Teams

Class 9

Working at Starbucks: Your Special Blend

- Your Special Blend will include:
  - Competitive pay
  - Bonuses
  - Equity: Starbucks stock/discounted stock purchase plan
  - Insurance: medical, drug, dental, vision, life, disability
  - Paid time off
  - Retirement savings plan
  - Adoption assistance
  - Emergency financial aid
  - Referral and support resources for child and eldercare
  - A free pound of coffee each week

What kind of incentives does stock/discounted stock purchase plan provides?

Bilateral and Multilateral Contracting

- Parties of the Contract:
  - One Principal, One Agent

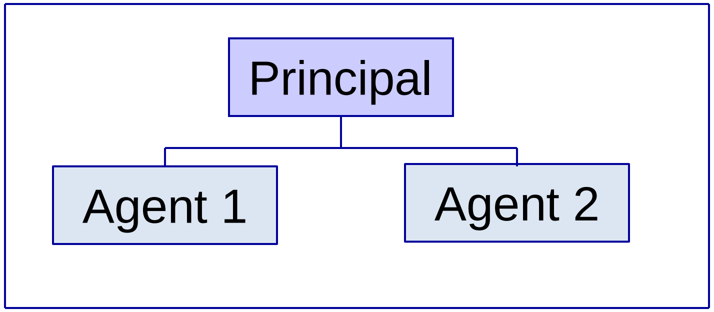
Bilateral

- Three possible alternatives:
  - One Principal, Many Agents
  - Many Principals, One Agent
  - Many Principals, Many Agents

Multilateral

Teams and Tournaments

- Multilateral contracts
  - We'll consider 'one principal-two agents' contracts



- Two types of contracts:
  - Teams : agents co-operate with each other (today)
  - Tournaments : agents compete against each other

Objectives for Today

1. Free Rider Problem
2. Peer Pressure
3. Empirical Methods: Difference-in-Differences
4. Application: Continental Airlines

Partnership Model

- A contract between two agents
- No principal

The Contract

- Let Q be the group output
- The contract consists of sharing rules s_1 and s_2:
  - Partner 1 receives s_1Q; Partner 2 receives s_2Q
  - $s_1 + s_2 = 1$ (Balanced Budget)

- Example: $s_1 = s_2 = 0.5$ (Equal Sharing Rule)

Elements

- Two identical, risk-neutral partners

Production

Individual: $q_1=e_1+u_{1,}$, $E[u_1]=0$

$q_2=e_2+u_{2,}$, $E[u_2]=0$

Group: $Q=q_1+q_2$

Cost of Effort $c_1=0.5e_1^2$, $c_2=0.5e_2^2$

Compensation $w_1 = w_2 = 0.5Q$

Private Choice of Action

- Nash Equilibrium
- Each partner chooses action, taking other partner's action as given

Partner 1

$\text{Max}_{e1}\ U_1=0.5(e_1+e_2)-0.5e_1^2$

First-order condition:

____

Partner 2

$\text{Max}_{e2}\ U_2=0.5(e_1+e_2)-0.5e_2^2$

First-order condition:

____

$\Rightarrow e_1 = e_2 =$ ________

Free Rider Problem

- Efficient actions maximize the joint surplus of both partners

$$\text{Max}_{e1,e2}\ W = U_1+U_2=e_1+e_2-0.5e_1^2-0.5e_2^2$$

$$\Rightarrow e_1 = e_2 = \_\_\_\_\_\_\_\_\_\_\_\_$$

Private Choice of Action

$U_i = 0.5(e_i+e_k)-0.5e_i^2$

$= 0.5(0.5+0.5)- 0.5(0.5)^2$

$= 0.5 – 0.125 = 0.375$

Social Choice of Action

$U_i = 0.5(e_i+e_k)-0.5e_i^2$

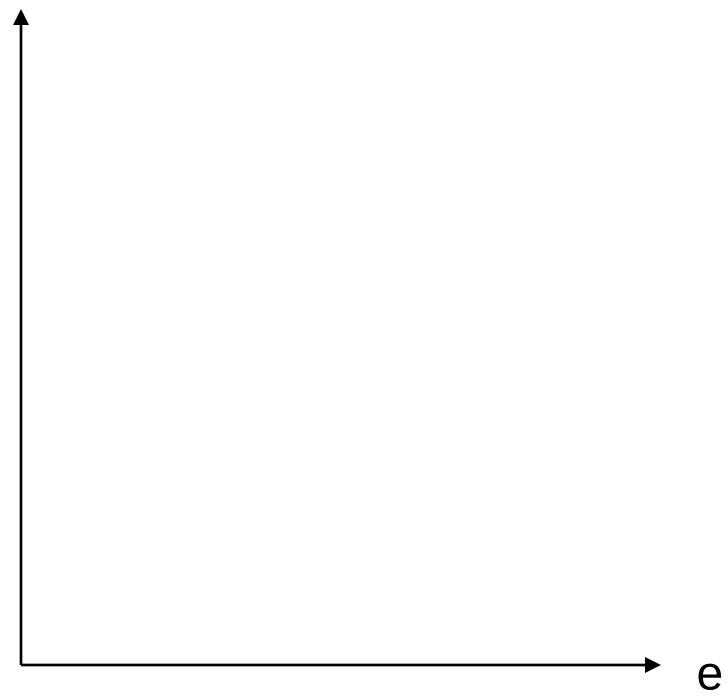
$= 0.5(1+1)- 0.5(1)^2$

$= 1 – 0.5 = 0.5$

Interpretation

- Social Benefit
  - $W = e_1 + e_2 - 0.5e_1^2 - 0.5e_2^2$
- Private Benefit
  - $U_1 = 0.5(e_1 + e_2) - 0.5e_1^2$

- Marginal cost of effort:
  - Social : e_1
  - Private : e_1
- Marginal benefit of effort:
  - Social : 1
  - Private : 0.5



Free Rider problem
because PMB < SMB!

Examples of Free Riding

- Private Benefit ≠ Social Benefit
  - Public goods (e.g. parks)
  - Student group projects

- Private Cost ≠ Social Cost
  - Pollution
  - Tragedy of commons

Puzzle

- Starbucks stock (SBUX) traded at $74.69 on June 13, 2014
- Market cap is 56.23B
- If you own 100 shares ($7,469), you own approximately 0.00001%

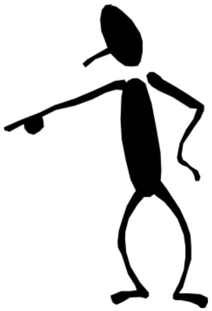
- You bear full cost of your actions
- Yet you benefit by only 0.00001% from the changes in the stock price
  - Huge free rider problem!!
- Additionally, many factors affect the price that you cannot control

Is the stock purchasing plan/profit sharing ever a good incentive tool?

