Restoring America's Lagging Investment in Capital Goods

BY LUKE A. STEWART AND ROBERT D. ATKINSON | OCTOBER 2013

Not only has the business investment rate stagnated in the 2000s, but investment that was once broadly distributed across industries is now much more concentrated in a few select domestic-serving services industries.

Investment in new equipment and software is the primary means through which innovation—the key driver of economic growth—diffuses throughout the economy. Without new capital investment refreshing a nation's capital stock, innovation loses its power, productivity growth stagnates, and national economic competitiveness declines. It is troubling, then, that over the past decade, business investment rates in the United States have stagnated. Between 1980 and 1989, business investment in equipment, software and structures grew by 2.7 percent per year on average and 5.2 percent per year between 1990 and 1999. But between 2000 and 2011 it grew by just 0.5 percent per year—less than a fifth of that of the 1980s and less than one tenth that of the 1990s. Moreover, as a share of GDP, business investment has declined by more than three percentage points since 1980.

In this report, we examine the role of private nonresidential capital investment in economic growth and then analyze trends in that investment over the past three decades. We find that, not only has the overall business investment rate stagnated in the 2000s, but investment that was once broadly distributed across industries is now much more concentrated in a few select domestic-serving services industries, and industries that once powered U.S. investment growth and global competitiveness are now falling behind. Industries in which we are thought to be global leaders, such as computers and chemicals products, have experienced declines in capital investment. The report reviews possible reasons behind the investment decline, suggesting that the rise of "short-termism" on the part of corporate managers and declining U.S. economic competitiveness have played key roles. To turn these around, Congress should use the tax code to more strongly encourage

investment in machinery, equipment and software, ideally through a new investment tax credit, while the administration should establish a task force on market short-termism to recommend policies to ameliorate it.

WHY CAPITAL INVESTMENT MATTERS

In developed, knowledge-based economies like the United States, innovation powers long-run economic growth. The mere act of innovating is not sufficient to grow an economy, however. Rather, for the economy to grow, that innovation must diffuse through the economy, being adopted by firms as they seek to improve productivity or the quality of products or services.[1] Investment takes on this role: once an innovation occurs, capital investment—the purchase of machinery equipment and software by organizations—is what spreads the innovation throughout the economy. This investment includes things like information processing equipment and software; industrial equipment such as engines, metalworking machinery, and materials handling equipment; transportation equipment like trucks and aircraft; and other equipment such as construction machinery and farm equipment.[2]

Capital investment acts as a diffuser of innovation because innovation is embedded in new investment. For example, new personal computers contain better, faster operating systems and other new or redesigned software; they include hardware innovations such as touch screens and solid state drives that lower boot time to mere seconds. Even seemingly "old economy" capital such as agricultural or mining equipment is now infused with highly advanced technologies, and each new generation is better than the last. The latest cotton harvesters built by John Deere, for example, include GPS location tracking, microwave sensors to measure the flow of cotton, radio-frequency identification (RFID) tagging to track the origin of each cotton bundle, and wireless data communication capabilities. One John Deere harvester contains about the same processing power as eight personal computers.[3] Likewise, warehouses today employ sophisticated new technologies. Warehouse management systems combine innovations in robotics, RFID and laser tagging with inventory management software to dramatically increase accuracy and productivity.[4] Even machine tools, a hallmark of what is sometimes called "dirty" manufacturing, are today brimming with the latest technologies. For example, one can purchase milling machines equipped with a computer, operating system and precision controller software.[5] In virtually all cases, when organizations buy new capital equipment, they are buying innovation.

Indeed, contrary to conventional economic doctrines, the value of investment is not in acquiring *more* machinery and equipment; it is in acquiring *newer* and *more productive* equipment—in essence acting as a "refresh" rate for the economy. (See Box 1) A high rate of investment enables innovations to swiftly spread through the economy, bestowing their economic benefits upon their users. Conversely, a low rate of investment can signal either a lack of innovation—such as when new equipment and software is not sufficiently superior to warrant an investment—or insufficient incentives for organizations to adopt those innovations.

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BOX 1: ECONOMIC DOCTRINES AND CAPITAL INVESTMENT

As ITIF has written, economics is not a science, but rather a collection of competing doctrines.[6] Adherents of different economic doctrines view the role of capital and investment in economic growth quite differently. Until the mid-1990s the economic debate was largely between neoclassical economists and neo-Keynesian economists; however, more recently, a new doctrine has emerged: innovation economics. The following provides a summary of neoclassical, neo-Keynesian, and innovation economics views on the subject of capital, investment and economic growth.

Neoclassical Economics

Perhaps the most important principle of neoclassical economics is that the accumulation of capital is what drives economic growth. Economist Robert Solow was awarded the Nobel Prize for empirically linking two explicit factors—labor and capital—to growth, and today in the neoclassical doctrine capital accumulation is the central focus.[7] While Solow acknowledged the importance of technology in growth, he did so by calling the model's unexplained residual "technical change" and treating it as exogenous—that is, lying outside of the model, and therefore outside of economic inquiry. As economist Michael Mandel notes, neoclassical economists are "capital fundamentalists" who "behave as if saving and investment in physical and (sometimes) human capital are the only forces driving growth. [They] generally ignore or minimize the role of technology. … They grudgingly acknowledge the importance of technological change, but they don't understand it or trust it."[8] The key here is that, for neoclassical economists, it is the amount of capital investment, not the rate at which it incorporates innovation, which matters to economic growth. In other words, for them, expanding capital investment by $1 billion in the first generation of a machine is just as effective at promoting growth as an investment of $1 billion in the second generation of the machine. Moreover, neoclassical economists do not distinguish between different sorts of capital, treating IT equipment, machinery, and structures equally as important to growth as the other.

Neo-Keynesian Economics

For neo-Keynesian economists, it is spending, rather than capital accumulation, which drives economic growth. In other words, the focus of the neo-Keynesians is on "aggregate demand," in that growth in the aggregate demand for goods and services is what drives economic growth. They view capital investment as simply another type of spending, a component of aggregate demand. Thus, if capital

investment falls or stagnates, consumer or government spending must rise in order to keep economic growth on course. The only real advantage increased capital investment brings is in an aggregate demand sense, in the same way that increased spending on clothing or food would spur aggregate demand. That said, in recent years some neo-Keynesians have attempted to update the aggregate demand story such that it fits the realities of the new economy. Some neo-Keynesians now acknowledge that investment is a key driver of productivity growth. However, their claim remains that it is spending that drives companies to increase investment, rather than innovation.[9] In their view, companies will invest more only if the overall demand for their products or services is increasing. This view, like the neo-classical view, ignores the role of capital investment in spreading innovation and innovation in driving investment.

Innovation Economics

Innovation economists believe that what primarily drives economic growth in today's knowledge-based economy is not the accumulation of capital, as claimed by neoclassicalists, nor spending, as claimed by neo-Keynesians, but *innovation*. This innovation-focused growth model is deemed "new growth" theory. Innovation economists argue that growth in developed economies over the last 20 years has occurred not because economies accumulated more capital to invest in even bigger steel mills or car factories; nor has it occurred because consumers spent themselves into prosperity (clearly). Rather, growth has occurred because a wide array of new technologies has been developed—particularly information technologies—and, importantly, deployed throughout the economy. This emphasis on innovation has led some adherents of new growth theory to assume that *only* intangible capital, such as research and development (R&D), is important and that tangible capital (equipment) is unrelated to innovation.[10] But this is a misreading of new growth theory and empirical analysis, which makes clear that innovation is enabled by the adoption of innovative capital equipment.

Why does this matter? First, modern economies like that of the United States require innovation in order to grow. Innovation, in turn, requires high rates of capital investment in order to be utilized. This brings up an important distinction: capital investment—which we are discussing here—should not be confused with capital stock. (See Box 2) Capital stock—the amount of equipment, software and structures in an economy—was once considered to be the primary driver of economic growth. The more capital, the theory went, the better. However, this "neoclassical" theory has been displaced by "new growth" theory, which argues, in essence, the more innovation, the better. As Paul Romer, a leader in new growth economics, explains:

> We now know that the classical suggestion that we can grow rich by accumulating more and more pieces of physical capital like forklifts is simply wrong. The problem an economy faces … is what economists call "diminishing returns." In handling heavy objects, a forklift is a very useful piece of equipment. When there were few forklifts in the economy, the return on an investment in an additional forklift was high. But as we increase the total number of forklifts the value of each additional forklift drops rapidly. Eventually, additional forklifts would have no value and become a nuisance. The return on investment in an additional forklift diminishes and eventually becomes negative. As

a result, an economy cannot grow merely by accumulating more and more of the same kinds of capital goods.[11]

Some economists—even some new growth proponents—have interpreted this to mean that capital investment is unimportant and that innovation is the only important growth driver.[12] But this is a misreading of new growth theory. In new growth theory, it is through investment in new machinery, equipment and software that innovation spreads. High rates of investment mean that the capital stock is refreshed and replaced with newer and more productive machinery, equipment and software. Low rates of investment mean that organizations are not adopting innovative new equipment and software as they might otherwise. Declining capital stock is an indicator that new equipment is not replacing old equipment faster than it is being worn out. Both capital investment and capital stock are important metrics of economic health.

In virtually all cases, when organizations buy new capital equipment , they are buying innovation.

BOX 2: INVESTMENT VERSUS NET STOCK

Two related terms, "investment" and "net stock," appear frequently in this paper. It is important to distinguish between them:

Investment
Investment in this report refers to nonresidential fixed asset investment, which refers to the annual purchases of goods that are not consumed immediately but are rather used to enable future production. These goods include equipment, software and structures. In economic parlance, they are referred to as physical capital, and in this paper the terms "investment," "fixed investment" and "capital investment" are used interchangeably.

Net stock of fixed assets
The net stock of fixed assets at a point in time is the sum of all of those fixed assets that have been purchased through investment, minus the depreciation of those fixed assets. (The "net" in net stock signifies that depreciation is subtracted.) In this paper the terms "net stock," "capital stock" and "net stock of fixed assets" are used interchangeably. Thus, unless the investment rate exceeds the rate of depreciation of existing stock of fixed assets, the net stock for an economy will decline.

One way to understand the role of capital investment in economic growth is to consider Romer's example of forklifts. What would be better: an economy with 20 percent more fork lifts or an economy where existing fork lifts were replaced with new ones that were robotically controlled? Assuming that the robotic ones cost 20 percent more, the capital-to-GDP ratio would be the same either way, but the economy would be more productive with robotic forklifts (assuming that they are more than 20 percent more productive). Indeed, while adding more forklifts will show diminishing returns (each additional forklift acquired would be less productive than the previous forklift acquired), better forklifts will not, at least in the short run.[13] Clearly, the robotic forklift innovation is essential; however, if only a few enterprises buy them, the full potential of the robotic forklift innovation will not be realized. In other words, the key is not how many machines an economy has; rather, it is

how advanced the machines are and how effectively they are used, and this is why the rate of capital investment in the economy is so important.

