Investing in Intangibles:
Is a Trillion Dollars Missing from GDP?

BY LEONARD NAKAMURA

In the 1990s, Americans saved less, but they became wealthy at an astonishing rate. What underlies this paradox of a lower savings rate coupled with increased wealth? As Leonard Nakamura states in this article, the short answer is capital gains. Stock-market capital gains are excluded from our measures of national income, yet they account for about half of the increase in American households' net worth in the past two decades. Nakamura discusses the pros and cons of including capital gains in national income accounts.

Writing *David Copperfield* in 1849, Charles Dickens put these rueful words into the mouth of the feckless Mr. Micawber: "Annual income twenty pounds, annual expenditure nineteen, nineteen six, result happiness. Annual income twenty pounds, annual expenditure twenty ought and six, result misery."[1] The inability to save leads to the poorhouse, as Dickens well knew, since his father's debts had done just that to his family. But in the 1990s Americans saved less and less, according to official U.S. statistics. Yet far from being miserable, they became wealthy at an astonishing rate.

What underlies this paradox of a small saving rate in tandem with increased wealth? The short answer is: capital gains. Specifically, saving and wealth gains diverge because of a convention in the U.S. income accounts that makes a good deal of sense. Because capital gains are so volatile, the national income accounts include only part of investment income: dividends and interest payments.[2] Capital gains are excluded, yet capital gains from the stock market have been responsible for about half of the increase in the net worth of American households in the past two decades.[3] This rise in capital gains has occurred because firms can reward shareholders either with dividends or with capital gains, and U.S. corporations have been retaining more of their earnings in the form of intangible investment and not paying them out in dividends.[4]

The official measure of U.S. household saving, the personal saving rate, is, like all economic statistics, a compromise between a theoretical ideal and the practical limitations of existing data.[5] Ideally, we expect key statistics, such as the saving rate, real GDP growth, and consumer price inflation, to convey important information as clearly

[1] Micawber's money is in pounds, shillings, and pence. There were 20 shillings to a pound and 12 pence to a shilling.

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[2] See the article by Richard Peach and Charles Steindel for an interesting discussion of this problem and the importance of realized capital gains (capital gains that investors have received by selling their investments and, thus, can be used to pay for consumption).

[3] The market value of domestic corporate equities rose $12 trillion, from $2 trillion at the end of 1979 to $14 trillion at the end of 2000, in 1996 dollars. During that time, the total net worth of U.S. households (which hold almost all of domestic equities) rose $23 trillion, from $15 trillion to $38 trillion. By contrast, real estate holdings of U.S. households rose by about $6 trillion during this period.

[4] See the article by Eugene Fama and Kenneth French.

[5] Reports about saving usually focus on household saving, that is, personal saving. Personal saving is defined as disposable (that is, after-tax) personal income less personal outlays (personal consumption expenditures plus transfers abroad). Personal income includes dividends and net interest payments from corporations, but not capital gains. It also includes wages and salaries, employment benefits like health insurance, noncorporate income such as proprietors' income and rental income, and net transfers from government, such as Social Security benefits.

as possible. In this ideal, a very low saving rate should not be compatible with substantial and sustained creation of wealth.

Let's look at Mr. Micawber again. If he has a steady income of 20 pounds a year and no capital assets, determining his income is simple: 20 pounds. And regular income, such as paychecks, are generally what our statistics measure. But what if Micawber owns some stock? Then measuring his income is no longer so simple. If his stock rises in value from 10 pounds to 11 pounds, should Micawber's income be calculated as 20 pounds or 21? And how should Micawber report his income when his paper profits disappear and turn into a paper loss? A key question then for Micawber's budget problem is: given that stock prices go up and down, how much of the gain can he rely on, and thus, how much can he afford to spend?

If we include capital gains in personal saving, the U.S. saving rate, properly measured, has generally risen rather than fallen.[6] But improving our statistical measures is by no means straightforward. Why? Fortunately for our economic well-being, but unfortunately for the credibility of our statistical measures, economic activity is increasingly concerned with the creation of new products. This type of economic activity is difficult to capture accurately in our economic measures. In fact, given how we construct the personal saving rate for the United States, a low or even negative saving rate is likely to coexist with substantially accelerated creation of wealth.

Shedding some light on this paradox of diminished saving and increased wealth and why it's difficult to eliminate it is the purpose of this article.

RESOLVING THE PARADOX

Why did wealth accelerate? Were we lucky? Or were we actually saving more, but miscounting it? To the extent that saving was undercounted, we should expect wealth gains to be sustainable in the future. But if all the gain was due to good luck, we must reduce our consumption relative to our incomes if we want our wealth to continue to grow over the long run.

