# Intangibles: What Put the *New* In the New Economy?

*Leonard Nakamura**

The U.S. economy is often called a new economy. One reason is that newly developed products are everywhere: Microsoft's Windows98, Paramount's movie "Titanic," Pfizer's Viagra, and Gillette's Mach3 razor blades are four prominent examples. Developing each product required its corporate sponsor to invest hundreds of millions of dollars. For example, Gillette invested $700 million to develop the Mach3 razor blade in an effort begun in 1990. Paramount spent over $200 million to bring director James Cameron's vision of "Titanic" to the screen.

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These investment expenditures gave rise to economically valuable, legally recognized *intangible assets*, including copyrights ("Titanic" and Windows98) and patents (Viagra and Mach3) that give the investing firms the exclusive right for a certain period to sell the newly developed products. Pfizer sold over $700 million worth of Viagra in 1998 after its introduction in April; "Titanic" sold $1 billion in theater tickets before it entered video sales; and Gillette's Mach3 razor blade was the top seller in the United States by the end of 1998, having secured more than 10 percent of the razor blade replacement market in less than a full year.

Patents and copyrights on new consumer products are not the only types of intangible as-

sets. New processes for making *existing* goods, such as the process for coating cookie wafers with chocolate, and new *producer* goods, like PC servers and fiber optic telephone cables, can also be patented or copyrighted or, perhaps, protected as trade secrets. Other intangible assets are brand names and trademarks, which can help a firm certify the quality of an existing product or introduce new products to potential purchasers. Not only can a reputation for quality persuade shoppers to try an item for the first time, but a clever use of advertisements can go a long way toward targeting precisely those who will gain the most from the product and thereafter become loyal, repeat customers.

Yet, because they are not investments in tangible assets, most expenditures on *intangible* assets are not recognized as investments in either U.S. companies' financial accounts or the U.S. national income and product accounts. This practice may have been reasonable when investment in such assets was a negligible portion of our total investment, but that is no longer the case. In this article, we will look at two key consequences of these accounting conventions. First, not only are reported corporate profits understated, they're understated more than they used to be because corporations are investing more of their cash flow in intangible assets. As a result, U.S. price / earnings ratios are overstated. Second, U.S. national income, saving, and investment are understated because a larger proportion of output is invested in intangibles. As we shall see, growing investment in intangibles also helps explain how the measured U.S. personal saving rate can be near zero even as U.S. wealth has grown considerably. U.S. economic and financial performance is less puzzling when we take this intangible investment into account.[1]

[1]In two previous articles in the *Business Review*, I have explored the consequences of new products and new retail practices for the measurement of inflation and output growth.

**TABLE 1**

## R&D, Tangible Investment, and Advertising Of Nonfinancial Corporations

**(as a proportion of nonfinancial corporate gross domestic product)***

| Period | Research and Development (%) | Fixed Tangible Investment (%) | R&D and Tangible Investment (%) | Advertising Expenditures (%) |
|---|---|---|---|---|
| 1953-59 | 1.3 | 12.6 | 13.9 | 4.2 |
| 1960-69 | 1.7 | 12.7 | 14.4 | 3.9 |
| 1970-79 | 1.8 | 13.9 | 15.7 | 3.4 |
| 1980-89 | 2.3 | 14.1 | 16.4 | 3.9 |
| 1990-97 | 2.9 | 12.6 | 15.5 | 4.1 |

Source: Flow of Funds, National Science Foundation, and McCann-Ericson.

*The gross domestic product originated by a firm is its revenues less purchases from other firms. Nonfinancial gross domestic product can be thought of as total nonfinancial domestic corporate revenues after eliminating double counting due to interfirm transactions. An advantage of using this measure over total revenues as a basis for comparison is that changes in corporate structure—mergers and spinoffs, for example—can affect the amount of interfirm transactions and thus change the amount of total corporate revenues even though total final production is unchanged.