Peer Pressure

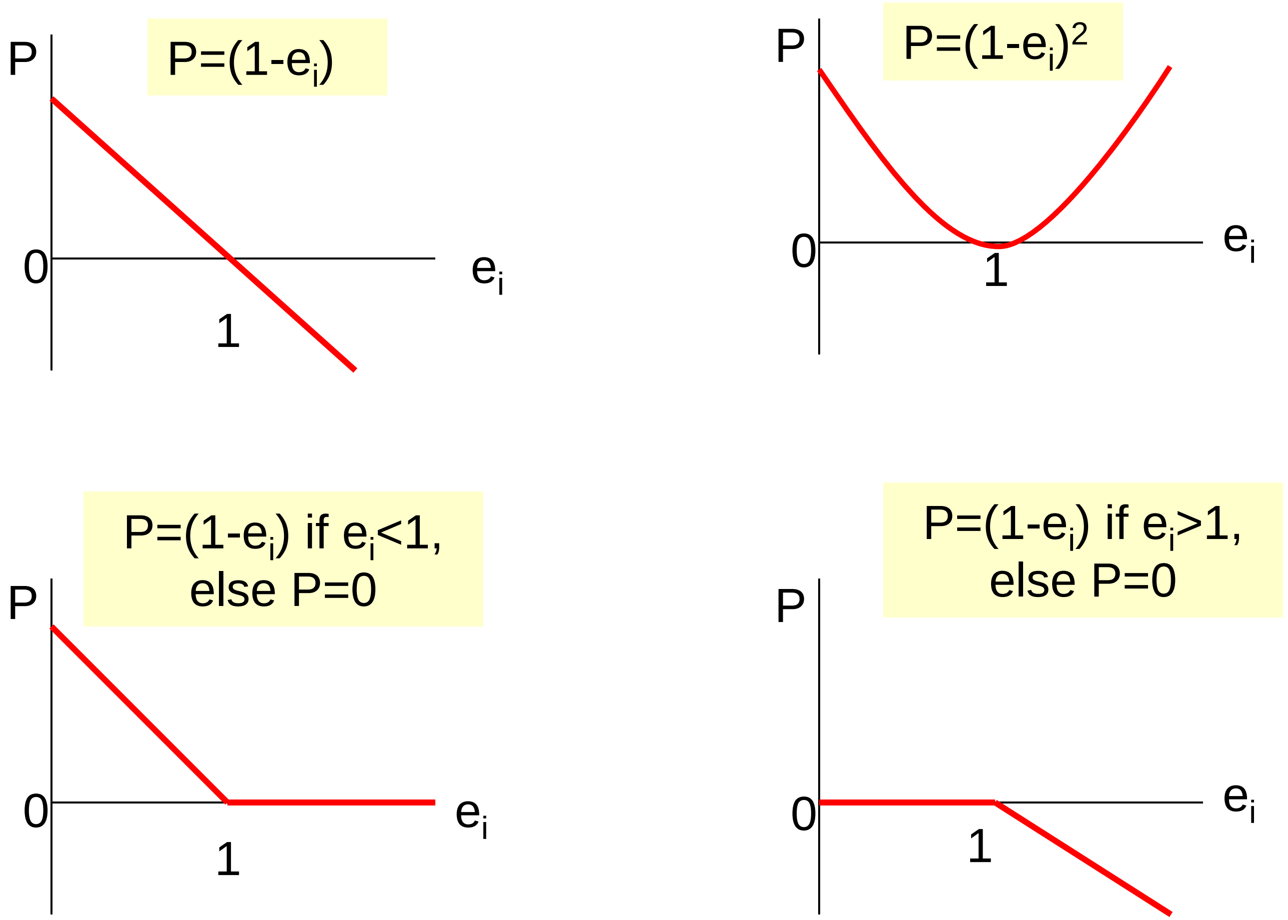
- Team members can influence each other

- Two types of influence:
  - Guilt : internal motivator
  - Shame : external motivator



- Influencing others is known as peer pressure
- Peer pressure function: $P(e_i)$
  - $P(e_i)>0$: 'Punishment'
  - $P(e_i)<0$: 'Reward'

Examples of Peer Pressure Function



Peer Pressure and Free Rider Problem

- Suppose $P(e)=(G-e)^2$
  - G is **group norm**

- Partner 1:

$$\text{Max } U_1 = 0.5(e_1+e_2)-0.5e_1^2 - (G-e_1)^2$$

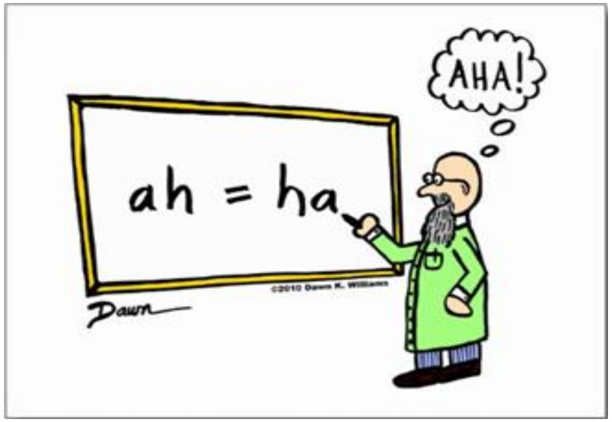
$\Rightarrow$ First-order condition: ______________________