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What we save can be measured as the resources we, as a society, put toward the future — the labor and capital devoted to new investment rather than immediate consumption. But investing is often risky: an investment sometimes returns a multiple of the original investment, but sometimes much less. When estimating GDP, we can calculate investment by measuring how much we invested or by measuring the outcome of the investment, that is, the net wealth generated.

Recently, in fact, the dot-com bubble gave us an object lesson in the difference between resources invested and wealth created, since much of the investment made in this sector has come to naught. This outcome is, unfortunately, all too typical when we try to create new products. The risk intrinsic to investing in new products means that the outcome of the investment and the dollars invested are very likely to be different.

Intangible assets are primarily derived from the property rights to which firms become entitled when they create new goods and services. We can use the analogy of cooking to divide economic activities into the creation of new menu items (creating recipes) and the actual production of food ready for the diner (following recipes). Intangible investment is the creation of recipes, and the intangible asset created — the result of the recipe — is the patent, copyright, trade secret, or brand name that protects the creator's right to exclusively reproduce or use the recipe. When a private corporation uses this right to sell new items, it can charge a monopoly price to consumers, and thus — if the new item is highly desirable — earn outsize profits on these assets, profits that repay the cost of creating the item. In turn, once private investors recognize the value of the creation, the corporation's stock-market value will rise, causing its shareholders' wealth to increase.

Even if we include the effects of the recent downturn in the stock market, in the past two decades, the wealth of U.S. households has increased dramatically, and much of this increase has taken the form of these stock-market capital gains due to successful investments in intangible assets.

Taking account of this investment has become more pressing because investment in intangible assets has become a bigger part of the U.S. economy. In the past, most business investment took the form of tangibles: equipment such as trucks, computers, and typewriters; and structures such as office buildings, shopping malls, and homes. But in the past 20 years, accelerating investment in intangibles — investments that result in patented discoveries like Viagra and Celebrex or copyright-protected products such as Windows2000, Pentium, and Harry

[6] I argue this case in my working paper, "What Is the U.S. Investment in Intangibles? (At Least) One Trillion Dollars a Year!"

Potter — has increasingly driven U.S. firms and raised their economic value. However, investing in intangibles is much riskier than investing in tangibles. And taking that riskiness into account is not easy.

There are two different approaches we can take: measuring outcomes or measuring more intangible investment. And each approach gives us a different answer.

If we measure outcomes, we ought to include stock-market capital gains as part of income. This gives us a measure that is useful in tracking wealth. However, including these capital gains in our definition of income makes income much more volatile than other measures of economic activity, such as employment.[7] Also, if we include capital gains in income, the personal saving rate, on average, would have been much higher over the 1990s, but also more volatile.

An alternative is to include more intangible investment as measured by the cost of the inputs — the resources used in this investment — rather than counting capital gains, which are a measure of the success of the investment. If we adopted this approach, measured corporate retained earnings and private gross saving would be larger, but the personal saving rate would likely remain low.[8]

CLASSIFYING OUTPUT AND MEASUREMENT

Measuring economic output entails a fundamental issue: how to avoid double-counting it. For example, when a consumer buys two scrambled eggs at a diner, we count the tab as part of output. We don't want to count separately the feed that the hen ate because the cost of feed is part of what the consumer paid for. The feed is an intermediate output used in producing the final output, scrambled eggs.

This same rationale might be used to exclude saving and investment from measures of national income. We *could* treat investments as intermediate goods because ultimately they are also incorporated into final consumption goods. After all, a truck's value to consumption derives from its role in production: hauling goods that are ultimately consumed. Similarly, without a stove, a short order cook can't make scrambled eggs.

Two Good Reasons for Counting Investment as Part of Output. But one reason we may wish to count investment as part of output is that we could have used the resources that went into investment to simply increase consumption today. By its very nature, investment takes resources that might otherwise have been consumed to create a product whose value will only be fully realized over time. If we fail to include investment as part of output, we undercount the potential productivity of our existing resources and omit the opportunity cost of the investment, that is, what else we could have done with our inputs.

A second reason for counting investment as part of output is that it represents a store of value. Investing in a truck or stove is valuable because these items can be used to help us create more consumables in the future. By counting these investments as part of output, we recognize that when investments succeed, our wealth increases. Our wealth, in turn, will enable us to consume more in the future. Not counting additions to wealth ignores the future output that this wealth could produce.

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But Intangibles Have Not Been Counted. Historically, in the U.S. national income accounts, only tangible investments in equipment and structures have been included in our measures of investment. Until very recently, investment in intangibles has been ignored. Intangibles have traditionally been treated just as if they are intermediate goods and services that need not be counted because they are subsequently incorporated into final goods and services. But because intangible investment uses resources to create products whose value is not immediately realized, failing to count it understates both our current ability to produce and our assets. When we incompletely count assets whose purpose is to increase future production, we will be surprised by the extra income earned subsequent to the investment, and profits will grow faster than anticipated.