**RISING INVESTMENT IN INTANGIBLES...**

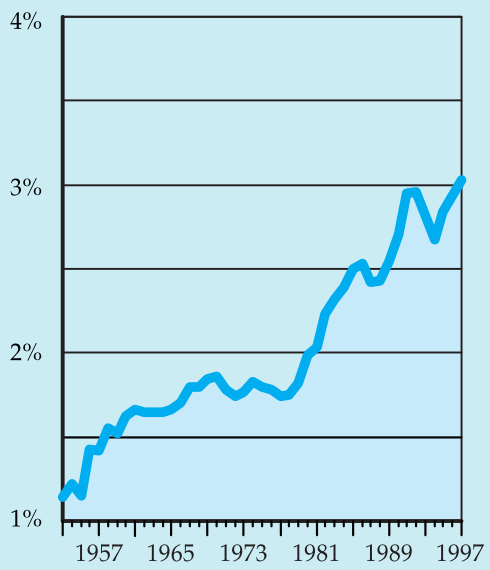
Research and development (R&D) expenditures to create new products have certainly been rising. Looking at the long sweep of U.S. data since 1953, we see that R&D expenditures have more than doubled as a proportion of nonfinancial corporate gross domestic product (GDP) (Table 1 and Figure 1). [2] By contrast, we see that tangible investment in plant and equipment (as a proportion of nonfinancial corporate GDP) was no higher in the 1990s than in the 1950s and 1960s (Table 1 and Figure 2).

During the postwar period, investment spending, including R&D, rose 1.6 percentage points as a proportion of nonfinancial corporate GDP, from 13.9 percent in the 1950s to 15.5 percent in the 1990s. All of this increase was due to R&D expenditures. Looking at Table 1, we can see that if we count R&D as investment, the years since

[2]The data we are discussing are stated in nominal terms, rather than being adjusted for inflation (i.e., in real terms). This distinction is important because prices of some investment goods—such as computers—have been declining rapidly, so firms are able to obtain a lot more computational power for their dollars today than in the past. On the other hand, these rapid technological improvements are not, by and large, reflected in the published deflators for R&D expenditures. Indeed, how to properly deflate R&D expenditures is a substantial, unsolved research question.

**FIGURE 1**

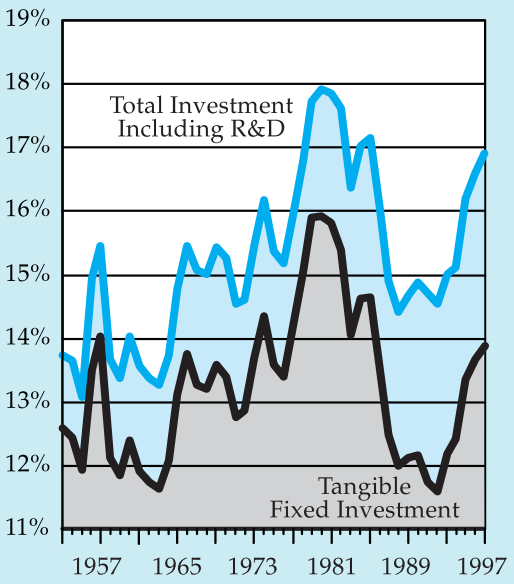
**R&D Investment As a Share of Nonfinancial Corporate GDP**




Source: Bureau of Economic Analysis: National Income Accounts; Federal Reserve System: Flow of Funds; National Science Foundation; and author's calculations.

**FIGURE 2**

**Gross Investment As a Share of Nonfinancial Corporate GDP**




Source: Bureau of Economic Analysis: National Income Accounts; Federal Reserve System: Flow of Funds; National Science Foundation; and author's calculations.

the 1970s have been ones of strong investment.

These calculations do not include a number of expenditures that might also be considered investments. *Advertising and marketing* expenditures are often a crucial cost of selling new goods, and at least some of these expenditures might well be considered investments.[3] U.S. advertising expenditures were high in the 1950s in the consumer boom after World War II, as households caught up with purchases postponed by the war. Then, advertising expenditures slipped through the mid-1970s as the consumer boom slowed. Since bottoming out at 3.2 percent of nonfinancial GDP in 1975, these expenditures have generally been rising along with spending on R&D (Table 1).

One might further argue that the *executive time* spent in support of investment decisions should be included in investment costs. Certainly, employment in executive occupations has grown in the past two decades, rising from less than 9 percent of U.S. employment in 1950, 1960, and 1970, to more than 10 percent in 1980 and more than 14 percent in 1997. (A parallel rise has occurred for manufacturing industries alone.) The rise in R&D expenditures in the 1980s and 1990s has been accompanied by increases in advertising expenditure and executive employment, some part of which was likely a necessary complement to the rise in R&D.

*Creativity* costs are generally also not included in official investment statistics and appear in the national accounts only as costs of production. For example, the investments made in "Titanic" would not be included in investment expenditures in the national accounts.