A second reason capital investment matters is that it has substantial "spillover" benefits—that is, benefits not just for the firm making the investment, but also for the rest of society. To put it another way, firms are unable to capture all of the benefits of their investments in capital. Many economists acknowledge that investments in the production of innovation (such as R&D) have spillovers, and that this is why policies like the R&D tax credit are important. But fewer recognize that investments in new machines, equipment and software also have spillovers. As with R&D, given that firms do not capture the full benefits of capital investment, these spillovers lead to chronic underinvestment.

Asset type	Firm benefit	Spillovers	Economy-wide benefit
Information Processing Equipment and Software (IPES)	High	High	High
Other equipment	High	Moderate	Moderate
Structures	Low	Low	Low

Table 1: The Benefits of Fixed Asset Investments by Type[14]

Firms capture on average only about half the total societal benefits from their investments in information processing equipment and software, suggesting that the current level of IPES investment is significantly less than is societally optimal.

Xavier Sala-i Martin finds that, economy wide, both equipment and non-equipment investment are strongly and positively related to growth, but that equipment investment has about four times the effect on growth as non-equipment investment such as buildings.[15] Bart Van Ark finds that the spillovers from investment in new capital equipment are larger than the size of the benefits accrued by the investing firm.[16] Studies at the industry and firm level have also found compelling evidence of capital equipment spillovers, particularly for information processing equipment and software (IPES). (See Box 3) Lauren Hitt and Prasanna Tambe find that the spillovers from firms' investments in IPES are "significant and almost as large in size as the effects of their own IPES investment."[17] In other words, firms capture on average only about half the total societal benefits from their investments in information processing equipment and software, suggesting that the current level of IPES investment is significantly less than is societally optimal.

BOX 3: WHAT IS IPES?

IPES stands for Information Processing Equipment and Software, a U.S. government term for a class of digital goods (or assets) that emerged in the latter half of the twentieth century. The types of goods included under IPES are:

- Mainframes
- Personal computers
- Printers
- Terminals
- Storage devices
- System integrators
- Software
- Communications equipment
- Medical instruments
- Photocopy and related equipment
- Accounting equipment

There are several reasons why firms are unable to capture the full benefits of their capital investments; however, this is not to say that all kinds of business capital investment have all of these characteristics. (See Box 4) When a company constructs a new building, it is more likely to capture all of the benefits of that investment. But when it buys new equipment or software it is not likely to be able to capture all the benefits. And these spillovers are likely to be even larger for information technology, in part because the learning cost curve appears to be steeper and because the network effects are larger.

This leads to a larger point: not all investments are created equal, at least in terms of benefit to the economy. As Table 1 shows, IPES has both a high private benefit to the firm and high spillover benefits, and thus has a high economy-wide benefit. Other sorts of equipment, such as industrial machinery and transportation equipment, provide high benefits to the firm but have smaller spillover benefits. Investments in structure provide lower productivity benefits to the firm and almost no spillover benefits, and thus its economy-wide benefit is low. In other words, unlike equipment and software investments, structure investments provide less of a pathway for the diffusion of new innovations.[18]

Finally, investment matters because a low refresh rate for capital will make it more difficult U.S. business establishments to be competitive in global markets. This is because both innovation and investment are essential to gain or maintain U.S. business competitiveness in the face of global competition. If investment declines, this means that, despite a high rate of innovation creation in the United States, there is a low rate of productivity and actual production in the United States. Furthermore, foreign companies may invest in innovative equipment and software, providing them with a competitive advantage over U.S. firms. In short, innovation creates, investment diffuses. Therefore, stagnant or declining investment could not only be another sign of U.S. competitive decline, but a cause.

BOX 4: THE REASONS BEHIND CAPITAL INVESTMENT'S SPILLOVER BENEFITS

There are at least six reasons why firms are not able to capture all the benefits from their investments in capital equipment:

- First, increased capital expenditures spur innovation in the capital goods industry as higher sales enable capital goods suppliers to fund more R&D, leading to even more productive capital goods equipment. Increased sales also move the capital goods industry down the production cost curve faster, allowing it to lower the price on future units, which in turn spurs adoption of even more capital equipment.

- Second, lower prices for equipment mean that equipment used in scientific research is cheaper, leading to more investment and more research breakthroughs.

- Third, investment in new equipment grants workers new knowledge about the equipment, and they in turn transmit this information to their subsequent employers, leading them to also invest in that new equipment. Indeed, users of new equipment learn what modifications need to be made and then transfer this experience to other firms through a host of means, from inter-firm labor movement to trade shows and professional association meetings.

- Fourth, some equipment, especially IPES, has network effects where the benefits to other firms from a firm adopting the technology are significant. As Hitt and Tambe note, "firm-level investments in communications technologies can create benefits for business partners. Alternatively, investments in information technologies can produce knowledge that can spill over between firms."[18] For example, when logistics firms adopted advanced information technologies in the 1980s, they were able to support just-in-time production processes by manufacturers. So while logistics firms benefited by investing in IT, so too did their customers.

- Fifth, in some innovation-based industries, especially capital goods industries, prices are often above marginal costs, in part because of increasing returns to scale. Consequently, rates of adoption will be too low.[19] However, since prices are higher than marginal cost, this is akin to a private tax that will lead demand to be lower than societally optimal.

- Sixth, as new equipment is replaced, it usually becomes more energy efficient, generating benefits firms don't capture fully (such as reduced CO2 emissions).

CAPITAL INVESTMENT TRENDS ANALYSIS

Any analysis of capital investment trends has to take into account trends in information processing equipment and software (IPES). (See Box 3) According to the U.S. government, from 1980 to 2011, investment IPES grew by 2,156 percent, over 31 times faster than the

next fastest growing type of equipment, transportation, which grew by just 69 percent. But this figure is significantly overstated. (See Appendix A) As ITIF has discussed in previous reports, government methodologies for measuring how goods quantities and qualities change over time do not apply well to information technology goods—in effect, Moore's Law (the trend of information technology prices falling dramatically and rapidly) boggles the government's economic accounting system. [21]

Therefore, before we begin our analysis, we adjust the growth rate of IPES assets to reflect more accurate measurements of actual purchases. (See Appendix B) This adjustment is more of an art than a science, as there is no strictly scientific way to do it. Instead of using the U.S. government's quantity and quality growth rate for IPES, we use the raw "nominal" (or "historical") growth rate for IPES, and then combine our new IPES growth rate with the rest of the government's growth rates for non-IPES assets. (We refer to quality and quantity as simply "quantity" in much of this paper, for simplicity.) We can then examine the past three decades of investment in the United States, beginning in 1980 (the earliest year possible, due to technical constraints) and extending to 2011 (the latest year of available data). Granted, even after our adjustment, IPES assets still grow at a very rapid 681 percent.

Although the 2000s experienced sharp ups and downs in investment, in 2011 investment was still six percent lower than in 2000.

We find that annual business fixed investment rates, including structures, equipment and software, grew in the 1980s, shot up rapidly in the 1990s, and then stagnated in the 2000s. (See Figure 1) Although the 2000s experienced sharp ups and downs in investment, in 2011 investment was still six percent lower than in 2000. In contrast, while the 1980s did not see investment grow as rapidly as it did in the 1990s, investment was 28 percent higher in 1989 than it was in 1980. As Figure 2 demonstrates, even in 1991, in the midst of the early 1990s recession, investment was 21 percent higher than it was in the midst of the short recession in 1980. In other words, despite ups and downs, the 1980s saw steady growth in investment throughout the decade, while the 2000s were anything but steady. Compare Figure 2 to Figure 3: both decades experience peaks and troughs, but only in the 2000s is the net change in investment flat.

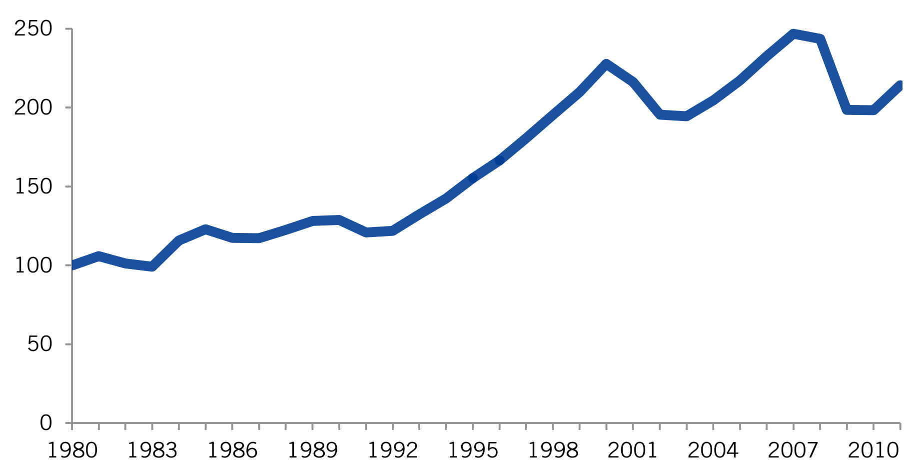

Figure 1: Total Nonresidential Fixed Investment (equipment, software and structures), IPES-Adjusted Quantity Index (1980=100)[22]

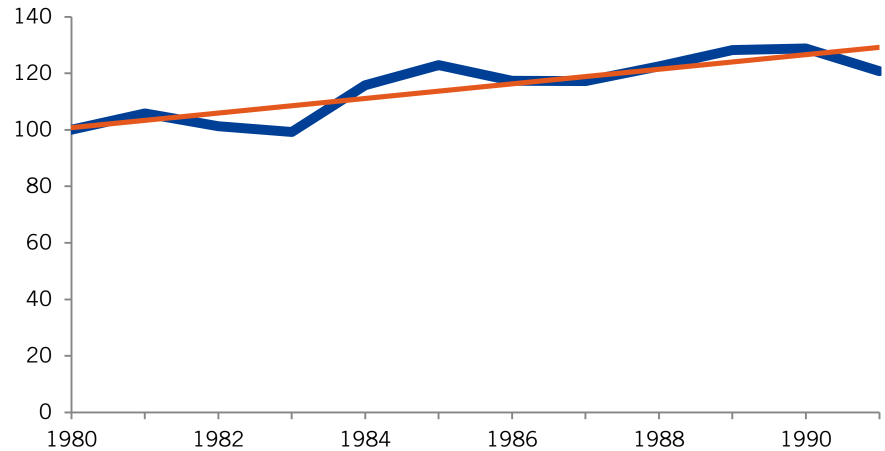

Figure 2: Total Nonresidential Fixed Investment in the 1980s, IPES-Adjusted Quantity Index (1980=100)[23]

This stagnation means that business investment rates are actually falling relative to the size of the economy. Figure 4 shows the nominal dollar level of investment as a share of the nominal dollar level of GDP over time, along with a dotted trend line. As a share of GDP, fixed investment was higher in the early 1980s—around 13 percent of GDP—than in any subsequent year. In 2011, fixed investment accounted for less than 10 percent of GDP. Given that it is investment that drives productivity growth, these statistics are sobering. Out of all the fundamental components of GDP—consumption, investment, government, and net exports—a fall in the relative magnitude of investment is the most worrying in terms of future economic performance.

