

# Measuring Innovation's Role in GDP & Productivity Growth

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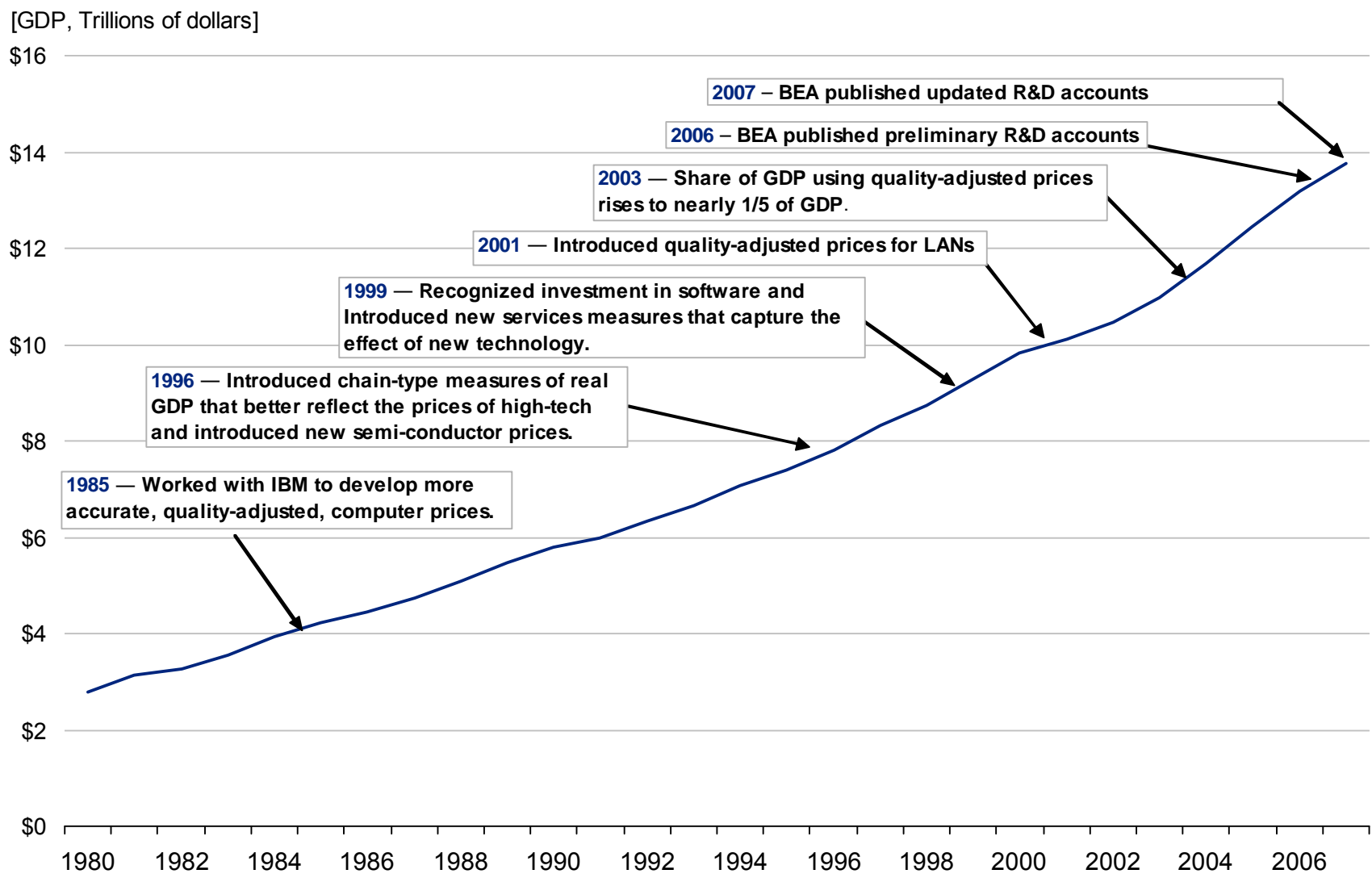
*Measuring the Nation's Economy.*



