Green Growth, Market Failures, and Technological Change

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WORLD TRADE ORGANIZATION

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GTAP

What's Green Growth?

- World Bank workshop in Mexico City (Jan 2012) – many presentations
  - Sustainable Development (20-30 years)
  - Maximizing social welfare subject to due consideration of intra- and inter-generational distributional equity (50+ years)
  - Is "GG" no more than re-packaging of pre-existing concepts?

- No, it's more than that, because "green growth" – the phrase – is *used by important political* bodies (OECD, UNEP, UN RIO+20, Korea, etc.)
  - A new phrase to organize social goals & policies, or at least to name them (That's fine with me – over my "pay grade" to question)

- So, I accept green growth as being *defined politically, not economically*
  - This does *not* denigrate or diminish GG
  - Rather, it elevates it, because – as we all know – ……
    - Political language trumps economic jargon
    - Political discourse is more important than economic discourse

Political Meaning of Green Growth

- United Nations: *"Green Growth is the process of **greening** a conventional economic system and a strategy to arrive at a **green economy.**"*
  - *"Green Economy can be defined as an economy where economic prosperity can go hand-in-hand with ecological **sustainability**."*
- OECD: "Green growth means fostering economic ***growth and development***, while ensuring that ***natural assets continue*** to provide the resources and environmental services on which our well-being relies."
- So, "green growth" is indeed a new phrase for "*sustainable development*"
- We then need to ask whether green growth is:
  - Nothing more nor less than *addressing* ordinary "market failures," including environmental externalities, plus equity? … or …
  - An *activist call* to coordinate growth & environmental policies? ... or …
  - A *conviction* that green policy is not only good for broadly-defined welfare, but for narrowly-defined GDP growth?
- In all 3 cases, green growth is tightly linked with technological change.

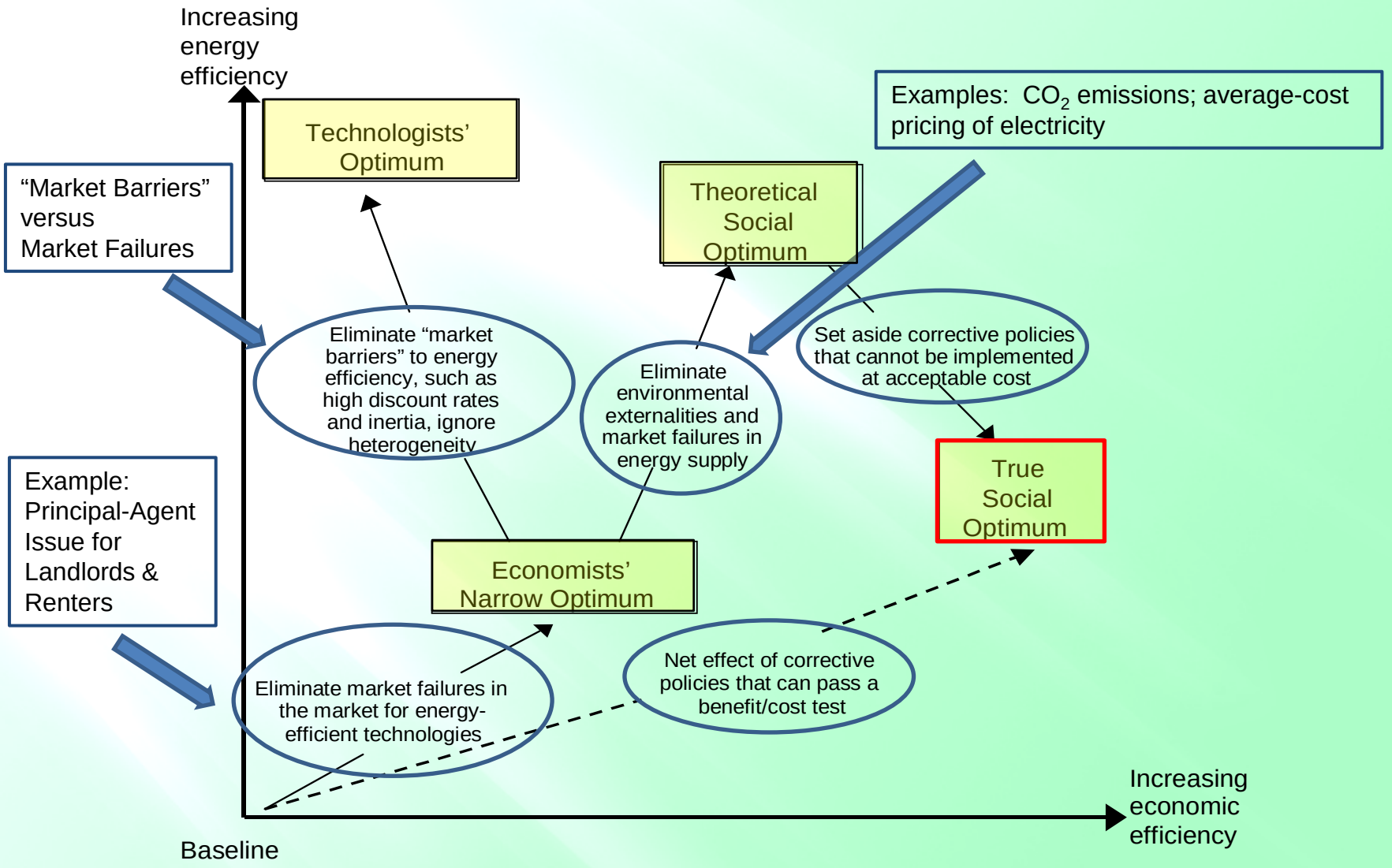
For green growth, technological change with regard to *energy efficiency* is very important