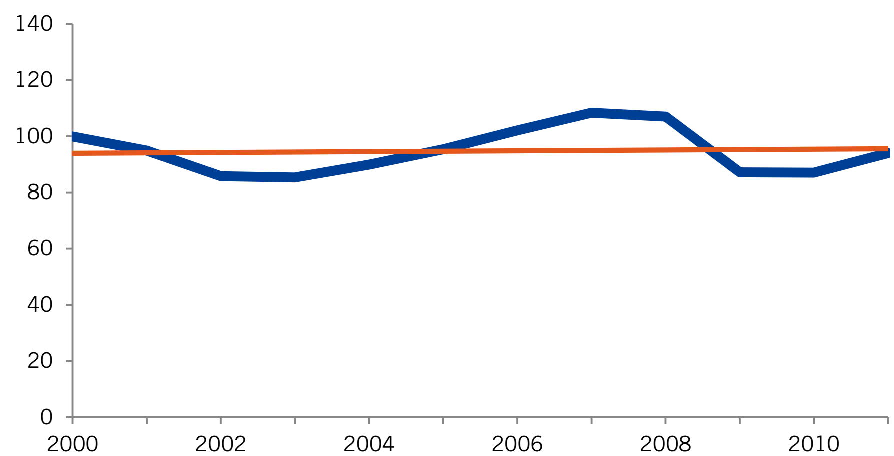

Figure 3: Total Nonresidential Fixed Investment in the 2000s, IPES-Adjusted Quantity Index (2000=100)[24]

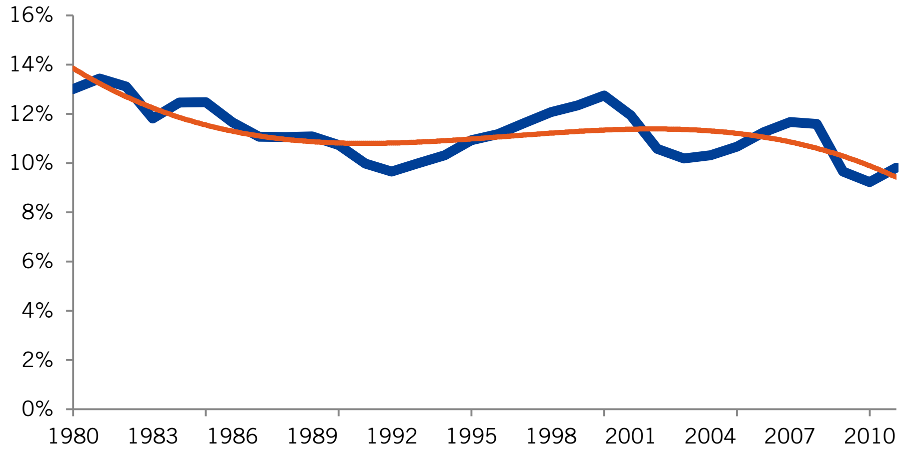

Figure 4: Total Nonresidential Fixed Investment as a Share of GDP, 1980–2011[25]

Now, let's turn to the components of fixed investment to ascertain what is responsible for investment growth in the 1980s and 1990s, and the stagnation of the 2000s.

Structures

As discussed, not all investment components are created equal: in terms of driving future economic growth, equipment investment is far more important than investment in structures. Furthermore, in 2011, non-residential structures investment was five percent lower than it was in 1980, and, on average over the period, contributed to less than 1.5 percent of the growth in total investment from year to year.[26] As a result, we will not spend a substantial amount of time analyzing investment in structures. There is, however, one pattern in structure investment that is worth examining, and to place it in context, it is worth zooming out from just the past three decades (unlike with equipment and software, we are able to look back earlier than 1980 for structures.)[27]

Figure 5 shows investment in manufacturing structures since 1925. At first, a trend may be difficult to see; however, after smoothing the line, a trend emerges: investment in manufacturing structures has plummeted since 1980. [28] This downshift in investment means that the number of new manufacturing structures is no longer keeping pace with the depreciation of existing manufacturing structures, which, in turn, means that the real quantity of manufacturing facilities in the United States is shrinking. Figure 6 shows that, for the first time since World War II, the net stock of manufacturing structures in the United States is falling. Between 2001 and 2011, the net stock of manufacturing structures fell by more than nine percent, a fall which, given investment's continued decline, will also undoubtedly continue. Furthermore, given the long life of structures—the average structure class's deprecation rate is less than a quarter that of the average equipment asset class—we can expect this fall in manufacturing structure investment to continue eroding the structure stock for decades to come.[29]

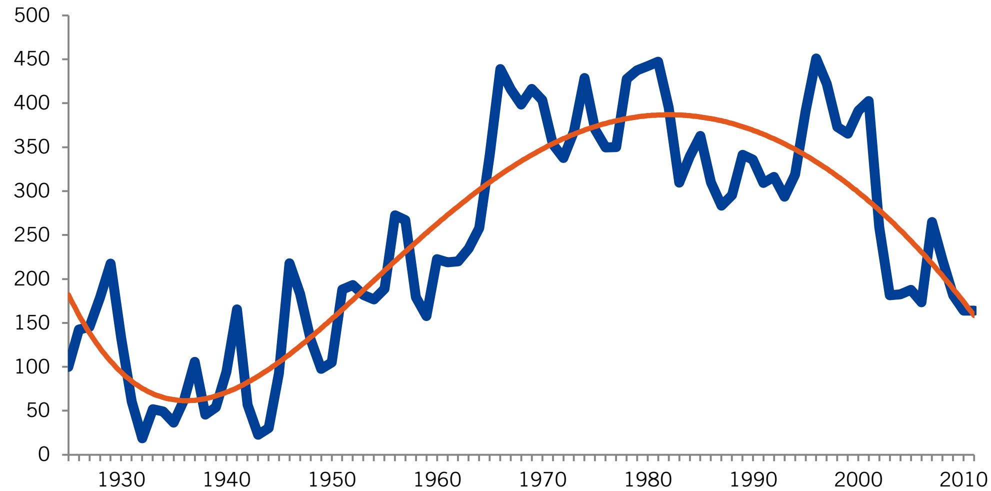

Figure 5: Private Investment in Manufacturing Structures, Quantity Index (1925=100), 1925–2011[30]

A decline in value of manufacturing structures in the United States is a key symptom of a decline in the international competitiveness of the U.S. manufacturing sector.

A decline in value of manufacturing structures in the United States is a key symptom of a decline in the international competitiveness of the U.S. manufacturing sector. However, it is only a symptom—it is not, in itself, a driver of competitive decline. In contrast, equipment and software investment is more of a driver of competitiveness, and thus its decline is far more ominous.

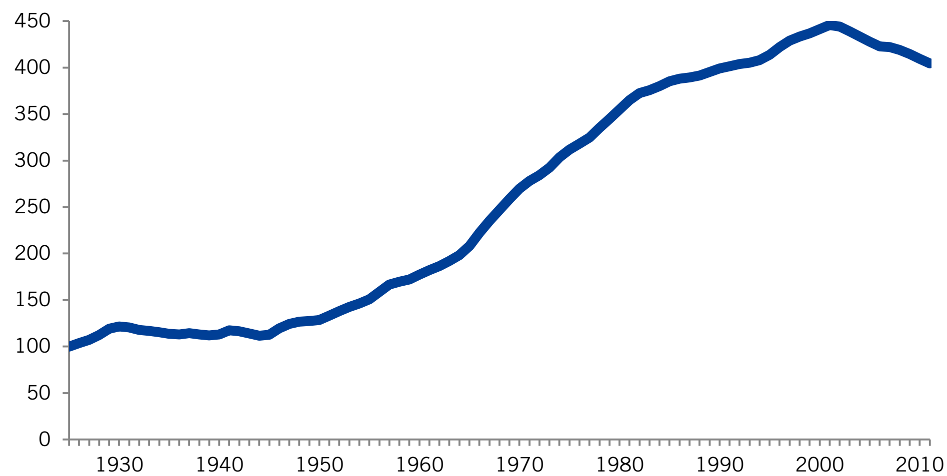

Figure 6: Net Stock of Manufacturing Structures, Quantity Index (1925=100), 1925–2011[31]

Equipment and Software

Total business investment in equipment and software, like total investment, grew in the 1980s, boomed in the 1990s, and then stagnated in the 2000s. (See Figure 7) As Figure 9 shows, between 2000 and 2011, equipment and software investment increased by just 2 percent. For comparison, Figure 8 shows that between 1980 and 1991, equipment and software investment increased by 37 percent.

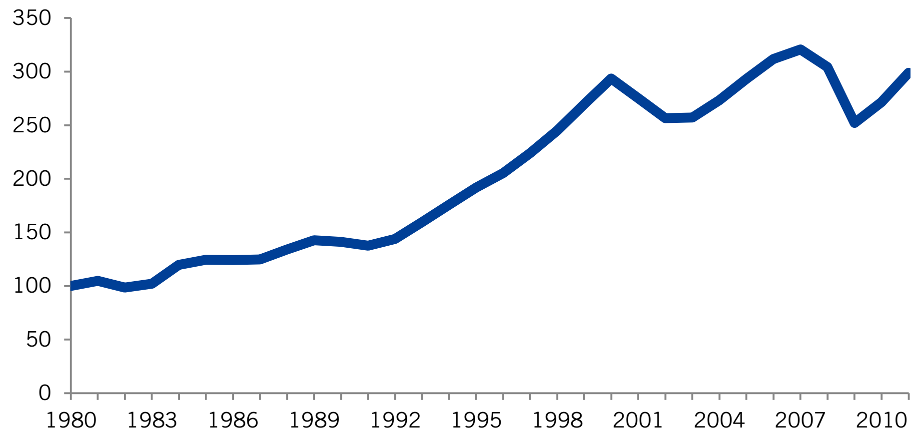

Figure 7: Private Nonresidential Fixed Investment in Equipment and Software, IPES-Adjusted Quantity Index (1980=100), 1980–2011[32]

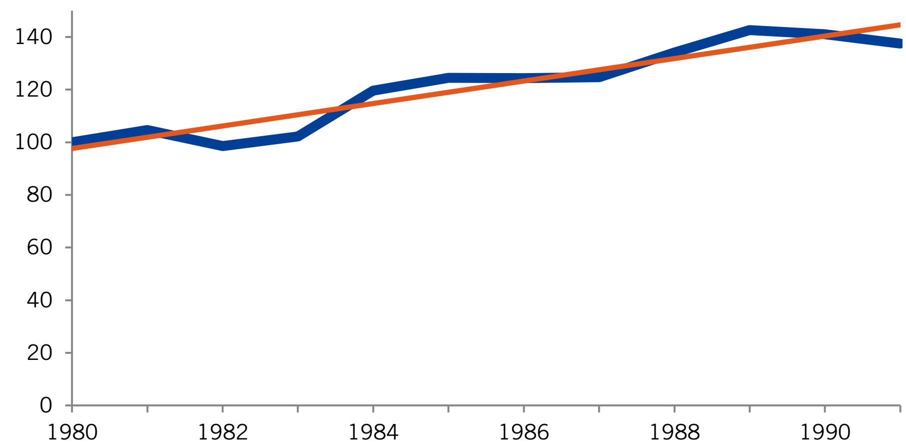

Figure 8: Nonresidential Equipment and Software Investment in the 1980s, IPES-Adjusted Quantity Index (1980=100)[33]

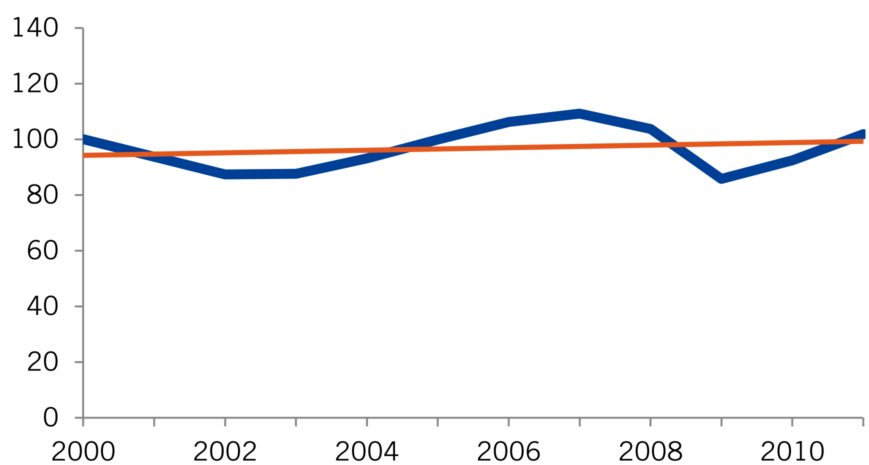

Figure 9: Nonresidential Equipment and Software Investment in the 2000s, IPES-Adjusted Quantity Index (2000=100)[34]

Also like total business investment, the 2000s stagnation means that equipment and software investment is falling relative to the size of the economy. The trend line on Figure 10 shows that, after increasing in the 1990s, equipment and software investment began to decline as a share of GDP in the 2000s.

