# What Ideas Are Worth:
# The Value of Intellectual Capital And Intangible Assets in the American Economy

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## Acknowledgments

We want to acknowledge research support provided by the Pharmaceutical Research and Manufacturers of America, as well as the research assistance of Chad Hill at the American Enterprise Institute and Jiwon Vellucci and Lisa Hamilton at Sonecon, LLC. The analysis and views are solely those of the authors.

## Executive Summary

The United States has become an idea-based economy, measured in very concrete terms. This study generates those measures and estimates their values. One sign that the United States is truly an idea-based economy comes from Federal Reserve data, which show that since the mid-1990s, a majority of U.S. business investments have gone into intangible assets rather than traditional physical assets. These intangible assets include the traditional intellectual property of patents and copyrights; the broader intellectual capital of databases, general business methods, and research and development (R&D); and the firm-specific and task-specific knowledge and practices of managers and workers, or their "economic competencies."

In 2005, we provided the first systematic measure of the value of the intellectual capital in the U.S economy – which includes patents, copyrights, and "other forms of economic ideas" like databases and general business methods. Using a primary methodology and a second approach to confirm the first one, we estimated the total value of U.S. intellectual capital at $5.0 trillion to $5.5 trillion in 2005. This study updates and extends those estimates. We find that in 2011,

- The value of the intellectual capital in the U.S. economy has increased to between $8.1 trillion and $9.2 trillion; and
- The value of the intangible assets – which includes intellectual capital plus economic competencies – in the U.S. economy totals an estimated $14.5 trillion in 2011.

The study also estimates the value of the intellectual capital and intangible assets held by 24 industries.[1]

- Of 24 industries, the ten with the largest stocks of intellectual capital are energy; software and software services; insurance and other finance; capital goods; pharmaceuticals, biotech and life sciences; technology hardware and equipment; food, beverages and tobacco; media; materials; and healthcare equipment and services.
- The ten industries whose intellectual capital represents at least 50 percent of their market value – the ten most intellectual-capital-intensive industries -- are media; telecommunications services; automobiles and components; household and personal products; food, beverages and tobacco; commercial and professional services; software and services; healthcare equipment and services; pharmaceuticals, biotech and life sciences; and consumer services.

[1] These industries cover the economy, based on the Global Industry Classification Standard (GICS). Certain financial companies that lack GICS codes were grouped with "Insurance" to make "Insurance & Other Finance."

The industry analysis shows that intellectual capital now pervades most industries, from the most advanced goods and services to traditional manufacturing. These data also show that three industries combine size and intensity with regard to intellectual capital: Software and services; pharmaceuticals, biotech and life sciences; and healthcare equipment and services are the only industries in the top ten in terms of both the value of their intellectual capital and the portion of their market value that intellectual capital represents.

The study also applies an industry analysis to U.S. intangible assets – intellectual capital plus the task and firm-specific skills or economic competencies of an industry's managers and workers. This is the broadest measure of the role of ideas in industries and firms. The industry analysis of intangible assets revealed that the same ten industries that have the largest stocks of intellectual capital, also have the largest stocks of intangible assets. Similarly, the ten industries whose intellectual capital represents at least 50 percent of their market value, are the same ten whose intangible assets represent at least 90 percent of their market value. This finding is to be expected given that intellectual capital makes up the majority of the value of intangible assets.

This study finds that intangible assets now pervade most U.S. industries. These data also show that three industries combine size and intensity with regard to intangible assets: Software and services; pharmaceuticals, biotech and life sciences; and healthcare equipment and services are the only industries in the top ten by both measures of intangible assets.

The economic importance of these broad developments lies in the central role played by new ideas in the growth, productivity and incomes of modern economies. Economists estimate that innovation in its various forms accounts for 30 percent to 40 percent of the gains in growth and productivity by the American economy during the 20$^{th}$ century, more than any other factor. Moreover, in recent years, the pace of innovation and its impact have increased. Furthermore, much of the very rapid growth and modernization by many developing nations in the last generation can be traced to their adoption of Western technological and organizational innovations, largely through the foreign direct investments of multinational companies.

The successful application of new ideas in innovations does not occur by chance; rather, it requires identifiable conditions. These conditions include large public and private investments in research and development, education and training, and an economic and political environment that promotes the creation of new firms and new investments by existing firms. One legal aspect is especially critical to the development and broad application of economically-powerful ideas – the strict protection and enforcement of intellectual property rights. Without such protections and enforcement, innovators have little incentive, especially to develop new technologies, materials and production processes. The same effect would apply to the development of new ways of financing, marketing and distributing goods and services, and new ways to organize and manage firms, when these ways take forms that are subject to patents or embodied in software that carries copyrights. Finally, the transfers of new technologies, production processes and other innovations through foreign direct investments to developing

economies also depend on the recognition and enforcement of the intellectual property rights of the innovators.

These intellectual property rights have been under attack in many developing nations, directly or implicitly through their lack of enforcement. The Organization for Economic Cooperation and Development (OECD) has estimated, for example, that $200 billion in counterfeited or pirated goods were traded across borders in 2005. By various studies, an estimated $12.5 billion in pirated music was sold in 2007, an estimated $51 billion in pirated software was sold in 2009, and an estimated $70 billion to $88 billion in counterfeit pharmaceuticals will be sold in 2011. With intellectual capital playing such key roles in U.S. productivity, growth and incomes, as well as in the competitiveness of U.S. companies in global markets, it is essential that the federal government make strict protection of intellectual property rights, here and abroad, a priority for U.S. policy – with particular consideration as to the potential impact such policies will have for idea-intensive industries.

## Introduction

> *"America's future economic growth and international competitiveness depend on our capacity to innovate…Innovation – the process by which individuals and organizations generate new ideas and put them into practice – is the foundation of American economic growth and national competitiveness."*—National Economic Council, 2011

Innovation is widely recognized by economists as the most powerful factor that can drive changes in an economy's underlying rates of productivity and growth. The quality of the new ideas embodied in those innovations and the pace at which innovations are developed and applied, therefore, significantly affect a nation's prosperity. In a 2005 study, we estimated the value of these ideas or intellectual capital (IC) in the American economy.[2] Drawing on the results of a Federal Reserve staff analysis, we developed a primary methodology to undertake this calculation and a secondary methodology to confirm the result. The two approaches produced very close results in 2005 (estimates of $5 trillion and $5.5 trillion), which we took to be the general dimensions and range of the value of intellectual capital in the U.S. economy.

Much of this intellectual capital represents intellectual property strictly defined – patents, copyrights, and the research and development that produces them. However, intellectual capital also includes other forms of economic ideas, such as databases and general business methods. Further, intellectual capital is a subset of intangible assets, which include brands, the firm-specific and task-specific knowledge and practices of managers and workers, and investments to improve the efficiency and productivity of particular organizations. Here, we will update our results from 2005 using the same primary and secondary methodologies to estimate and confirm the current dimensions of the intellectual capital and intangible assets in the U.S. economy. We also will allocate these results across U.S. industries to shed light on the distribution of intellectual capital by industry. Finally, we will update our analytical methods and review alternative approaches which suggest that the stock of intellectual capital and intangible assets in the economy may be even larger.

The central role of intellectual capital in economic growth and productivity has not diminished since our analysis in 2005, even as the economic turmoil of 2008-2010 has affected the operations of many businesses. To understand that role, we look at both the intellectual capital reported by publicly-held companies on their balance sheets and their off-balance sheet intellectual capital, which actually constitutes the larger share. In 2005, we focused on the off-balance sheet intellectual capital. Applying our primary methodology, we will see that the off-balance-sheet pool of intellectual capital grew from $5.0 trillion in 2005 to $5.9 trillion today. (Table 1, below) We also extend the analysis to include intellectual capital on corporate balance sheets. Here, we see a larger increase: The total intellectual capital held by U.S. public companies rose from an estimated $6.3 trillion in 2005 to an estimated $8.1 trillion in 2011.

[2] Hassett and Shapiro (2005).

Our secondary or confirmatory methodology casts a broader net: It uses data from the Bureau of Economic Analysis (BEA) on both publicly-held and privately-owned firms. These data measure non-residential fixed investments and their relation to investments in intellectual capital. Using this approach, we will see that the value of the intellectual capital of all U.S. firms increased from an estimated $5.5 trillion in 2005 to $9.2 trillion in 2011 (Table 1, below). Thus, with regard to genuine intellectual capital, including all strictly-defined intellectual property, its total value in the American economy now stands between an estimated $8.1 trillion and $9.2 trillion, the equivalent of 55 percent to 62.5 percent of U.S. GDP in 2010.

In addition, we estimate the value of other intangible assets held by U.S. firms, including the "economic competency" of their employees. Applying this analysis to data from 2005 and the current period, we can see that the value of all intangible assets, including intellectual capital, grew from an estimated $13.4 trillion in 2005 to $14.5 trillion in 2011.

**Table 1. Estimated Value of U.S. Intellectual Capital and Intangible Assets, 2005 and 2011**

| | 2005 | 2011 |
|---|---|---|
| **Intellectual Capital, Primary Method (Publicly-Held Firms)** | | |
| Off Balance Sheet Only | $5.0 trillion | $5.9 trillion |
| Off and On Balance Sheet | **$6.3 trillion** | **$8.1 trillion** |
| **Intellectual Capital, Secondary Method (All Firms)** | | |
| On and Off Balance Sheets | **$5.5 trillion** | **$9.2 trillion** |
| **All Intangibles, Primary Method (Publicly Held Firms)** | | |
| Off Balance Sheet Only | $10.6 trillion | $10.6 trillion |
| Off and On Balance Sheet (including Economic Competencies) | **$13.4 trillion** | **$14.5 trillion** |

We also use our primary approach for estimating the value of intellectual capital to estimate the intellectual capital held by each industry and therefore the distribution of intellectual capital across the economy. We will see, for example, that six industries each hold more than $500 billion in intellectual capital – energy; software; pharmaceuticals, biotech and life sciences; insurance and other finance; capital goods; and technology hardware and equipment (Table 2, below). Similarly, intellectual capital comprises 70 percent or more of the total assets of six industries. These idea-dominated industries include not only ones that traditionally are research and development (R&D) intense – pharmaceuticals, biotech and life sciences; software and its services; technology hardware and equipment; and semiconductors – but also household and personal services, and food, beverages and tobacco.

These findings also show that intellectual capital is now distributed very broadly across the U.S. economy. Part of this development reflects the spread of advanced information technologies and their application to develop new intangible assets in very traditional industries. Virtually every industry, for example, now makes use of

sophisticated databases to help them develop and target new goods and services. The popular perception that a few "high tech" industries account for most intellectual capital – in particular, traditional leaders in R&D such as pharmaceuticals and software -- is no longer accurate.