Beginning in 1998, the Bureau of Economic Analysis (BEA) has included software as the first intangible investment in its measure of GDP. Between 1998 and 2000, measured

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[7] Some of this volatility reflects fundamental volatility in the economy, while some of it reflects uninformative noise. Disentangling the two sources of volatility is very difficult, particularly over short periods.

[8] Total national gross saving includes personal saving, corporate gross saving, and government saving. Corporate gross saving includes retained earnings and depreciation allowances. As we include more intangibles in gross investment, both measured retained earnings and depreciation allowances will rise. Only when dividends rise (shifting saving from the corporate sector to private households) to fully reflect increases in corporate profits will the personal saving rate return to its longer run average.

business investment in software rose from $140 billion to $183 billion, in current dollars.

Other investments in intangible assets, such as research and development (R&D), movie and book production, designs and blueprints, and the advertising associated with the new products produced, could also be included in output. Because these are important sources of wealth creation, it seems likely that the BEA will eventually do so. In the meantime, official statistics in the United States will continue to understate output and saving.

MEASUREMENT PROBLEMS: GREATER BECAUSE INTANGIBLES ARE RISKIER

A substantial difference between tangibles and intangibles is that the production process for tangibles is much less risky than that for intangibles. When a truck or an oven is produced, the outcome — and its value — are highly predictable. Mass production, by its very nature, churns out multiple, identical copies of the same product. If a firm spends $10 million to equip a factory, the value of that equipment is relatively easy to document.

Mass-produced equipment often has a second-hand market in which the value of the used equipment can be determined. Indeed, in some cases, such as cars and trucks, standard estimates of the value of "pre-owned" equipment are published. Moreover, accountants and auditors can verify the existence of the asset. If the equipment loses its value in the second-hand market, and the purpose for which the equipment was bought turns out to be worthless, the accountant is supposed to write off the investment, deducting it as an expense.

When firms invest in intangibles, on the other hand, the product of the investment is unique and often hard to evaluate objectively. In fact, the product often turns out to be worthless. When a firm invests in producing a design, a movie, or a drug, it hopes to end up with something sufficiently original so that it will have, at least for a time, a monopoly of some segment of the market. For the monopoly to have substantial value, the intangible asset must offer something no other product on the market offers.

But efforts to produce what no one has been able to make before often misfire. For example, many drugs that are promising in theory and that work well in the laboratory or on animals turn out to be unsafe or ineffective for human patients in clinical trials. Other drugs turn out to be worth tens of billions of dollars. A large pharmaceutical company may have dozens of drugs in its development pipeline. Generally, less than one in 10 will earn back more than its cost, but that one success may well justify all the failures and make a company's overall research program a success.

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Frederic Scherer and Dietmar Harhoff's research on patents issued in the United States and Germany showed that the most valuable 10 percent of patents accounted for between 81 percent and 93 percent of the total value of the sets of patents studied.[9] In their sample of 772 German patents, for instance, the top five — less than 1 percent — accounted for 54 percent of the value of the pool. Thus, a disproportionate part of the value of all projects is included in a few successful projects.[10]

A firm making a $10 million investment in each of 10 new products may wind up with an asset worth nothing nine times out of 10, but the tenth time may produce an asset worth $100 million. Realizing the long odds against success in intangible investment, accountants have opted to write off intangible investments — acting as if they were intermediate products that did not result in wealth creation. And if the samples in Scherer and Harhoff's study are a good guide, writing off the investment will be the right thing to do in most instances. But the right thing to do most of the time is, on average, the wrong thing to do. Why? Because the few investments in intangibles that do succeed may well be worth more than all other investments put together. In the example above, the firm's 10 investments turn out to be — in all — worth $100 million. So if the firm had written off none of its investments, it would have much more accurately represented its total investment than if it had written off nine out of the 10 – or 10 out of 10, as is current practice.

A Successful Investment in Intangibles: An Example from Pharmaceuticals. As an alternative to current practice, what about measuring inputs? Consider a pharmaceutical company that does research to discover a drug that will cure a previously

[9] The studies that Scherer and Harhoff survey include corporate patents, university patents, and pharmaceutical patents.

[10] Technically speaking, these sorts of risks are said to have highly skewed probability distributions.

incurable disease. For example, in June 2000, Eli Lilly announced its belief that Xigris, its treatment for septic shock, would pass its final trials and that its application to the Food and Drug Administration would be successful.[11] Test results indicated that Xigris would save perhaps 20,000 lives annually and earn Eli Lilly as much as $1 to $2 billion annually in profits over the next decade.