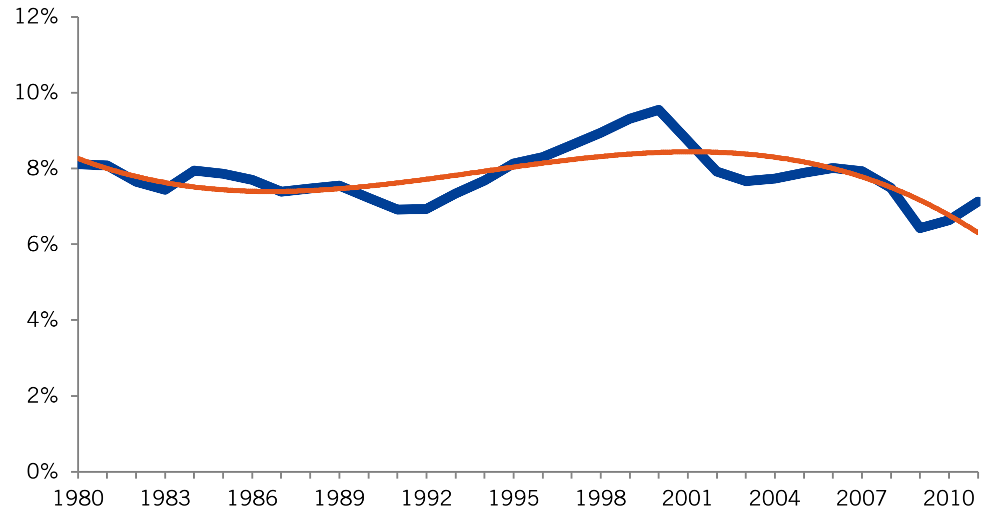

Figure 10: Nonresidential Equipment and Software Investment as a Share of GDP, 1980–2011[35]

The stagnation in investment is showing up in the net stock data. Equipment and software investment has not been stalled for the same length of time as investment in manufacturing structures, thus the effect on net stock is less pronounced in Figure 11 than it is in Figure 6. However, there is an unmistakable flattening out that occurs post-2008: in the four years prior to 2011, the net stock of equipment and software declined by 0.6 percent. Moreover, if we compare the size of the net stock to the size of the economy using GDP, the picture looks much worse, with sustained decline across all three decades. (See Figure 12) As IPES assets with faster depreciation rates form an ever-greater share of the stock of fixed assets, a growing rate of investment will be required in order to maintain a steady stock of equipment and software assets. Assuming the stagnation in investment continues, we can expect to see the net stock of equipment and software to decline in the future as well.

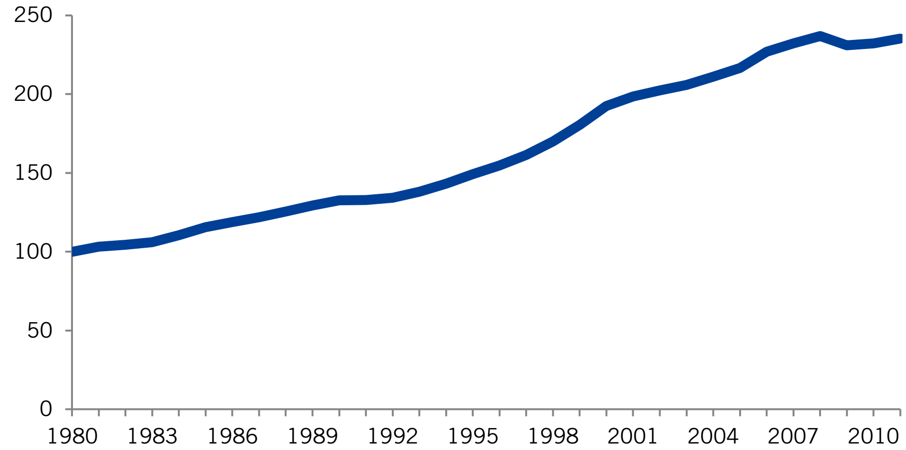

Figure 11: Net Stock of Private Nonresidential Equipment and Software Assets, IPES-Adjusted Quantity Index (1980=100), 1980–2011[36] (1980 equals 100)

Looking at Figure 7, we see three distinct periods[37] of change in business equipment and software investment: relatively steady growth from 1980 to 1991; a boom from 1992 to 2000; and, net the peaks and the troughs, stagnation from 2001 to 2011. Indeed, from 1980 to 1991, equipment and software investment grew, on average, 2.5 percent per year. From 1992 to 2000, it grew more than three times as fast, 8.8 percent per year. But, from 2001 to 2011, it grew by just 0.5 percent per year. (See Figure 13)

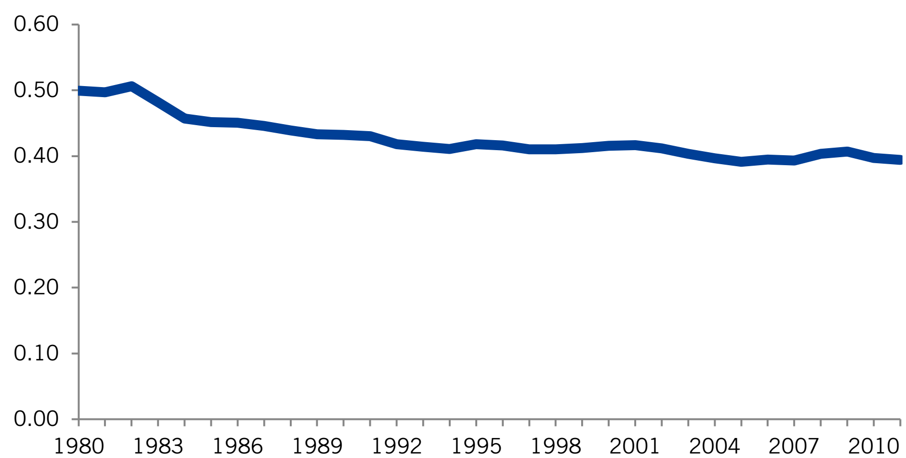

Figure 12: Net Stock of Private Nonresidential Equipment and Software Assets, Ratio to GDP, 1980–2011[38]

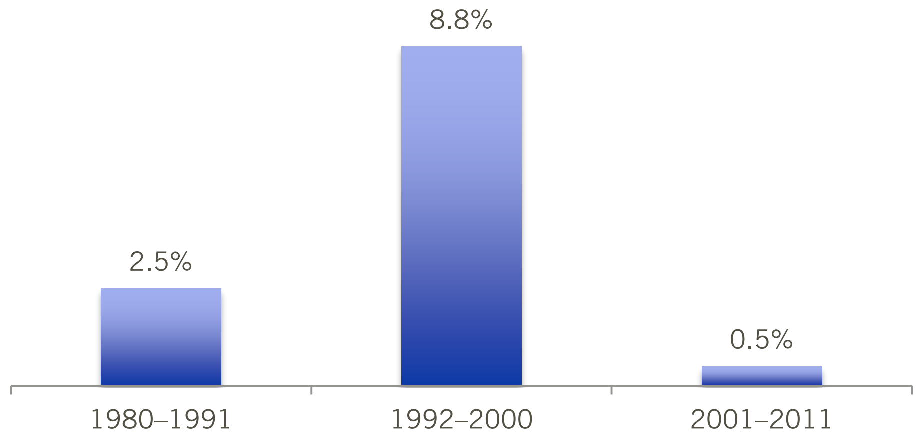

Figure 13: Average Annual Percent Change in Nonresidential Equipment and Software Investment, IPES-Adjusted Quantities[39]

One final look at equipment in aggregate is to see how the picture looks when we remove IPES assets from total equipment, leaving assets such as industrial machinery and transportation equipment. (See Figure 14) Here, the picture over the past decade is even worse. Instead of merely stagnant growth, non-IPES investment has declined over eight percent since 2000.

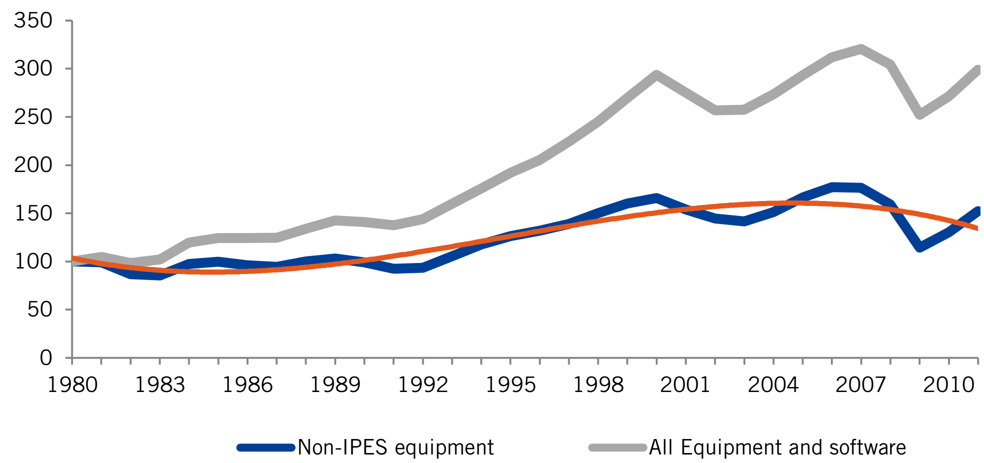

Figure 14: Private Nonresidential Fixed Investment in Non-IPES Equipment, Quantity Index (1980=100), 1980–2011[40]

Investment in Equipment and Software by Industry

Equipment and software show different growth rates for different sectors in different periods. Figure 15 shows the average percentage point contribution of each sector to the growth shown in Figure 13. In other words, the sector percentage point changes in each period of Figure 15 sum to the percent changes in each period of Figure 13.

