

Mgmt 444

Technological Change

In “The health care quadrilemma,” Burt Weisbrod weaves together three main ideas

(1) The most important long run determinant of cost and quality change is technology

- Role of technology as the dominant determinant of quality is self-evident, though we will try to quantify things next week

- Inflation-adjusted costs have increased worldwide for the better part of the last 100 years

 - . Process of elimination leaves technology as the culprit

- All OECD nations have experienced substantial cost growth

 - . Thus, the nature of the health care system (e.g. free market versus centralized) has only a second order effect on spending *growth*

 - . (The nature of the system can affect spending *levels*, however.)

 - . This also rules out administrative costs and malpractice as key drivers of long term spending growth

- Researchers have been able to show that demographics and epidemiology (e.g. AIDs) explain about 10 percent of long term spending growth

- By default, what is left must be due to technological change

- Examples of how new technology drives spending

 - . \$30 billion annual US spending on neonatal intensive care (NICU)

 - . \$10 billion in organ transplants in US (versus \$2.5b in the EU)

 - . \$5 billion for implantable cardiac defibrillators (ICD) in US and EU

(2) Technological change is *endogenously determined by market forces*

- New technology results from scientific opportunity and R&D spending
- Much basic research is funded by government, including US NIH
- Private sector R&D is equally crucial, including additional basic research and nearly all development spending
 - . Profit seeking firms allocate R&D dollars among many competing projects, accounting for scientific merit *and* market potential

(3) Characterize new technology along two dimensions: Cost increasing/decreasing and quality increasing/decreasing

- . Economic incentives established by payers (private insurers and government payers) have historically favored cost increasing/quality enhancing technologies
- Cost growth is both the result of historical payment practices, but also shape current and future payment practices
 - . This endogenous feedback has critical implications for the path of technological change

Weisbrod's theory implies that the innovation cycle is a *closed loop* that looks something like this:

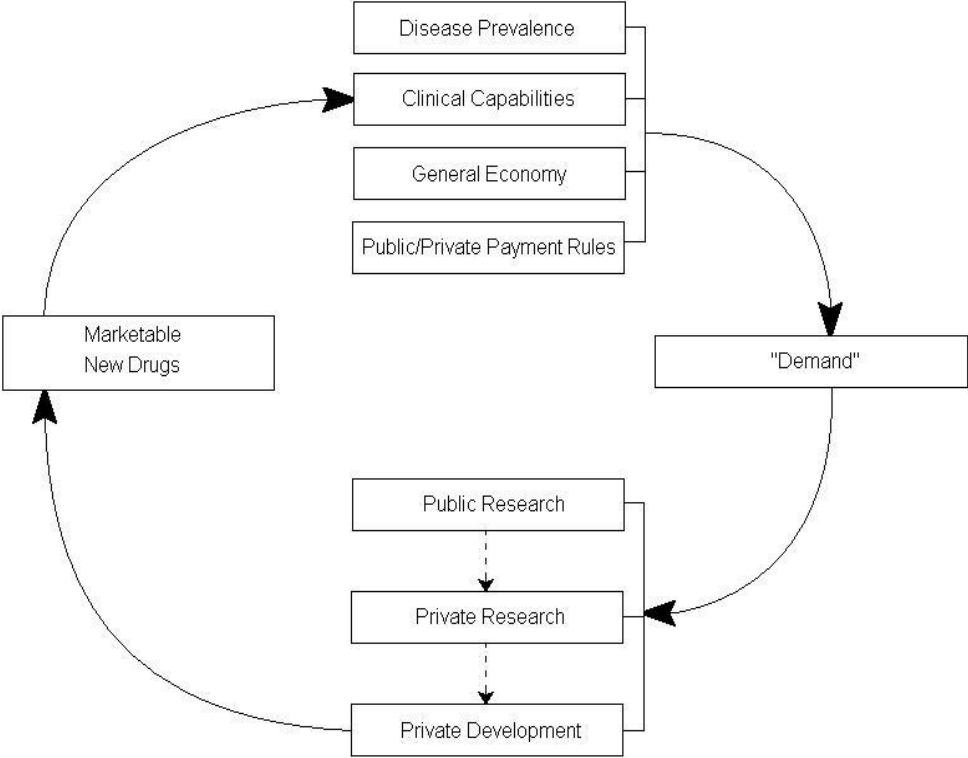


Figure 1

Weisbrod's views were sparked by an essay by the famed biologist Lewis Thomas that appeared in his classic book *The Lives of a Cell*. In one chapter of the book, Thomas describes three phases of medical technology, using the treatment of polio as an example. I will add the treatment of clogged arteries.

- No technology

- . There is currently no treatment to prevent, cure, or mitigate the symptoms of disease
- . E.g. polio circa 1900. Clogged arteries through 1960s

- Partial or halfway technology

- . Current treatments can mitigate symptoms and prolong life. Patient experiences a permanent reduction in health status
- . E.g. polio circa 1940 (treated by "iron lung"). Clogged arteries circa 1970-2005 (treated by CABG surgery/angioplasty)

- Full technology

- . Condition can be either fully prevented or fully treated
- . E.g. polio circa 1960 (Salk vaccine). Statin drugs to reduce or eliminate blockages.

