

# R&D SATELLITE ACCOUNT: Preliminary Estimates

Comments By  
Charles Hulten

BEA Advisory Committee Meeting  
November 3, 2006

# EXPANDING GDP/GDI TO INCLUDE R&D EXPENDITURES

- R&D outlays are currently expensed; capitalization expands size of GDP/GDI
- Capitalizing R&D is both complicated and hard to do
  - move into area with which there is limited precedent and experience
  - involves valuation of an asset for which there is no market price

# STRONG EFFORT BY BEA

- Congratulations and praise due to BEA for making significant progress on a host of complex issues
- More remains to be done as the paper itself points out, including
  - Some large conceptual issues
  - Many smaller technical issues
  - Improved exposition

# FOCUS ON LARGER ISSUES

- The rate of return to both R&D and tangible capital
- The “ownership” of R&D problem
- The definition and scope of R&D
- R&D price deflators

# 1. Rate of Return Issues

GDP/GDI Without Intangibles:

$$p_t^Q Q_t = p_t^L L_t + p_t^K K_t = p_t^L L_t + (r + \frac{\delta}{k}) p_t^K K_t$$

GDP/GDI Without Intangibles:

$$p^Q_t Q_t = p^L_t L_t + p^K_t K_t = p^L_t L_t + (r + \frac{\delta}{K}) p^I_t K_t$$

With Intangibles and Common Rate of Return:

$$\begin{aligned} p^Q_t Q_t + p^N_t N_t &= p^L_t L_t + p^{K^*}_t K_t + p^R_t R_t \\ &= p^L_t L_t + (r + \frac{\delta}{K}) p^I_t K_t + (r + \frac{\delta}{R}) p^N_t R_t \end{aligned}$$

With Intangibles and “Own” Rates of Return:

$$p_t^Q Q_t - p_t^L L_t + p_t^N N_t = p_t^{K^*} K_t + p_t^R R_t$$

$$= (r_K + \boxed{\times}) p_t^K K_t + (r_R + \boxed{\times}) p_t^R R_t$$

$$\begin{aligned}
p_t^Q Q_t - p_t^L L_t + p_t^N N_t &= p_t^{K^*} K_t + p_t^R R_t \\
&= (r_K + \boxed{\times}) p_t^I K_t + (r_R + \boxed{\times}) p_t^N R_t
\end{aligned}$$

$r_R$  is estimated to be approximately 15%.

This is an exogenous *ex ante* rate of return.

If the same logic is applied to  $r_K$  (an exogenous *ex ante* rate of return), there is no guarantee that the accounts will balance (GDP not equal to GDI).



If  $r_K$  is treated as an endogenous *ex post* rate of return (following Jorgenson and Griliches), you get adding-up but  $r_K$  now depends on assumptions about  $r_R$ :

$$\partial r_K / \partial r_R = - (p_t^R R_t / p_t^I K_t)$$

Increasing the assumed rate of return to R&D drives down the endogenous *ex post* rate of return to other forms of capital.

## SPILOVER EXTERNALITIES

$r_R$  is the *private* rate of return to R&D. It excludes spillover externalities of R&D knowledge. Good idea because:

- ! Including spillovers forces use of exogenous rate of return,  $r_R$ , with the problems already noted
- ! Spillovers are hard to measure, and raise the issue of spillover into and out of U.S.
- ! Spillovers tend to be “competed away” in lower product prices
- ! Ignoring spillovers puts effects into MFP residual (as in Lucas/Romer)

# Some Suggestions ...

- COMPUTE IMPLIED RATES OF RETURN TO TANGIBLE CAPITAL UNDER THE DIFFERENT SCENARIOS AND ASSUMPTIONS
- COMPUTE STATISTICAL DISCREPANCY IF EXOGENOUS RATES OF RETURN ARE USED FOR BOTH TANGIBLES AND R&D

## This would help illustrate a larger point:

- When BEA moves to incorporate a complete production account into the NIPAs, the issue of the rate of return becomes all important.
- This is not apparent right now because there is no production account, and hence no *explicit*  $r_K$ . This rate of return is, however, implicit.

# Thus ...

- BEA should *not* make piecemeal improvements in the NIPA, like the R&D satellite account, without considering its longer range goals for the future structure of the NIPA
- Old sins cast long shadows

## 2. The “ownership” of R&D problem

- Paper makes the distinction between the “funder” of the R&D and the “performer”
- Assumes the government owns all of the R&D that it funds
- Potential asymmetry between R&D and tangible capital on ownership/use issue

# Compare Investment in (1) Equipment, (2) Own-Account R&D, and (3) Govt. funded R&D

- Funder
- Performer
- Owner
- User

### 3. The definition and scope of R&D

- BEA uses Frascati definition of R&D
- Includes “social science” and “humanities” R&D in addition to “scientific” R&D
- Doesn't in R&D for “commercialization”
- Doesn't including broad list of intangibles, as in Corrado, Hulten, and Sichel