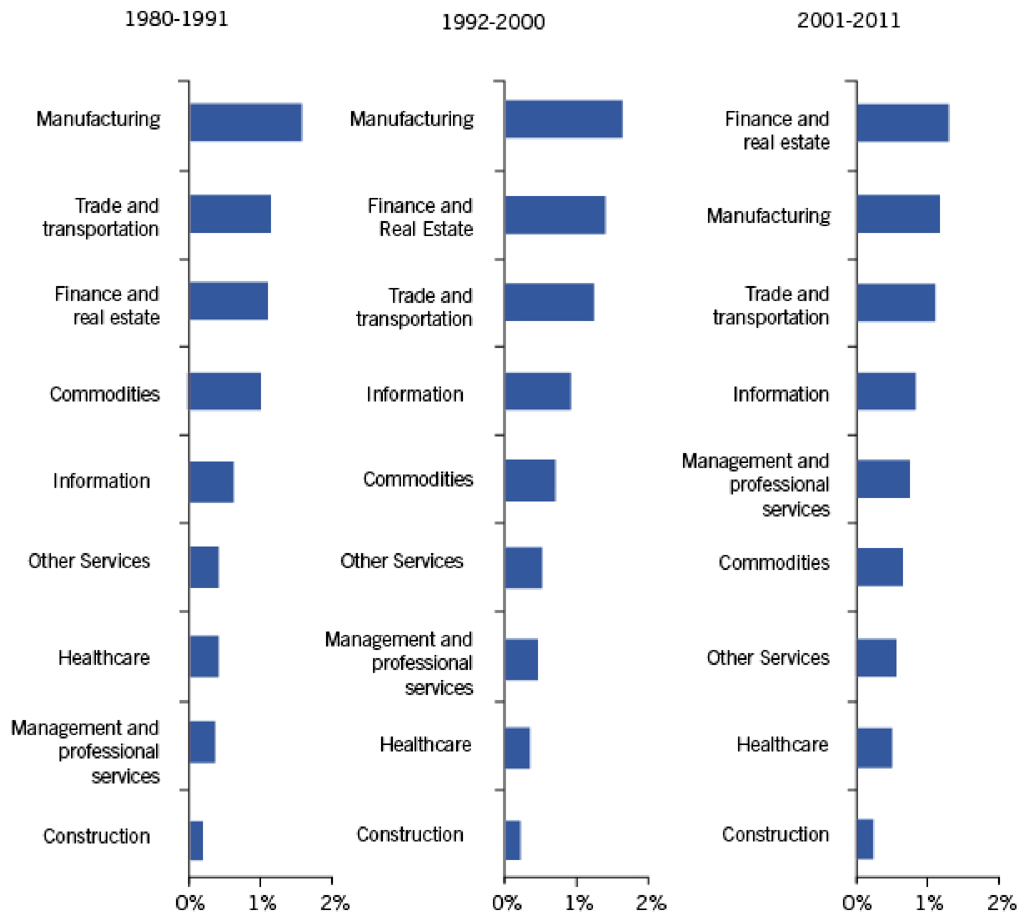

Figure 15: Average Annual Percentage Point Contribution to Percent Change in Nonresidential Equipment and Software, by Sector[41]

The composition of investment went from being spread over a broad base of sectors, especially in the 1990s, to being concentrated in a few select sectors in the 2000s.

The results of this decomposition are striking. Not only did equipment and software investment show almost no growth in the 2000s, but the composition of investment went from being spread over a broad base of sectors, especially in the 1990s, to being concentrated in a few select sectors in the 2000s. In the 1980 to 1991 period, only commodities and construction—and to a lesser extent, trade and transportation—put a drag on total equipment and software growth—every other sector expanded investment rates. Likewise, investment grew across the board in the 1992 to 2000 period, although over 23 percent was in the real estate and financial services industry. From 2001 to 2011, however, only three sectors—management and professional services, commodities and healthcare—saw substantial increases in equipment and software investment. Meanwhile, investment in sectors such as manufacturing and information fell.

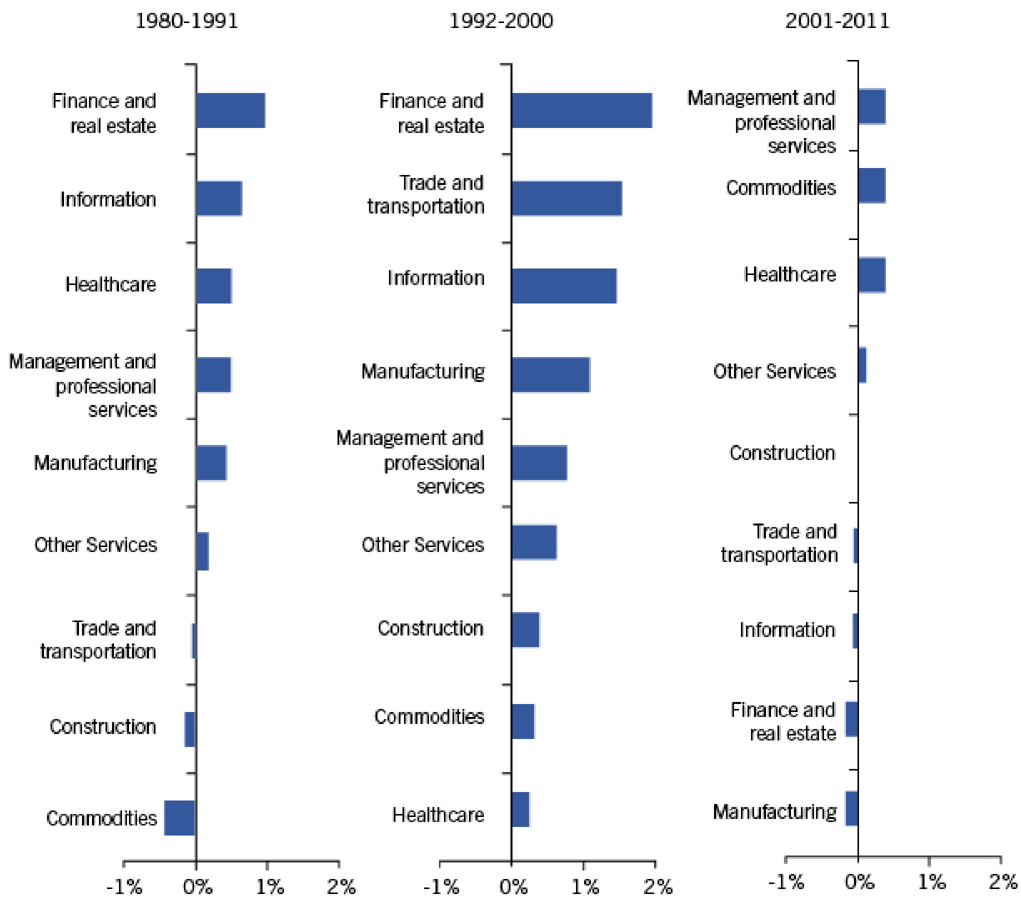

Figure 16: Nonresidential Investment in Equipment and Software, Average Share of GDP, by Sector[42]

As Figure 16 shows, manufacturing led in the 1980s and 1990s but was displaced in the 2000s by finance and real estate, much of that made in the ramp up to the financial collapse of 2008. Indeed, investment by manufacturers in the United States in equipment and software in 2011 was 13 percent below its 1998 peak, even as GDP was 71 percent higher.[43] Figure 17 shows the trend: like equipment and software investment as a whole, manufacturing equipment and software investment increased in the 1980s and 1990s, and then began its downward trend following 2001. And, correspondingly, the net stock of manufacturing equipment and software assets has stagnated, as Figure 18 shows.

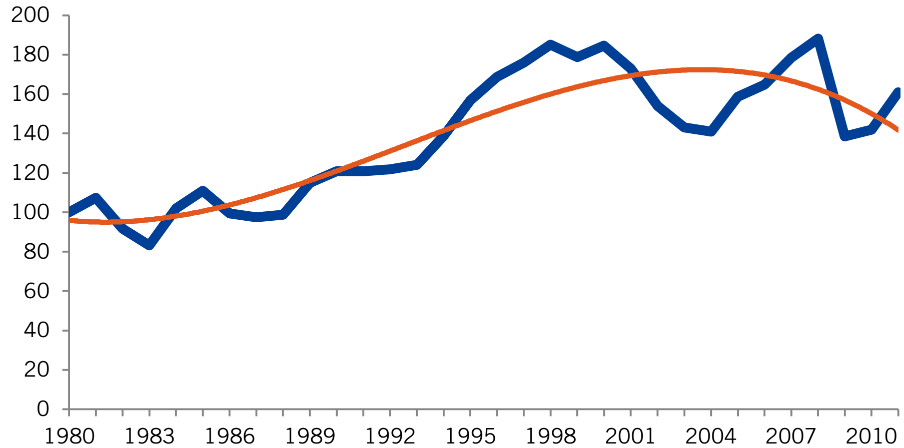

Figure 17: Equipment and Software Investment in Manufacturing, IPES-Adjusted Quantity Index (1980=100), 1980–2011[44]

One response to the decline in manufacturing investment might be that this is to be expected, as "old" manufacturing industries such as textiles move offshore. However, the investment decline is apparent in even industries where the United States is supposed to hold a competitive advantage. Take the chemical industry, for example. The trend line on Figure 19 shows that, on net, equipment and software investment in the chemical industry is over 14 percent lower in 2011 than it was in 1998. As such, and much like equipment and software investment as a whole, the net stock of equipment and software assets in the chemical industry has stagnated in recent years, having experienced a 0.9 percent decline since 2008. (See Figure 20)

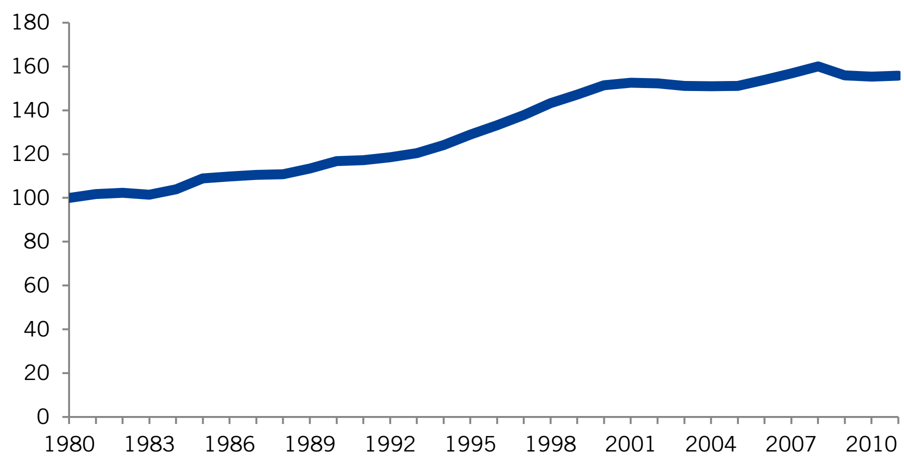

Figure 18: Net Stock of Equipment and Software Assets in Manufacturing, IPES-Adjusted Quantity Index (1980=100), 1980–2011[45]