Eli Lilly's expenditures on Xigris — including the research that went into discovering its use as a treatment for septic shock, the clinical trials to establish the safety and efficacy of the treatment, and efforts to publicize and market the drug to doctors and medical systems around the world — are investments that will bear fruit in the form of substantial profits over an extended period.

However, our national accounts don't include these expenditures as investments. Instead, these expenditures are treated as expenses — as if they were part of the inputs into products Eli Lilly is currently selling. To draw a parallel, consider two other types of expenditures Lilly might make. One is the purchase of equipment for mass producing a drug. This equipment is considered an investment because it will continue to produce output well after the year of its purchase. Another type of expenditure is the purchase of ascorbic acid, which will be used in a chemical process to make a particular drug. The ascorbic acid will be almost completely used in the year it is purchased, and it is one of the costs that Lilly rightly expenses in making that particular drug. Similarly, by calling research and development an expense, we are in effect saying that when the R&D is finished, Eli Lilly doesn't possess a valuable asset. And that is surely not the case.[12]

> Another important difference between tangible and intangible investing is that the firm that makes tangible capital goods is typically different from the firm that will use them.

On the day Eli Lilly announced the likely success of its drug (no previous septic shock treatment had been successful), its stock-market value went up $16 billion. Will Xigris' profits justify this increase in value? Given the size of the potential market for the drug and the number of lives it could save, analysts who follow Lilly judged that this single product could well be worth $10 billion or more.

However, Lilly did not invest $16 billion to produce Xigris. Indeed, from 1980 to 1999, Lilly's entire R&D budget, not adjusted for inflation, was $15.1 billion; carried forward to 2000, this investment had a present value of about $40 billion. Because of its unusual success, Xigris alone could justify much of Eli Lilly's R&D investment for the previous two decades.[13]

This example demonstrates that from the perspective of reporting to shareholders, as well as for internal corporate operations, there should be a strong presumption against the premature expensing of intangible investments because doing so understates the profitability of current operations. For example, a corporation might capitalize and depreciate intangible assets according to a predetermined schedule, just as it would a tangible investment. Only when it's clear that a whole group of intangible investments has failed would the corporation write them off as an expense.

Furthermore, this example shows that the resources that go into a risky intangible investment rarely equal its product. The economic resources used in producing an intangible asset will rarely even approximately equal the market valuation of the results of the new product development.

By contrast, in a mass-production economy, input almost always equals output. That is, any given

[11] Specifically, Eli Lilly released an announcement that the trial would be closed to new patients earlier than planned.

[12] This represents a fundamental problem in accounting for investment in intangible assets, one probably not entirely solvable using standard accounting treatment of investment. Tangible investments are capitalized, then depreciated. That is, when the expense is first incurred, it is charged to the capital account and not deducted from current revenues. Then, over time, as the tangible asset declines in value, the depreciation is subtracted from current revenues, or expensed. By contrast, since accountants don't want to include as investment assets that cannot be concretely evaluated, intangible assets are expensed when incurred, rather than over time. As corporate investment shifts away from tangibles toward intangibles, current profits become understated. See my 1999 *Business Review* article.

[13] In addition to Xigris, Eli Lilly's research has also produced Prozac, an antidepressant, and Zyprexa, a treatment for schizophrenia, whose market values were even greater than that of Xigris. As we went to press in October 2001, the Food & Drug Administration had not yet approved Xigris for sale. In measuring Lilly's investment in developing new products, it is not obvious that failures should be written off, since the successful few were expected to make up for these losses. Certainly Lilly's intangible assets are greater than its total R&D investments. And on average, accountants have found that R&D expenditures result in future profits that justify these investments (see the articles by Dennis Chambers, Ross Jennings, and Robert Thompson.; Baruch Lev and Theodore Sougiannis; and Doron Nissim and Jacob Thomas).

input will almost certainly result in a salable product. As production of intangible assets becomes a more important part of the U.S. economy, this tight, contemporaneous relationship between input and output weakens. Whether any given input will lead to a salable output becomes difficult to predict for individual firms.[14]

Intangible Investments: Hard to Measure, But Not Impossible. Another important difference between tangible and intangible investing is that the firm that makes tangible capital goods is typically different from the firm that will use them. For example, the firm that will use — that is, invest in — computers will generally buy them from another firm rather than making them itself. This makes the investment highly visible: a transaction has occurred, and money has changed hands to attest to the investment's value.

By contrast, intangible investment is generally done in-house: Intel's chips are designed by its engineers, Microsoft's software is designed by its programmers, and Eli Lilly's drugs are developed by its biochemists. So the outlay made to create intangibles is harder to verify. Moreover, while some expenses are clearly aimed at creating intangible assets, other expenses are harder to determine. For example, it is difficult to know how much of a chief executive's time is devoted to producing intangibles and how much to coordinating production.