*Software* purchases are generally not considered investments either.[4] Moreover, much of the work done on a computer has an investment element. For example, a substantial part of the work of architects, engineers, artists, photographers, and scientists is now written onto computer disks (including hard drives and removable media), where it can be more easily saved and used in future projects.

These examples suggest that rising R&D expenditures are but one piece of a larger acceleration of intangible investment since the mid-1970s, much of which has not been viewed as investment in our corporate or national accounts.

## ...LEADS TO RISING STOCK MARKET VALUE OF FIRMS

One surprising aspect of the U.S. economy has been the rapid growth in the value of corporations' stock market equity. The Dow Jones Industrial Average of share prices rose from 933 in 1981 to 9300 in early 1999. This tenfold increase contrasts with the performance of nonfinancial corporations' after-tax reported profits, which went up fivefold, and with the growth of nonfinancial GDP, which went up less than 2.5 times.[5] The swift rise in share prices has led to a rise in the ratio of stock prices to current after-tax profits (called the price/earnings ratio) to a level which, while not unprecedented, has been rare (Table 2 and Figure 3). This turn of events has worried many observers and has raised the possibility that stockholders have become excessively optimistic about the value of U.S. corporations.

[3]New goods, unlike existing goods, are by definition unfamiliar to consumers. Educating consumers about a new good's existence and how to use it raises the value of the corporation's product (so it is an investment in a corporate asset) and raises the benefit received by consumers (so it is a social asset generating consumer surplus). An example is the sales force of a pharmaceutical company that rapidly disseminates information about a new drug.

[4]The Bureau of Economic Analysis has announced that for the national income and product accounts, it is likely to reclassify software purchases as investment.

[5]The growth of the market value of nonfinancial corporate equity, the S&P 500, and the Dow Jones Industrials has been approximately equal over this period.

**TABLE 2**

## Profits and Stock Market Value of Nonfinancial Corporations

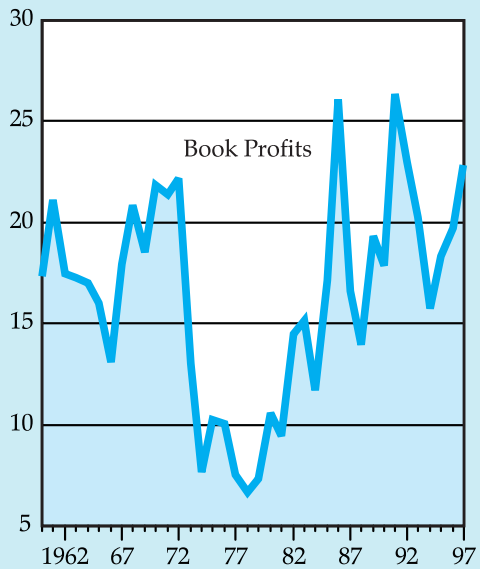
**(as a proportion of nonfinancial corporate gross domestic product)**

| Period | 1. After-Tax Book Profits (%) | 2. Stock Market Value (%) | Price-Earnings Ratio= (2)/(1) |
|---|---|---|---|
| 1953-59 | 8.8 | 110 | 12.56 |
| 1960-69 | 8.3 | 145 | 17.48 |
| 1970-79 | 7.7 | 92 | 11.90 |
| 1980-89 | 5.2 | 75 | 14.55 |
| 1990-97 | 6.3 | 127 | 20.21 |

Source: Bureau of Economic Analysis and Flow of Funds. Book profits are after-tax nonfinancial corporate profits. Stock market value is market value of nonfinancial corporate equity.

**FIGURE 3**

## Price-to-Earnings Ratio, Based on Book After-Tax Earnings of Nonfinancial Corporations




Source: Bureau of Economic Analysis: National Income Accounts; Federal Reserve System: Flow of Funds; National Science Foundation; and author's calculations.

Other things equal, the price/earnings ratio should be high when the expected growth rate of profits (and thus of earnings per share) is high relative to the rate of return that stockholders require on the shares they own. That can happen when profits are temporarily low and expected to bounce back, as was the case during the 1990-91 recession. It can also happen when profits are high, as during the second half of the 1990s, if they are expected to grow rapidly in the future.

But over the long run, profits have tended to grow at the same rate as the economy as a whole. Is there any rational reason to believe that profits should grow strongly in the future and thereby justify the high valuations placed on shares? In fact, there is. As we shall show, rising investment in intangible assets reduces measured current profits and raises expected future profits. Thus, rising new product development can help explain the high price/earnings ratio. To see how investment in intangibles affects reported price/earnings ratios, we first need to think about how we measure profits.

