{t+1} + \rho_{t+1} \cdot \overline{Q}_{t+1}.$$

Therefore, $\overline{Q}_t$, $\underline{Q}_t$, ρ_t are endogenously determined in the general equilibrium.

THE EFFECTS OF THE ORGANIZATIONAL CHANGES IN FINANCE INDUSTRY

TWO MAIN EFFECTS

1. **Increased competition**
   - In the model this is captured by a reduction in the vacancy cost τ.

2. **Weakened the commitment of investors**
   - In the model this is captured by a shift from one-sided limited commitment to double-sided limited commitment.

Calibration (Double-sided limited commitment in 2000s)

Parameters

$\hat{\beta}$	Discount factor	0.962
ω	Death probability	0.025
z	Productivity in the nonfinancial sector	0.731
ψ	Fraction of workers searching for financial jobs	0.042
p	Probability of successful innovation	0.035
α	Utility parameter for dis-utility innovation effort	0.139
τ	Cost of posting a vacancy in the financial sector	0.174
A	Matching productivity	0.500
η	Matching share parameter (pre-set)	0.500

Calibration moments

Interest rate	0.04
Life expectancy of workers	40.00
Employment share in finance	0.04
Value added share in finance	0.08
Inequality index (coeff. variation) in financial sector	2.00
Time allocated to innovation in finance	0.30
Probability of finding an occupation in finance	0.50
Probability of filling a vacancy	0.50

Steady state statistics

	One-sided limited commitment	*Double-sided limited commitment*
Low competition ($\tau = 0.261$)		
Average value of λ	0.151	0.242
Offer probability, ρ	0.445	0.441
Filling probability, ϕ	0.561	0.567
Share of employment financial sector	0.040	0.040
Share of output financial sector	0.065	0.073
Earnings in the nonfinancial sector	0.731	0.731
Earnings in the financial sector	1.110	1.257
Average investor value $Ev(q)$	0.581	0.716
Coefficient of variation	0.356	0.826
High competition ($\tau = 0.174$)		
Average value of λ	0.147	0.300
Offer probability, ρ	0.497	0.500
Filling probability, ϕ	0.503	0.500
Share of employment financial sector	0.040	0.040
Share of output financial sector	0.065	0.080
Earnings in the nonfinancial sector	0.731	0.731
Earnings in the financial sector	1.116	1.388
Average investor value $Ev(q)$	0.912	1.017
Coefficient of variation	0.351	3.999

CONCLUSION

- We have proposed a model where managers have incentives to implement risk-taking projects to increase their outside value.

- If contracts are not enforceable, the outcome is excessive risk-taking at the firm level.

- If contracts are not enforceable, the incentive to undertake risky projects increases with competition for managers.

- The general model captures (qualitatively) several of the changes experienced by the US economy, and the financial sector in particular, during the last three decades.