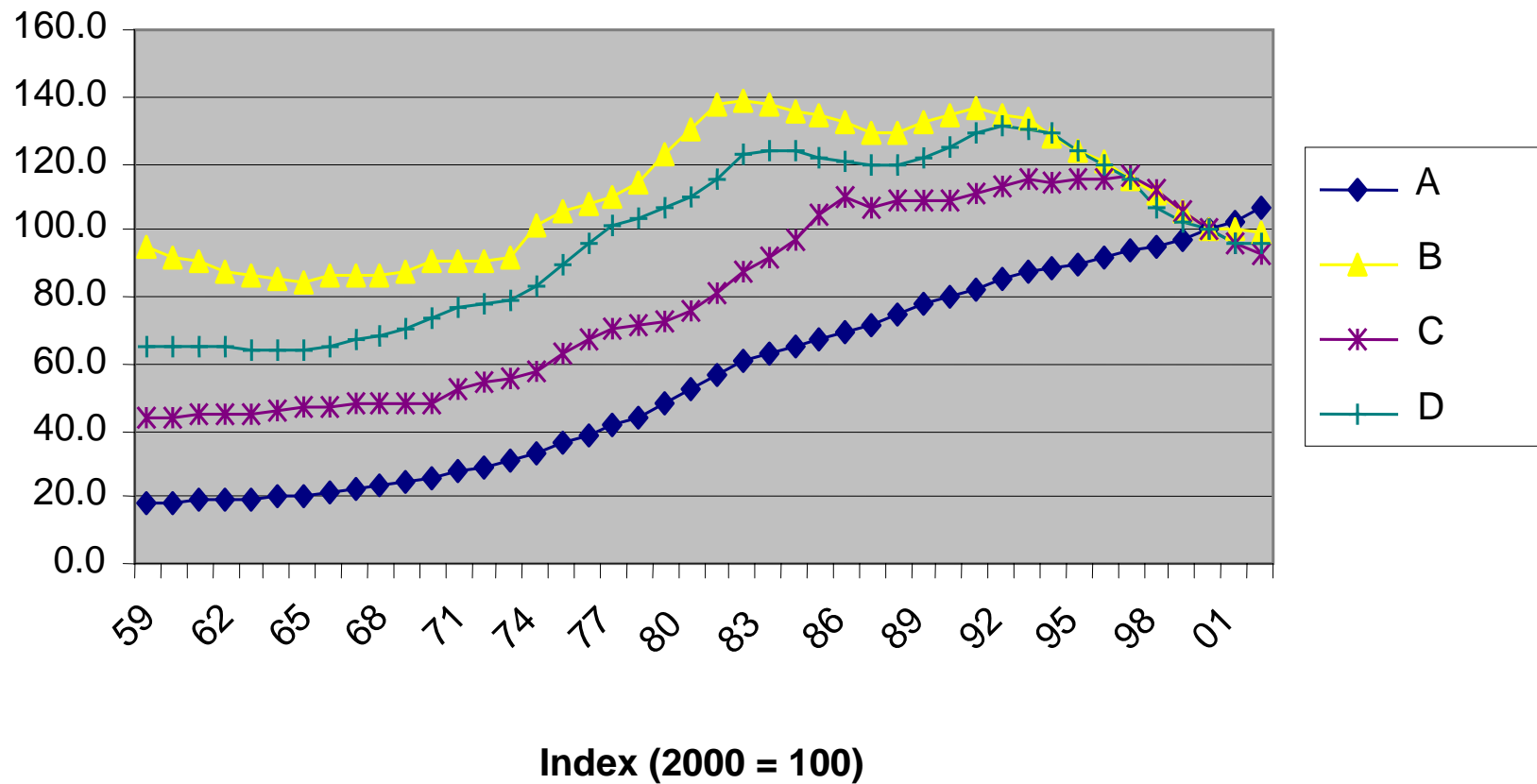
# \$1 trillion of Intangible Investment U.S. nonfarm business, 1998-2000

- COMPUTERIZED INFORMATION (\$154,\$154)
  - COMPUTER SOFTWARE (\$151)
  - COMPUTERIZED DATABASES (\$3)
- SCIENTIFIC PROPERTY (\$424,\$424)
  - SCIENTIFIC R&D (\$184)
  - MINERAL EXPLORATION (\$18)
  - COPYRIGHT AND LICENCE COSTS (\$75)
  - OTHER PRODUCT DEVELOPMENT (FINANCE, ARCHIT.) (\$149)
- ECONOMIC COMPETENCIES (\$642,\$505)
  - BRAND EQUITY (ADVERTISING) (\$236)
  - FIRM-SPECIFIC HUMAN CAPITAL (TRAINING) (\$116)
  - ORGANIZATIONAL STRUCTURE MANAGEMENT CONSULTING, PLANNING ETC.) (\$291)

## 4. R&D price deflators

- One of the hardest problems to crack, since own-account R&D leaves no objective price foot prints
- Cost-based deflators clearly inadequate because they ignore increased productivity in the research process
- The use of four scenarios is one of the strongest points of the paper
- More work needs to be done

## BEA Alternative Scenarios for R&D Deflator



# CONCLUSION:

- VERY GOOD START ON A HARD PROBLEM.
- BETTER EXPOSITION
- CONSIDERATION OF HOW THE CHOICES MADE ABOUT THE R&D SATELLITE ACCOUNT FIT INTO THE FUTURE STRUCTURE OF THE NIPAs
- EXTENSION OF THE R&D SATELLITE ACCT. TO INCLUDE OTHER INTANGIBLES
- PROGRESS ON MANY “SMALL” TECHNICAL ISSUES