But it is not impossible. Some corporations attempt to allocate expenses to current production or to future projects. Such corporations require their employees to report work hours on a project-by-project basis. These projects can be classified into those that contribute to current production and those that produce intangible assets. Thus, it might be possible for a corporation to divide money spent on sales and general and administrative needs into expenses for current production and intangible asset production. Doing so might well provide a corporation with a measure of the resources that go into intangible investment that would be of substantial value to its shareholders. If this practice became widespread, statistical analysis would then be possible to evaluate which proportion of these expenditures result in the creation of an intangible asset.

There are cases in which the intangible investment yields a salable asset. When Chrysler designs a new car, or Eli Lilly develops a new drug, or J.K. Rowling writes a new Harry Potter novel, the design, or the drug, or the novel is a product that could be sold to the highest bidder for a fixed sum. Indeed, this sometimes happens. A design firm such as Pininfarina can design a car for a manufacturer; a small biotech start-up may sell a new drug to a major pharmaceutical company; and a writer may be commissioned to ghost write a book. In these cases, there is no real problem in classifying each of the sales as either income or output.

But with intangible assets it's more difficult. Most of the time, there is no direct transaction to tell us what the intangible asset is worth. Transactions that do tell us about the value of intangible assets are capital transactions: the buying and selling of the equity shares of firms that have invested in and produced the intangible assets. So our only way to measure the success of the vast majority of investment in intangible assets is changes in the stock-market value of firms — which are highly volatile.

MEASURING INCOME AND OUTPUT THROUGH INPUTS AND OUTCOMES

Are there practical ways to measure the major *inputs* that go into producing intangible assets? If there are, and if most of our investment outcomes are the result of such inputs, we will, over the long run, account for most wealth creation without the sharp ups and downs of the stock market overly influencing our statistics. We do have reasonably good measures of investment in R&D, advertising, and software. But the discussion in this section underscores the difficulties in measuring production of most intangible assets, and the

[14] Output and employment are also closely associated in mass-production economies — so much so that economic forecasters have summarized the relationship in Okun's law. A recent formulation of Okun's law states that a decline of 2 percent in real output will be reflected in an increase in unemployment of 1 percentage point. (See the article by Glenn Rudebusch.) This relationship would not hold if income included capital gains.

estimates noted are generally conservative estimates of investments in intangibles.

Consider the various input costs that go into making a new good available to consumers. In the case of a prescription drug, a disease must first be targeted, and an approach to its control or cure must be established. Then a chemical compound must be discovered or constructed that effects the required control or cure. Next, the chemical compound must undergo animal trials, then human clinical trials. Initial clinical trials establish that the compound is safe and effective. A third round of clinical trials involving large numbers of patients and doctors must determine the range of symptoms for which the drug is effective and the appropriate dosages. These data must be presented to the Food and Drug Administration for approval; a process for mass production for the compound must be designed; and teams of sales personnel must instruct doctors and nurses around the world in the use of the compound. The company may further directly inform patients through print or broadcast media advertising.

Costs of research and development, administration, marketing, and media advertising all enter into the intangible investment. The firm making these investments must believe that these fixed costs will at least be repaid, on average, by the returns to successful intangible assets.

Research and Development. According to National Science Foundation estimates, in 2000, U.S. corporations spent $181 billion of their own funds on R&D. This expenditure represented 3.3 percent of the gross domestic product of nonfinancial corporations and 1.8 percent of total GDP.[15] By contrast, in 1978, such corporate R&D expenditures were 1.8 percent of nonfinancial corporate GDP and 1 percent of aggregate GDP. Both of these figures probably underestimate R&D expenditures. Firms that invest in R&D typically have to make additional expenditures to support product development, including marketing, consumer testing, and executive decision making, that are not part of the engineering and scientific expenses that account for most of what the National Science Foundation calls research and development.

> [Prepackaged software] sales to *firms* were counted as expenses, not investment, until the BEA changed its method in 1998.

Advertising. According to advertising agency McCann-Erickson, firms spent $233 billion on advertising in 2000. This expenditure represents 2.3 percent of GDP, up from 1.9 percent in 1978. However, McCann-Erickson's data reflect the market for advertising agencies; they do not include many other marketing expenses that firms incur, such as the sales forces of pharmaceutical companies or fees paid to public relations firms and athletes — marketing expenses that have been rising faster than agency fees. To the extent that firms spend this money to inform consumers about new products, advertising and marketing expenditures should be counted as investments in intangible assets because the information supplied to consumers through these avenues will generate profits over a sustained period.