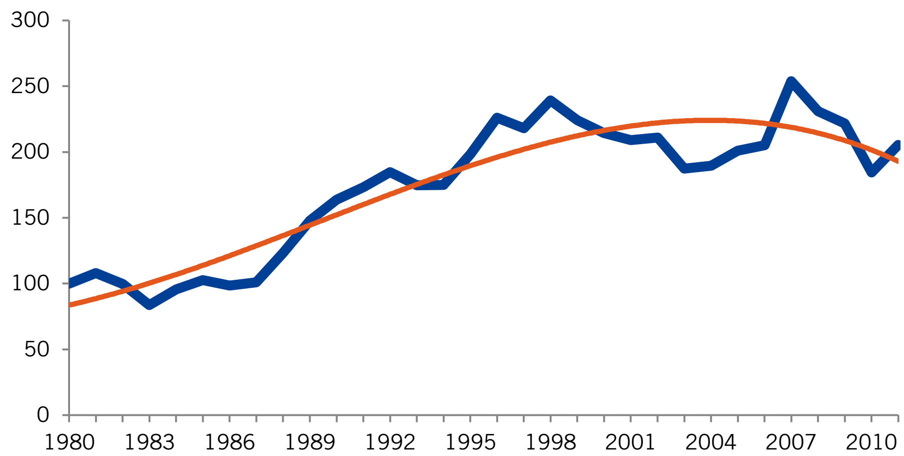

Figure 19: Equipment and Software Investment by the Chemical Products Industry, IPES-Adjusted Quantity Index (1980=100), 1980–2011[46]

The investment trends in the computer and electronic products industry are even worse: we see a 36 percent decline in equipment and software investment since 2000. (See Figure 21) Moreover, the net stock of its equipment and software assets began to fall long before that of the private business sector as a whole. As of 2011, the net stock for this industry is 13 percent lower than its peak in 2001. (See Figure 22) This is a substantial decline when it comes to stock, and it demonstrates in part the drag that the higher depreciation rates of IPES can have on an industry's capital stock as they increase as a share of the industry's capital stock: in 2011, IPES formed 38 percent of the computer and electronics industry's capital stock, compared to 31 percent for the private business sector as a whole; the share for both was 18 percent in 1980. Indeed, in order for its stock to recover, the computer and electronics industry would need to see significant growth in its investment; simply treading water would still cause its stock to shrink because existing capital stock depreciates faster than in most other industries.

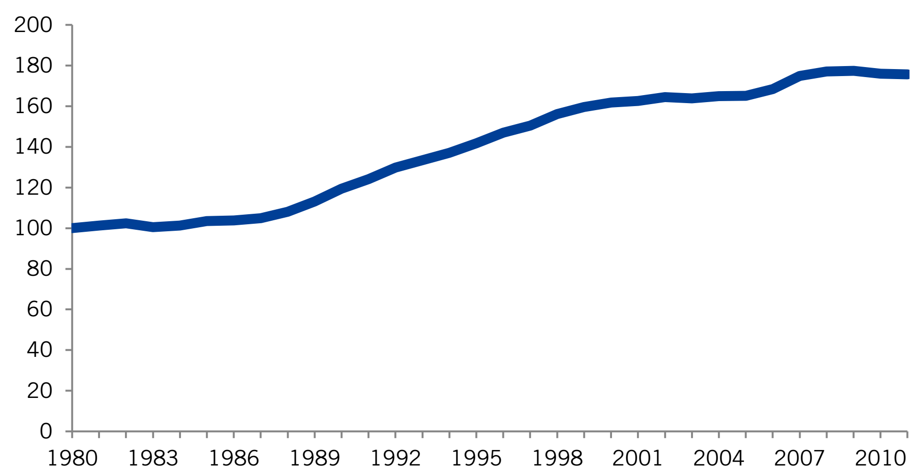

Figure 20: Net Stock of Equipment and Software Assets in the Chemicals Industry, IPES-Adjusted Quantity Index (1980=100), 1980–2011[47]

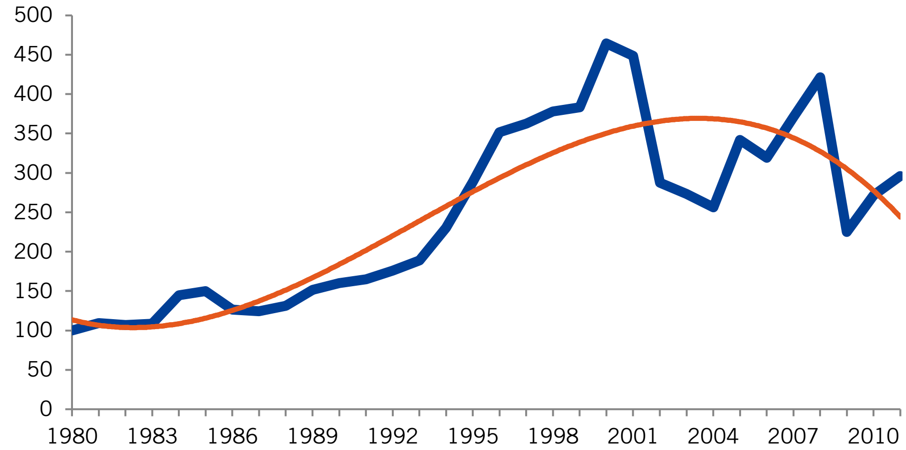

Figure 21: Equipment and Software Investment by the Computer and Electronic Products Industry, IPES-Adjusted Quantity Index (1980=100), 1980–2011[48]

Even "leader" industries outside of manufacturing saw their investment rates slow in the 2000s. The information industry (which includes software, publishing, media, telecommunications, and data processing services) is one example, as Figure 23 shows. After peaking in 1999 and 2000 (the years of the "dot-com" bubble), investment rates fell significantly but were back on trend line by 2007. Since then, they have fallen. Meanwhile, investment by the finance and real estate sectors has fallen significantly since the booms of the past two bubbles, although it has recovered somewhat since 2010. (See Figure 24)

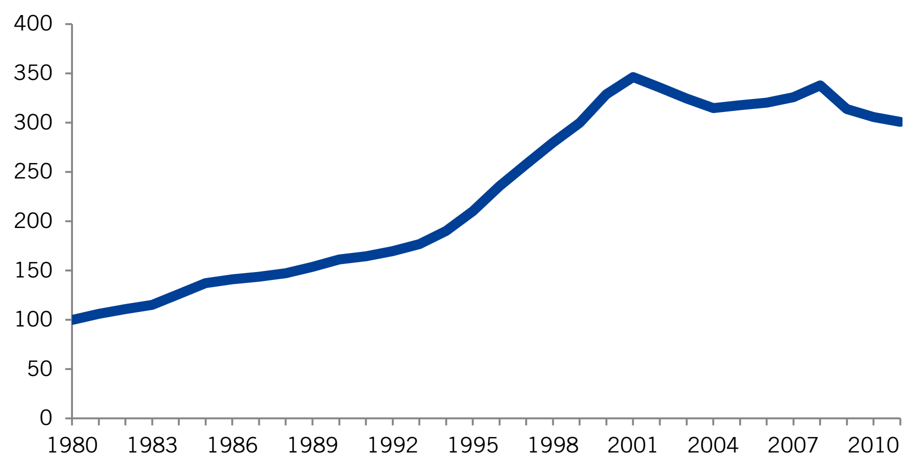

Figure 22: Net Stock of Equipment and Software Assets in the Computer and Electronic Products Industry, IPES-Adjusted Quantity Index (1980=100), 1980–2011[49]

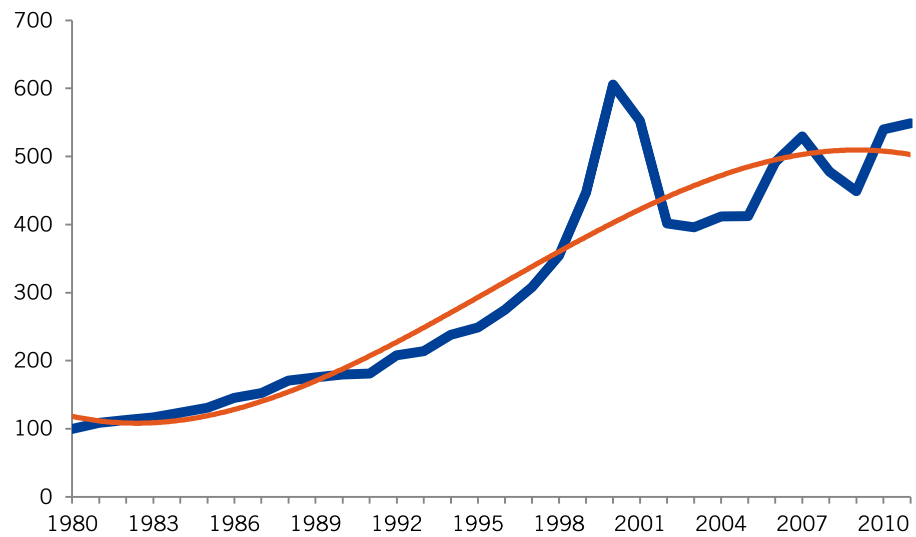

Figure 23: Equipment and Software Investment by the Information Industry, IPES-Adjusted Quantity Index (1980=100), 1980–2011[50]

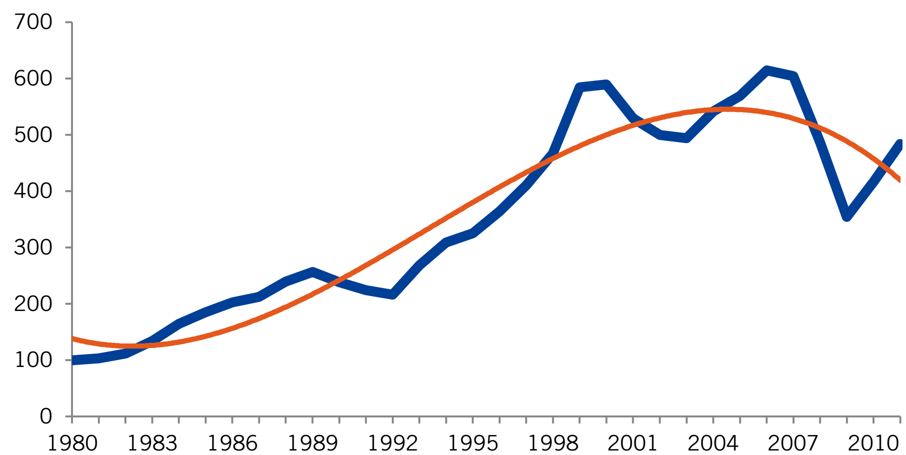

Figure 24: Equipment and Software Investment by the Finance and Real Estate Sectors, IPES-Adjusted Quantity Index (1980=100), 1980–2011[51]

Investment in Equipment and Software Since the Great Recession

Finally, it is important to note that as the post-2008 recovery has proceeded, investment has shown a significant level of growth in 2010 and 2011. Indeed, as a rising tide lifts all boats, nearly every sector posted gains in equipment and software investment over the period. This is heartening—growth is far better than decline, of course—however, there are troubling signs amidst the good news. First, the growth—almost nine percent per year in 2010 and 2011—has been driven in large part by the rebound in the finance and real estate sectors. In fact, in 2010 and 2011, finance and real estate accounted for over one-fourth (27 percent) of the equipment and software investment growth over the period. By comparison, finance and real estate accounted for just 16 percent of the investment growth on average during the housing and Wall Street boom between 2003 and 2007. (See Figure 25) Second, compared to a decade ago, equipment and software investment is stagnant, even taking this mini-boom into account. Even after this recent increase, investment is up

only two percent over 2000 levels. Compare this to the 1980s, when investment grew by 43 percent, and the 1990s, when investment grew by 191 percent. Clearly, while the recent increase in investment is a welcome sign, it is far too little to truly be called a "recovery."

