

# **"Estimating Past Returns, Projecting Future Payoffs: An Historical Update of What Economists Know and Don't Know"**

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# Opening Comments

- Task oriented presentation
- Economist's way of thinking and working; not restricted to examination of economic impacts (e.g. GDP/N) of S&T
- Eclectic coverage of economics
- Sampling frame of authors cited: 25 foot retrieval method
- Present at the creation; still present
- Real, real-time problem

# A Physicist's Perspective on Measurement

“When you cannot measure it, when  
you cannot express it in numbers,  
your knowledge is of a meager and  
unsatisfactory kind”

Lord Kelvin

# **An Economist's Perspective on Measurement**

“When you can measure it, when you  
can express it in numbers, your  
knowledge is still of a meager and  
unsatisfactory kind”

Jacob Viner

# Parsing The Problem

- Rationales for public investments in S&T
- Estimating future payoffs
- Estimating past returns

# Placing The Problem Statement Within The S&T Policy Cycle

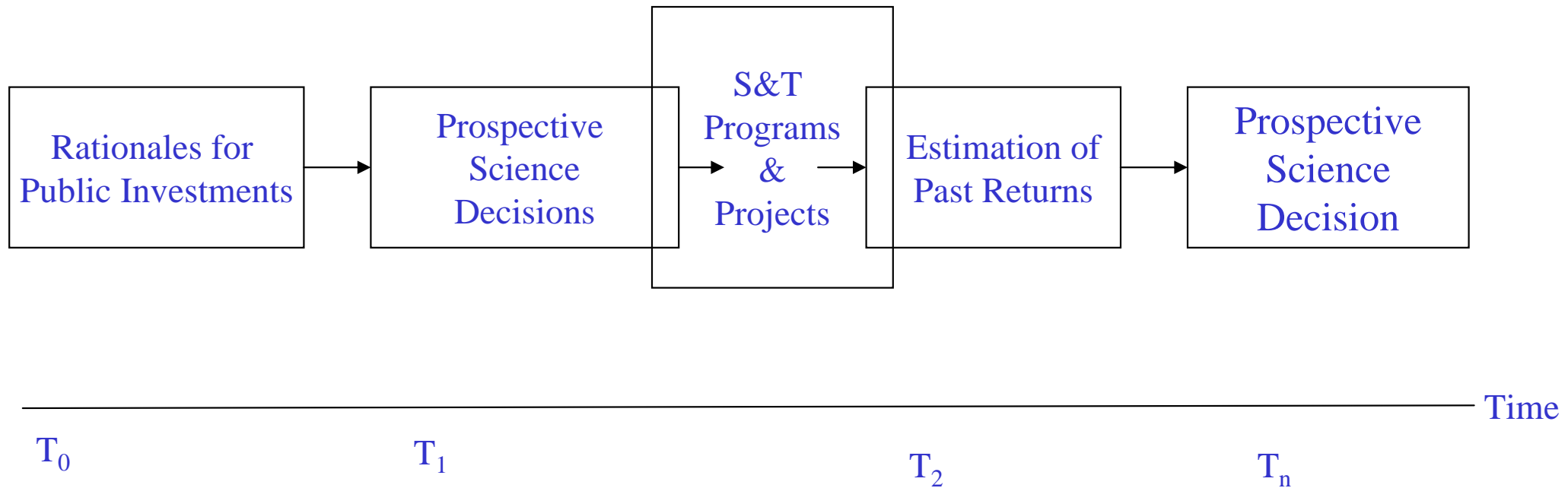


Figure 1

# Placing Economic Research Into The S&T Policy Cycle

## Rationales

### Macroeconomic -Growth-Competitiveness

Solow, Abramovitz, Romer, Baumol,  
Jorgenson

### Market Failure

Nelson  
Arrow

### Economics of Science & Technology

Schmookler, Rosenberg, Dasgupta,  
David, Ruttan

## Prospective Science Decisions

Murphy & Topel\*

## Estimation of Past Returns

Mansfield-Griliches  
(Social savings)

Evenson, Waggoner, Ruttan  
(Agriculture)

Cutler, Wise (Health)

Jarmin, Shapira (MEP)

Hall (R&D Tax Credits)

NBER (ATP)

Thursby, Thursby, Mowery  
(Bayh-Dole)

Figure 2

# Summary Assessment of the Contribution of Economics to S&T Policy Formulation

- Key contributor to rationales for public sector investments
- Extensive, improving ability to assess aggregate, distributive, efficiency and effectiveness impacts of S&T programs
- Limited, static ability to contribute to projecting future returns, especially for basic science

# Analytical Contributions of Economic Perspectives On Projecting Future Returns

- Diffusion research (Counter to presbyopia-David)
- Counter to dominance of reductionist, neo-classical paradigm (e.g. PART)
- Theory-based identification of where to search for impacts (Feller-Nelson)

