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# **Harvesting without killing the plant – investment incentives under regulation**

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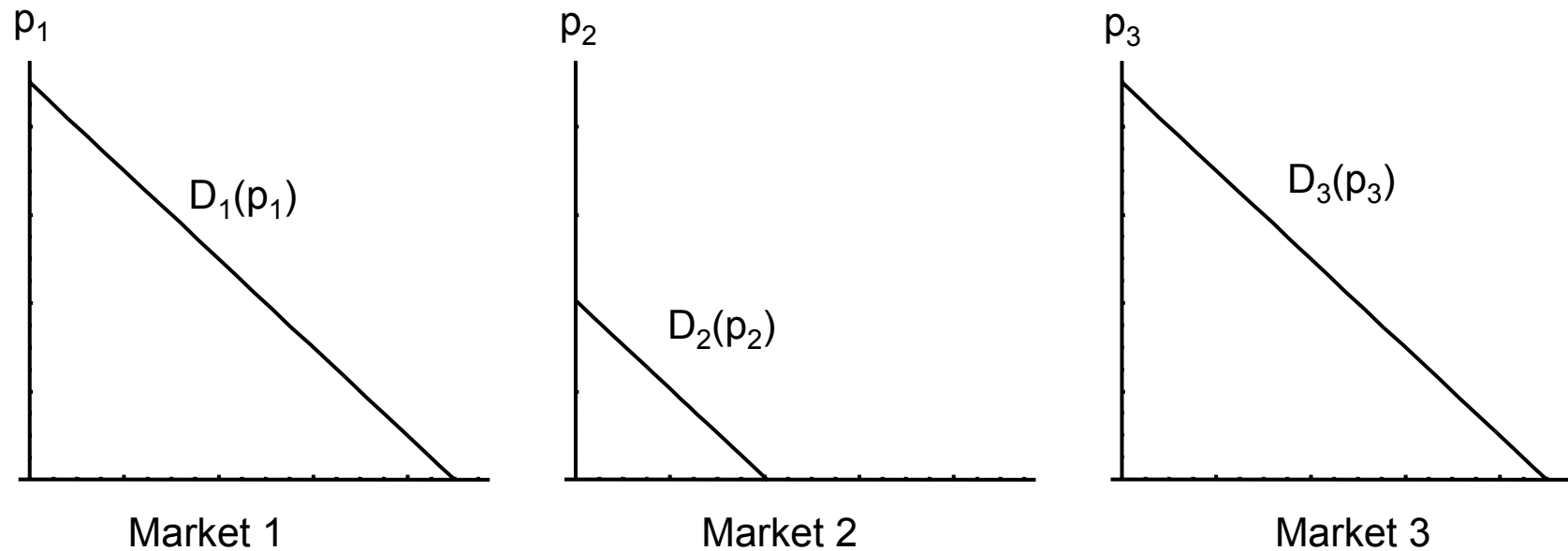
# Theoretical questions