**Financial Accounting.** The accurate measurement of profit is fundamental to financial accounting. Profit tells us two things: how much revenues exceeded costs (a measure of the economic value of current operations of the firm) and how much the assets of the corporation have increased (before any cash distributions to shareholders). Formally, accountants define profit as

"the excess of revenues over all expenses." Expenses are "the costs of goods, services, and facilities used in the production of current revenue" (Estes, 1981). To the extent that a firm buys things that are not used up in production, those additional costs are investments, not expenses, and are capitalized, that is, considered assets. A capital asset gives rise to an expense only to the extent that the capital asset's value falls while in use, a process called depreciation or capital consumption. The intertwining of the measurement of corporate earnings and corporate assets depends on how we define investment and assets. To understand how our definitions of investment affect our measures of profit, we need to follow the details of corporate profit accounting.

**The World According to GAAP.** In the United States, corporate books are kept by certified public accountants who apply a set of rules called generally accepted accounting principles (GAAP). According to GAAP, "All R&D costs covered by GAAP are expensed when incurred," that is, R&D costs are treated as part of the current expenses of the firm, and this treatment reduces reported profit.[6] (See the Appendix, *Are All R&D Projects Lemons?*) The only part of R&D costs not expensed is purchases of durable, tangible assets "that have alternative future uses" beyond the project at hand.[7] The rationale for this treatment of R&D is, in part, that firms might be tempted to artificially manipulate profits if R&D were capitalized. For example, by pretending that some ordinary expenses of the business were R&D, the firm might disguise a loss. Another part of the rationale is that R&D expenditures are more speculative than investments in fixed assets (fixed assets may have alternative uses and thus could be sold to others, but the product under R&D may not pan out and therefore have no alternative use).

Notice that expensing R&D, by lowering profits, reduces corporate taxes and thus encourages R&D spending. But there are alternative ways to subsidize R&D if that is what we wish to do. Indeed, the federal government already provides additional subsidies to R&D through the research and experimentation tax credit.

Over the years, studies have relatively consistently shown that a firm's R&D expenditures raise the stock market valuation of that firm by at least an equal amount.[8] This finding suggests that the book value of assets would be a better guide to the true value of a corporation if R&D expenditures were capitalized, that is, treated as long-term investments and depreciated over time.[9]

Indeed, in some industries creativity expenditures are treated just this way. For example, in the film industry, the expenses of making a movie are capitalized, then depreciated over the commercial life of the property.[10] So the investing groups that produced "Titanic" had to forecast the revenues expected from movie theaters, pay-per-view broadcasts, cable TV rights, and video

[6]See Jan R. Williams, chapter 41, p. 41-04. This treatment was formalized in 1974. Before that, most companies followed "the conservative procedure of expensing such costs as incurred, rather than capitalizing any part of them," Johnson and Gentry, p. 443.

[7]That is, a computer purchased for an R&D project can be capitalized to the extent that after its current use, it will retain value because it can be used in future projects. But durable lab equipment whose only use is the project at hand should be expensed.

[8]See, for example, the article by Bronwyn Hall.

[9]Although ideas need not deteriorate over time, they do tend to lose their economic value. In particular, patents and copyrights give their owners monopoly rights over the assets for a limited time (20 years in the case of patents).

[10]Note that even though these creativity expenses are treated as investments and capitalized under GAAP, they are not treated as investments in the national accounts, as discussed earlier.

sales and depreciate the expenses of making the movie over the period in which these revenues were expected to be earned. If investments as risky as films can be capitalized and depreciated, there seems little reason to believe that an acceptable estimate cannot be made for R&D expenditures.

Fortunately, under GAAP, accountants are required to record R&D expenditures separately so that shareholders and others can be aware of them. Thus, we have data to empirically estimate what corporate profits would be if R&D expenditures were treated the same way as tangible investment expenditures.

Can expensing R&D, rather than capitalizing and depreciating it, make an important difference in how we assess the profitability of U.S. firms over the past half century? Consider Table 3. The first column represents after-tax profits of corporations as they are normally reported, so-called book profits, from Table 2. These "book profits" show that profitability as a proportion of corporate product has generally declined. True, earnings in the 1990s are higher than the low earnings of the 1980s, but both are well below earnings in the three other postwar decades. And the price / earnings ratio based on book profits averages 20.21 from 1990 to 1997 compared with only 17.48 in the 1960s.