We have measured the intellectual capital for 24 industries and the share of their total book value and market value which that intellectual capital represents.[3] In six of the 24 industries, their intellectual capital is equal to at least two-thirds of their book value (the value of their physical assets). Twelve of the 24 industries hold intellectual capital equal to at least one-half of their book value. Using the market value of an industry's stock as the measure, ten of the 24 hold intellectual capital equal to one-half or more of their total market value (Table 2, below).

**Table 2. Market Value and Intellectual Capital of U.S. Industries, 2009[4]**

| Industry | Intellectual Capital ($ Billions) | Market Value ($ Billions) | Intellectual Capital as a Share of Market Value |
|---|---|---|---|
| **Energy** | **$773** | $2,027 | 38.12% |
| **Software and Services** | **$749** | $1,408 | 53.24% |
| **Insurance and Other Finance** | **$745** | $1,914 | 38.93% |
| **Capital Goods** | **$632** | $1,313 | 48.18% |
| **Pharmaceuticals, Biotech, Life Sci.** | **$532** | $1,019 | 52.17% |
| **Technology Hardware, Equipment** | **$495** | $1,053 | 47.00% |
| **Food Beverage and Tobacco** | **$443** | $764 | 57.94% |
| **Media** | **$378** | $504 | 75.07% |
| **Materials** | **$349** | $737 | 47.42% |
| **Healthcare Equipment and Services** | **$348** | $650 | 53.60% |
| **Telecommunication Services** | **$292** | $406 | 71.92% |
| **Retailing** | **$267** | $610 | 43.69% |
| **Diversified Financials** | **$212** | $1,074 | 19.77% |
| **Semiconductors and Equipment** | **$191** | $440 | 43.41% |
| **Household and Personal Products** | **$182** | $300 | 60.82% |
| **Consumer Services** | **$170** | $339 | 50.34% |
| **Food and Staples Retailing** | **$161** | $383 | 41.97% |
| **Transportation** | **$142** | $293 | 48.53% |
| **Real Estate** | **$139** | $462 | 30.10% |
| **Banks** | **$133** | $554 | 23.98% |
| **Automobiles and Components** | **$133** | $213 | 62.26% |
| **Consumer Durables and Apparels** | **$104** | $225 | 46.33% |
| **Commercial & Professional Services** | **$91** | $162 | 56.15% |
| **Utilities** | **$4** | $510 | 0.77% |
| **TOTAL** | **$7,665** | **$17,360** | **44.16%** |

[3] Industry classifications based on Standard & Poor's *Global Industry Classification Standard* (GICS).
[4] Industry intellectual capital is based on 2009 industry data from the Bureau of Economic Analysis. 2009 is the most recent year for which industry data is available.

Finally, the intellectual capital of all industries, based on BEA industry data, comes to $7.67 trillion, which is within five percent of our $8.1 trillion estimate based on the aggregate data. Given the different data sources for the two estimates, these close results provide powerful confirmation of the basic accuracy of our estimates.

We also extend these calculations to cover each industry's intangible assets, which is the sum of intellectual capital and "economic competencies" – the value of the firm-specific and task-specific skills and knowledge of an industry's managers and employees, as well as other intangible assets such as brands. This is the broadest measure of the role and value of ideas in firms and industries. Based on the aggregate data, we estimated the value of all intangible assets in the U.S. economy in 2011 at $14.5 trillion (Table 1, above). Using 2009 industry data, our estimate of the value of all intangible assets comes to $13.75 trillion, again within five-to-six percent of the estimate based on aggregate data (Table 3, below).

**Table 3. Intangible Assets: Intellectual Capital and Economic Competencies of U.S. Industries, 2009**

| Industry | Intangible Assets as a Share of Market Value | Intellectual Capital On and Off the Balance Sheets ($ Billions) | Economic Competencies On and Off the Balance Sheet ($ Billions) | Intangible Assets: Intellectual Capital + Economic Competencies ($ Billions) |
|---|---|---|---|---|
| **Energy** | 68.4% | $773 | $613 | **$1,385** |
| **Software & Services** | 95.5% | $749 | $595 | **$1,344** |
| **Insurance & Other Finance** | 69.8% | $745 | $590 | **$1,336** |
| **Capital Goods** | 86.4% | $632 | $502 | **$1,134** |
| **Pharmaceuticals, Biotech, Life Sci.** | 93.6% | $532 | $422 | **$954** |
| **Technology Hardware & Equip.** | 84.3% | $495 | $393 | **$888** |
| **Food Beverage & Tobacco** | 103.9% | $443 | $351 | **$794** |
| **Media** | 134.6% | $378 | $300 | **$678** |
| **Materials** | 85.0% | $349 | $277 | **$627** |
| **Healthcare Equipment & Services** | 96.1% | $348 | $276 | **$625** |
| **Telecommunication Services** | 129.0% | $292 | $231 | **$523** |
| **Retailing** | 78.4% | $267 | $211 | **$478** |
| **Diversified Financials** | 35.5% | $212 | $168 | **$381** |
| **Semiconductors & Equipment** | 77.9% | $191 | $152 | **$343** |
| **Household & Personal Products** | 109.1% | $182 | $145 | **$327** |
| **Consumer Services** | 90.3% | $170 | $135 | **$306** |
| **Food & Staples Retailing** | 75.3% | $161 | $128 | **$288** |
| **Transportation** | 87.0% | $142 | $113 | **$255** |
| **Real Estate** | 54.0% | $139 | $110 | **$249** |
| **Banks** | 43.0% | $133 | $105 | **$238** |
| **Automobiles & Components** | 111.7% | $133 | $105 | **$238** |
| **Consumer Durables & Apparel** | 83.1% | $104 | $83 | **$187** |
| **Commercial & Professional Serv.** | 100.7% | $91 | $72 | **$164** |
| **Utilities** | 1.4% | $4 | $3 | **$7** |
| **TOTAL** | **79.2%** | **$7,665** | **$6,080** | **$13,749** |

The estimated value of the intangible assets in the U.S. economy in 2011 ($13.75 trillion to $14.5 trillion), therefore, was roughly equal to the GDP in that year ($14.5 trillion). In fact, the weighted average intensity of intangibles per-industry – their value as a share of an industry's total market value – was more than 79 percent. And ten of the 24 industries held intangible assets equal to at least 90 percent of their total market values. These top 10 include, again, science-based and R&D intensive industries such as pharmaceuticals, biotech and life sciences; software and its services; and healthcare equipment and services. These top 10 also include, as expected, two industries based largely on advanced information technologies (IT) – media and telecommunications services. However, half of the 10 most intangible asset-intensive industries are based on neither science nor IT -- food, beverages and tobacco; household and personal products; consumer services; automobiles and their components; and commercial and professional services. The large role of intangible assets in these industries may reflect the enormous value of brands in many of these industries as well as the impact of information technologies on their production processes, marketing and, in some cases, online services.

> *These measures also show that two industries -- software and their services; and pharmaceuticals, biotech and life sciences – uniquely combine idea intensity and size with regard to both intellectual capital and intangible assets. For example, intellectual capital accounts for at least 50 percent of the market value of ten industries; but among those ten, only software and pharmaceuticals also hold intellectual capital valued at $500 billion or more. Similarly, the intangible assets of ten industries account for at least 90 percent of their market value; but among those ten, only software and pharmaceuticals also hold intangible assets valued at $800 billion or more.*

Nevertheless, many industries now maintain high levels of intellectual capital and intangible assets, and this reflects the central economic role that ideas now play across the American economy. This broad distribution of intellectual capital and intangible assets also testify to the extent to which ideas now supersede traditional physical assets as the source of new value in industries as diverse as automobile manufacturing, household and personal products, and pharmaceuticals. As we will see, the capacity of American firms to develop, adopt and apply new ideas have continued to be a key driver of U.S. GDP, productivity, income gains, and the competitiveness of American firms at home and abroad. Furthermore, while our primary focus here is the American economy, the economic impact of ideas also helps to explain the extraordinarily rapid modernization achieved by China, South Korea, Taiwan, and many other developing countries. In all of these cases, nations opened their economies to waves of foreign direct investments by Western multinational companies and, through this process, quickly assimilated generations of technological and organizational innovations.

> *As the world's most advanced economy, the United States and its multinational companies use their intellectual capital and intangible assets*

> *to create comparative advantages in global markets. Therefore, many industries which are highly idea-intensive, measured by intellectual capital and intangible assets, occupy prominent positions in U.S. exports. Pharmaceuticals and medicines, for example, were the third largest class of U.S. exports in 2009, exceeded only by semiconductors and aerospace products and parts.*[5]

The development of a predominantly idea-based economy in the United States and the powerful impact of innovation on the modernization of many developing countries have both depended on the enforcement of intellectual property rights for the intellectual capital and much of the other intangible assets of modern companies. An extensive economic literature attests to the positive impact of strong intellectual property rights and enforcement on income gains in both developing and advanced countries, and the relatively low levels of foreign direct investment (FDI) in countries with weak intellectual property rights and enforcement. Nevertheless, opposition to these rights has intensified in some developing nations such as India and Brazil, targeted especially to multinational foreign direct investors based in the United States and Western Europe, and often involving such vital goods as pharmaceuticals and software.

Even when the attenuation or abrogation of intellectual property rights is not official policy, pirating and counterfeiting of patented or copyrighted goods is common in many developing nations. Pirating of software and music, for example, has been pervasive across much of the developing world, reaching from Argentina and Paraguay to Turkey and the Ukraine, and on to China and Indonesia.[6] Even more troubling, counterfeit pharmaceuticals comprise as much as 10 percent of the worldwide market, at a current annual cost of $70 to $88 billion.[7] Since fast-growing foreign markets play an increasingly important role in justifying the large investments required to develop new ideas and the new products and services based on them, it is vital that the United States and other governments use every available tool to protect the worldwide intellectual property rights of innovative companies.

[5] U.S. Census Bureau, Foreign Trade Division (2011).
[6] Business Software Alliance and IDC (2010).
[7] Frontier Economics LTD (2011).