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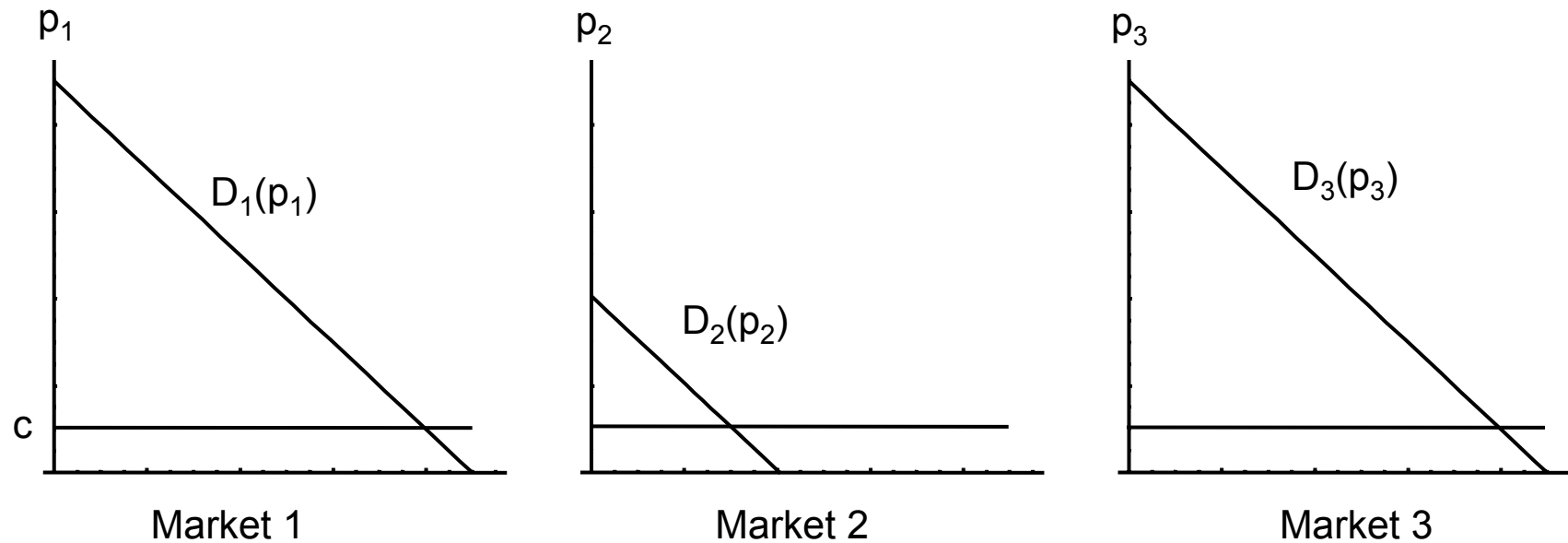
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- What are the investment incentives of a regulated monopoly?
  - How should regulation be adapted for investment incentives?
  - How about structural distortions of investments?
- Questions addressed in a very simple model