# Understanding Intangible Assets Role In Economic Growth

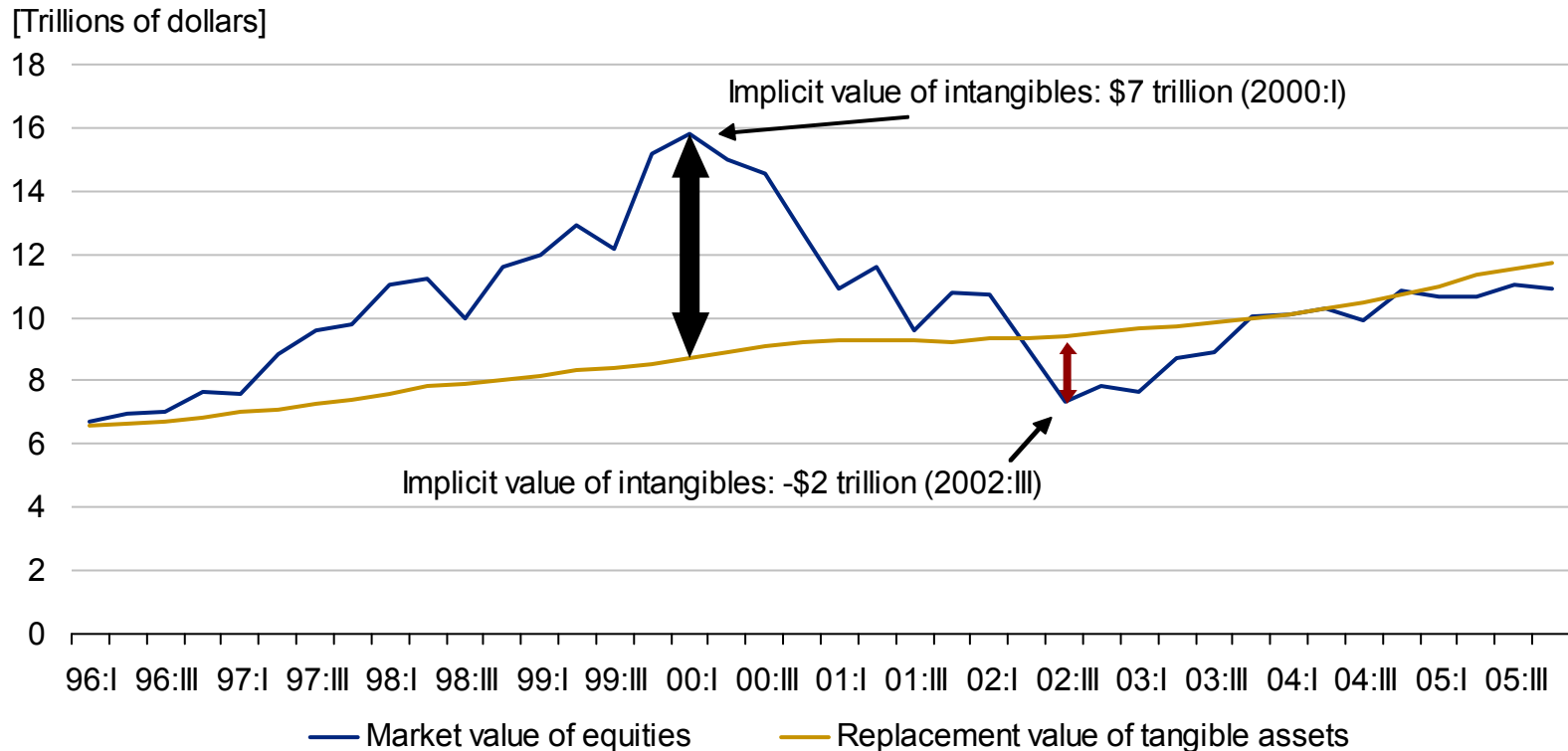
- A Little History
  - Product but no production function
  - Solow's residual
    - As much as half of economic growth could not be accounted for by increases in labor and tangible capital inputs
    - The residual (TFP) was attributed to "advances in knowledge"
- Better informing economic policy
  - The large unknown factor in economic growth (TFP): knowledge, technology, management, policy or changes in the economy?
    - Greenspan & IT
    - Bernanke and innovation
  - Integrated GDP and productivity accounts
  - Innovation Satellite Account

# The Importance of Updating Economic Measurements - Past Efforts



Note: Data through the final estimate of 2007Q2

# Tobin's Q: Intangibles or Irrational Exuberance?



Source: FRB Flow of Funds (L.102 and B.102) release March 9, 2006. Data based on nonfarm nonfinancial corporate business.

Note: A number of analysts attributed the large difference between equity values and the replacement value of plant and equipment to intangibles during the market run-up in the late 1990s.