## The Role in Modern Economies of Innovation and New Ideas

The natural resources that fuel every economy — energy, minerals, animal and plant life, arable land, and so forth — have been a vital part of society for centuries. While these factors have changed relatively little over time, the knowledge and ideas which make up intellectual property and which change all of the time have long played a central role in the development and growth of economies and nations. The minerals used to build microchips, supercomputers and advanced fiber optics, and the elements harnessed to cure disease and infections, all have been around for years or centuries before we developed the capacity to use them. Such productive use of those and other resources has depended on waves of innovations, often over many decades. It took generations of developing new ideas, built one upon another, to translate such natural materials into the technologies and products that drive economic growth and prosperity today. Sir Francis Bacon said it most succinctly in the late 16th century, noting that "knowledge is power."[8] Several centuries later, Joseph Schumpeter put innovation at the center of the development of capitalism through what he called "creative destruction." Further, he wrote in *Capitalism, Socialism and Democracy*, the kind of competition that counts most is "the competition from the new commodity, the new technology, the new source of supply, the new type of organization — competition which commands a decisive cost or quality advantage and which strikes not at the margins of the profits and the outputs of the existing firms but at their foundations and their very lives."[9]

The impact of economic innovations and the intellectual property system and rights which promote their development is evident across the globe. Indeed, innovation played a much larger role in the economic progress of the United States over the course of the 20th century than, for example, increases in capital investment or even improvements in the skills and education of workers. Beginning with the research of Nobel laureate Robert Solow in the 1950s, economists have established that the development and adoption of innovation has been the single most powerful determinant of a nation's underlying rate of economic growth. For example, Solow along with Edward Denison and others found that at least 30 percent of the economic gains achieved in the United States in the 20th century can be traced to economic innovation, encompassing not only new technologies, materials and processes, but also new ways of financing, marketing and distributing goods, and new approaches to organizing a business and managing the workplace.[10] By contrast, increases in the American economy's capital stock can explain only 10 percent to 15 percent of those gains, while perhaps another 20 percent can be traced to improvements in the education and skills of American workers.

Moreover, data suggest that the economic importance of innovations has increased in recent times. For example, one recent study used a version of Solow's growth accounting to examine the impact of innovation on U.S. growth since 1973, and

[8] Bacon (1597).
[9] Schumpeter (1942).
[10] Solow (1965); Solow (1957); Denison (1962).

compared two periods – 1973 to 1995, and 1996 to 2003.[11] The authors concluded that the impact of innovation on growth increased significantly, from 25 percent in the first period to 35 percent in the second.[12] This conclusion is consistent with recent work by researchers at the Federal Reserve Board of Governors, who analyzed how companies use ideas by examining various categories of business spending on so-called "intangibles." These investments in intangibles included spending on software programs and databases, scientific and non-scientific R&D, new-product development costs by service firms; advertising and market research to create brands; the development of new business models and corporate cultures; and expenditures on firm-specific training. Importantly, the authors found that since 1995, and for the first time on record, U.S. businesses have been investing as much in these idea-related intangibles – about $1 trillion a year in the early years of this decade – as they do on plant, equipment and other traditional, tangible forms of investment.[13]

The authors also found that U.S. business spending on long-lasting, knowledge capital grew faster than any other type of business or personal spending. Moreover, they traced more than four-fifths of the gains in U.S. productivity achieved in the latter-1990s to the development and application of new ideas, especially those involving new IT. Specifically, from 1995-2001, the development of new information technologies accounted for 28 percent of those productivity gains, capital investments in those technologies accounted for another 34 percent, research and development accounted for 10 percent more, and changes in the organization of firms and worker training in response to IT innovations accounted for another 10 percent. Other researchers have applied this approach to data covering 2001-2003, and estimate that nearly 90 percent of U.S. economic growth during that recent period can be attributed to increases in the stock of intangible assets.[14]

From a different perspective, a comparable dynamic with associated benefits might well apply to the knowledge embodied in recent pharmaceutical and medical device innovations. For example, the use of new treatments and procedures has reduced by 50 percent U.S. death rates from first heart attacks since 1980, presumably with large productivity benefits.[15] More generally, the economic benefits from the sharp reductions in infant and childhood mortality in most large, fast-growing developing nations have been enormous.

The development and application of new ideas often determines the outcome of competitions between firms, both within and across economies. The capacity of a country's firms to develop, adopt and apply economic innovations has become a key driver of a nation's GDP, productivity gains, and wage growth, both absolutely and relative to other nations. Innovations have value only to those who adopt and apply them. Therefore, while companies and nations compete to develop such innovations,

[11] Van Art, *et al.* (2009).
[12] They divided up growth factors and found that the contribution of "multifactor productivity," largely a proxy for the development and application of innovations, increased from 25 to 35 percent.
[13] Corrado, *et al.* (2004).
[14] Hassett and Shapiro (2005).
[15] Ford, *et al.* (2007)

governments have an interest in promoting the broad and appropriate use of innovations regardless of where they are originally developed. Moreover, both the development and application of economically-powerful innovations depend not only on the genius and perseverance of innovators, but also on a government's commitment to protect the intellectual property rights of those who develop and transfer such innovations, and thereby enable them to profit from so doing.

While new technologies and business methods are usually developed in advanced economies like the United States and Europe, their transfer to other countries also has been a key factor in the growth and modernization of developing nations and a much more important factor than their natural resources. Consider the rapid emergence of modern economies in Taiwan, South Korea, Hong Kong, and Singapore, the so-called Asian Tigers, over the last half century. South Korea, with relatively few resources, has experienced rates of per-capita income growth that have been nearly three times greater than that of resource-rich Brazil.[16] Much of the difference can be attributed to South Korea's openness to innovations developed elsewhere and imported through licensing agreements and FDI, as well as its extraordinarily large commitments to high-quality secondary education and very broad access to higher education.[17]

Paul Romer, a leading theorist of the sources of economic growth, has made this point in the following way:

> The knowledge needed to provide citizens of the poorest countries with a vastly improved standard of living already exists in the advanced countries. If a poor nation invests in education and does not destroy the incentives for its citizens to acquire ideas from the rest of the world, it can rapidly take advantage of the publicly available part of the worldwide stock of knowledge. If, in addition, it offers incentives for privately held-ideas to be put to use within its borders (for example, by protecting foreign patents, copyrights and licenses, and by permitting direct investment by foreign firms), its citizens can soon work in state-of-the-art productive activities.[18]

As Peter J. Klenow and Andres Rodriguez-Clare put it, "most of income above subsistence is made possible by international diffusion of knowledge."[19] Many studies have supported this conclusion. For example, the World Bank found that since 1980, the world's greatest economic gains have been achieved by developing countries aggressively opening their economies to foreign technologies and business methods, and protecting intellectual property rights.[20] Another World Bank study linked the incidence of patenting and higher growth: In a 92-country sample covering 1960 to 2000, the researchers found that a 20 percent increase in the number of patents granted was associated with a 3.8 percent increase in economic output.[21] Again, the

[16] World Bank (2011).
[17] *Ibid.*
[18] Romer (1993).
[19] Klenow and Rodriguez-Clare (2004).
[20] World Bank (2011).
[21] Chen and Dahlman (2004).

contrast between Asian and Latin American economies in this regard is striking. From 1980 to 2001, the developing East Asian economies averaged more than 7.4 percent growth per year, and the developing economies of South Asia averaged 5.4 percent annual growth. In contrast, the economies of Latin America, with stricter foreign investment policies and weaker intellectual property protections, grew by less than 2.5 percent.

Economic researchers for the last generation have established a series of findings which demonstrate clearly the economic impact of intellectual property rights. Evidence not only establishes the role of intellectual property protection in accelerating innovation in advanced economies, but also finds a strong link between the protection of intellectual property in developing nations and transfers of advanced technologies and business methods from more advanced nations, through imports as well as FDI. These transfers often create powerful spillovers in which the new technologies and business methods are adopted by domestic firms, increasing both their productivity and the rate at which they develop their own intellectual property. Similarly, researchers have found that weak intellectual property protections result in both lower overall FDI and transfers which on average are less advanced and sophisticated.

As a result, countries with relatively weak intellectual property protections and low FDI often attract counterfeiting or pirating of patented or copyrighted goods and technologies. The Organization for Economic Cooperation and Development (OECD) has estimated that worldwide trade in such counterfeit goods totaled $250 billion in 2007, a figure that does not include online or domestic production and consumption of counterfeit goods.[22] The International Chamber of Commerce has estimated that when such domestic and online counterfeit activity is taken into account, the total counterfeit market reached $650 billion in 2008 and could reach $1.8 trillion by 2015.[23] In just one area, pharmaceuticals, the World Health Organization (WHO) has estimated that counterfeit drugs comprise 8 percent to 10 percent of the world market,[24] especially in countries with weak intellectual property rights or enforcement, and other research has valued the global counterfeit drug market at $75 billion.[25]

The centrality of these rights to the developments of innovations is a matter of heated debate among economists. Many economists continue to believe that innovation arises outside the world of economic incentives, when a gifted person happens to have a bright new idea. This view is derived from a narrow or very strict reading of the neoclassical model of markets, and recent research analyzing the catalogues of inventions displayed at three 19th century world exhibitions found that inventors remained active in Denmark and Switzerland during periods in the 19th century when those nations lacked intellectual property protections.[26] The research also found that those inventions typically involved products in which secrecy could be maintained without a patent, such as new food stuffs with “secret recipes.” The vast

[22] OECD (2009).
[23] Frontier Economics LTD (2011).
[24] *Ibid*.
[25] *Ibid*.
[26] Moser (2003).

majority of economically-powerful inventions exhibited at the world fairs – innovations which accelerated economic development and often lifted productivity and living standards -- were developed in the Americas, Germany and other places with strong intellectual property protections.

These dynamics reflect, at least in part, specific economic incentives to innovate. Most people are not true altruists, but rather are willing to expend the resources and effort required to develop something new which may benefit others if doing so also benefits themselves. Moreover, as corporations have come to dominate the innovations process, the prospect of future gains has become even more important. The development of most modern innovations, especially those involving new technologies, generally requires highly-skilled people and sophisticated equipment and business organizations. Businesses are willing to bear these costs only when there is a real prospect of significant future gains.

The prospect of earning future returns from new ideas depends on legal property rights and protections for those ideas. In economic terms, the ideas that animate economic innovations are "non-rival goods." Unlike "rival goods" such as a piece of equipment or real estate, ideas can be used by more than one person at a time, and they can be easily duplicated. Because ideas are not physical things that can be possessed like a parcel of land or a piece of equipment, its use by those who develop them does not preclude others from using them as well.[27] For this reason, the legal protection of those ideas is necessary to secure the returns of innovation. Moreover, since the development of a new product or process is risky and often expensive, the protections accorded the ideas which animate a new product or process involve the monopoly right of a patent or copyright, the only legal monopoly routinely provided in market-based systems. A 1986 survey of U.S. R&D executives in the pharmaceutical sector confirms the value of this incentive: Without strict patent protections, at least 60 percent of the projects which ultimately led to discoveries would never have been undertaken.[28] Given the increased uncertainties related to biopharmaceutical R&D, a survey today would likely result in an even higher number.

[27] In economic terms, ideas are also considered to be "partially non-excludable goods": An innovator acting as a private agent cannot prevent others from using his idea, as compared to someone who owns a piece of land or a factory who can prevent others from using it by hiring security guards.

[28] Mansfield (1986); For a literature review of the connections between innovation and intellectual property protections, see Kanwar and Evenson (2001).

