The R&D Production Process: Measuring R&D

Valuation in Current Dollars:

- **Cost Approach**: This approach is used in valuing tangible assets and is sometimes used in valuing intangibles. It provides an estimate of the value of the cost of producing or replacing an asset. It sometimes is thought as a lower bound for the value for assets.
    - Consistent with NIPA/SNA accounting for Own-Account Construction
    - Uses available data from NSF on R&D expenditures
    - Shortcomings: limited data on the composition of industry-specific R&D costs; concept of replacement cost is better suited tangible assets or individual innovations than aggregate valuations; and the results would likely be similar to the aggregate estimates already produced (but may be important for industry-specific estimates).

- **Comparable Market Value Approach**: If information were available on the market value of comparable assets, this would be the preferred measure. While this approach is sometimes used in at the firm level in assessing the fair market value for valuing specific intangible assets, such comparable data on market value are generally not available in the aggregate or at the industry level. BEA has thus far not pursued this approach.
    - Lacking direct data on market value, one option is to infer an implicit market value for intangible assets based on such market values as equity prices or royalties and license fees.
    - Shortcomings: shares characteristics of estimation by residual and associated difficulties in isolating the impact of R&D from other factors; resulting estimates can be large and volatile.

- **Income, or Present Discounted Value, Approach**: This indirect measure is used to estimate the discounted value of the stream of income produced by financial investments, new products, and intangibles and is used in SEC filings of fair market value for intangibles. The framework also allows the use of selected data for key components for the development of consistent estimates for other key factors (see below). BEA plans to refine its first year proxy estimates (Scenarios B-D) within this framework.
    - Accurate estimation of the market value of R&D through the present discounted value method requires the use of either assumptions, estimates from firm-level studies, or proxies for:
        - The discount rate on R&D
        - The income stream produced by the R&D (including the price premium commanded by the new asset or service that embodies the R&D, or the royalties "avoided" by internally-produced intangible asset, and the time profile for that income stream)
        - The service life for the R&D

    - Shortcomings: Lack of information for many of these parameters, reliance on proxies, and potential high sensitivity to alternative assumptions.

Real Estimates:

- **Cost-Based Estimates**:
  o Real estimates provide a useful estimate of the "constant" cost of producing R&D and the method uses available input cost data.
  o BEA plans to continue to produce baseline R&D cost estimates but is considering a methodology that incorporates industry-specific costs rather than using the distribution of input costs from the "Scientific R&D Services Industry (NAICS 5417)
  o Shortcoming: Method sheds little light on the R&D's contribution to real GDP growth or productivity; and valuation of real R&D output using the same prices as R&D input produces – by construction – zero MFP growth.

- **Market-Transactions Based Estimates:** The method produces an estimate of the current market, but no obvious method for estimating the real value and its contribution to real GDP or productivity.

- **Income, or Present Discounted Value-Based Estimates**: The estimates for the input data required to estimate the current market value of the present-discounted value can also be used to produce consistent real estimates.
  o Assumptions used on observed market prices for goods and services embodying R&D, input-costs and productivity of similar industries, and the service lives and depreciation of those assets can be used in real estimates of R&D.
  o Shortcomings: Same lack of information on parameters, reliance on proxies, and potential high sensitivity embodied in current dollar estimates.

Market Valuation and Spillovers:

All of the methods discussed above use market values or proxies for market values and do not capture spillover benefits to other industries. This approach is consistent with the existing NIPA treatment for other assets and the proposed SNA treatment for R&D.
- NSF and other users continue to be interested in spillovers and within the framework of the satellite account, not the main accounts, is it useful to attempt to measure spillovers?
- Is there information that could be developed for the R&D satellite accounts that would be helpful for analysts attempting to decompose the contributions of various industries and investments to TFP?