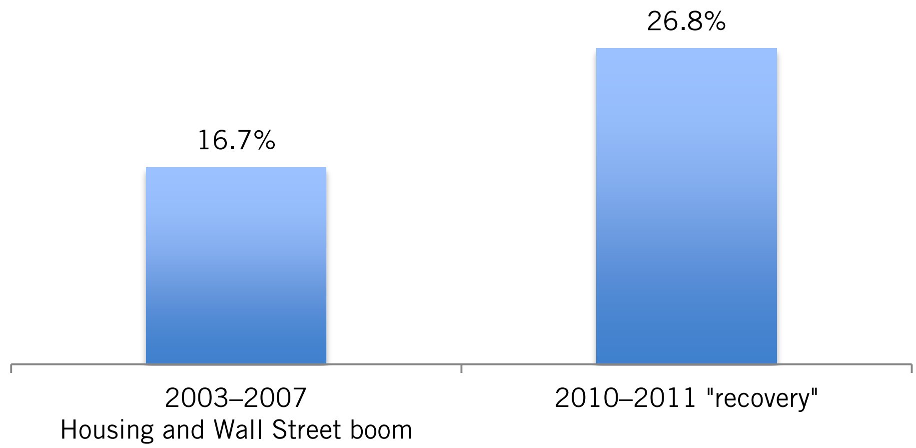

Figure 25: The Finance and Real Estate Sectors' Average Contribution Share of the Growth in Equipment and Software Investment, IPES-Adjusted[52]

While the recent increase in investment is a welcome sign, it is far too little to truly be called a "recovery."

THE CAUSES OF INVESTMENT STAGNATION

Business investment in the United States is lackluster. The question that naturally follows is why? While a full analysis is beyond the scope of the report, we would point to two possible reasons. First is the decline in the competiveness of U.S. traded-sector businesses on the global market that has been occurring, particularly over at least the past decade. Second is the "short-termism"—the obsession with the upcoming financial report rather than long-range planning—that pervades publicly traded businesses facing stockholder pressures.

Declining U.S. Competitiveness

The United States' competitive decline has been a relatively untold story over the past decade, although its symptoms have clearly manifested in the dramatic fall in manufacturing employment and investment since 2000, and in the sluggish, never-quite-there "recovery" since the Great Recession.[53] Although it is often overlooked in Washington, it is a failure of the United States to adapt to a global economy that is ever more dependent on knowledge and innovation for growth—the so-called "New Economy"—that is causing traded sector firms to look to other, more competitive countries when it comes to choosing locations, and causing the United States to lose share in traded sector industries. In turn, the United States loses out on the capital investment that follows those firms overseas, which does not come as much as it once did from overseas firms investing here.

U.S. competitive decline over the past decade has been demonstrated in numerous studies. In 2010, the Boston Consulting Group ranked the United States just eighth in global innovation-based competitiveness, analyzing factors such as corporate and government

R&D investment, venture capital, and scientists and engineers, among others.[54] In 2011, ITIF ranked the United States fourth out of 40 nations in innovation-based competitiveness.[55] Apologists for the status quo might point out that the United States is still in the top 10. But it is not just that we are no longer number one, as we were as recently as the early 2000s; it is that our rank is slipping rapidly: the ITIF report found that the United States was second-to-last out of 44 countries in the rate of change in its competitive position between 1999 and 2011.[56]

Competitive decline has been most dramatically felt in U.S. manufacturing, the key traded sector industry. U.S. manufacturing employment has declined 33 percent between 2000 and 2011, exceeding the loss during the Great Depression.[57] And as ITIF has pointed out, this loss was not principally due to higher productivity in manufacturing. Rather, when measured properly, U.S. manufacturing output actually fell over 10 percent in the 2000s, the first decline since the government began measuring output in the 1940s. Indeed, the United States has seen its global share of manufacturing eviscerated in industry after industry. For example, whereas the United States claimed 29 percent of the printed circuit board (PCB) production in 1998, by 2009 that share had plummeted to eight percent. Likewise, the U.S. share of the photovoltaic (solar panel) market cratered from 30 percent in 1999 to less than six percent in 2008. Meanwhile, China's position in these industries has been the direct inverse of America's. Its share of PCB manufacturing grew from seven percent in 1999 to over 31 percent in 2008, and its share of the solar panels market grew from six percent to 32 percent. The song remains the same across the manufacturing landscape.[58] That said, while manufacturing has been hard hit, isn't the U.S. high-tech industry doing well? Not really. After running a trade surplus for decades in high-tech products, the United States began to run a trade deficit in this sector in the 2000s.

Another symptom of competitive decline lies in the United States' foreign direct investment (FDI) numbers. While many observers have touted the robustness of foreign direct investment in the United States, it is important to realize that there are two kinds of FDI. The first kind is FDI that is used to establish new U.S. businesses—known as "Greenfield" investment. The second kind is FDI that is used to acquire preexisting U.S. business (those that were previously owned by American entities). In general, the first kind is far better for economic growth than the second kind. So, which kind of FDI dominates, Greenfield FDI or acquisitions of existing businesses? Unfortunately, the U.S. government has discontinued its survey of Greenfield investments, and thus the latest available data are for 2008. However, the data from 1992 to 2008 paint a bleak picture. On average, Greenfield FDI constituted just 14 percent of all new foreign direct investment outlays in the United States, while acquisitions accounted for 86 percent.[59] In 2008, Greenfield investment was just seven percent of new FDI outlays. The rate of change is no better: from 1998 to 2008, acquisition investment grew at a rate of 2.9 percent per year, while Greenfield investment had a growth rate of -6.1 percent per year.[60]

When the United States loses its attractiveness as a production location for traded-sector businesses, those businesses move, taking their investment along with them. By the same token, fewer foreign firms make Greenfield investments here in the United States. Hence, we see investment declines in traded-sector industry after trade-sector industry, from

information to computers to chemicals, as we demonstrated in the previous section. But it gets worse. Traded-sector businesses provide the economic lift upon which the rest of an economy rides. As Gene Sperling, director of the White House National Economic Council, recently put it, "If an auto plant opens up, a Walmart can be expected to follow. But the converse does not necessarily hold—that a Walmart opening does not definitely bring an auto plant with it."[61] In other words, traded-sector firms are the "anchors" of an economy, and when the anchor is uplifted, the rest of the economy drifts away. This means that, not only does competitive decline reduce investment in the traded sector, but it also reduces investment in the non-traded sector. Pizza parlors, retail stores, hair salons—you name it—will purchase less machinery and equipment if the traded sector is declining.

But not only is lower investment a symptom of competitive decline, it is also a *cause* of competitive decline. As we discussed in the section "Why Capital Investment Matters," since investment diffuses innovation, investment declines imply low rates of innovation adoption. Indeed, this is true regardless of whether the country is innovating at a high rate or not—most of those innovations are only fully utilized with investment. Moreover, while U.S. firms pull back on investments in new innovations, companies in other nations will continue to invest, and, as they reap the benefits of those innovations, will gain a competitive advantage over U.S. firms within the global marketplace. Thus we start to see a vicious spiral: declining competitiveness leads to declining investment, and then declining investment leads to further declines in competitiveness, and so on. This is a dangerous situation for the U.S. economy and policymakers should pay it serious attention.

In recent decades, the pressure on companies by Wall Street to achieve short-term profits has all too often come at the expense of long-term investment.

Market Short-Termism

In recent decades, the pressure on companies by Wall Street to achieve short-term profits has all too often come at the expense of long-term investment. As the Business Roundtable, the leading trade association for large U.S. businesses, reports, "The obsession with short-term results by investors, asset management firms, and corporate managers collectively leads to the unintended consequences of destroying long-term value, decreasing market efficiency, reducing investment returns, and impeding efforts to strengthen corporate governance."[62] In a 2004 survey of more than 400 U.S. executives, more than 50 percent said they would delay new investment projects in order to meet short-term earnings targets, even if it meant sacrifices in value creation.[63] A 2013 study by John Asker, Joan Farre-Mensa and Alexander Ljungqvist found that public firms invested substantially less than privately held firms in terms of capital expenditures (CAPEX) and mergers and acquisitions (M&A). Furthermore, the public firms were less responsive to changes in the investment climate. Significantly, they found that this divergence in investment behavior was most strong in industries where stock prices were most sensitive to current earnings. The authors surmised that the cause was the pressure on the management of public firms to achieve short-term profits.[64]

This market "short-termism" can be seen in trends in earnings reinvestment into capital equipment verses paying earnings out to as dividends shareholders. For U.S. manufacturers, the ratio of dividends paid to the amount invested in capital equipment increased from the low 20 percent range in the late 1970s and early 1980s, to around 40 percent to 50 percent in the early 1990s, to above 60 percent in the 2000s.[65] In other

words, rather than reinvesting in capital, market pressures have forced companies to keep share prices high by paying greater dividends (or by undertaking share buybacks). These dividend payments increased substantially after Congress slashed the tax rate that individuals paid on corporate dividends in 2003. This was predicted by New York University Professor Aswath Damodaran, who stated that tax cuts on dividend income would lead to "a dramatic surge both in the number of companies that pay dividends and in how much they pay and a cutback on larger investments that take longer to receive a payback." He went on to portend: "If the desire to pay dividends causes firms to shift funds from good investments to dividends, these firms and society will pay a price in the form of less real investment and lower growth."[66]

Harvard Business School Professor and author of the book *The Innovators Dillema* Clayton Christensen explains that in order to present themselves in a favorable light to investors seeking short-term returns, companies rely on accounting measures that lead to limited investment. [67] For example, Christensen writes, "There's another [measure] called RONA—rate of return on net assets. It causes you to reduce the denominator—assets—…because the fewer the assets, the higher the RONA."[68] He goes on to describe how companies in other nations view this:

The first step to addressing market short-termism is for Congress and the Obama administration to acknowledge and take seriously the problem.

> Christensen recalls an interesting talk he had with the Morris Chang the chairman and founder of one of the firms, TSMC [TSM], who said: "You Americans measure profitability by a ratio. There's a problem with that. No banks accept deposits denominated in ratios. The way we measure profitability is in 'tons of money.' You use the return on assets ratio if cash is scarce. But if there is actually a lot of cash, then that is causing you to economize on something that is abundant.

This pressure for short-term returns appears to help explain why capital investment in the 2000s has been stagnant. It will require in-depth analysis and innovative thinking for policymakers to tackle it.