## The Value of the Intellectual Capital in the American Economy

Given the enormous impact of economic innovations and the intellectual capital embedded in them for U.S. growth and productivity gains, as well as for the modernization of developing nations, identifying rigorous ways to estimate the value and distribution of this intellectual capital is a matter of import. There is general agreement that such a value is very large. For example, one recent study found that "core" copyright industries – music, publishing, broadcasting, and software – generated 6.4 percent of U.S. GDP in 2007 ($889.1 billion dollars).[29] The contribution to U.S. GDP of all copyright-related industries—those identified as "core," plus design-oriented industries such as jewelry and video games, support industries such as telecom services, and the manufacturers and retailers of CDs, DVD players, and computers—is nearly twice as large: some 11.1 percent of U.S. GDP, or $1.52 trillion in 2007, can be traced to the creation and sale of this subset of intellectual capital.[30]

A number of researchers also have noted the increasing prominence in U.S. output and production of "intangible" goods,[31] and the increasing importance of R&D investments. For example, studies have found that a firm's market value relative to its book value (the accounting value of its assets) increases following investments in intangibles,[32] that R&D expenditures increase a firm's future earnings by about 20 percent per year,[33] and that the stock market returns of companies increase following significant R&D investments.[34] Moreover, the difference between the market value of U.S. publicly-held companies and their "book value" – what their physical assets are worth on the open market – suggest that their off-balance sheet intangible assets account for more than 61 percent of their total market value. In fact, our analysis will show that total intangible assets account for as much as 83.5 percent of the market value of U.S. publicly-held companies. By either measure, the conclusion that intangible assets are more important than tangible assets in determining the market value of American companies – and therefore the basis for new wealth and value -- is also consistent with recent work by Federal Reserve senior staff on the role of intangible assets in productivity and business investment.[35]

Intangible assets and its subset, intellectual capital, are found both on and off the balance sheets of U.S. companies. Some of a company's investments in intangibles will appear on its balance sheet – for example, the cost of a database less its depreciation, or an estimate of the value of a brand name such as "Coca-Cola." Other intangibles and intellectual capital do not appear on a company's balance sheets, and

[29] Siwek (2009).
[30] *Ibid*.
[31] Nakamura (1999) provides a detailed analysis of recent trends in this regard.
[32] Megna and Klock (1993) is a recent example of a large literature that began with Griliches (1981). The ratio of a company's market value to its book value is considered a strong and reliable measure of the importance of intangible capital; and even with the turmoil in U.S. stock markets of recent years, the ratio of market value to book value for the S&P 500 in March 2011 was 2.57. See also, Barron's (2011).
[33] See Lev and Sougiannis (1996), for example.
[34] Megna and Klock (1993); Griliches (1981).
[35] Corrado, *et. al.* (2004), See Section II.

these off-balance sheet assets might include the value of patent less the direct cost to produce it. The on-balance intangibles and intellectual capital are reported by the BEA, however, we have to calculate and estimate their off-balance sheet counterparts.

Our first rigorous published attempt to calculate the total value of the intellectual capital in the American economy appeared in 2005, when we used a primary and an alternate methodology. Our hope was that the two differing approaches would provide a glimpse of the possible range of the importance of intellectual capital. Our estimate of the stock of intellectual capital in the U.S. economy at that time came to between $5 trillion and $5.5 trillion, depending on the methodology used[36] (See Table 1, above). In this section, we will focus on the first method, which we consider the primary one. The second method will be discussed below as the alternative. In our primary method, we began with an estimate by the Federal Reserve that 47.5 percent of all intangible investment represents intellectual capital, as of 2005. More recent data suggest that this share has risen to 55.8 percent since that time,[37] including software and databases, R&D, and scientific and creative property. Expenditures for organization, branding and firm-specific skills comprise the remaining 44.2 percent of intangible assets.

These data allow us to calculate the value of intellectual capital that does not appear on company balance sheets. Using this approach, the value of intangible assets is equal to the difference between the market value of U.S. companies and their book value, which is the current market value of their physical or tangible assets. As of March 7, 2011, the ratio of market value to book value for the S&P 500 was 2.57, which means that off-balance sheet intangible assets comprised 61.11 percent of the total market value of those firms. As of February 28, 2011, the total market value of all publicly-traded U.S. firms was $17.4 trillion. This suggests that in early 2011, the value of the intellectual capital of U.S. publicly-traded firms which did not appear on their balance sheets was $5.9 trillion: $17.4 trillion [total firm market value] * (0.611[off-balance sheet intangible assets as a share of market value] * 0.558 [share of intangible assets that represent intellectual capital]). In addition, based on the intangible assets that are claimed on corporate balance sheets, we calculate that the intellectual capital on those balance sheets came to another $2.2 trillion. Therefore, the total value of the intellectual property of all U.S. publicly-traded firms in March 2011 came to $8.1 trillion. Table 4, below, details these calculations.

[36] Hassett and Shapiro (2005).
[37] For 2006-2007. Author's calculations based on U.S. Census Bureau, NSF (2011), and BEA (2011) data.

**Table 4. Intellectual Capital Held by Publicly-Owned U.S. Companies, 2011, Based on Primary Method**[38]

| | Value | Variable |
|---|---|---|
| Intellectual Capital of U.S. Firms as Share of Market Value | 34.1% | a |
| Market Value of U.S. Equities | $17.4 trillion | b |
| **Value of Intellectual Capital Not on the Balance Sheet** | **$5.9 trillion** | **c = a*b** |
| Value of Total Intangible Assets on Balance Sheet | $3.9 trillion | d |
| Intellectual Property as Share of Intangible Value | 55.8% | e |
| **Intellectual Capital on the Balance Sheet** | **$2.2 trillion** | **f = d*e** |
| **Total Intellectual Capital of Publicly Traded U.S. Firms** | **$8.1 trillion** | **g = c+f** |

For this calculation, we limit the definition of intellectual capital to R&D, computerized information in software and databases, and scientific/creative property. If the definition of intellectual capital is expanded to include "economic competencies"—including the off-balance sheet value of brands, firm-specific human capital, and a firm's specific organizational structure —the total value of the intellectual capital broadly defined, or intangible assets held by all publicly-traded U.S. firms, jumps to $10.6 trillion off their balance sheets and to $14.5 trillion including the intellectual capital recognized on their balance sheets (Table 5, below).

**Table 5. Estimated Value of U.S. Intellectual Capital and Intangible Assets, 2011, Based on Primary Method**

| Asset | Value ($ trillions) |
|---|---|
| Intellectual Capital | |
| Off Balance Sheet Only | $5.9 trillion |
| **Off and On Balance Sheet** | **$8.1 trillion** |
| All Intangibles | |
| Off Balance Sheet Only | $10.6 trillion |
| **Off and On Balance Sheet** | **$14.5 trillion** |

While the estimated value of U.S. intellectual capital increased only modestly from 2005 to 2011 under the assumptions that exclude economic competencies for the primary method, the estimate using the alternative method shows a sharper increase, from $5.5 trillion in 2005 to $9.2 trillion in 2011 (see discussion below). This reflects a significant rise in the value of tangible capital investments from $11.7 trillion in 2005 to $16.5 trillion in 2011 and, based on the Federal Reserve's conclusions, a corresponding increase in the value of intangible investments. Further, the share of all intangible assets assumed to represent intellectual property or capital increased from 47.5 percent in 2005 to 55.8 percent in 2011.

To put these values in perspective, if we assume, as previously discussed, that the stock of intellectual property yields a return of 20 percent per year, then the flows

[38] Note: Publicly held firms only. Market value as of February 28, 2011. Standard and Poor's (2011).

from it accounted for about 11 percent of GDP using our low stock estimate of $8.1 trillion. The high values for both U.S. intellectual capital and intangible assets under both approaches are consistent with the extraordinary reach and pace of technological and organizational innovations in this period, especially in IT and Internet-based or Internet-networked business organizations, and in biotechnology treatments and production processes. These high values may also reflect an intensification of competition associated with globalization. For firms operating in global markets, profitability depends to an increasing degree on the depth and quality of their intellectual capital, rather than merely on relative costs and sunk tangible investments. Firms with the most valuable intellectual capital are more likely to succeed in intensely-competitive global markets and, therefore, are also more likely to have high market values.

## The Distribution of U.S. Intellectual Capital by Industry

The intellectual capital held by firms within an industry varies significantly by industry. Table 6, below, shows our estimates for each industry. The industry specific calculations are derived using the primary method.

**Table 6. The Value of Intellectual Capital by Industry, 2009, Based on Primary Method**

| Industry | Ratio: Market Value to Book Value | Intellectual Capital as a Share of Market Value | Market Value ($ Billions) | Intellectual Capital Not on the Balance Sheet ($ Billions) | Intellectual Capital on the Balance Sheet ($ Billions) | Total Intellectual Capital ($Billions) |
|---|---|---|---|---|---|---|
| **Energy** | 2.82 | 38.12% | $2,027 | $729 | $44 | **$773** |
| **Software and Services** | 4.27 | 53.24% | $1,408 | $601 | $148 | **$749** |
| **Insurance and Other Finance** | 2.62 | 38.93% | $1,914 | $660 | $85 | **$745** |
| **Capital Goods** | 2.30 | 48.18% | $1,313 | $414 | $219 | **$632** |
| **Pharma, Biotech, Life Sci.** | 2.73 | 52.17% | $1,019 | $360 | $172 | **$532** |
| **Tech. Hardware, Equip.** | 3.70 | 47.00% | $1,053 | $429 | $66 | **$495** |
| **Food Beverage and Tobacco** | 4.27 | 57.94% | $764 | $326 | $117 | **$443** |
| **Media** | 2.66 | 75.07% | $504 | $175 | $203 | **$378** |
| **Materials** | 3.28 | 47.42% | $737 | $286 | $64 | **$349** |
| **Healthcare Equip. & Services** | 2.63 | 53.60% | $650 | $224 | $124 | **$348** |
| **Telecommunication Services** | 1.42 | 71.92% | $406 | $67 | $225 | **$292** |
| **Retailing** | 3.04 | 43.69% | $610 | $228 | $38 | **$267** |
| **Diversified Financials** | 0.91 | 19.77% | $1,074 | -$56 | $269 | **$212** |
| **Semiconductors & Equip.** | 3.69 | 43.41% | $440 | $179 | $12 | **$191** |
| **Household, Personal Prod.** | 3.67 | 60.82% | $300 | $122 | $61 | **$182** |
| **Consumer Services** | 4.08 | 50.34% | $339 | $143 | $28 | **$170** |
| **Food and Staples Retailing** | 2.38 | 41.97% | $383 | $124 | $37 | **$161** |
| **Transportation** | 3.78 | 48.53% | $293 | $120 | $22 | **$142** |
| **Real Estate** | 2.01 | 30.10% | $462 | $130 | $9 | **$139** |
| **Banks** | 1.18 | 23.98% | $554 | $48 | $85 | **$133** |
| **Autos and Components** | 5.09 | 62.26% | $213 | $95 | $37 | **$133** |
| **Consumer Durables, Apparel** | 2.77 | 46.33% | $225 | $80 | $24 | **$104** |
| **Commercial, Prof. Serv.** | 2.38 | 56.15% | $162 | $52 | $39 | **$91** |
| **Utilities** | 0.83 | 0.77% | $510 | -$59 | $63 | **$4** |
| **TOTAL or AVERAGE** | **2.30:1** | **44.2%** | **$17.4** | **$5.48** | **$2.19** | **$7.67** |

As noted earlier, these estimates rely on the ratio of market value to book value to estimate the value of the intangible assets in each industry, the finding by the Federal Reserve that intellectual capital comprises 55.8 percent of total intangible value, and estimates of intellectual capital both on-balance sheets and off-balance sheets. The exclusion of private firms will affect some industries more than others. Pharmaceuticals, biotechnology, and life sciences as well as software and its services are both areas with hundreds of small, privately-owned firms whose assets consist almost entirely of their intellectual property and intellectual capital more generally.