Software. One area in which the national income accounts have come to grips with measuring investment in intangibles is software. According to the BEA, in 2000, private businesses invested $183 billion in software, or 1.8 percent of GDP, compared with 0.3 percent in 1978. This software investment comes in three types: prepackaged software; custom software; and own-account software.

Prepackaged software ($61.4 billion in 2000) is sold at arm's length, that is, the company that invests in the software is different from the company that makes it. Sales of prepackaged software to *consumers* have always been counted as consumer expenditures. But such sales to *firms* were counted as expenses, not investment, until the BEA changed its method in 1998. Note that as part of the investment in new software, firms must also train their employees in the use of the software.[16] Thus, purchases of software underestimate the total resources firms must allocate when they invest in new software.

The software investments of firms that purchase prepackaged software do not include the intangible investments made by the producers of

[15] In addition, the National Science Foundation estimates that governments in the U.S., mainly the federal government, spent $72 billion on research and development in 2000, while universities, colleges, and other nonprofit organizations spent an additional $12 billion. In all, $265 billion is estimated to have been spent on research and development, or roughly 2.6 percent of aggregate U.S. GDP. Expenditures by private industry are counted here because all of this expenditure has as its purpose the creation of private intangible assets. Moreover, the public expenditure on research and development is already included in gross domestic product as part of government expenditures. It is also the case, however, that, increasingly, universities, colleges, and other organizations and individuals take advantage of research sponsored by the federal government or nonprofits to license new product development, thereby creating intangible assets.

[16] This point was emphasized by Shinkyu Yang and Erik Brynjolfson.

the software. A company's investment in creating software is separate from the purchasing company's investment in software. For example, Microsoft's investments in producing the Windows operating system and in the Microsoft Office suite of products are separate from the investments that corporations make when they buy these programs. Microsoft's value as an ongoing concern resides primarily in the intellectual property rights it holds for the software it has created and is separate from the value created by other firms' investments to acquire licenses to use Microsoft Windows and Microsoft Office.

Custom software is also purchased, but like custom clothing, it is uniquely adapted for the buyer ($57 billion in 2000). In some of these cases, the rights to the software are sold to the buyer. In other cases, a substantial proportion of the software rights remain with the software producer. When property rights remain with the producer, custom software sales data may understate the value of the producer's investment.

Own-account software is made by employees of the user ($64 billion in 2000). To measure investment in own-account software, the BEA examines how many programmers are employed at firms that don't sell software and estimates how much of their work goes into developing new software (investment) versus maintenance and repair of existing software (expense). The most recent study of this division, which was published in 1982, found that 62 percent of programmers' time was spent on creating new programs.[17] The BEA estimates that since then, programmers have become more involved in repair and maintenance. Therefore, the BEA counts 50 percent of programmers' time as new software investment, a figure it describes as underscoring the arbitrariness of such measures.

Other Industries' Data Are Sparser. Expenditures on R&D, advertising, and software do not exhaust, by any means, firms' expenditures on intangibles. For example, most financial corporations do not report their expenditures to develop new products as R&D expenses. Yet financial corporations have been making a large and growing investment in financial innovations, including investment vehicles like derivatives and mutual funds, electronic payment systems, ATMs, and credit and debit cards. They have also invested large sums in customer databases and in customer relationships associated with these new instruments.

Almost no data are collected on financial corporations' expenditures on intangibles.[18] However, financial corporations' noninterest expenditures have been rising rapidly. For example, in 2000, noninterest expenditures for commercial banks were $215.5 billion, or 2.1 percent of GDP, up from 1.6 percent of GDP in 1978. Noninterest expenditures include commercial banks' innovations and marketing expenses, but they are only an *indicator* of banks' investment in intangibles because they also include expenditures for tellers and bank branches. The market value of financial institutions has recently averaged more than 20 percent of the market value of nonfinancial corporations, compared with around 11 percent in 1978. If financial corporations spend proportionally as much on R&D as nonfinancial corporations report spending, this would add another $50 billion to R&D. Commercial banks alone have added more than $50 billion in noninterest expenditures in this same period. And that neglects the innovative expenditures of mutual funds, insurance companies, real estate firms, other depositories, or investment banks.

> During the earlier period of relatively high saving rates, Americans did not become rich, and as measured saving fell during the 1990s, Americans' wealth increased dramatically.

Writers, artists, and entertainers make additional investments in intangibles, and these investments are not recorded as part of R&D. In 1997, according to the U.S. economic census, the publishing, motion picture, and sound recording industries had a total revenue of $221 billion. Associated with this stream of revenues are investments in creativity and in finding, developing, and publicizing artists and their work.[19]

Much of the investment in movies, television, and other media pays off quickly because it shows up in movie-theater ticket sales or videotape rentals. Other programming costs, such as many television network broadcasts, are paid for by advertising. However, as Richard Caves points out, television series are produced at a loss — the network's payment for first broadcast rights does not cover the production costs of the series. What producers hope for is that the series will run long enough (three to five seasons has usually been

[17] Thus this study comes from the era before the widespread use of personal computers and computer networks.

