

# Managerial Economics 10-14 May 2010

The Warwick MBA

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Final Day, 14 May 2010

# Final Day

## Performance Based Incentives

# Schedule for Final Day

9.00-10.30am

- Principal-Agent Model revisited (Performance measurement and incentives in firms)
- Venture capitalists as principals (plus Deloitte survey)
- Coffee 10.30-11.00am

11.00-12.00pm

- Optimal design of intellectual property (Ch. 4 Suzanne Scotchmer *Innovation and Incentives* MIT Press, 2004)
- Essay Guidance
- Feedback
- End

# Principal-Agent Model revisited

## Performance measurement and incentives in firms

# Hidden Action, Moral Hazard Model

- Agent chooses effort ' $e$ '
- Two outcomes possible:
  - Success  $y=1$
  - Failure  $y=0$
- Assume success occur with probability  $p(e)$  and failure  $1-p(e)$
- Higher effort improves chances of success
- Agent (manager) faces a cost for supplying effort (disutility) which at the margin increases in effort (**convexity**)
- Principal (owner) is the residual claimant and offers a performance based 'contract' to the agent (worker)
- The agent receives  $w_1(y=1)$  and  $w_0(y=0)$
- Principal's utility is  $V(y-w)$  and the Agent's utility is  $u(w)-\psi(e)$
- Simplifying assumption  $\psi(e)=e$

# Hidden Action, Moral Hazard Model

Assume effort is observable and verifiable [reference case]

*The first best outcome*

The Principal solves an optimisation problem which states a level of effort and sets a wage contingent on the realisation of  $y$ :

Principal's optimisation problem:

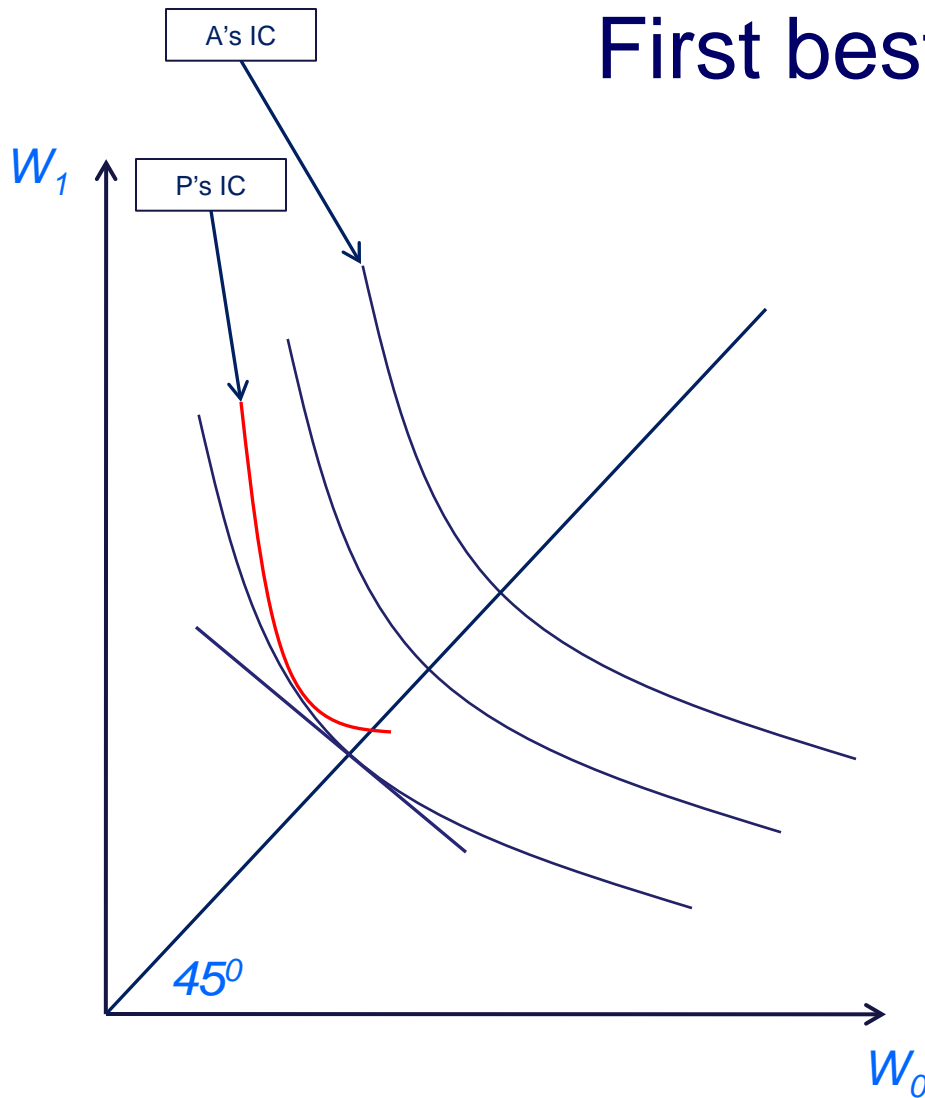
$$\max_{e, w_0, w_1} p(e)V(1 - w_1) + [1 - p(e)]V(-w_0)$$