Nevertheless, we would not expect that the inclusion of privately-held firms would change the distribution of intellectual capital, by industry, to a dramatic degree.

Considering publicly-held firms, the industries that with the highest values of intellectual capital, as expected, are those associated with very large investments in R&D, innovation and highly technical products, including software, pharmaceuticals, and energy. For example, the market value of publicly-traded firms involved in energy is 2.82 times book value, and the value of the intellectual capital across the industry comes to $773 billion. Similarly, software and its services hold an estimated $749 billion in intellectual capital, followed by insurance and other finance at $745 billion, capital goods at $632 billion, and pharmaceuticals, biotechnology and life sciences at $532 billion.

This industry analysis also highlights intellectual capital as a share of market value, and the results provide another demonstration of the breadth of the idea-based economy in the United States. Across all industries, intellectual capital accounts for 44.2 percent of market value, and the intellectual capital for 18 of the 24 industries, or three-quarters of the total, is 40 percent or greater. Moreover, the analysis also found that the intellectual capital not counted on standard balance sheets ($5.48 trillion) is more than twice the size, on average, of the intellectual capital included on balance sheets ($2.91 trillion).

The intellectual capital in the U.S. economy, under this analysis, comes to a total of $7.67 trillion, or within 5 percent of the $8.1 trillion total estimated using aggregate data. Six industries are estimated to hold intellectual capital of $500 billion or more, six industries which by other measures represent the leading edge of the economy, scientifically and technologically: energy; software and its services; insurance and other finance; capital goods; pharmaceuticals, biotechnology and life sciences; and technology hardware and equipment.

The final table of this section (Table 7, below), provides estimates of the value of “economic competencies” for each industry, which together with the intellectual capital from each industry provide a measure of the size and significance of intangible assets to different industries. As Table 9 shows, the estimated value of economic competencies not included in corporate balance sheets is 2.5 times greater than the value of economic competencies that do appear on those balance sheets. The dominance of these unrecognized intangible assets helps explain why the notion of an idea-based economy remains abstract for most Americans. All told, intangible assets account for more than three quarters of the market value of all publicly-traded companies (79.2 percent).

## Table 7. Intangible Assets: Intellectual Capital and Economic Competencies, By Industry, 2009

| Industry | Total Intellectual Capital ($ Billions) | Economic Competencies Not On Balance Sheets ($ Billions) | Economic Competencies On Balance Sheets ($ Billions) | Intangible Assets: Intellectual Capital + Economic Competencies ($ Billions) | Intangibles as a Share of Market Value |
|---|---|---|---|---|---|
| **Energy** | **$773** | $578 | $35 | $1,385 | 68.36% |
| **Software and Services** | **$749** | $477 | $118 | $1,344 | 95.47% |
| **Insurance and Other Finance** | **$745** | $523 | $68 | $1,336 | 69.77% |
| **Capital Goods** | **$632** | $328 | $174 | $1,134 | 86.41% |
| **Pharma, Biotech, Life Sciences** | **$532** | $286 | $136 | $954 | 93.56% |
| **Technology Hardware and Equip.** | **$495** | $340 | $53 | $888 | 84.29% |
| **Food Beverage and Tobacco** | **$443** | $259 | $92 | $794 | 103.91% |
| **Media** | **$378** | $139 | $161 | $678 | 134.63% |
| **Materials** | **$349** | $227 | $51 | $627 | 85.04% |
| **Healthcare Equipment and Serv.** | **$348** | $178 | $98 | $625 | 96.13% |
| **Telecommunication Services** | **$292** | $53 | $178 | $523 | 128.99% |
| **Retailing** | **$267** | $181 | $30 | $478 | 78.36% |
| **Diversified Financials** | **$212** | -$45 | $213 | $381 | 35.46% |
| **Semiconductors and Equipment** | **$191** | $142 | $10 | $343 | 77.85% |
| **Household and Personal Products** | **$182** | $97 | $48 | $327 | 109.07% |
| **Consumer Services** | **$170** | $113 | $22 | $306 | 90.28% |
| **Food and Staples Retailing** | **$161** | $98 | $29 | $288 | 75.27% |
| **Transportation** | **$142** | $95 | $17 | $255 | 87.03% |
| **Real Estate** | **$139** | $103 | $8 | $249 | 53.97% |
| **Banks** | **$133** | $38 | $68 | $238 | 43.01% |
| **Automobiles and Components** | **$133** | $76 | $30 | $238 | 111.65% |
| **Consumer Durables and Apparel** | **$104** | $64 | $19 | $187 | 83.08% |
| **Commercial and Prof. Serv.** | **$91** | $42 | $31 | $164 | 100.70% |
| **Utilities** | **$4** | -$47 | $50 | $7 | 1.38% |
| **TOTAL** | **$7,665** | **$4,345** | **$1,739** | **$1,375** | **79.2%** |

Furthermore, intangibles represent at least 70 percent of market value of 19 of the 24 industries, or more than three-quarters of industries, and at least 100 percent of the market value of six of the 24 industries, or one-quarter of industries. This tells us that some intangible assets may be systematically undervalued by investors, especially the firm-specific economic competencies of employees. The data also reveal certain anomalies: In two cases, an industry's book value for its tangible assets was greater than its market value, producing a negative value for intangibles' share of those industries' market value. One of these industries is diversified financials, where market value was sharply depressed by the financial meltdown of 2008-2009. We would expect later data to show positive values. The other case is the utilities industry, in which the very long depreciation periods for its physical assets increase the reported value of its tangible assets. In addition, the regulation of utility rates and other aspects

of the industry can cap the sector's profitability under certain conditions, reducing its appeal to investors and consequent market cap.

## Alternative Method and Discussion

While the estimated value of U.S. intellectual capital increased only modestly from 2005 to 2011 under the assumptions that exclude economic competencies for the primary method, the estimate using the alternative method shows a sharper increase, from $5.6 trillion in 2005 to $9.2 trillion in 2011. This reflects a significant rise in the value of tangible capital investments from $11.7 trillion in 2005 to $16.5 trillion in 2011 and, based on the Federal Reserve's conclusions, a corresponding increase in the value of intangible investments. Further, the share of all intangible assets assumed to represent intellectual property or capital increased from 47.5 percent in 2005 to 55.8 percent in 2011.

The Federal Reserve study also found that the value of all U.S. intangible investments was approximately equal to the value of all U.S. tangible investments. The alternative method relies on this equivalence. Here, we assume that the value of intangible and tangible assets continue to be approximately equal, which requires that intangible and tangible investments have the same or very similar productivity and depreciation rates, and that investment patterns over the last five years reflect the patterns of the preceding decade. The BEA estimates that the total stock of tangible business assets in 2009 was $16.5 trillion.[39] Using the alternative method, we infer that the stock of intangible capital assets also totaled $16.5 trillion. Since intellectual capital comprises 55.8 percent of the total value of intangible assets according to our recent estimates, we conclude that the total value of the intellectual capital in the U.S. economy in 2009 was approximately $9.2 trillion. Table 8, below, shows this analysis. This estimate is higher than the $8.1 trillion estimate using our primary method, but that difference is expected: The basis for the alternative calculation, the tangible capital stock, covers both privately-held and publicly-held firms, while the estimate using the primary method covers only publicly-held firms. While we do not have sufficient data to adjust the primary method fully to make the numbers comparable, we note that according to U.S. Census Bureau and stock market data, the receipts of publicly-held and privately held firms are approximately equivalent, so that including privately-held firms would significantly increase the value of intellectual property estimated by our primary method.[40]

[39] BEA (2009), Table 1.1.

[40] This calculation uses the U.S. Census Bureau 2007 County Business Patterns and 2007 Economic Census to calculate the receipts of all firms. The estimate for Wilshire 5000 Index is used as a proxy for all publicly traded firms. Note that this estimate is based on receipts data, and uses the price to sales ratio of the Wilshire 5000 to calculate the sales of public companies. Additionally, the estimate does not include firms with receipts below $10 million, as these firms are unlikely to have significant intellectual capital.

**Table 8. Intellectual Capital Held by All U.S. Companies, 2011, Based on Secondary Method**

| | Value | Variable |
|---|---|---|
| Intellectual Capital as Share of Total Intangible Investment | 55.8% | A |
| Current Tangible Capital Stock | $16.5 trillion | B |
| **Total Intellectual Capital of U.S. Firms** | **$9.2 trillion** | **c = a*b** |

These estimates of the value of the intellectual property or capital in the U.S. economy suggest that companies have altered their investment behavior to some degree since 2005, when we made our first estimates. As the table below shows, the estimate of total intellectual capital from 2005, $5 trillion to $5.5 trillion, increased to between $5.9 trillion to $9.2 trillion for early 2011. Using the primary method for both years, we see that the value of on-balance sheet intangibles increased from $6.3 trillion for 2005 to $8.1 trillion for early 2011, which raised the estimate of intellectual capital for 2011. Here, we reproduce the summary table from the introduction to this study:

**Table 9. Estimated Value of U.S. Intellectual Capital and Intangible Assets, 2005 and 2011**

| | 2005 | 2011 |
|---|---|---|
| **Intellectual Capital, Primary Method (Publicly-Held Firms)** | | |
| Off Balance Sheet Only | $5.0 trillion | $5.9 trillion |
| Off and On Balance Sheet | **$6.3 trillion** | **$8.1 trillion** |
| **Intellectual Capital, Alternative Method (All Firms)** | | |
| On and Off Balance Sheets | **$5.5 trillion** | **$9.2 trillion** |
| **Intangibles, Primary Method (Publicly-Held Firms)** | | |
| Off Balance Sheet Only | $10.6 trillion | $10.6 trillion |
| Off and On Balance Sheet | **$13.4 trillion** | **$14.5 trillion** |

This sharp increase in investments in intangibles that appear on corporate balance sheets may reflect large numbers of mergers: When a company is acquired, payments exceeding the book value of the acquired company are entered as intangible assets on the acquiring company's balance sheet. However, when we expand the definition of intangibles under the primary method to include off-balance sheet "economic competencies," the total comes to $10.6 trillion in 2011, the same estimate as in 2005. We may safely assume that the value increased from 2005 to 2007 and then fell with the U.S. financial crisis of 2008-2009 and accompanying recession. As it is, the market capitalization of U.S. public companies rose from $15.2 trillion in 2005 to $17.4 trillion in early 2011, a 14 percent increase. However, the impact of this change on our estimate of the total value of intellectual property was offset by a decline in the

share of a company's market value attributed to intangible assets, from 69.9 percent in 2005 to 61.1 percent in 2011.