[18] See the article by Bob Hunt.

[19] See the book by Richard Caves.

the minimum) so that reruns can be profitably syndicated. Syndication will sometimes pay substantially more than the initial broadcast rights. Similarly, a movie series like "Star Wars" can become a multibillion dollar property, since sequels, video games, toys, and clothes based on the series can be sold.

All told, it can be argued that when the inputs that make up intangible investment are measured more accurately, domestic U.S. corporations' investment in intangibles is likely in the range of $700 billion to $1.5 trillion.[20]

STOCK-MARKET CAPITAL GAINS: USING OUTCOMES TO MEASURE INCOME

The official measures of household income include dividend payments but not stock-market capital gains. The measured personal saving rate is low because stock-market capital gains are high and dividends are low. Personal saving in the United States was low throughout the 1990s, but the net worth of Americans increased from $20 trillion to $41 trillion from the end of 1989 to the end of 2000. Adjusting for inflation, this figure represents a real increase, in 1996 dollars, of $14 trillion (from $24 trillion to $38 trillion).[21] During the three decades before 1990, the U.S. personal saving rate (the ratio of personal saving to disposable personal income) averaged 9 percent. From 1952 to 1989, the annual personal saving rate never fell below 6.9 percent (Figure).

By contrast, in the 1990s, the saving rate averaged much less, 6 percent, and fell during the course of the decade, from 7.8 percent in 1990 to 2.4 percent in 1999. In 2000, it was 1 percent.

But during the earlier period of relatively high saving rates, Americans did not become rich, and as measured saving fell during the 1990s, Americans' wealth increased dramatically. This puzzle remains whether we measure savings and wealth in nominal terms or in real terms.[22]

During the 1960s and 1970s, stock-market capital gains were 0.4 percent of GDP. During the 1980s they were 3.7 percent of GDP, and in the 1990s, 16.0 percent.[23] If we use these averages over decades to smooth growth, then from the 1970s to 1980s, the nominal and real growth of the economy, including stock-market capital gains, may have been 0.3 percent higher than reported, and from the 1980s to the 1990s, about 1.2 percent higher.[24]

If we attribute this rate of capital gains to intangible investment,

[20] Further discussion of a variety of data that suggest this is in my working paper.

[21] Specifically, we've used the GDP deflator to eliminate the effects of inflation.

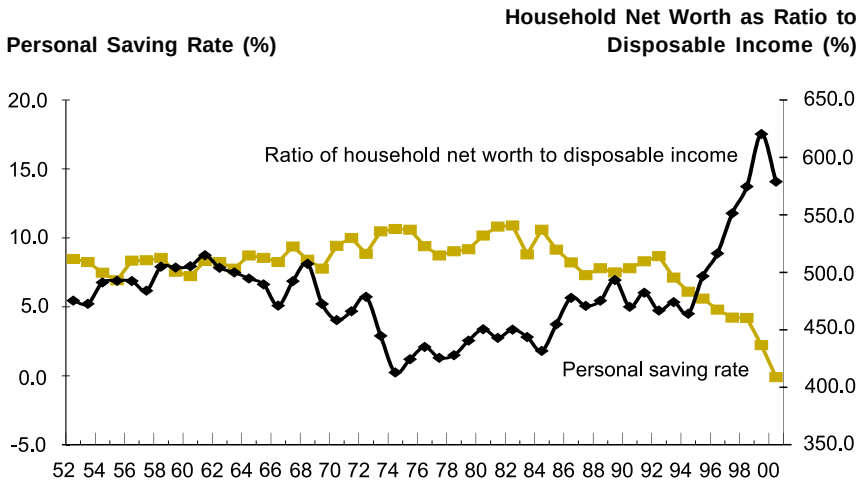
[22] In nominal terms, during the three decades before 1990, the net worth of American households as a proportion of after-tax income actually fell slightly, from 504 percent to 493. So with the lower saving rate of the 1990s, we might have expected a still lower net worth. Instead, net worth rose to 620 percent of after-tax income at the end of 1999, before falling to 579 by the end of 2000. Alternatively, in real terms, net worth, measured in 1996 dollars, rose from $8.4 trillion at the end of 1959 to $23.4 trillion at the end of 1989 — a $15.0 trillion increase over 30 years and a compound annual growth rate of 3.5 percent. By the end of 1999, net worth rose to $38.1 trillion — a $14.7 trillion increase in just 10 years and a compound annual growth rate of 4.8 percent. Thus, whether we compare increases in wealth with nominal incomes or with consumer price inflation, households' wealth grew more rapidly in the 1990s than in previous decades.