However, book profits are somewhat deceptive. *Economic profits* are a better measure (Table 3). For one thing, economic profits correct for the fact that during the 1970s, corporate earnings were bloated by inventory "profits" that corporations earned because inventories they were holding rose in price along with everything else.[11] Furthermore, economic profits also adjust depreciation rates to reflect more accurately the

[11]This adjustment, called the inventory valuation adjustment, removes the part of inventory profit due strictly to inflation and also adopts a uniform convention for the valuation of inventories.

**TABLE 3**

## Profits and Stock Market Value Of Nonfinancial Corporations

**(as a proportion of nonfinancial corporate gross domestic product)**

| | Profits | | | | Price-Earnings Ratios | | |
|---|---|---|---|---|---|---|---|
| Period | 1. After-Tax Book Profits (%) | 2. After-Tax Economic Profits[a] (%) | 3. R&D Adjusted Economic Profits[b] (%) | 4. Stock Market Value (%) | 5. After-Tax Book Profits (4) / (1) | 6. After-Tax Economic Profits (4) / (2) | 7. R&D Adjusted Economic Profits (4) / (3) |
| 1960-69 | 8.3 | 9.3 | 9.9 | 145 | 17.48 | 15.67 | 14.70 |
| 1970-79 | 7.7 | 6.1 | 6.8 | 92 | 11.90 | 14.98 | 13.55 |
| 1980-89 | 5.2 | 6.2 | 7.1 | 75 | 14.55 | 12.19 | 10.53 |
| 1990-97 | 6.3 | 7.6 | 8.6 | 127 | 20.21 | 16.62 | 14.84 |

[a]After-tax nonfinancial corporate profits with inventory valuation and capital consumption adjustments.
[b]After-tax nonfinancial corporate profits with inventory valuation and capital consumption adjustments were further adjusted as R&D expenditures were capitalized and depreciated as described in the text.

economic lives of corporate tangible assets.[12] Even economic profits, however, treat R&D as an expense rather than as an investment.

How different would profit measures be for nonfinancial corporations if we included R&D expenditures as investments and capitalized and depreciated them? Suppose we use a relatively conservative depreciation period of six years, a figure suggested by the work of Dennis Chambers, Ross Jennings, and Robert Thompson. The third column in Table 3 shows what happens when we capitalize and gradually depreciate R&D expenditures, rather than expensing them.

R&D-adjusted profits are higher than economic profits. On average during the 1990s, R&D-adjusted profits have been 13 percent higher than economic profits and nearly 37 percent higher than book profits. More important, the amount by which R&D-adjusted profits exceed economic profits has been growing. The gap has nearly doubled from the 1960s to the 1990s, rising from 0.6 percent of corporate product to 1 percent. Hence, as we see in the seventh column of Table 3, the adjusted price-earnings ratios of the two periods are roughly equal—about 14.8.

Although other factors are undoubtedly important in explaining stock prices and earnings, treating R&D in a way that parallels treatment of tangible investment expenditures takes an important step toward improving our understanding of current stock market equity values (Figure 4). The low stock market valuations of the 1970s and the relatively high valuations of the 1960s and 1990s are easier to understand.[13]

[12]This adjustment, called the capital consumption adjustment because capital consumption is a synonym for depreciation, is necessary because depreciation charges allowed by tax law often do not match true depreciation.

[13]Still, the 1980s appear somewhat out of line, since stock market valuation in general was very low then.

And R&D is just one example of investment in intangible assets. Adjustments to account for other intangibles would have similar effects.

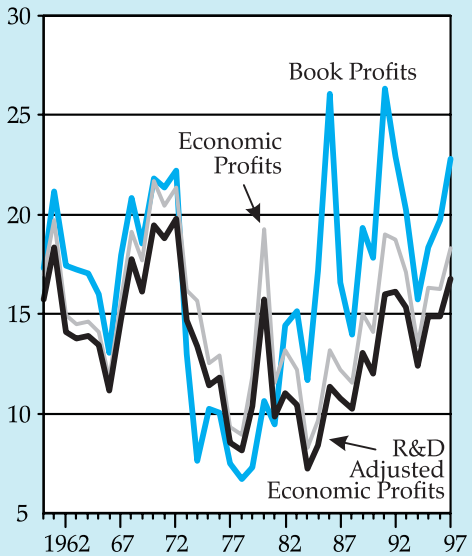
## NATIONAL INCOME ACCOUNTING AND INTANGIBLES: RISING WEALTH, FALLING SAVING

The difference in accounting treatment of tangible and intangible assets affects the U.S. national income and product accounts as well as corporate financial statements. By not counting spending on R&D and other intangible assets as investment, our national accounts understate not only investment but also national income and national saving.