# A Monopolist for three Markets

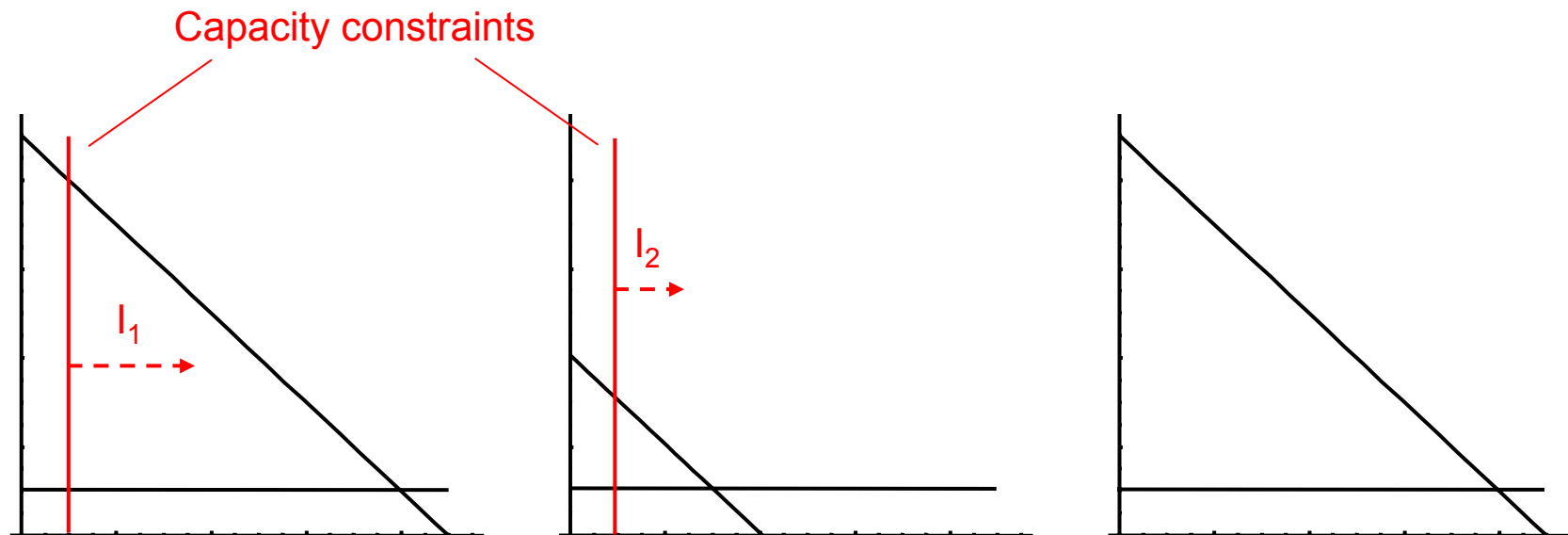


# A Monopolist for three Markets



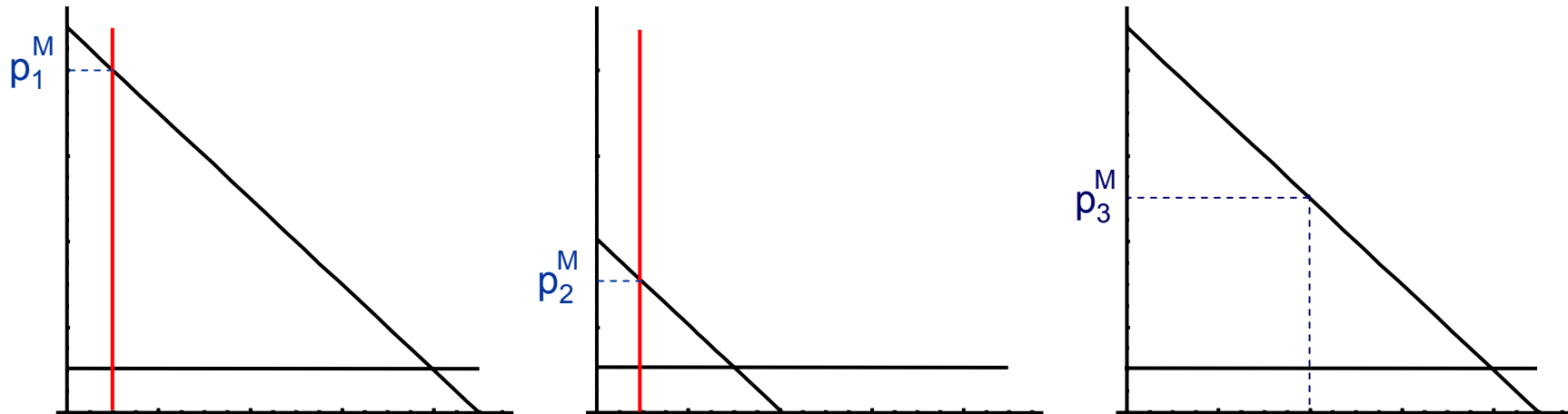
- Identical constant marginal cost  $c$
- Fixed cost  $F$