Social Norms and Efficient Actions

$\Rightarrow e_1=(2G+0.5)/3$

$\Rightarrow$ To induce e*=1, set G=________

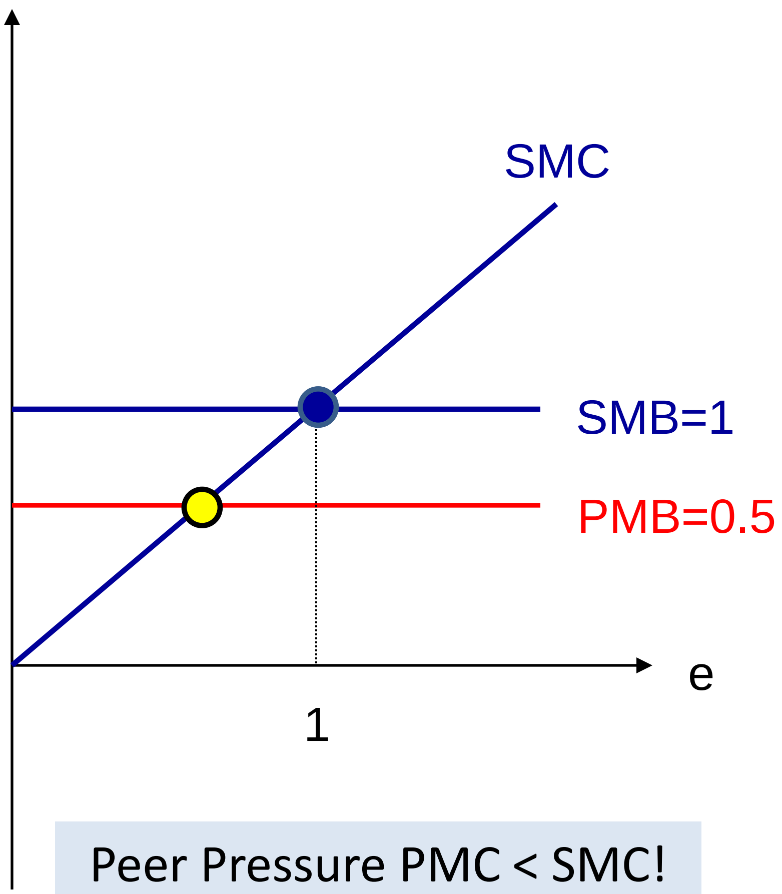
Given a team of any size N, the efficient level of effort can be induced by appropriately choosing P function.



Interpretation

- Social Benefit
  - $e_1+e_2-0.5e_1^2-0.5e_2^2$
- Private Benefit
  - $0.5(e_1+e_2)-0.5e_1^2-(1.25-e_1)^2$

- Marginal cost of effort:
  - Social : e
  - Private : e-2(1.25-e)
- Marginal benefit of effort:
  - Social : 1
  - Private : 0.5



Peer Pressure PMC < SMC!

Empirical Model

$$y_i = \alpha + \beta D_i + \varepsilon_i$$

where:

- i indexes workers, i=1,2,…,n
- y = output
- D = indicator, 1 if team compensation, 0 if alternative
- ε = all other variables that affect output

Treatment and Selection Effect

$y = \alpha + \beta D + \varepsilon$

- Comparison of average outcomes between two groups:

  $E[y|D=1]-E[y|D=0]$

  $= \{\alpha+\beta+E[\varepsilon|D=1]\}- \{\alpha+E[\varepsilon|D=0]\}$

  $= \beta+E[\varepsilon|D=1]-E[\varepsilon|D=0]$

- β = treatment effect
- $E[\varepsilon|D=1]-E[\varepsilon|D=0]$ = selection effect

Identification problem

- What to do if we suspect that $E[\varepsilon|D=1] \neq E[\varepsilon|D=0]$?