Our national income accounts need not use the same investment definitions as do financial accountants; indeed, it is economic profits and

**FIGURE 4**

**Price-to-Earnings Ratios of Nonfinancial Corporations**




Source: Federal Reserve Board: Flow of Funds; and author's calculations.

not book profits that fit into our measures of national income. Nevertheless, the national income accounts do not treat spending on intangible assets as investment. Why?

**Two Types of Wealth: Intangible and Tangible.** Peter Hill, of the Organization for Economic Cooperation and Development and one of the chief modern architects of national accounting systems, has traced the exclusion of intangible assets back to the distinction between goods and services. He argues persuasively that as far back as Adam Smith, goods were material and could be stored while services were immaterial and transitory. This transitory nature meant services could not be counted as assets, but goods could. Logically, then, things counted as investment must be tangible. The role of immaterial assets, such as patents or the goodwill of brand names, was easily downplayed or ignored, given this basic dichotomy. Irving Fisher, the Yale Economics professor who invented the chain-weighted index now used to construct quantity and price indexes in the U.S. national income accounts, began his 1911 classic, *The Purchasing Power of Money*, by defining economics as "the science of wealth" and wealth as "material objects owned by human beings." This definition—that only what is material, and therefore tangible, can constitute wealth—underlies the national income accounting conventions we use to determine asset value, profit, saving, and investment. But as we have seen, tangible assets—equipment, structures, and land—are not the only assets of lasting economic value. Indeed, investment in intangible assets represents a growing proportion of our economy.[14]

More investment and higher profits mean more output and saving, too. Gross domestic product (our primary measure of U.S. production of goods and services) is constructed by summing estimates of the following: production of goods and services used by consumers and by governments, production of goods and services sold to foreigners, investment goods used by businesses, and construction of housing and other buildings. As we have seen, treating spending on intangible assets the same way we treat spending on tangible assets would raise measured business investment. Thus, similar treatment would also raise measured output of goods and services. Making the adjustment for R&D investment alone would raise measured U.S. gross domestic product in the 1990s roughly 1.5 percent.[15]

Treating investment in R&D in the same manner that we treat investment in tangible assets would raise reported national saving, too. National saving is the sum of saving done by households, governments, and businesses. Business saving is defined as retained earnings plus depreciation and amortization allowances. (Thus, business saving is that part of firms' total revenue not paid out to employees, suppliers, creditors, owners, or governments.) Treating investment in R&D the same way we treat investment in tangible assets would not only show that profits—and thus retained earnings—were higher than reported in the 1990s, but it would also make depreciation allowances larger. These two adjustments would raise reported business saving enough to raise reported gross national saving in the 1990s from 15.9 percent to 17.1 percent of GDP.[16]

[14]The Bureau of Economic Analysis has recently published a statistical accounting of R&D investment and assets (a "satellite" account) but has neither incorporated these data into its regular accounts nor kept the data up to date (see the article by Carol Carson, Bruce Grimm, and Carol Moylan).

[15]Between 1990 and 1997, R&D spending by corporations averaged $104 billion per year and GDP averaged $6.81 trillion per year.

[16]Between 1990 to 1997, gross national saving averaged $1.08 trillion per year before adjustment for R&D, but it averaged $1.18 trillion per year adjusted for R&D. GDP after adjustment for R&D averaged $6.91 trillion per year.

These numbers probably understate the importance of investment in intangible assets because they account only for R&D and not other intangible investments. Nonetheless, they make clear that standard measures of investment, output, income, and saving are systematically understated. That understatement has become bigger as intangible investment has become more important.

Though our official statistics rarely treat spending on R&D and other intangible assets as investment, the stock market recognizes that such investments usually generate future profits. That is why investment in R&D generally makes stock prices rise. The resulting capital gains are taxed when realized but are not counted in personal income. That fact helps explain why our official measure of personal saving—saving out of *after-tax* income—fell nearly to zero in 1998. (See *If the Personal Saving Rate Is So Low, Why Are We Becoming Wealthier?*)

## CONCLUSION: A NEW PARADIGM?

This article has explored how investment, profit, and saving are understated in our corporate and national accounts, particularly since the mid-1970s, because of our accounting treatment of intangible assets.[17] In fact, the U.S.