# A Monopolist for three Markets with capacity investments



- Capacity can be increased by  $I_i$
- Investment cost are quadratic

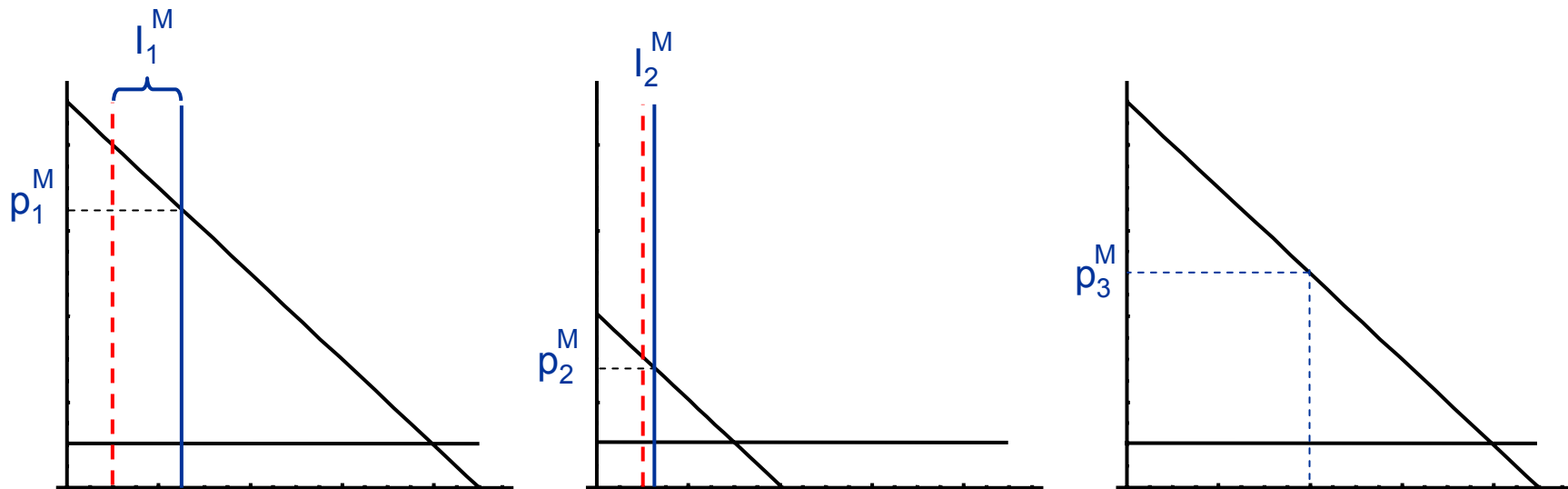
# Monopoly prices without investment



Results:

- Profit = 5 (fixed cost  $F = 20$ )
- Consumer surplus = 9
- Welfare = 14

# Monopoly investments and prices

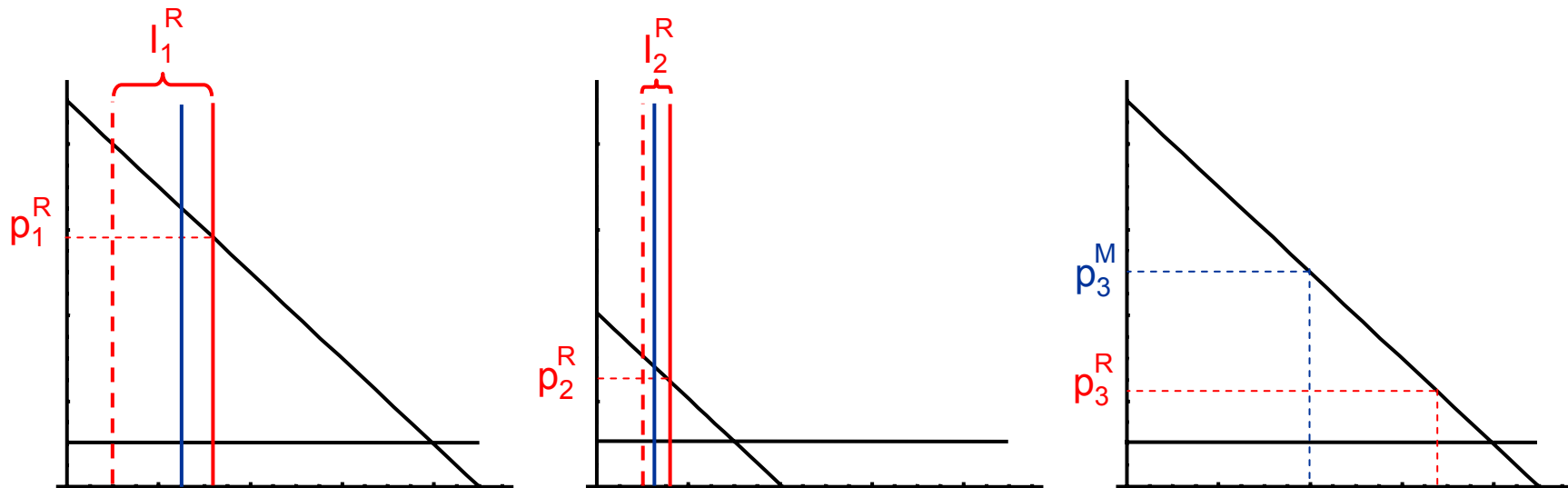


Results:

- Profit = 5 → 10
- Consumer surplus = 9 → 11
- Welfare = 14 → 21

# Social optimum without deficits (Ramsey)

Ramsey Problem: maximize welfare subject to non-negative profit by choice of prices and investments.