# Projecting Future Returns: An Example

- A 1% permanent reduction in mortality from cancer would be worth \$500b. Assume a Federal commitment of an additional \$100b over the next 10 years
- “Our estimates imply that the program would be worthwhile if it had only a 1 in 5 chance of producing a 1% reduction in cancer mortality, and a 4-in-5 chance of Producing nothing”
- Murphy & Topel (1999) “The Economic Value of Medical Research”

# Further Contributions of Economics in Understanding Processes of S&T Policy Formulation

- “Government Failure”— Premature, Inefficiently Rapid Promotion of S&T Projects (“Bureaucratic Entrepreneurship”) – Eads & Nelson
- Technological Pork Barrel (Cohen & Noll)
- Political Economy of Earmarking (Payne, DeFigueriedo & Silverman)

# Why Is Projecting Future Returns So Difficult?

Cole's Cone

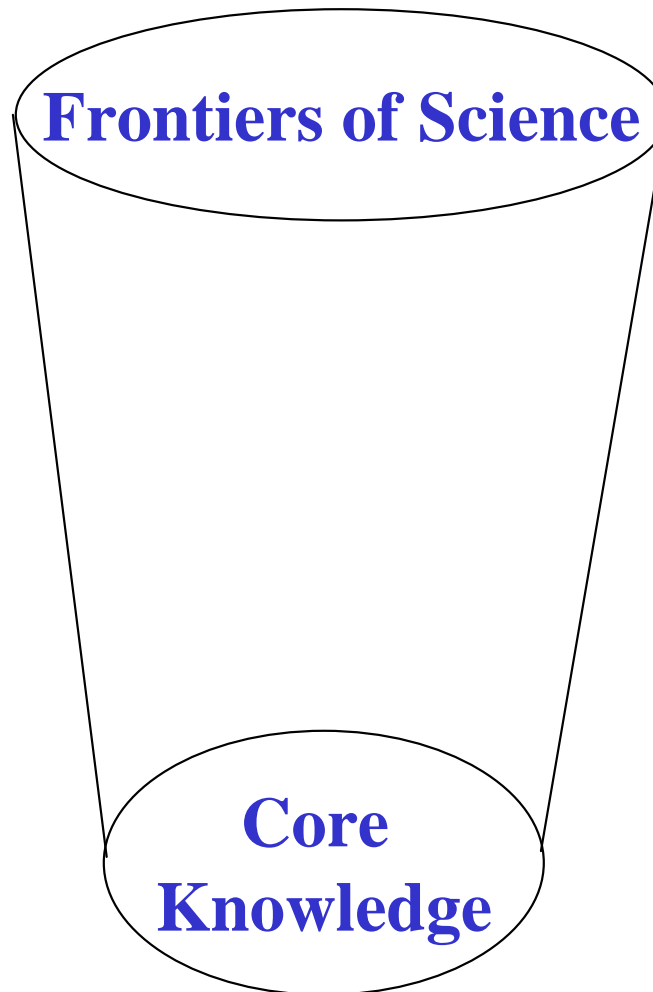


Figure 3

# Future Returns and Past Impacts

Scientific Uncertainty/  
Consensus about  
Priorities/Consensus  
about Findings