subject to agent's participation constraint  
or individual rationality (IR) constraint:

$$p(e)u(w_1) + [1 - p(e)]u(w_0) - e \geq \bar{u}$$

Assume  $\bar{u} = 0$

# First best outcome



- For a given effort level  $e$ , the Principal and the Agent will find different combinations of the contingent wage equally attractive
  - Indifferent curves (IC)
- Agent's utility is increasing in the wage rate
- Principal's utility decreasing in wage
- Efficient outcome is where ICs tangential
- Diagram assumes  $p(e)=1/2$
- If Principal risk neutral offers full insurance

# Hidden Action, Moral Hazard Model

Assume effort is unobservable

*The second best outcome*

The Principal solves an optimisation problem which offers a state contingent contract:

Principal's optimisation problem:

$$\max_{e, w_0, w_1} p(e)V(1 - w_1) + [1 - p(e)]V(-w_0)$$

subject to agent's IR constraint:

$$p(e)u(w_1) + [1 - p(e)]u(w_0) - e \geq 0$$

And what is termed an Incentive Compatible (IC) constraint implicit in:

$$\max_e p(e)u(w_1) + [1 - p(e)]u(w_0) - e \Rightarrow$$

$$p'(e)[u(w_1) - u(w_0)] = 1$$

# Venture Capitalists as Principals

# Kaplan & Strömberg 2001

- The K&S 2001 paper presents an overview of their research on the role of venture capitalists as Principals
- Principal is the *investor (VCs)*
- Agent is the *entrepreneur*
- VCs provide funds in exchange for promised returns deriving from effort of entrepreneurs
- K&S report on their investigations into whether entrepreneurs' equity-compensation functions are more sensitive to performance when incentive and asymmetric information problems are more severe

# Kaplan & Strömberg 2003

- The sample comprises a cross-section of investments:
  - 213 VC investments
  - 119 portfolio companies
  - 14 VC partnerships
- Companies
  - Biotech/Medical 18
  - IT/Software 50
  - Telecom 15
  - Healthcare 11
  - Retail 11
  - Other 14
- Period of financing 1999/2000
- Companies based in the US
- Convertible preferred stock nearly 80% of financing
  - Preferred issues that the holders can exchange for a predetermined number of the company's common stock
  - The exchange can occur at any time the investor chooses regardless of the current market price of the common stock.

# Kaplan & Strömberg 2003: Some Descriptive Results

- Convertible preferred stock most commonly used security
- VCs receive different class of common stock than founders
- VCs typically control roughly 50% of cash flow rights
- Almost 73% of financings explicitly include some type of contingency
  - Over 17% on financial performance
  - Almost 9% on non-financial performance
  - 11% on actions

# Kaplan & Strömberg 2003: Test of PA Theory

- PA theory predicts:
  - Investor will maximize the sensitivity of the entrepreneur's compensation to the **signal**
    - This may not hold if the entrepreneur is risk averse and/or multi-tasking
    - Screening likely with higher sensitivity offered to screen out risk-averse entrepreneurs
  - Due to something known as the *Informativeness Principle* the investor should make the entrepreneur's compensation contingent on as many verifiable signals correlated with effort as possible
- Empirical results
  - Entrepreneurs get a large fraction of equity in firms and this increases in performance (but founder's equity stake typically declines over relationship – asymmetric information effect diminishing)
  - Contractual equity compensation contingent on multitude of financial and non-financial variables

# Kaplan & Strömberg 2003: Summary of Results on PA Theory

- Largely supportive of classical PA theories and their screening implications
- As uncertainty about the quality of the venture and founder increases VCs increase the pay performance sensitivity by making the founder's cash flow compensation increasingly convex in performance through:
  - More explicit performance compensation
  - More time vesting
  - Fewer liquidation cash flow rights
- As explicit performance signals become noisier measures of true performance, contracts substitute explicit performance benchmarks with more vesting and lower liquidation cash flow rights

# Kaplan & Strömberg 2001

- Reports on the role of monitoring by VCs
- VCs play a large role in shaping and recruiting the senior management team
  - In 14% of investments, VC plays a role in shaping management team before investment
  - In 50% of investments VC expects to play a role in shaping management
  - In over one-third of cases the VC is involved in helping the business develop

# Kaplan & Strömberg 2001

- Conclude by stating VCs play a large role:
  - In designing and implementing sophisticated contracts
  - Pre-investment screening
  - Post-investment monitoring and advising
- The evidence suggest the above are usually interrelated