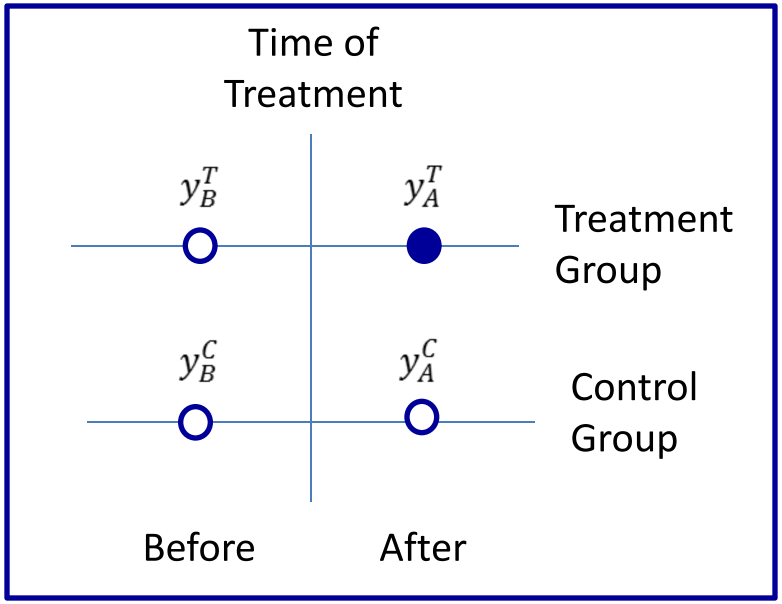
1. Multivariate Regression
2. Randomized Experiments

- Difference in differences (DD)
  - Based on the idea that differences may be constant over time
    - $E[\varepsilon_t|D=1] \neq E[\varepsilon_t|D=0]$ but
    - $E[\varepsilon_t-\varepsilon_{t-1}|D=1] = E[\varepsilon_t-\varepsilon_{t-1}|D=0]$ (common trend)

DD Model

Main elements:

1. Treatment
2. Two groups:
   - Treatment
   - Control (placebo)
3. Two time periods:
   - Before treatment
   - After treatment
4. Outcome of interest