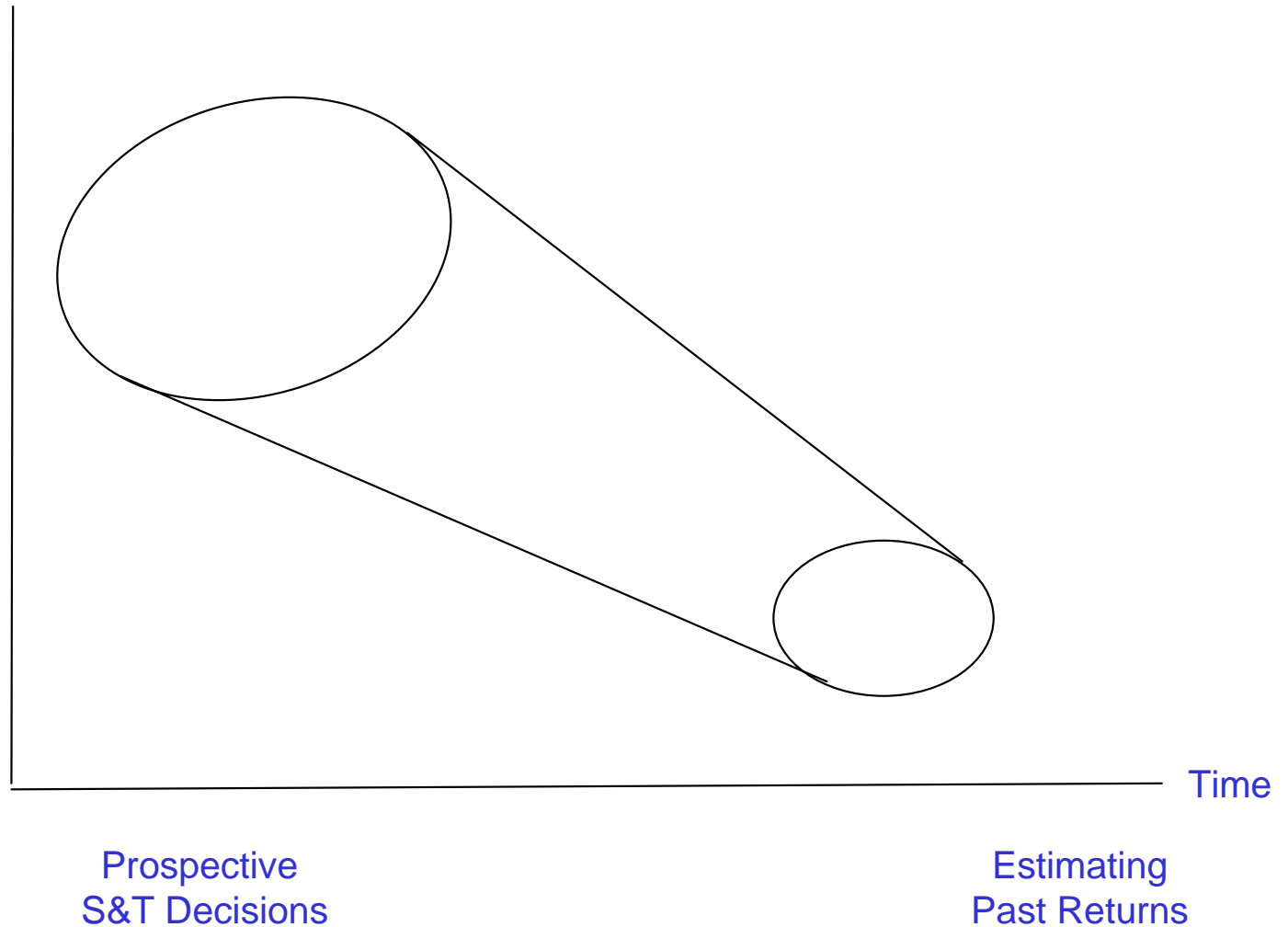


Figure 4

# Weinberg Criteria Redux (Where is the Economics?)

- *Internal Criteria*
- Is the Field Ready for Exploration?
- Are the scientists in the field really competent?
- *External Criteria*
- Technological Merit
- Scientific Merit
- Social Merit

# “Linear Collider Gains Friends”

What do an economist, a biologist, and a science policy expert have in common? ....

(T)hey all think the United States should spend between \$300 million and \$500 million total over the next 5 years laying the groundwork for the proposed ILC with the goal of hosting the multibillion dollar machine”

*Science*, 28 April 2006

# Real-time Policy Decision: NRC- Investments in Elementary Particle Physics

- “The United States should remain globally competitive in elementary particle physics by playing a leading role in the worldwide effort to aggressively study Terascale physics”
- “Plan and initiate a comprehensive program to become the world-leading center for research and development on the science and technology of a linear collider, and do what is necessary to mount a compelling bid to build the proposed International Linear Collider on U.S. soil”

*NRC: Revealing the Hidden Nature of Space and Time*

# National Research Council: “Revealing The Hidden Nature”-- Rationales

“The committee affirms the intrinsic value of elementary particle physics as part of the broader scientific and technological enterprise and identifies it as a key priority within the physical sciences”

Referring to the “development of the key protocols that underpin the World Wide Web at the CERN laboratory, “These advances arose because of a synergy among particle physics and other developments in science and technology; that is, the committee does not claim that particle physics is the best or only path to drive such innovations. Rather the committee argues that strong program in particle physics is an essential of an overall strategy to foster such breakthroughs”

(p. 86)

# Vision Thing

“When I heard the learn’d astronomer (“economist”)  
When the proofs, the figures, were ranged in columns  
before me;

When I was shown the charts and diagrams, to add, divide,  
and measure them; when I, sitting, heard the astronomer,  
where he lectured with much applause in the lecture room,

How soon, unaccountable, I became tired and sick;  
Till rising and gliding out, I wander’d off by myself,  
In the mystical moist night-air, and from time to time,  
Look’d up in perfect silence at the stars”

Walt Whitman (1965)

# Importance of New ‘Unifying’ Program In S&T Studies

- Historic intellectual indebtedness to previous NSF support
- Conversion of vibrant external and internal research program to politicized staff function and subsequent erosion and fragmentation of NSF support of science studies (+ termination of OTA)
- Disparate science studies research communities
- Disparate, mission-agency research output
- Excessive reliance on contract research