## Challenges to Intellectual Property Rights in a Global Economy

The rapid globalization of this era presents new challenges for the United States in maintaining its preeminence in the development of intellectual capital. As the rate of scientific innovation has accelerated, especially with the spread of information technologies and the Internet, the period of time during which a firm can market its innovation with no direct competition from substitutes contracts. In response, many firms have sought to recapture their development costs more quickly by expanding their worldwide market. As 74 percent of global GDP and demand are located outside the United States,[41] the potential increase in revenues from global marketing and sales immediately following an innovation's introduction is immense. However, these sales depend on the innovator's intellectual property rights being respected outside the United States.

Some developing countries have been inclined to ignore or outright deny foreign intellectual property rights. Using a simple calculus, they see themselves importing innovative technologies and business methods at patent-protected or copyright-protected prices while generating relatively little innovative activity of their own that would need protection in other markets. This anti-IP disposition -- seen recently, for example, in pharmaceuticals in countries such as India and Brazil, and foreign-developed information-technology innovations in China – is typically accompanied by piracy or counterfeiting, sometimes supported by domestic judicial or regulatory holdings that invalidate a patent or copyright. There is no doubt that intellectual-property protections in developing nations directly stimulate the pace of innovation in advanced economies.[42] The prospect of earning returns over a larger market – and therefore earning higher returns – directly increases R&D. But there also is no doubt that ignoring or denying foreign IP rights will lower the price for certain innovative products in those countries. This is particularly true with regard to some corporations, which use their patent protections to maintain monopolies and deter potential competitors from entering the market, rather than developing additional new products.[43] The question is, does it make economic sense for a developing country to do so?

The consensus from economic research is that the costs to a developing nation of ignoring the intellectual property rights of foreign companies *significantly exceed* any benefits, even though innovative activity is largely concentrated in advanced countries that can afford substantial financial commitments to R&D. The essential factor is that the modernization and growth of developing nations now depend on the quality and

[41] From USDA Economic Research Service (2010).
[42] Diwan and Rodrik, (1991).
[43] These charges, summarized in Falvey, Foster, and Greenway (2004), are made by many opponents of intellectual property protections, including the Group of Friends of Development in their April 2005 submission to WIPO (see references for full citation).

quantity of the transfers of innovative technologies and business methods through foreign direct investments – and most companies permit those transfers only to those markets that respect their intellectual property rights in the goods and services being transferred.

Many studies confirm this dynamic. One major analysis, using data for 95 countries from 1960 to 1988, found that intellectual property rights had a significant effect on the growth rates of both the high-income countries where the innovations were developed and low-income countries where strong patent protections encourage the importation and inward foreign direct investments of innovations.[44] Another study conducted in 2004 looked at 80 countries over four, discrete time periods spanning 1975 to 1994.[45] The researchers found that strong IP protections stimulated *even greater gains* in countries with low *per capita* incomes than in the high-income countries exporting or transferring their innovative technologies and business operations.[46]

While China is sometimes cited as an exception owing to the potential value to foreign companies of China's huge and fast-growing market, recent work suggests that this linkage affects China as well, including its impact on the development of domestic innovating firms.[47] Researchers looked at high-tech firms across Chinese provinces, controlling for local factors such as banking, system development, and government corruption. They found that high-tech firms located in provinces which strictly enforced intellectual property rights secured more external debt and equity financing, invested more in R&D, and participated more frequently in joint ventures than similar firms in provinces with lax enforcement of intellectual property rights.

Technology transfers can occur through export as well as foreign direct investments, depending on the product and the market, and several studies have also found that countries with relatively strict intellectual property rights attract relatively more technologically-advanced imports.[48] This linkage reflects the interest of companies in protecting their innovations from local knock-offs, which also could then be exported to third country markets. Companies usually favor foreign direct investments over exports for large markets which also have low barriers to establishing new firms or joint ventures, and especially for products which are R&D-intensive and are expensive to transport and/or trade.[49] For example, as a nation strengthens its intellectual property protections, the foreign direct investments coming into that nation will tend to include complex technologies that are easily copied or imitated, especially compared to

[44] Gould and Gruben (1996); Thompson and Rushing (1996) found these effects only when a country had achieved a certain level of GDP.
[45] Falvey, Foster, and Greenway (2004).
[46] *Ibid*. The researchers could not establish the same link for middle-income countries: The positive effects of patents on growth, from imports and foreign direct investment, were offset by negative effects associated with discouraging domestic imitators and slowing the pace with which new knowledge is diffused.
[47] Ang, *et. al.* (2009).
[48] Maskus and Penubarti (1995); Smith (1999).
[49] Maskus (2000).

technologies and products that are more standard and labor intensive.[50] The result is that both the quality and quantity of the technologies transferred to developing countries generally rise as those countries strengthen their intellectual property rights.[51]

This is further confirmed by research that has established direct connections between technology transfers to developing markets and the strengthening of patent rights in those markets, especially when domestic companies compete with the foreign innovators.[52] One study found that every one-percent increase in the degree of patent protection in a developing country was associated with a 0.45 percent increase in the stock of U.S. investment there.[53] Similarly, another study looked at how reforms in intellectual property rights in 16 countries over the period 1982 to 1999 affected technology transfers by U.S. multinational firms to foreign affiliates.[54] The researchers found that royalty payments to parent companies for the use or sale of technologies transferred to their affiliates increased at the times of those reforms, as did R&D carried out by the affiliates as a complement to the technology imports from their parent companies.[55] Not surprisingly, the results showed that this effect was largest in firms whose revenues prior to the reforms depended most on intellectual property.

The data showed further that bilateral trade in manufactured goods also rose sharply when intellectual property protections were enhanced -- which may also help explain the finding by the World Bank that the share of global trade comprised of knowledge-intensive or high technology products rose sharply during the same periods of intellectual property reform.[56] Finally, research shows that the strict enforcement of intellectual property rights is also a prerequisite for multinationals to shift some of their R&D activities to developing nations, with substantial positive feedback effects for those nations. For example, one study found that as a country's intellectual property protections increase, foreign-based firms focus more of their operations within that country on the development of intangible assets, with significant positive effects on the country's GDP growth.[57]

Conversely, countries with weak intellectual property rights receive relatively little FDI, and the FDI they do attract is less technologically-sophisticated.[58] Thus, a survey of 100 U.S.-based multinational firms found substantial reluctance to conduct business in India, Brazil, Argentina and Indonesia, all countries cited by the Office of the U.S.

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[50] Intellectual property protections also affect the composition of foreign direct investment. One study found that the investment that flows to countries with weak intellectual property rights tends to focus on distribution channels for the company's products, rather than production technologies and manufacturing. See Smarzynska (2002).
[51] Vishwasrao (1994).
[52] Taylor (2004).
[53] Maskus (1994), cited in Maskus (2000).
[54] Branstetter,*et al.*(2005).
[55] The countries include Argentina, Brazil, China, Indonesia, Japan, South Korea, Mexico, the Philippines, Spain, Taiwan, Thailand, and Turkey.
[56] Fink and Braga (1999).
[57] Claessens and Laeven (2002).
[58] Lee and Mansfield (1996).

Trade Representative for failing to respect and protect the intellectual property rights of American companies and citizens.[59] For example, 62 percent of those surveyed said that they would not license domestic production of their products in Argentina, 69 percent said they would not do so in Brazil, and 73 percent would not do so in Indonesia. Further, more than 80 percent of pharmaceutical companies reported that they would not conduct joint ventures or transfer or license their technologies in India, one of the world's leading producers of both legal and illicit generic treatments.[60]

All of these findings establish clear lines of causality which in some cases can produce a virtuous economic circle. Developing nations which respect intellectual property rights are more likely to receive FDI transfers of state-of-the-art technologies and business methods. Once those countries' own businesses and managers become familiar with the more advanced equipment and ways of operating, domestic firms adopt them as well and often increase their own commitments to developing new intellectual property. These development, in turn, lead to faster growth by domestic firms, which make the country an attractive locale for further FDI by multinational companies. In fact, researchers have found that as a developing country modernizes, its R&D expenditures as a share of its GDP tend to not only increase, but to rise *at an increasing rate*.[61] As a result, R&D expenditures and economic growth greatly exceeded global norms in nations such as Taiwan and South Korea, with strong intellectual property protections, especially compared to Latin American countries with lax intellectual property rights and enforcement. Finally, multinational firms are more likely to invest in large research projects that would benefit certain nations or regions, if those nations or regions respect the firms' intellectual property rights. Thus, a recent study found that research into anti-malaria treatments by pharmaceutical firms increased following improvements in intellectual property protections by countries subject to malaria outbreaks.[62]

[59] Mansfield (1986); cited in Maskus (2000).
[60] Similarly, among the machinery producers surveyed, 73 percent said that they would not license the production of their products in Brazil and 59 percent would not do so in India.
[61] Lederman and Maloney (2003).
[62] Lanjouw and Cockburn (2000).

## The Costs of Violating Property Rights in Intellectual Capital

The dimensions of the intellectual capital in the U.S. economy and their dominant role in the market value of many industries increase the economic importance of the property rights which developers and owners have in their own intellectual capital. These developments also highlight the serious economic harm posed by counterfeiting and piracy of intellectual capital and other violations of intellectual property rights. The costs associated with these illegal activities, which are common across much of the developing world, go far beyond the revenue losses for the businesses that own the intellectual capital. For example, these activities also cost lost wages for workers from those firms, expenditures to police who pursue these crimes, and injuries and deaths from counterfeit pharmaceuticals. Perhaps most important, counterfeiting, piracy, and on occasion, the direct abrogation of patents and copyrights by foreign governments reduce the returns on innovation, which in turn reduce investments in research and development. In an idea-based economy such as the United States, such reductions can have substantial and far-flung adverse economic effects.

There are no comprehensive data to measure the extent of such counterfeiting and other violations and appropriations of the intellectual capital of American companies. However, a number of organizations have developed estimates of various aspects of the problem. The Organization for Economic Development (OECD), for example, has estimated that the value of counterfeited and pirated goods traded internationally in 2005 came to about $200 billion.[63] This figure did not include goods counterfeited and then sold domestically or digital goods pirated and sold on the Internet. It is also likely that much of this total involved the counterfeiting or piracy of American intellectual capital, since the United States is both the world's largest economy and accounts for the largest share of patenting and copyright activity in the world.