## If the Personal Saving Rate Is So Low, Why Are We Becoming Wealthier?

We have seen that firms that invest in R&D and other intangible assets generally see the price of their shares rise as a result. Those capital gains are taxed when they are realized, but they are not counted as income in our national accounts. The seemingly paradoxical result is that rapid growth of spending on R&D and other intangible assets can make stockholders' wealth grow rapidly and at the same time make their personal saving rate appear to decline. Indeed, this phenomenon helps to account for the reported decline in the U.S. personal saving rate in the 1990s.

Personal saving is measured as after-tax personal income (also called disposable income) less personal outlays. In our national accounts, capital gains are not included in personal income.[a] But taxes on realized capital gains are part of the taxes subtracted from personal income to get after-tax income. Thus, our definition of personal saving does not count capital gains as income, but does subtract capital gains taxes from income, artificially lowering measured disposable income and personal saving. Consumers have spent an essentially constant fraction of their pre-tax income since 1994. But after-tax income has fallen relative to pre-tax income in part because of unusually high capital gains taxes. So the difference between disposable income and outlays—personal saving—has fallen steadily.

According to the Congressional Budget Office, capital gains realizations likely increased about $230 billion between 1994 and 1997, and capital gains taxes rose by about $40 billion over that same period. This surge in capital gains taxes helps to explain how, in the wake of the extraordinary rise in the U.S. stock market in the 1990s, rising taxes have helped erase the budget deficit and turn it into a surplus.[b]

[a]There is a good reason for this, in that capital gains are large and volatile; in most years the change in the market value of stocks is substantially larger than the change in all other personal income. So if we included capital gains in personal income, variations in personal income would mainly represent the change in the value of stocks.

[b]Another important contributor to the surplus has been rising Social Security payments.

economy is in better condition than statistics suggest. Rising investment in intangible assets helps explain the rising value of U.S. equities. That explanation, in turn, suggests that continued strong economic growth and strong profit growth in the future are not so implausible. The economic growth that ensues from rapid development of new products has largely been hidden from economists because our accounting framework does not reveal this linkage clearly.

However, there can be no guarantee that investment in intangibles will grow as it has in the past two decades. The growth of intangible investment depends on the continuing belief that new products are waiting to be discovered, invented, and created, and the accompanying belief that such products will prove to be profitable. If the expected rate of return to intangible investment were to decline, such investment would slow.

R&D creates risks as well as opportunities. The popularity of new products can cause old product lines to be abandoned and existing businesses to become outmoded. Economist Joseph Schumpeter referred to this process as "creative destruction." In an ideal world, creativity would run ahead of destruction, keeping workers employed and consumption rising at a steady pace. In the real world, the disruptive forces sometimes gain the upper hand, and we encounter widespread unemployment, declines in asset values, and slowdowns in investment in intangibles.

In either case, in good times or in bad, we need to recognize the increasing importance of intangible investment for our economy. Otherwise, statistical conventions can cause us to misread the fundamental forces propelling economic activity.

[17]Additional discussion of how mismeasurement of inflation has contributed to the underestimation of output since the mid-1970s can be found in my 1997 *Business Review* article.

# Appendix
# Are All R&D Projects Lemons?

Accountants use balance sheets and income statements to illustrate the interrelationship of income, expenses, profits, and assets. Balance sheets present the assets of the firm, such as cash and inventory, and its liabilities, or debts. The excess of assets over the firm's debts is called the book value of equity. (This equity is listed as a liability, since it is "owed" to the owners of the business, so total liabilities, including equity, are equal to total assets.) Income statements present the income and expense flows that determine whether a profit has been made. The difference between book value of equity at the start of an accounting period and at the end of the period equals the profit shown on the income statement for that period.

Take as an example my son, Moses, setting up a lemonade stand. He starts with $5 on hand; at this point his "firm" has a book value of equity of $5 (Balance Sheet 1a). Assume, for the sake of simplicity, that the only cost of production for the lemonade stand is lemons.* Lemons cost 25 cents each, so the $5 is used to purchase 20 lemons, which are in turn used to produce lemonade, which is then sold for $10. Revenues were $10 and expenses were $5, so profit was $5 (Income Statement 1). This $5 profit is reflected in the asset balance sheet, because Moses now has $10 cash-in-hand to prove that his firm's net worth has gone up $5 (Balance Sheet 1b).