- Why? Because global energy consumption is on a path to grow 50% over the next 25 years
  - Increased air pollution, greenhouse gas emissions, oil consumption, and energy prices
- And energy efficiency improvements are an important mechanism for decreasing energy consumption
- Key questions:
  - How do people & businesses make energy efficiency decisions?
  - What are the effectiveness, costs, and benefits of energy-efficiency policies?
- In the context of green-growth, a central issue is the "energy paradox" or "energy efficiency gap" (Shama 1983; Jaffe & Stavins 1994) ….

What is the “energy paradox” or “energy-efficiency gap?”

- It is the *apparent* reality that energy-efficiency technologies that would pay off for adopters … are nevertheless *not* adopted
  - Seminal studies by Hausman 1979, and Dubin & McFadden 1984
- Let’s be clear about what *adoption* means
- Three stages of technological change (Schumpeter 1939)
  - *Invention* – creation of new equipment (in the laboratory)
  - *Innovation* – commercialization, i.e. taking it from the laboratory to the showroom floor
  - *Diffusion* – gradual process of *adoption* (purchase) of product
  - [And, of course, *utilization* – use of the adopted product]
- Energy paradox is mainly about *diffusion, …*
  - … but there are multiple interpretations of the “gap” …….

Alternative notions of the "energy-efficiency gap"



An Economic Perspective: Potential Explanations of the Paradox/Gap

- ***Market-Failure*** Explanations
- ***Behavioral*** Explanations
- ***Model and Measurement*** Explanations

Potential Explanations of the Paradox/Gap: *Market-Failure Explanations*

- Information Problems
  - Principal-agent issues (e.g., renters/landlords – Davis 2011)
  - Lack of information, asymmetric information (research on residential construction, Jaffe & Stavins 1995; Palmer *et al.* 2011)
- Energy Market Failures
  - Externalities – environmental, security (Krupnick, *et al.* 2010)
  - Average-cost electricity pricing (Joskow 1976; & others)
- Capital Market Failures
  - Liquidity constraints
  - Particularly relevant in developing countries
- Innovation Market Failures
  - R&D spillovers due to public-good nature of information (evidence from patent studies by Griliches 1992; Jaffe 1998; Popp; & others)

Potential Explanations of the Paradox/Gap: *Behavioral Explanations*

- Inattentiveness/salience issues
  - Electricity billing (Allcott; Mullainathan; Wolfram; Greenstone; & many others)
  - Water billing practices (Olmstead, Hanemann, & Stavins 2007)
  - Regulations may increase effects of prices (Newell, Jaffe, & Stavins 1999)

- Bounded rationality, heuristic decision-making
  - Do consumers make choices on basis of NPV?
  - Rules-of-thumb
  - *What about firms?*

Potential Explanations of the Paradox/Gap: *Model and Measurement Explanations*

- Unobserved costs of adoption
  - An explanation of “negative costs” in the McKinsey cost curve (2009)?
- Product characteristics/attributes
  - Hedonics: products as a bundle of attributes
  - First-generation compact fluorescent light bulbs: color & noise
  - CFLs: size, shape, dimmers, etc.
- Heterogeneity in demand across potential adopters
  - Griliches (hybrid corn, 1957; Hausman and Joskow 1982)
  - Ubiquitous phenomenon with virtually all new technologies
- Uncertainty (real, not informational)
  - Future energy prices (theory – Dixit & Pindyck 1994)
  - Empirical analysis (home improvements, Hassett and Metcalf 1994)

Any Policy Implications from Economic Research?

- What about *conventional*, command-and-control regulations?
  - Major effect is to *remove* some technologies from the market (examples: CAFE standards, energy-efficiency standards)

- What about *subsidies* as a diffusion (adoption) policy?
  - Can provide perverse incentive to *increase* energy use (rebound effect)
  - Require large public *expenditures* per unit of effect (infra-marginal units)

- Multiple market failures – in climate change context, environmental *externality* and *public-good* nature of information generated by R&D
  - Pricing of externality is *necessary, but not sufficient*
  - Direct technology policy is *necessary, but not sufficient*

- Major Implications of Economic Research:
  - Innovation & diffusion respond to market incentives (price signals)
  - But multiple market failures clarify the case for combining pricing (tax or CAT) policies with broader-based public support for technology innovation

Good News for Economists

- *More Research is Needed!*
- Key Research Problem
  - Bricks – incentive structure for academic researchers
  - Walls – not very sound
  - House – the interests and needs of policy makers
- What does existing evidence tell us when assembled?
  - Where are there inconsistencies?
  - What are the most important knowledge gaps?
- This will produce a substantial agenda for research, …
  - … and for communication and action

For More Information

Harvard Environmental Economics Program
www.hks.harvard.edu/m-rcbg/heep/

Harvard Project on Climate Agreements
www.belfercenter.org/climate

Blog: An Economic View of the Environment
http://www.robertstavinsblog.org/

www.stavins.com