- It is obvious which technologies provide the greatest value to patients. But *which provide the greatest value to providers?*

- . The implication is that medical R&D firms expect strong demand for halfway technologies, regardless of their cost
- . This encourages the development of halfway technologies
- . Weisbrod conjecture: modern medicine is replete with too many iron lung technologies and not enough Salk vaccine technologies. This reflects the incentives that are at work

It should be clear that the demand for technology is linked to the process by which medical providers choose treatments. This is not the last time that we will consider the central role of MDs.

This is a useful place to discuss the *value chain* in health care.

Q: Take an individual who has chest pain. What does the value chain for this individual look like? (In-class discussion)

Now let's evaluate the claim that the economics of the healthcare system favors halfway technology. We will focus on institutions (mainly hospitals) as that is where most of the costly technology is utilized.

First the US:

- Start with the situation prior to 1980s. Think of NICU and open heart surgery, two of many burgeoning, expensive, new technologies.
- Hospitals received *cost-based reimbursement*. Hospitals computed their average costs per patient and insurers paid this amount plus some additional factor to cover the cost of capital

. Q: Implications for adopting NICU or open heart surgery suite?

- If we move forward to today, the typical payer (Medicare and most managed care organizations) pays a fixed fee per admission
 - . There are over 500 "Diagnosis Related Groups" with a different fee for each DRG
 - . How does a DRG-system affect incentives to adopt technology?

Now let's look at the rest of the developed world:

- Rules differ but the essential are fairly similar
- The price paid for technology, say ICD, is negotiated between the vendor and the state.
- Providers receive a global budget from the state; each year's budget is based on past spending and "planning" projections
- Some nations are now performing benefit/cost analyses prior to approving new technologies or setting prices
 - . The implications for technology adoption are obvious
 - . But there are many devils in these details, as I will explain later

Research on the Technology Development Cycle

Industry advocates and critics alike have attempted to measure the magnitude of the linkages along the R&D cycle. Let's take a quick look at the research evidence.

Studies linking Demand to R&D

- Several studies confirm that R&D spending and output increase in response to favorable market conditions.
- Ward and Dranove (1995) estimate the magnitude of the link between demand and R&D spending.
 - . A 10 percent increase in demand for care in a therapeutic area leads to a 5-8 percent increase in R&D spending. (NIH spending for basic research is not as market-driven.)
- A 10 percent increase in NIH spending in a therapeutic area leads to a 6-8 percent increase in industry spending.
- Thus, *the industry is both pulled by market demand and pushed by developments in basic science.*

- Finkelstein (2004) examines the effects of changes to three federal policies affecting the demand for six vaccines.

. The demand-boosting policy changes were associated with a statistically significant increase of slightly more than 1 new vaccine trial per year for each affected disease.

. Focusing on hepatitis B and the flu, she estimates that each additional \$1 in expected annual market revenue generates about 6 cents in additional R&D spending.

- Acemoglu and Linn (2004) links demand to drug output.

. Each 2.5 percent increase in demand in a specific therapeutic area (based on demographic trends) is associated with the introduction of one additional drug.

These studies confirm that economic incentives matter (surprisingly, many industry critics have doubted this point), but they have some limitations when we examine the quadrilemma

- Studies ignore the distinction between cost increasing and cost decreasing technology

- Studies also ignore a critical distinction between “breakthrough” and “me-too” drugs.

Studies Linking New Drugs to Improvements in Patient Outcomes

There are two broad categories of studies linking new drugs to patient outcomes. By far the most common are traditional cost-effectiveness studies.

- Neumann et al. (2000) reviewed over 200 published cost-effectiveness studies of prescription drugs.
 - . They report that in 79 percent of these studies, the drug had a positive cost per “quality adjusted life year”
 - . The median cost per quality adjusted life year was \$12,000

Another class of studies is associated with Columbia’s Frank Lichtenberg.

- These are prominent, if controversial studies, in part because Lichtenberg receives considerable industry funding and in part because the studies are of variable quality
- Lichtenberg and Virabhak (2002) is a good example
 - . They find that patients who used newer drugs (based on year of FDA approval) had better outcomes. The cost of newer vintage drugs required to keep a person alive is only \$8214
 - . Concern: patients who receive newer drugs may differ from patients who receive older drugs in other ways (omitted variable bias)

Perhaps the most interesting studies are a set of papers by David Cutler and various colleagues

- We will discuss these next week
- Bottom line: Overall, new technology is well worth the added cost

Discussion

In light of the research on the quadrilemma, we can discuss policy issues such as importation. First, let's discuss this from a public policy perspective.

What are the public policy arguments for and against importation?
How much should we worry about medical R&D?
Does the research give us much guidance?

Let's turn now to the industry.

Suppose that you are Director of Policy for a major U.S. pharmaceutical company. Your job is to lobby the federal government on regulatory and legislative matters that affect your company, and to advise the CEO on how to respond to regulatory and legislative challenges. The next U.S. President may direct the Secretary for Health and Human Services to certify the safety of drugs imported from Canada, setting the stage for importation. You now believe that importation is inevitable, but you also believe that the specific rules and regulations for importation are in flux.

What specific rules would you seek so as to minimize the potential harm to your firm and industry? What advice would you give to your CEO for dealing with the potential threat of importation?