The illegal appropriation of American intellectual property affects different industries to varying degrees, with a strong, natural correlation between the severity of these problems and the level of an industry's intellectual capital and intangible assets. One primary target, therefore, has been the "core" copyright industries, including software, musical recording and motion pictures, which represent some 6 percent of U.S. GDP.[64] The software industry estimates that more than 40 percent of all software installed throughout the world in 2009 was pirated, with commercial value of $51 billion.[65] Estimated software piracy rates range from 20 percent in the United States -- the lowest rate of 42 countries sampled – to 63 percent of installed software in Turkey, 63 percent of the entire Latin American market, 87 percent of the Russian market, and

[63] OECD (2007).
[64] Siwek (2007).
[65] Business Software Alliance and IDC (2010).

between 85 percent and 91 percent in the Ukraine.[66] Studies also have found pervasive software counterfeiting and piracy across much of Asia, especially in China, Vietnam and Indonesia.

Similar rates of piracy and counterfeiting affect the global trade in musical recordings. By one estimate, music piracy cost the U.S. industry $4.5 billion in 2005; and by 2007, those losses reached $12.5 billion per-year.[67] As with software, rates of music piracy vary across nations. One industry report identifies Latin America as the hub for counterfeiting in musical recordings, with piracy rates of 50 percent or more in every Latin American country surveyed.[68] Paraguay is the worst offender, and one study estimates that counterfeits comprise a staggering 99 percent of the entire recording market. China and Indonesia are not far behind, with piracy rates of 85 percent and 88 percent, respectively. The recording industry also reports that counterfeits comprise up to 66 percent of the recording market in Russia and 68 percent of the market in the Ukraine.

Industries reliant on patents such as pharmaceuticals and semiconductors also are prime targets for counterfeiting and piracy, sometimes with deadly consequences. While traffic in other counterfeit markets causes substantial economic harm, especially for an idea-based economy like the United States, counterfeit medicines often cause injuries and death as well economic damage. At least 30 people in Cambodia died from counterfeited anti-malaria drugs in 2000, and 59 children died in Haiti in 1997 after taking counterfeit fever medications.[69] On a much larger scale, the *Shenzhen Evening News* reported that more than 100,000 people died of fake drugs in China in 2001 alone.[70] Many researchers have tried to quantify the global market in counterfeit drugs. For example, *Business Week* reported that the value of counterfeit drugs sold in 2001 was somewhere between $6 billion and $19 billion, while another study calculated that counterfeiting costs pharmaceutical companies $12 billion per year.[71]

The actual costs may well be substantially greater. The European Federation of Pharmaceutical Industry Associations reports that counterfeits account for up to 50 percent of certain pharmaceuticals sold in China, as well as more than 50 percent of the total drug market in Pakistan, and 10 percent of the market in other Asian countries and Russia.[72] Moreover, the World Health Organization (WHO) estimates that counterfeit drugs account for 8 percent to 10 percent of the worldwide pharmaceutical market.[73] The WHO estimate implies that pharmaceutical counterfeiting will cost a staggering $70 billion to $88 billion in 2011, based on a projected worldwide market this year of $880

[66] *Ibid*.; Business Software Alliance and IDC (2010).
[67] Siwek (2007).
[68] IFPI, (2005).
[69] See German Pharma Health Fund (2004).
[70] *Ibid*.
[71] Capell and Timmons (2001); Power (2002).
[72] EFPIA, (2005).
[73] Frontier Economics LTD, (2011).

billion.[74] If the real losses are in this range, pharmaceutical counterfeiting may be exerting a significant dampening effect on research and development into new treatments, with untold costs for society.

## Conclusions

Intellectual capital and intangible assets have come to dominate the creation of new value and wealth in the American economy, signaling a substantial shift to an idea-based economy. To a significant degree, every economy is and has always been idea-based: The development and application of new ideas in the form of economic innovations, more than any other factor, drive changes in the underlying rate at which all economies grow and at which the productivity and incomes of their people increase. Moreover, in recent years, the investment focus of U.S. businesses has shifted from tangible assets – plant, equipment, real estate – to intellectual capital such as databases, research and development, patents and copyrights. Similarly, the market value of U.S. public firms in most industries is no longer driven mainly by the value of their physical assets. Today, the market values of U.S. countries are set, to a much greater degree than ever before, by the value of a firm's intangible assets -- including not only its intellectual capital, but also by other intangible assets, such as the firm-specific skills of its executives and workers, and investments that enhance the efficiency and productivity of its organizational arrangements.

Given the increasing economic importance of intellectual capital and intangible assets, we set out to measure the total value of the intellectual capital and intangible assets in the American economy and calculate their distribution across its industries. Using two alternate methodologies derived from an analysis by the Federal Reserve, we find that the value of U.S. intellectual capital increased from its 2005 levels of $5 trillion to $5.6 trillion to between $8.1 trillion and $9.2 trillion today. The intellectual capital in the U.S. economy today is equivalent to between 55 percent and 63 percent of U.S. GDP. Moreover, the stock of intellectual capital has grown nearly three-times faster than the overall economy over the last five years, increasing by 45 percent compared to a 16 percent growth in nominal GDP.

Similarly, we find that the value of the intangible assets in the economy increased from $13.4 trillion in 2005 to $14.5 trillion today, which is approximately equivalent to GDP. These intangible economic assets, then, are generally equivalent to U.S. GDP. It is striking that the stock of U.S. intellectual capital grew much more as well as much faster than the stock of intangible assets. This suggests that the 2005 stock of intellectual capital weathered the 2007-2009 recession better than the stock of intangible assets. This development would be expected: Intangible assets that fall outside intellectual capital include the firm-specific and task-specific skills of managers and workers, several million of whom lost their positions during this period. Intangible assets also include productive organizational arrangements specific to particular

[74] Figure is an IMS (2010) Health forecast.

businesses, and the 2007-2009 recession was marked by very high rates of business failure.

This study also provides the distribution by industry of the U.S. stock of intellectual capital and intangible assets. Measured by quantity, the industries with the most intellectual capital and intangible assets include intellectual property-intensive areas such as software, pharmaceuticals, and computer hardware, as well as capital goods, energy, and insurance. Moreover, the industries with the most intellectual capital and intangible assets as shares of their market value are very broadly distributed. Ten industries out of 24 have intangible assets equal to at least 90 percent of their market value. They include not only obvious candidates such as pharmaceuticals, software, media, and telecommunications, but also industries less obviously dependent on ideas such as food, beverages and tobacco, health care equipment and services, household and personal products, autos, consumer services, and commercial and professional services. Similarly, ten out of the 24 industries have intellectual capital equal to at least 50 percent of their market value, including but not limited to software and its services, pharmaceuticals, media, and telecommunications services. This high-intellectual-capital group also includes commercial and professional services; food, beverages and tobacco; healthcare equipment and services; household and personal products; consumer services; and automobiles.

The large and fast-growing role of intellectual capital in the U.S. economy also increases the importance of secure property rights for such capital, in order to maintain the incentives to develop new intellectual capital. Yet, in recent years, the governments of such disparate countries as Brazil and India have challenged some of the most basic intellectual property protections in U.S. and European law for patents and copyrights. Furthermore, the production and purchase of counterfeit or pirated U.S. software, music, films and pharmaceuticals – much of it concentrated in Latin America and the developing nations of Asia – has become a global business so large that it could undermine the economic incentives for people to innovate. The U.S. Government must aggressively resist these developments, and preserve and protect all legitimate property rights to new intellectual capital.

Certain problems with the way the United States protects and enforces intellectual property rights are more subtle than the countenance of gross counterfeiting. But those issues can involve substantial adverse effects so long as the United States remains the world's most innovation-based, large advanced economy. For example, it has at time been difficult to ensure adequate funding for the U.S. Patent and Trademark Office (PTO), especially given the fast-expanding and costly technical expertise required to properly adjudicate many contemporary patent filings and challenges. More broadly, given the central role that IP-Intensive industries now play in U.S. growth and competitiveness, the U.S. Government should make enforcement of intellectual property rights a high priority in both the United States and abroad. Furthermore, the U.S. Government should actively promote strong intellectual property rights and their enforcement in free trade agreements. In implementing these new policies, it is important to consider the potential implications for the future of innovation and the valuable jobs accompanying industries with a high intensity of intellectual capital.

## References

Ang, James S., Yungmei Cheng and Chaopeng Wu (2009) "Does Enforcement of Intellectual Property Rights Matter in China? Evidence from Financing and Investment Choices in High Tech Industry." AFA Denver Meetings Paper.

Bacon, Sir Francis (1597) *Religious Meditations, Of Heresies.*

Barron's (2011) "Indexes PEs and Yields." http://online.barrons.com/public/page/9_0210-indexespeyields.html.

Blustein, Paul (2004) "China, U.S. Smooth Rough Spots in Trade; Bush Touts Plan; Democrats Don't." *Washington Post*, April 22, 2004.

Branstetter, Lee, and Raymond Fisman, and C. Fritz Foley (2005) "Do Stronger Intellectual Property Rights Increase International Technology Transfer?" National Bureau of Economic Research, Working Paper No. 11516.

Bureau of Economic Analysis (2005) "Table 2.1, Current-Cost Net Stock of Private Fixed Assets, Equipment and Software, and Structure by Type, 1987-2003."

_____ (2005) "Value Added by Industry in Current Dollars as a Percentage of Gross Domestic Product." Annual Industry Accounts.

_____ (2009) "2009 Private, Nonresidential Fixed Assets." U.S. Department of Commerce, BEA economic tables Table 1.1, http://bea.gov/national/FA2004/SelectTable.asp.

_____ (2011) "Table 11. Software Investment and Prices." http://www.bea.gov/national/xls/soft-invest.xls.

Business Software Alliance and IDC (2004) "First Annual BSA and IDC Global Software Piracy Study."

_____ (2010) "2010 Piracy Impact Study: The Economic Benefits of Reducing Software Piracy."

Capell, Kerry, and Suzanne Timmons (2001) "What's in That Pill?" *Business Week*, June 18, 2001.

Carol Corrado, Charles Hulten, Daniel Sichel (2004) "Measuring Capital and Technology: An Expanded Framework." Federal Reserve Board, *Finance and Economics Discussion Series*, No. 2004-65.

Chen, Derek H.C., and Carl Dahlman (2004) "Knowledge and Development: A Cross-Section Approach." World Bank Policy Research Working Paper No. 3366.

Claessens, Stijn and Luc Laeven (2002) "Financial Development, Property Rights, and Growth." The World Bank, Policy Research Working Paper Series 2924.

Denison, Edward F. (1962) “The Sources of Economic Growth in the United States and the Alternatives Before Us.” Committee for Economic Development, Supplementary Paper Number 13.

Diwan, Ishac and Dani Rodrik (2005) “Patents, Appropriate Technology and North-South Trade.” *Journal of International Economics*, Vol. 29, No. 1.

