A Theory of Investment for Energy-Efficient Technologies

Part II

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Review

Research Question

What places attract energy-efficient buildings? How do neighborhood and area characteristics relate to the number of certified energy-efficient buildings?

Last Week:

- Discrete Choice, Random Utility Model
- Energy Savings v. Purchase Price
- People appear to undervalue their future energy costs

Paper

Allcott, Hunt and Michael Greenstone, "Is there an energy efficiency gap?," *Journal of Economic Perspectives*, 2012, *26* (1), 3–28.

Definition (Energy-Efficiency Gap)

"The wedge between the cost-minimizing level of energy efficiency and the level actually realized." (Allcott and Greenstone, 2012)

Overview

Purpose Do people adopt EE goods when it minimizes their costs? How should we design policy for EE goods?

Model Create a condition for the adoption of energy-efficient technology that considers investment inefficiencies and energy use externalities

Method Survey and evaluate empirical estimates and evidence of an energy-efficiency gap

Results Yes, there is an energy-efficiency gap – no, we cannot stop climate change at a negative cost

The Model

Baseline Investment Decision

$$\underbrace{\frac{pm_i(\lambda_E - \lambda_I)}{1+r}}_{\text{Energy Savings}} > \underbrace{c+\omega}_{\substack{\text{Adoption} \\ \text{Costs}}} \tag{1}$$

- p : Price of Energy
- m_i : Tastes for Energy Use for agent i (Output)
- λ_E : Energy Intensity for Efficient Good (Energy/Output)
- λ_I : Energy Intensity for Inefficient Good
- r : Discount Rate
- c : Explicit Adoption Costs
- ω : Unobserved (Implicit) Adoption Costs

Including the Externality and Investment Inefficiency

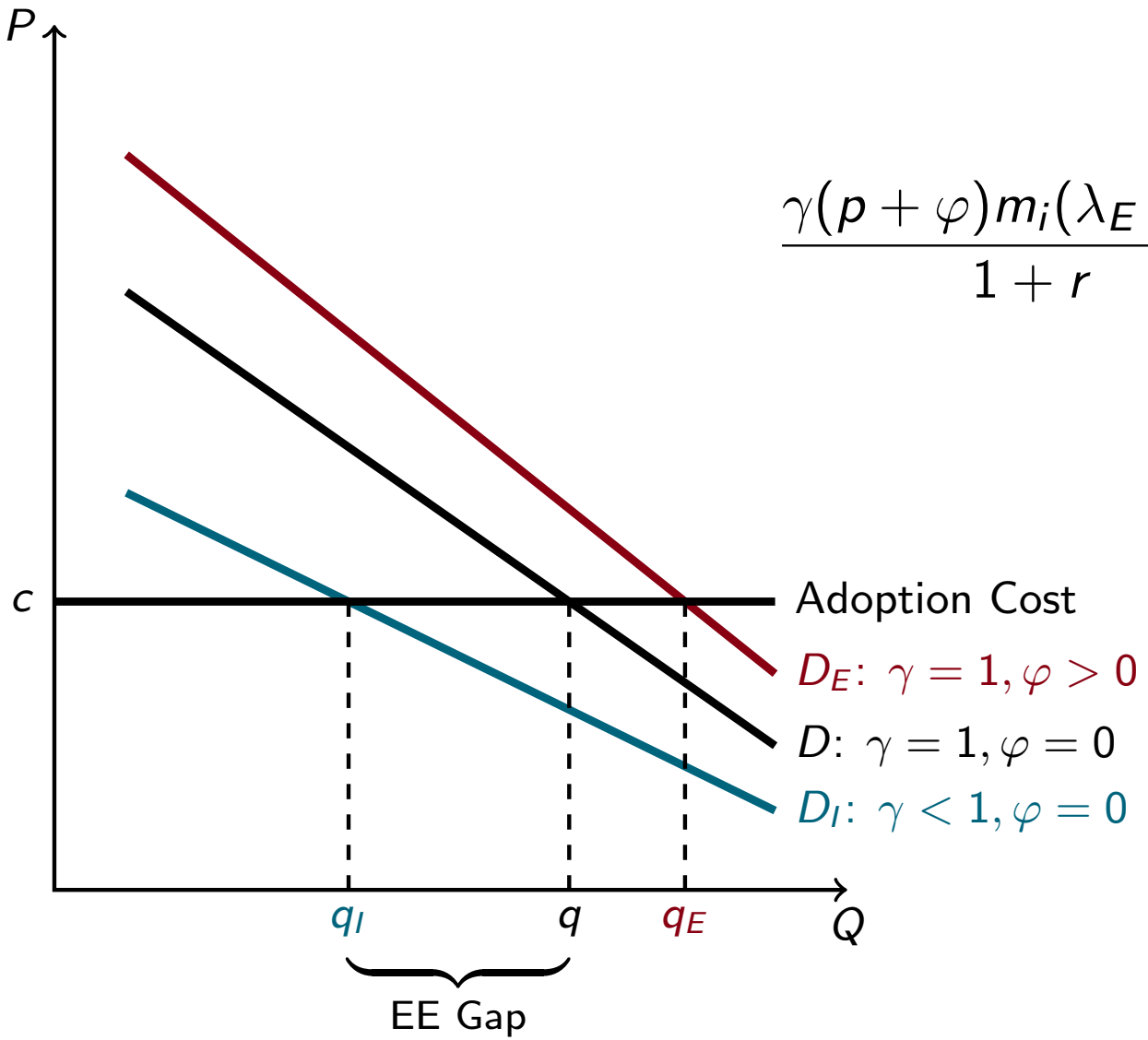
Let φ be the social cost of energy:

$$\frac{(p+\varphi)m_i(\lambda_E - \lambda_I)}{1+r} > c + \omega \tag{2}$$

Let γ be a weight on the discounted energy savings:

$$\frac{\gamma p m_i(\lambda_E - \lambda_I)}{1+r} > c + \omega \tag{3}$$

Figure 1: Demand for an Energy-Efficient Good



$$\frac{\gamma(p+\varphi)m_i(\lambda_E - \lambda_I)}{1+r} > c + \omega$$

Results & Implications

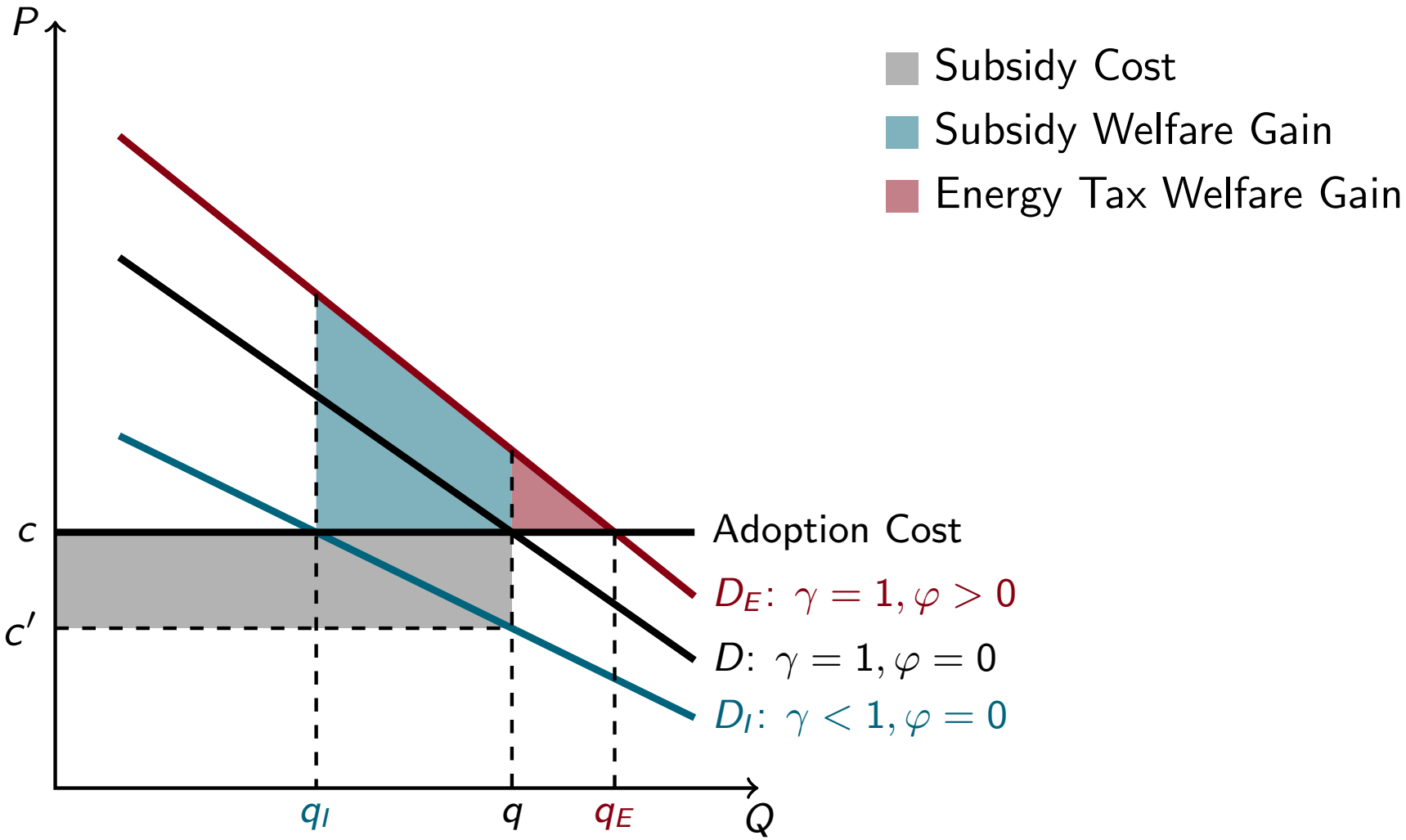
Results

1. Yes, there is an energy-efficiency gap
   - Imperfect Information
   - Inattention

2. No, the energy-efficiency gap is not massive

3. Welfare gains are largest when:
   - Pigouvian tax on energy
   - Target subsides towards agents with highest investment inefficiencies

Figure 2: Energy-Efficient Good Policy Intervention



Relevance to Project

$$\frac{\gamma p m_i (\lambda_E - \lambda_I)}{1 + r} > c + \omega \tag{4}$$

- Investment inefficiencies, γ, and implicit costs, ω, are new
- Have a plausible spatial relationship

Next Week

Eichholtz, Piet, Nils Kok, and John M Quigley, "Doing well by doing good? Green office buildings," *American Economic Review*, 2010, *100* (5), 2492–2509.

- Start thinking about energy efficiency in buildings
- Discuss the background and goals of energy efficient building
- Will people and/or firms pay more for an energy-efficient building?

References

Allcott, Hunt and Michael Greenstone, "Is there an energy efficiency gap?," *Journal of Economic Perspectives*, 2012, *26* (1), 3–28.

_ , Sendhil Mullainathan, and Dmitry Taubinsky, "Energy policy with externalities and internalities," *Journal of Public Economics*, 2014, *112*, 72–88.

Hausman, Jerry A, "Individual discount rates and the purchase and utilization of energy-using durables," *The Bell Journal of Economics*, 1979, pp. 33–54.