**Balance Sheet 1a**
(beginning of day)

| | |
|---|---|
| Assets: | |
| cash | $5 |
| Liabilities: | |
| Book value of equity: | $5 |

**Income Statement 1**

| | |
|---|---|
| Revenues: | |
| lemonade | $10 |
| Expenses: | |
| lemons | $ 5 |
| Profit: | $ 5 |

**Balance Sheet 1b**
(end of day)

| | |
|---|---|
| Assets: | |
| cash | $10 |
| Liabilities: | |
| Book value of equity: | $10 |

**Lemons as Tangible Assets.** Now suppose that Moses had started with $10 on hand (Balance Sheet 2a). This purchases 40 lemons, 20 of them used to make $10 worth of lemonade, and 20 stored for the next day's business. Again there is a $5 profit, for although $10 was spent on lemons, only $5 worth was used to produce current revenue (Income Statement 2). Twenty lemons went into inventory, the technical term for goods owned by the firm that are available for future use or sale. So the lemonade firm is now worth $15, consisting of $10 cash and $5 in lemon inventory (Balance Sheet 2b).

**Balance Sheet 2a**
(beginning of day)

| | |
|---|---|
| Assets: | |
| cash | $10 |
| Liabilities: | |
| Book value of equity: | $10 |

**Income Statement 2**

| | |
|---|---|
| Revenues: | |
| lemonade | $10 |
| Expenses: | |
| lemons used | $ 5 |
| Profit: | $ 5 |

**Balance Sheet 2b**
(end of day)

| | |
|---|---|
| Assets: | |
| cash | $10 |
| lemon inventory | $ 5 |
| Liabilities: | |
| Book value of equity: | $ 15 |

When a firm invests in tangible assets—in this case 20 lemons—there is no deduction from profit until the assets either are used in production or begin to depreciate or spoil. If assets depreciate, a portion of the initial expense is deducted. The principle is that the facilities used to produce current revenue are a cost only to the extent that their value has declined during use. For example, if four of Moses' lemons spoil, his $5 inventory will decline in value to $4. In this case, the firm's accounts would show spoilage of $1, profits of $4, and a lemonade firm worth $14 (Income Statement 3 and Balance Sheets 3a and 3b).

| **Balance Sheet 3a** (beginning of day) | |
|---|---|
| Assets: | |
| cash | $10 |
| Liabilities: | |
| Book value of equity: | $10 |

| **Income Statement 3** | |
|---|---|
| Revenues: | |
| lemonade | $10 |
| Expenses: | |
| lemons used | $ 5 |
| lemon spoilage | $ 1 |
| Profit: | $ 4 |

| **Balance Sheet 3b** (end of day) | |
|---|---|
| Assets: | |
| cash | $10 |
| lemon inventory | $ 4 |
| Liabilities: | |
| Book value of equity: | $14 |

**Are All R&D Projects Really Lemons?** So far, we have said nothing about intangible investment. Again, let's suppose Moses starts with $10 cash-in hand (Balance Sheet 4a), but let's suppose he is also a designer, who spends $5 developing a lemonade-pitcher design and sells $10 worth of lemonade using $5 worth of lemons. According to standard accounting principles, his firm's total revenue is $10, and the cost of the R&D to design the lemonade pitcher is expensed, that is, counted as a cost of current operations, not as an investment. In other words, the investment in the design of the lemonade pitcher is treated as an additional cost of making the lemonade. The day's profits are zero (Income Statement 4). The accounting value of the lemonade firm is $10, the proceeds from the sale of lemonade (Balance Sheet 4b). Until Moses sells the lemonade-pitcher design, the design's accounting value is zero. If Moses can later sell the lemonade-pitcher design for $10, the firm will recognize a capital gain of $10 and an extraordinary profit of $10. The profit, in accounting terms, will appear out of nowhere. Put another way, accounting procedures treat all R&D efforts as if they are destined to be failures— they produce zero assets until proven otherwise.

| **Balance Sheet 4a** (beginning of day) | |
|---|---|
| Assets: | |
| cash | $10 |
| Liabilities: | |
| Book value of equity: | $10 |

| **Income Statement 4** | |
|---|---|
| Revenues: | |
| lemonade | $10 |
| Expenses: | |
| lemons used | $ 5 |
| design costs | $ 5 |
| Profit: | $ 0 |

| **Balance Sheet 4b** (end of day) | |
|---|---|
| Assets: | |
| cash | $10 |
| Liabilities: | |
| Book value of equity: | $10 |

*Thus to avoid cluttering up the analysis, we assume that the sugar, water, cups, and labor normally used in selling lemonade are not necessary in this case or, perhaps more realistically, are supplied free by Moses' dad.

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