# The Multi-Factor Productivity Residual: Intangibles or Institutional Factors?

[Percent]	<u>1960-2005</u>	<u>1960-95</u>	<u>1995-2000</u>	<u>2000-2005</u>
Gross domestic product	3.35	3.31	4.29	2.76
Hours worked	1.39	1.52	1.89	-0.02
Average labor productivity	1.96	1.78	2.40	2.78
Contribution of capital deepening	1.03	0.94	1.36	1.40
Information technology	0.40	0.31	0.92	0.56
Non-information technology	0.63	0.63	0.45	0.84
Contribution of labor quality	0.29	0.29	0.19	0.35
<b>Total factor productivity</b>	<b>0.64</b>	<b>0.56</b>	<b>0.85</b>	<b>1.03</b>
Information technology	0.22	0.16	0.51	0.33
Non-information technology	0.42	0.40	0.34	0.70
			<b>Addendum-Growth Rates</b>	
Labor input	1.88	2.02	2.21	0.56
Labor quality	0.48	0.49	0.32	0.57
Capital input	3.94	3.81	5.23	3.57
Capital stock	2.93	3.05	2.81	2.19
Capital quality	1.02	0.77	2.42	1.38

Source: Jorgenson, Dale W., Mun S. Ho, and Kevin J. Stiroh. 2005. Information Technology and the American Growth Resurgence, Cambridge, MA: MIT Press, pp. 38-39

# Results from BEA's 2007 R&D Satellite Account:

- Between 1959-2004, R&D accounted for 5 percent of growth in real GDP
- Between 1995-2004, R&D's contribution rose to 7 percent
  - In comparison, business investment in commercial and all other types of buildings accounted for just over 2 percent of real GDP growth.
  - R&D's stepped-up contribution is almost as large as the contribution of computers in the existing GDP measure.

# Results from BEA's 2007 R&D Satellite Account:

- If spillovers (residual unexplained portion of growth) from R&D are - as research suggests- at least as large as the direct returns, R&D may account for 1/6 of TFP growth
- Recognition of R&D as investment raises business investment by 10.6 percent in 2004
- National saving rate rises by 2.7 percentage points from 13.8 percent to 16.5 percent

# A Broader Measure of Business Intangibles, 1998-2000

(billions of dollars, annual average)

Type	Total Spending	Comments on evidence as capital spending	Capital spending (included in NIPAs)
<b>1. Computerized information</b>	154	Firms capitalize only a fraction of purchased software in financial accounts. Relatively little is known about the service life of software assets.	154 (151)
<b>2. Innovative property</b>			
(a) Scientific R&D	201	Research suggests that scientific R&D yields relatively long-lasting returns and is capital spending.	201 (16)
(b) Nonscientific R&D	223	Little is known about nonscientific research R&D, but a portion of new product development expenditures in the entertainment industry apparently have relatively short-lived effects.	223 (40)
<b>3. Economic Competencies</b>			
(a) Brand equity	235	Research shows that the effects of some advertising dissipate within one year, but that more than half has effects that last more than one year.	140 (0)
(b) Firm-specific resources	407	Research suggests that firm-specific training is investment. Spending for organizational change is also likely has long-lived effects, but a portion of management fees probably is not capital spending.	365 (0)
<b>Total</b>	1220		1085 (205)
<b>Percent of existing GDP</b>			11.7
<b>Ratio of Tangible Capital Spending</b>			1.2

Source: Corrado, Carol, Charles Hulten and Daniel Sichel. "Intangible Capital and Economic Growth," Working paper as part of the Finance and Economics Discussion Series, Divisions of Research and Statistics and Monetary Affairs, Federal Reserve Board, Washington, D.C. April 2006.



# Future research & long term plans

- R&D: Source data development and conceptual work
- Further steps toward integrated productivity accounts as recommended by 2008 Revision of the SNA
- Secretary's Innovation Committee draft recommendations relating to:
  - Expanded data sharing
  - Improved measures of services output
  - Integrated macro model of GDP and productivity

# Expanded measurement of intangibles – Candidates for innovation satellite account

- Research and Development (R&D): Spending on scientific and engineering R&D
  - Product and process innovation
  - More timely data and more frequent indicators
  - Receipts (royalties and license fees) as well as expenditures
  - Associated capital investment expenditures
  - Someday: Valuation of Intellectual Property
- Expenditures on Design and Development (D&D): Spending on social science design and development of new products and processes.
  - Expanded sample frame
  - Explicit subcategories for:
    - Industrial product and process design and development
    - Artistic and entertainment product and process design and development
- Human Capital: Employer spending on employee training and development

# For More Information

- *Measuring Capital in the New Economy*, Corrado, Haltiwanger, and Sichel, eds. 2005
- *A New Architecture for the U.S. National Accounts*, Jorgenson, Landefeld, and Nordhaus, eds. 2006
- “Research and Development Satellite Account Update”, Robbins and Moylan, *Survey of Current Business*, October 2007
- *Innovation Measurement: Tracking the State of Innovation in the American Economy*, The Advisory Committee on Measuring Innovation in the 21<sup>st</sup> Economy, 2008. [www.innovationmetrics.gov](http://www.innovationmetrics.gov)