EFPIA (2005) “Counterfeit Medicines,” www.efpia.org/2_indust/counterfeitdrugs.pdf. (August 31, 2005)

Engen, Eric and Kevin Hassett (2002) “Does the U.S. Corporate Tax Have a Future?” *Tax Notes*, 30th Anniversary Issue.

Falvey, Rod, Neil Foster, and David Greenway (2004) “Intellectual Property Rights and Economic Growth.” Research Paper 2004/12, University of Nottingham.

Fink, Carsten, and Carlos A. Primo Braga (1999) “How Stronger Protection of Intellectual Property Rights Affects International Trade Flows.” The World Bank, Policy Research Working Paper Series 2051.

Ford, Earl S., et al. (2007) “Explaining the Decrease in U.S. Deaths from Coronary Disease, 1980-2000.” *New England Journal of Medicine*, Vol. 356, No. 23, pp 2388-2398.

Frontier Economics LTD (2011) “Estimating the global economic and social impacts of counterfeiting and piracy.” www.iccwbo.org/uploadedFiles/BASCAP/Pages/Global%20Impacts%20-%20Final.pdf.

German Pharma Health Fund (2004) “Counterfeit Medicines - An Unscrupulous Business.” www.gphf.org/web/en/minilab/hintergrund_arzneimittelfaelschungen.htm.

Gould, David M. and William C. Gruben (1996) “The Role of Intellectual Property Rights in Economic Growth.” *Journal of Development Economics,* Vol. 48, No. 2, pg 323-350.

Griliches, Zvi (1981) “Market Value, R&D and Patents.” *Economics Letters,* Vol. 7, No. 2, pp 183-187.

Group of Friends of Development (2005) “Proposal to Establish a Development Agenda for the World Intellectual Property Organization (WIPO): An Elaboration of Issues Raised In Document 22 Wo/Ga/31/11.” *Submission to the World Intellectual Property Organization.*

Grubert, Harry (2003) “Intangible Income, Intercompany Transactions, Income Shifting, and the Choice of Location.” *National Tax Journal,* Vol. 56, No. 1, Part 2, pp. 221-242.

Hassett, Kevin A. and Robert J. Shapiro (2005) “The Economic Value of Intellectual Property.” http://www.sonecon.com/docs/studies/IntellectualPropertyReport-October2005.pdf.

IFPI (2005) “The Recording Industry Commercial Piracy Report 2005.”

*Investor’s Business Daily (1998)* “Sink The Web Pirates.” October 9, 1998.

IMS (2010) “IMS Health Forecasts Global Pharmaceutical Market Growth of 5-7 Percent in 2011, Reaching $880 Billion.” Press release, October 6, 2010.

Kanwar, Sunil, and Robert Evenson (2001) “Does Intellectual Property Protection Spur Technological Change?” Yale University, Economic Growth Center Discussion Paper No. 831.

Klenow, Peter J. and Andres Rodriguez-Clare (2004) “Externalities and Growth.” National Bureau of Economic Research Working Paper No.11009.

Lanjouw, Jean O. and Iain Cockburn (2000) “Do Patents Matter?: Empirical Evidence after GATT.” National Bureau of Economic Research Working Paper No. 7495.

Lederman, Daniel and William F. Maloney (2003) “Research and Development (R&D) and Development.” The World Bank, Policy Research Working Paper Series 3024.

Lee, Jeong-Yeon and Edwin Mansfield (1996) “Intellectual Property Protection and U.S. Foreign Direct Investment.” *Review of Economics and Statistics,* Vol. 78, No. 2, pp 181-86.

Lev, Baruch and Theodore Sougiannis (1996) “The Capitalization, Amortization and Value-Relevance of R&D.” *Journal of Accounting and Economics,* Volume 21, No. 1, pp 107-138.

Mansfield, Edwin (1986) “Patents and Innovation: An Empirical Study.” *Management Science,* Vol. 32, No. 2, pp 173-181.

——— (2004) “Intellectual Property Protection, Foreign Direct Investment and Technology Transfer.” International Finance Corporation, Discussion Paper 19.

Maskus, Keith (1994) “The International Regulation of Intellectual Property.” *Weltwirtschftliches Archiv*.

——— (2000) “Intellectual Property Rights and Foreign Direct Investment,” Center for International Economic Studies, University of Adelaide, CIES Policy Discussion Paper 0022.

Maskus, Keith, and Mohan Penubarti (1995) “How Trade-Related Are Intellectual Property Rights?” *Journal of International Economics*, Vol. 39, Issue 3-4, pp. 227-248.

McDonald, Joe (1998) “U.S. Official: Clinton Visit Adding Urgency To Trade Talks.” *Associated Press*, April 14, 1998.

Megna, Pamela, and Marck Klock (1993) “The Impact of Intangible Capital on Tobin's q in the Semiconductor Industry.” *American Economic Review,* Vol. 83, No. 2, pp. 265-269.

Moser, Petra (2003) “How Do Patent Laws Influence Innovation? Evidence from Nineteen-Century World Fairs.” National Bureau of Economic Research Working Paper No. 9909.

Nakamura, Leonard (1999) “Intangibles: what put the new in the new economy?” Federal Reserve Bank of Philadelphia, *Business Review,* July/August 1999, pp. 3-16.

NDC Health (2005) “2005 Pharma Insight.”

NSF (2011) “Business and Industrial R&D.” http://www.nsf.gov/statistics/industry/

O’Grady, Mary (2005) “Brazil Mulls Drug Patent Theft as an AIDS Antidote.” *Wall Street Journal*, June 24, 2005.

Olesen, Alexa (2005) “U.S. Officials: China Promises To Prosecute More Pirates, Ease Software Rules.” Associated Press, July 11, 2005.

Organisation for Economic Co-operation and Development (1998) “The Economic Impact of Counterfeiting.”

_____ (2007) “The Economic Impact of Counterfeiting and Piracy.” http://www.oecd.org/dataoecd/13/12/38707619.pdf (March 8, 2011).

_____ (2009) “Magnitude of Counterfeiting and Piracy of Tangible Products: An Update.” www.oecd.org/document/23/0,3343,en_2649_34173_44088983_1_1_1_1,00.html.

Power, Geoff (2002) “Pharmaceutical Counterfeiting, Tampering and Diversion.” American Bank Note Holographics Inc.

Reuters (2005) “Brazil health minister to break Abbott AIDS drug patent.” June 24, 2005.

Romer, Paul (1993) “Economic Growth.” in the *Fortune Encyclopedia of Economics*, David R. Henderson, ed., Warner Books, 1993.

Samuelson, Robert J. (1996) “Punishment For Piracy.” *Washington Post*, May 22, 1996.

Scheer, Adam (2002) “Pharmaceutical Counterfeiting, Tampering and Diversion.” American Bank Note. Holographics, Inc.

Schumpeter, Joseph (1942) *Capitalism, Socialism and Democracy.*

Siwek, Stephen E. (2004) “Copyright Industries in the U.S. Economy, The 2004 Report.” Economists Incorporated.

_____ (2007) “The True Cost of Sound Recording Piracy to the U.S. Economy.” Institute for Policy Innovation, Policy Report No. 188.

_____ (2009) “Copyright Industries in the U.S. Economy, The 2003-2007 Report.” Economists Incorporated, prepared for the International Intellectual Property Alliance (IIPA).

Smarzynska, Beata K. (2002) “Composition of Foreign Direct Investment and Protection of Intellectual Property Rights: Evidence from Transition Economies.” The World Bank, Policy Research Working Paper No. 2786.

Smith, Pamela J (1999) “Are Weak Patent Rights a Barrier to U.S. Exports?” *Journal of International Economics*, Vol. 48, No. 1, pp. 151-177.

Solow, Robert M. (1956) “A Contribution to the Theory of Economic Growth.” *Quarterly Journal of Economics,* Vol. 70, pp. 65-94.

——— (1957) “Technological Change and the Aggregate Production Function.” *Review of Economics and Statistics,* Vol. 39, No. 3, pp. 312-320.

Standard and Poor's (2011) Compustat (North America) Database.

Summers, Larry (2009) “A Vision for Innovation, Growth, and Quality Jobs.” The White House Blog. September 21, 2009. http://www.whitehouse.gov/blog/A-Vision-for-Innovation-Growth-and-Quality-Jobs/

Taylor, M. Scott (1994) “Trips, Trade and Growth” *International Economic Review*, Vol. 35, No. 2, pp. 361-381.

Thompson, Mark A. and Francis W. Rushing (1996) “An Empirical Analysis of the Impact of Patent Protection on Economic Growth.” *Journal of Economic Development,* Vol. 21, No. 2, pp 61-79.

United Nations (2005) “Brazil May Face Trade Sanctions If IP Negotiations Fail.” *Daily International Pharma Alert*, May 25, 2005.

U.S. Census Bureau (2011) “U.S. Census Bureau 2007 County Business Patterns and 2007 Economic Census.”

U.S. Census Bureau, Foreign Trade Division (2011) https://www.usatradeonline.gov/.

USDA Economic Research Service (2010) “Real Historical Gross Domestic Product (GDP) Shares and Growth Rates of GDP Shares.” http://www.ers.usda.gov/Data/Macroeconomics/Data/HistoricalGDPSharesValues.xls

U.S. Department of Commerce, U.S. Trade Representative (2001) “2001 Special 301 Report.”

———(2002) “2002 Special 301 Report.” www.ustr.gov/Document_Library/Reports_Publications/Section_Index.html

———(2003) “2003 Special 301 Report.” www.ustr.gov/Document_Library/Reports_Publications/Section_Index.html.

———(2004) “2004 Special 301 Report.” www.ustr.gov/Document_Library/Reports_Publications/Section_Index.html

——— (2005) Special 301 Report.” www.ustr.gov/Document_Library/Reports_Publications/Section_Index.html

_____(2005) “U.S. Expands Outreach in Campaign To STOP! Trade In Fakes.” Press Release, June 6, 2005.

Van Art, Bart, Linda Barrington, Gail Fosler, Charles Hulten, and Christopher Woock (2009) “Innovation and U.S. Competitiveness: Reevaluating the Contributors to Growth.” Research Report 1441, The Conference Board.

Vishwasrao, Sharmila (1994) “Intellectual Property Rights and the Mode of Technology Transfer.” *Journal of Development Economics,* Vol. 44, No. 2, pp. 381-402.

Wilshire Associates (2011) “The Wilshire 5000 Total Market Index.” http://www.wilshire.com/Indexes/Broad/Wilshire5000/Characteristics.html.

World Bank (2004) “Total GDP 2004.” www.worldbank.org/data/databytopic/GDP.pdf (September 6, 2005).

_____ (2005). *World Development Indicators,* Washington, DC: World Bank, 2005.

_____(2011). *World Development Indicators*, Washington, DC: World Bank, 2011.

Xinhua General News Service (2005) “US To Determine If Quotas Should Be Reimposed On China’s Textile Products.” April 4, 2005.