# Bernstein *et al* 2010

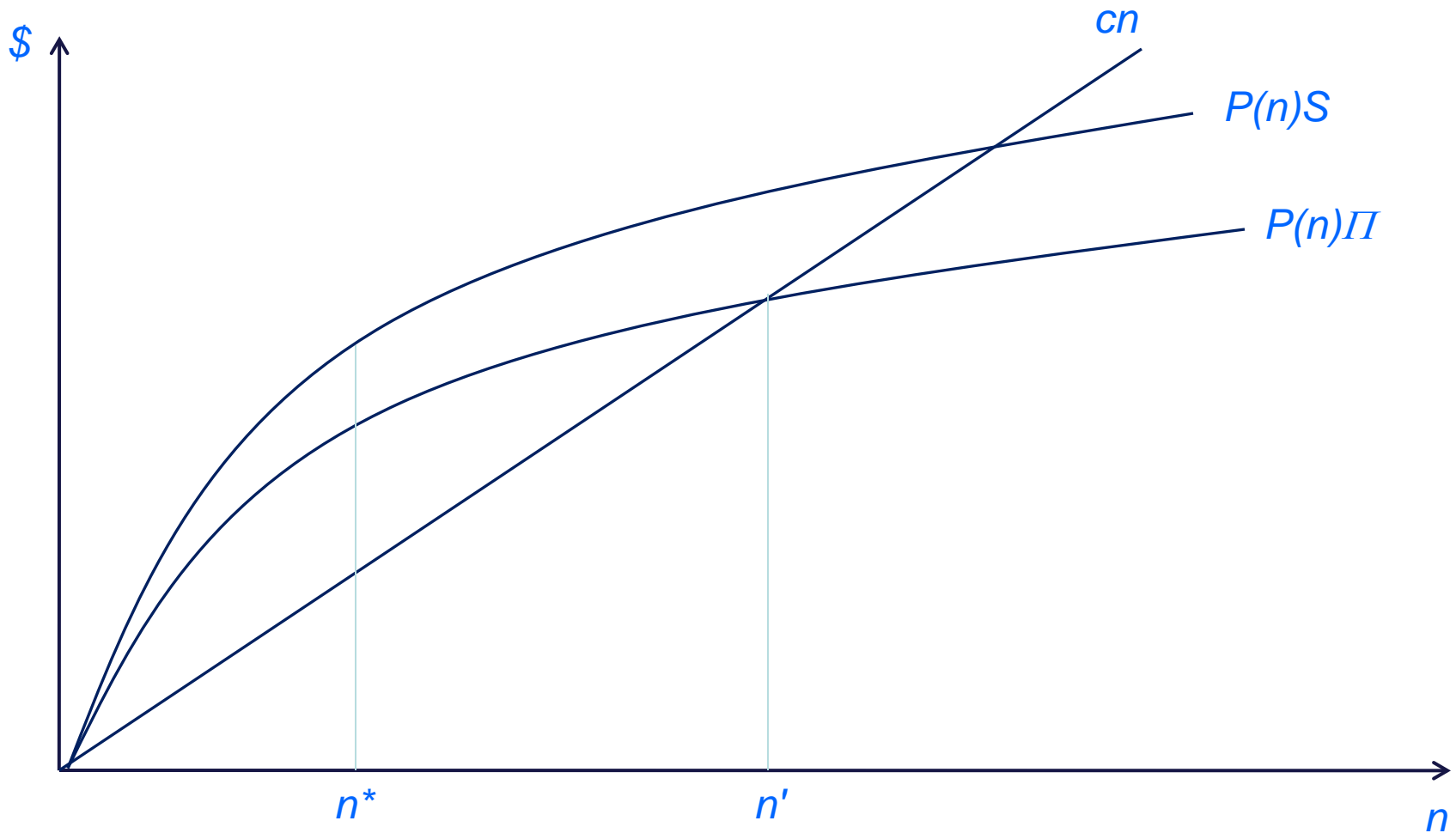
- Examination of the impact of private equity (PE)
- Builds on theoretical prediction emanating from Jensen (1989) HBR article stating PE has the ability to
  - Closely monitor managers
  - Restrict free cash flow through debt and incentivise managers with equity
- Research based on OECD data for firms ('going private', 'leveraged buyout', 'management buyout') between 1986 and 2007
  - 11.135 country-industry-year observations

# Intellectual Property

# Intellectual Property

- “A virtue of intellectual property as an incentive mechanism is that it decentralises decision making”
- Increasing length of protection stimulates innovation
- On the other hand, longer protection results in more ‘deadweight loss’
- Longer protection also encourages more competition to capture the ‘rents’ (imposing deadweight loss) – the effect being excessive duplication
- Scotchmer shows that too many may enter into a ‘race’
- Breadth of patents also critical

# Patents



# Essay Guidance

# Essay Template

## 1. Introduction (10)

- i. Start by stating in brief your subject.
- ii. Describe how your subject fits within the course material.
- iii. Summarise conclusions/findings.
- iv. Outline contents.

## 2. Theory/Economics (20)

- i. Outline relevant economics/game theory
- ii. Summarise any predictions from theory which are used in your essay

## 3. Case (20)

- i. Describe your case/example and explain your choice

## 4. Analysis (40)

- i. Present your findings where you analyse your case against the backdrop of economics

## 5. Conclusion (10)