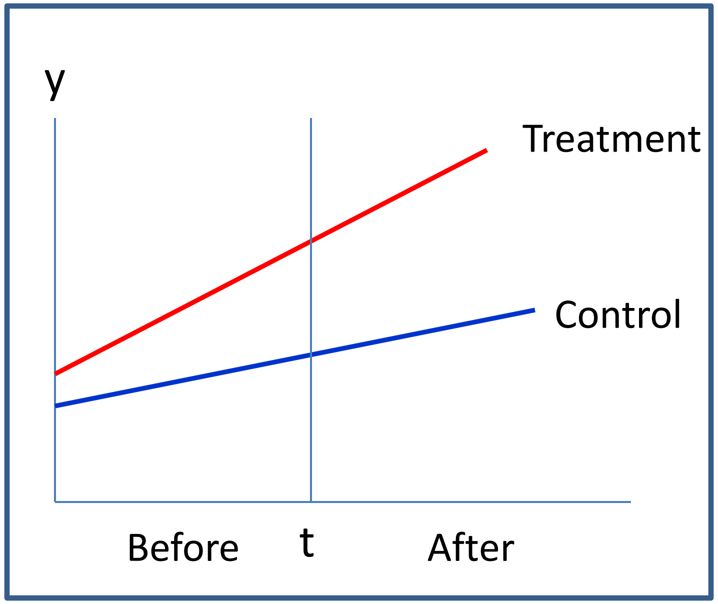


DD Estimate =

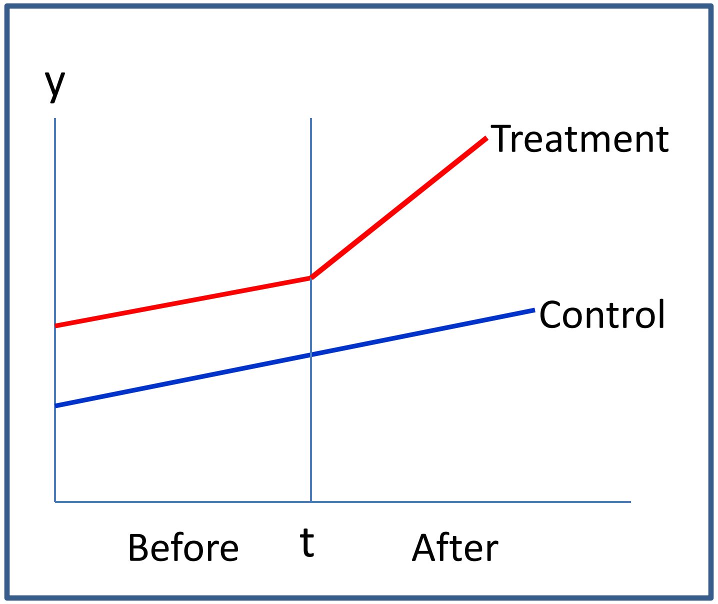
$$(y_A^T - y_B^T) - (y_A^T - y_B^T) = \Delta y^T - \Delta y^C$$

Common Trend Assumption

$E[\varepsilon_t - \varepsilon_{t-1} | D=1] \neq E[\varepsilon_t - \varepsilon_{t-1} | D=0]$



$E[\varepsilon_t - \varepsilon_{t-1} | D=1] = E[\varepsilon_t - \varepsilon_{t-1} | D=0]$



Does it look like anything happened to the treatment group after time t?

Does it look like anything happened to the treatment group after time t?

DD Regression Model

$$y_{it} = \alpha + \beta D_i + \gamma After_t + \delta D_i \times After_t + \varepsilon_{it}$$

	Before (After=0)	After (After=1)	Difference
Control (D=0)			
Treatment (D=1)			
		Difference in differences	

Example

$$E[y]=10 + 5D + 3After + 2D\times After$$

	Before (After=0)	After (After=1)	Difference
Control (D=0)			
Treatment (D=1)			
		Difference in differences	

Example: Impact of Immigration on Wages

Study	Card (1992)
Treatment	Immigration
Outcome	Wages
Quasi Experiment	Fidel Castro
Treatment	Miami
Control	Atlanta, Denver, Dallas

Empirical Method	Representation	Identifying Assumption
Bivariate regression	$y = \alpha + \beta D + \epsilon$	Similar in everything except D
Multivariate regression	$y = \alpha + \beta D + \gamma X + \epsilon$	Similar in everything except D and X
Randomized experiment	$E[y\|D = 1] - E[y\|D = 0]$	Randomization ensures similarity in everything except D.
Difference-in-differences	$\Delta y^T - \Delta y^C$	Common trend assumption.

Application: Continental Airlines

Knez and Simester (2001)

- Case Study: Continental Airlines (CA)
- Prior to 1995, CA one of the worst performers:
  - bankruptcy protection, unprofitable, last in terms of on-time arrival, baggage handling, customer complaints
- "Go Forward Plan" in 1994
  - Goal to increase on-time arrival and departure performance
  - Monthly group bonus – each employee gets $65 in every month that CA ranks among the best 5 airlines