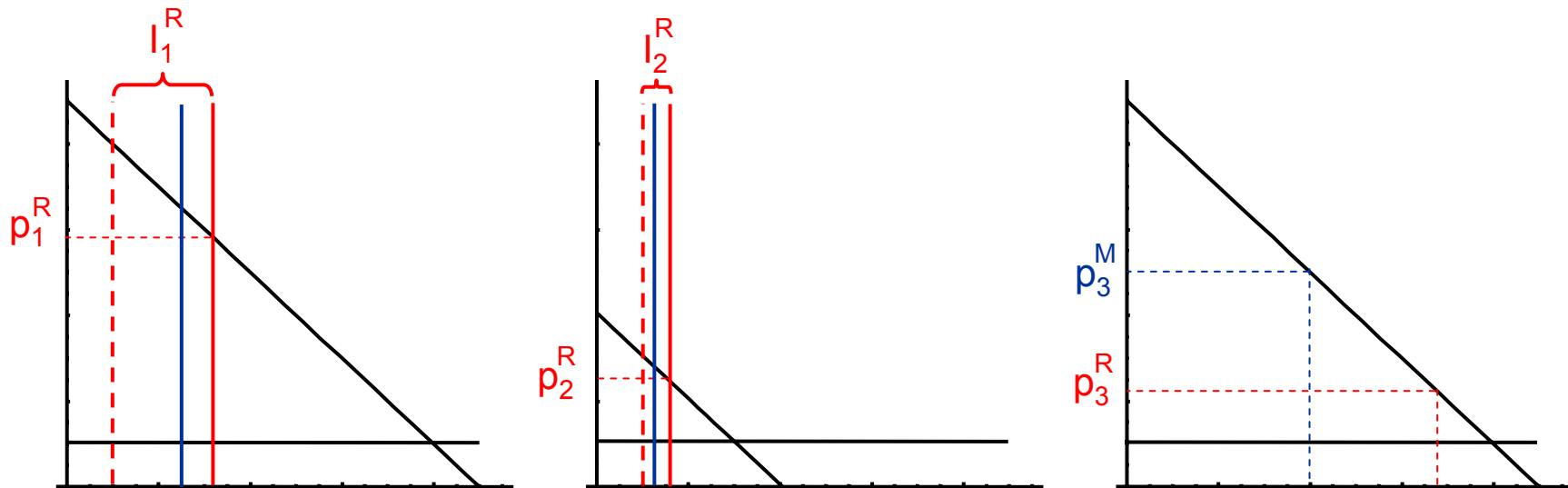
Results:

- Profit = 5  $\rightarrow$  10  $\rightarrow$  0
- Consumer surplus = 9  $\rightarrow$  11  $\rightarrow$  30
- Welfare = 14  $\rightarrow$  21  $\rightarrow$  30



# Social optimum without deficits (Ramsey)

Ramsey Problem: maximize welfare subject to non-negative profit by choice of prices and investments.



How to regulate towards Ramsey?

# Price-cap regulation

- Suppose the regulator caps the sum of weighted prices using Ramsey quantities as weights
- Suppose he has no idea about investment opportunities and calculates Ramsey quantities for  $I_1 = I_2 = 0$ :  $D_1 = D_2 = 1, D_3 = 6.236$ .
- Price-cap is:

$$p_1 + p_2 + 6.236 p_3 \leq F + c (1 + 1 + 6.236)$$

$$p_1 + p_2 + 6.236 p_3 \leq 28.236$$

# Price-cap regulated Monopolist

- For  $I_1 = I_2 = 0$  (no investment), the monopolist would choose Ramsey prices.
- With investment choice, the following holds:

	Monopoly	Ramsey	Price-Cap
$I_1$	1.5	2.17	1.65
$I_2$	0.25	0.58	0.4
$I_2/I_1$	6	3.74	4.125

# Basic Results of the Exercise

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- Without investment opportunities, price-cap regulation - correctly applied - leads to Ramsey-pricing (static efficiency)
- With investment opportunities, there is a tradeoff between static and dynamic efficiency
- However, the Ramsey-regulated monopolist (based on a no-investment hypothesis) invests more than the non-regulated monopolist
- The structure of investments is not strongly distorted
- Even an additional, moderate cap on  $p_1$  would not distort too much
- Thus it seems, if there is a problem of regulation and investment, it is the commitment problem (danger of regulatory holdup), not the price-cap itself

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# Thank you!