[23] From the end of 1959 to the end of 1979, capital gains on equities of domestic corporations, according to the Flow of Funds accounts, averaged just $12.8 billion a year in 1996 dollars, while real GDP averaged $3.6 trillion. From the end of 1979 to the end of 1989, yearly stock-market capital gains averaged $209 billion while real GDP averaged $5.6 trillion. From the end of 1989 to the end of 1999, annual stock-market capital gains averaged $1.2 trillion while real GDP averaged $7.6 trillion.

[24] Thus, if we add capital gains to output, much of the productivity slowdown after the mid-1970s may disappear.

FIGURE

Saving and Wealth



intangible investment must have been quite large. As measured by inputs, investments in intangibles add up to $1 trillion a year.[25] If so, this can help explain why capital gains have been so large.

Some Consequences of Excluding Capital Gains. Excluding capital gains from our measures of household and national income has several disquieting consequences. First, the household saving rate is very low and likely to remain so as long as stock-market capital gains remain strong. Since these capital gains are founded on very large investments in intangible assets, there is little reason to think they will not continue, on average. Of course, volatility will continue, as the recent stock-market downturn reminds us.

Second, if stock options continue to rise in importance as a form of reward to employees, employee compensation will increasingly depend, at least in part, on stock-market capital gains. This compensation can be measured in terms of the market value of the option when issued or in terms of the realized value of the option when it's exercised. How to properly measure this compensation in our accounts is a question that is yet unanswered. At present, most employee stock options are included in personal income when they are exercised, not when they are granted. Recently, personal income for 2000 was revised upward, in part because the amount of stock options exercised was larger than initially anticipated. As a result, measured personal saving rose from a negative to a low positive number.

Third, when stock options are exercised or when stocks are sold and capital gains are realized, tax obligations are accrued. These capital gains taxes have been an important element of the surge in personal income tax payments in the late 1990s that has continued into the new millennium. As a consequence, tax payments as a proportion of measured household income have risen. Thus, even if we ignore capital gains in our income and compensation measures, they have an important impact on government finance and measured household saving, since increased personal tax payments raise government saving and lower household saving.

Finally, the income of financial intermediaries often feeds off capital gains. For example, firms that manage investment funds often earn a proportion of the capital gains they accrue on behalf of clients, and an investment bank may make a substantial fraction of its income from capital gains. How to include such earnings in the national accounts is not easily determined, but since such corporations account for a fifth of all stock-market equity, they are an important part of the economy.

CONCLUSION

Changes in the U.S. economy have made U.S. economic developments inherently more difficult to analyze. In particular, production becomes riskier as more of our efforts are devoted to producing intangible assets. Measuring this effort is hard, and measuring its outcome is even harder. Yet making the effort to measure these investments is surely preferable to ignoring them, even though the outcome is not entirely satisfactory.

If we were to include increases in households' net worth in GDP, the variability of these capital gains would overwhelm that of the rest of income. In 1999, real household net worth rose by $4 trillion (in 1996 dollars); in 2000 it fell about $2 trillion. Since real GDP was roughly $9 trillion in 1999, real GDP including these capital gains was about $13 trillion; in 2000, it tumbled to $7 trillion.[26] Thus GDP growth measured this way was negative by more than 40 percent! That decline is the amount we would generally associate with an economic catastrophe like the Great Depression. Yet the unemployment rate scarcely changed between 1999 and 2000; in fact, it fell slightly from an average of 4.2 percent to 4.0 percent.

It may well turn out that excluding capital gains from our measures of national income and living with a spuriously low personal saving rate may be the best alternative. However, we might wish to add another measure of household income and saving that does include capital gains. Indeed, we might want to have one measure that includes capital gains that have been realized, that is, where the investor has taken the profit by actually selling the stock, and another one that includes all stock-market capital gains, realized and unrealized.

It may not be possible to use a single standard of GDP as our sole measure of U.S. economic progress. Nevertheless, we should continue to improve our measures of GDP. The BEA has taken an important step by including software investment in GDP. Other items the BEA should consider in the future include R&D and advertising.

[25] For details, see my forthcoming working paper.

[26] To be more precise, if we use the GDP deflator to convert net worth into 1996 dollars, in 1999 households' net worth rose $4.2 trillion and in 2000 it fell $1.9 trillion. In 1999, real GDP without capital gains was $8.9 trillion, and in 2000 it was $9.2 trillion. Thus, including capital gains, real GDP was $13.1 trillion in 1999, and $7.3 trillion in 2000, a decline of 44 percent.

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