CA Rank in On-Time Performance

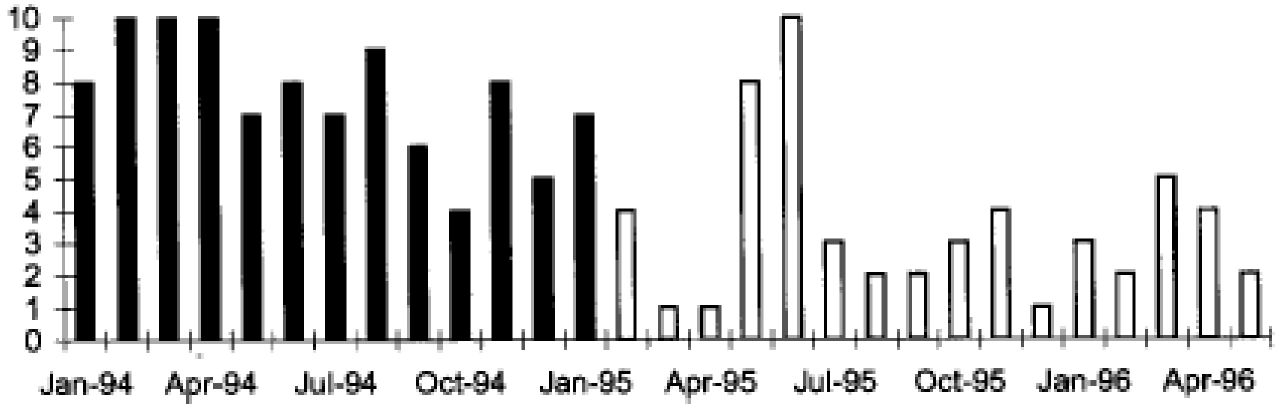


FIG. 1.—Department of Transportation on-time performance rankings: Continental's rank among the 10 major airlines

Looks like CA performance improved after February 1995. But would this occur anyways, even without the introduction of the group bonus??

Sample and Empirical Model

Sample

- 32 airports, monthly data from Jan 1994 to Nov 1996
- Treatment: "Go Forward" Group Bonus program
- Treatment group: airports where CA used own employees
- Control group: airports where CA used outsourcing

Model

$$y = \alpha + \beta \bullet D + \gamma After + \delta \bullet D \bullet After + \lambda X + \varepsilon$$

- y = improvement in departure
- D = 1 if treatment airports, 0 if control airports
- After = 1 if after Feb 1995, 0 if before Feb 1995
- X = control variables

Control Variables (X)

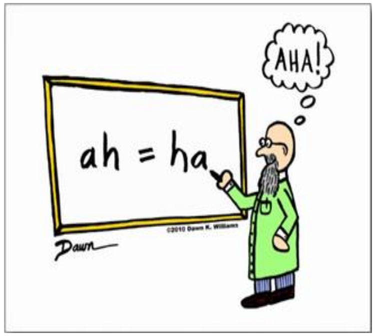
- Monthly number of departures
- Average passengers/flight
- Average years of tenure for employees
- Weather differences
- Management changes, etc.

Factors that may change differently over time for treatment and control airports (recall the common trend assumption).

Results

Outcome = On-line Departure Rank		
Variable	Estimate of δ (t-stat)	Estimate of δ (t-stat)
Full Outsourcing	-1.52 (1.88)	-3.42 (5.18)
Partial Outsourcing	-0.37 (0.80)	-1.63 (2.81)
Controls?	NO	YES

1. Performance better after the bonus program.
2. Improvement stronger for full outsourcing airports – consistent with the causal impact since more employees participate in the bonus program.
3. Important to control for other factors – otherwise, the impact smaller, statistically insignificant.



Main Points

1. **Free Rider Problem**: The main problem with team-based compensation is the free-rider problem which arises because the agents don't consider the impact of their actions on the total outcome but only their own payoff.
2. **Peer Pressure**: Peer pressure can act as a powerful incentive tool, by affecting either internal ('guilt') or external ('shame') motivation, that can be used by teams to address the free rider problem.
3. **Difference-in-Difference (DD) Method**: The DD method consists of comparing the change in outcomes for two groups, of which one is affected by treatment and the other is not, before and after the treatment is introduced. The DD estimate will identify the treatment effect provided the common trend assumption is satisfied (i.e. the change in the outcome for the two groups would be the same if there was no treatment).