POLICY RECOMMENDATIONS

Given the importance of investment in machinery and equipment to economic growth, the stagnation of the rate of investment and decline in the stock in the 2000s is alarming. Even more alarming is that investment is declining relative to the size of the economy. Without policies to stem the decline and stimulate new investment, productivity growth will slow, as will growth in GDP, jobs and tax revenues. It is not too late, however, for policymakers to put in place policies to encourage the private sector to restore investment rates.

Address Market Short-Termism

Short-termism among publicly traded U.S. businesses is an insidious problem that has undercut U.S. capital investment rates for at least the past decade. Some groups have focused on solutions. The Aspen Institute has proposed several key changes that could alleviate the problem by 1) creating market incentives to encourage long-term capital investment, including making changes in capital gains tax provisions to discourage excessive trading and encourage long-term stock ownership, and removing the limitations on capital loss deductibility for long-term holdings; 2) better aligning the interests of

financial intermediaries and investors; and 3) improving the transparency of investor disclosures.[69] Others have proposed changes in corporate governance, including the establishment of loyalty shares that encourage long-term investing by rewarding shareholders after a set period of time.[70] Still others have recommended fundamentally changing the corporate culture.[71] Wall Street could play a key role here, if it chose to do so, with financial industry leaders acknowledging the problem and proposing solutions. But to date they have largely been silent. As such, we submit that the first step to addressing market short-termism is for Congress and the Obama administration to acknowledge and take seriously the problem. The next step is to begin a detailed analysis of the problem, and thus we recommend the following:

Establish a Task Force to Study Market Short-Termism and Recommend Policies to Ameliorate It

The White House should establish a task force, led by the National Economic Council, and bring together members of the Council of Economic Advisers and the Treasury Department to study the causes and nature of short-termism, and, most importantly, to draft a set of recommendations to ameliorate it. The task force should analyze all potential options for reigning in market short-termism, ranging from changes to tax law to corporate governance solutions to encouraging changes in the U.S. corporate cultures within business schools, corporate boardrooms and "Wall Street."

Establish a Tax Credit for Investing in Equipment and Software

For many years prior to the Tax Reform Act of 1986, companies in the United States could take an investment tax credit (ITC). Although there have been various tax incentives enacted temporarily since, the country currently has none. Nevertheless, studies of the ITC have found it to be a potent tool for increasing investment. Ben Bernanke, for example, found that "a one percentage point increase in the [pre-1986] ITC raises net equipment investment 1.9 percent … in the first year."[72] Austan Goolsbee has found that investment demand is "very responsive" to investment tax policy and that this results in increased investment quantity in the medium and long run.[73] Likewise, Larry Summers and Alan Auerbach found that the investment tax credit spurred investment in equipment and growth in GDP.[74] Jesse Edgerton found that the pre-1986 ITC produced a large and significant decrease in the relative price of farm machinery.[75] Some have argued that the pre-1986 ITC was ineffectual, since investment continued to rise after its repeal. However, Alan Auerbach and Kevin Hassett disproved this claim, finding that the increases in investment pre-dated the credit's repeal, and that investment following its repeal fell far short of what would have been expected on the basis of nontax factors alone.[76]

Unlike the United States, other nations have significant corporate tax incentives for investment. These include:

- Austria, where firms can receive a tax credit of six percent on the costs of education and training their workforce;[77]
- Malaysia, where companies can depreciate general plant and equipment over six years, with heavy machinery over four years, and computer and IT equipment even faster;[78]

- The United Kingdom, where firms can expense investment for plant and machinery up to £250,000 in the first year;[79]

- Singapore, where firms can expense in the first year all computers and prescribed automation equipment, robots and energy efficiency equipment. In addition, companies in manufacturing and engineering services industries may receive investment allowances for projects in addition to depreciation allowances;[80]

- Japan, where companies can benefit from a modestly accelerated depreciation scheme (consisting of "increased initial depreciation" and "accelerated depreciation"); and[81]

- And Canada, where purchases of computers are eligible for a 55 percent declining-balance capital cost allocation rate in the first year. Manufacturing equipment is also eligible for accelerated depreciation.[82]

Congress should enact an investment tax credit (ITC) to provide a 35 percent credit on all capital expenditures made above 75 percent of a base amount.

Some argue that an investment tax credit distorts corporate decisions-making away from optimal decisions. For example, even though Summers and Auerbach found that the ITC led to greater GDP growth, they recommended it be abolished since it led to less "investment" in structures.[83] Others, like Jane Gravelle of the Congressional Research Service, argue that "economic analysis suggests that capital is allocated efficiently and the economy is more productive, absent some market failure or other existing distortion, if all capital income is taxed at the same rate."[84] But this ignores the significant and mostly new analysis discussed above that suggests that there are significant externalities from investment in equipment and software. Moreover, it is hard to argue that markets allocate capital efficiently given the rampant short-termism now prevalent in the U.S. economy. As such, to maintain a competitive edge over other nations and to restore investment growth for the sake of economic growth, ITIF recommends that Congress provide a stronger tax incentive for investment in machinery and equipment.

Congress should enact an investment tax credit (ITC) to provide a 35 percent credit on all capital expenditures made above 75 percent of a base amount. The ITC would be modeled on the Alternative Simplified Research and Experimentation Tax Credit (ASC). The ASC provides a credit of 14 percent on R&D expenditures above 50 percent of the average of the firm's R&D expenditures over the previous three years. Similarly, the base for the ITC would be the average expenditures on qualifying capital equipment over the last three years, with the credit applying to all expenditures made above 75 percent. This would cost an estimated $45 billion per year over the next 15 years.[85] Because of the larger societal economic impact of investments in equipment and software, the credit would apply only to those investments and not to structures. Allowing for a tax credit for purchases of equipment and software will reduce the after-tax price of investment, raising the level of domestic investment and the productivity of firms.

If Congress does not enact an ITC, it should at least allow firms to expense, for tax purposes, the entire cost of equipment and software in the first year instead of having to

depreciate the costs over a number of years. While expensing allows a tax-paying entity to deduct the full cost of assets in the year of purchase, depreciation spreads these deductions over a federally determined asset lifetime. This costs firms more because they have less capital in early years. However, in part because this does not affect book value of firms as much as an ITC would, it may have less stimulative effect on investment dollar-for-dollar than an ITC.[86]

CONCLUSION

Over the last decade, U.S. business investment has stagnated and economic growth and competitiveness have suffered. Indeed, this has been a vicious circle. As investment declines, economic growth declines. As economic growth declines, the capital available for investment and demand for new investment declines. If this trend continues, innovation will slow, competitiveness will continue to decline, and productivity growth will weaken. Thus, it is essential that policymakers make challenging this problem a top priority. While the policy recommendations listed in this paper are not in themselves silver bullets—many countries have similar policies in place already—they will at least put the United States on a more equal footing in the global economy.

APPENDIX A: MEASURING INFORMATION PROCESSING EQUIPMENT AND SOFTWARE

According to the U.S. government, between 1980 and 2011, over 85 percent of the growth in investment in private business fixed assets was accounted for by information processing equipment and software (IPES). Between 2000 and 2011, that share rises to 96 percent.[87] Figure 26 shows the growth in IPES relative to the growth of industrial, transportation, and other equipment. Between 1980 and 2011, IPES investment grew by 2,156 percent, over 31 times faster than the next fastest growing type of equipment, transportation, which grew by just 69 percent over the period.[88] Measured IPES investment is so high relative to the other types of investment that it completely dominates the aggregate investment figures.

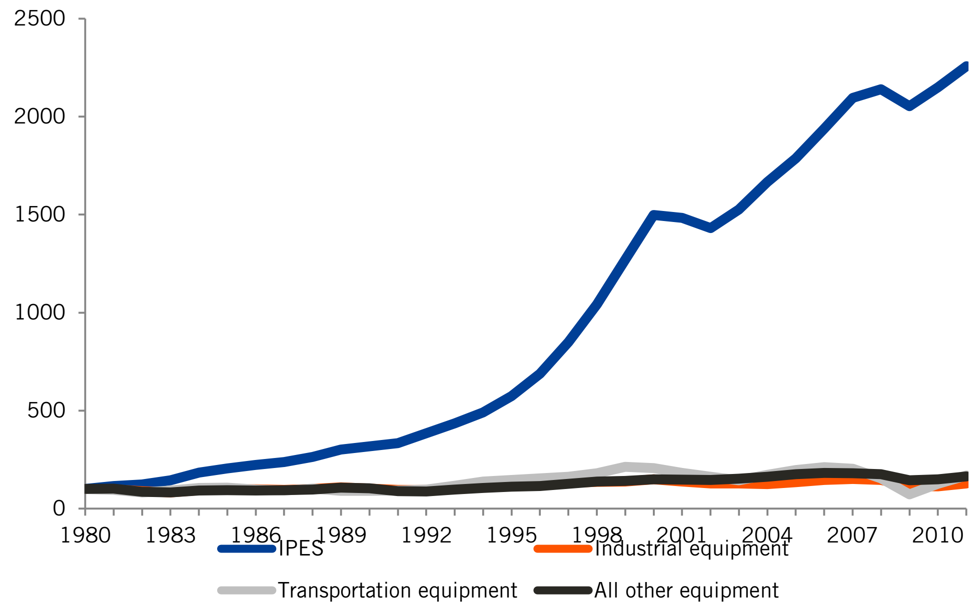

Figure 26: Nonresidential Fixed Investment by Major Asset Type, Quantity Indexes Before Adjustment (1980=100), 1980–2011[89]

Underlying this rapid growth is the high rate of technological improvement, or quality improvement, of information-technology-based goods (and thus IPES assets). Simply put, in order to accurately track changes in the *quantity* of goods over time, statistical agencies must adjust for *quality* changes in those goods over time. This logic applies to output statistics and investment statistics alike: for example, a new tractor that is twice as powerful as an old tractor must count for more than the old tractor when you want to know how the tractor factory's output is changing over time or how farm investments are changing over time. Statistical agencies use a number of different methods to adjust for quality changes, depending on the type of good.[90] Unfortunately, when these methods are applied to IT goods such as computers, the rate of quality change is extremely rapid, and this leads to perverse statistics. For example, according to the U.S. government, the computer and electronics industry's output has increased by 2,186 percent since 1995, and 24,881 percent since 1980.[91] It contributed to 113 percent of the growth in manufacturing output between 2000 and 2011—that is, it grew by more than the entire rest of the manufacturing

sector combined (which in fact declined overall).[92] Now the United States is not producing 24,881 percent more computers than it was in 1980, and there is a strong argument to be made that we are in fact producing significantly fewer computers than we were in 1995;[93] instead, these enormous growth figures result from the statistical agencies' quality change methods when they are applied to IT goods.

Is this reasonable? Economist Milton Friedman famously argued that economic models should be judged on the accuracy of their predictions rather than the validity of their assumptions,[94] and so we will likewise not judge whether the assumptions underlying the quality change methodologies are valid. However, we will certainly judge the accuracy of their predictions: in the real world, computer and electronic products did not account for 113 percent of the growth in manufacturing output over the past decade. Likewise, IPES assets did not account for 85 percent of the growth in investment over the past decade as the U.S. government says. Nor did investment in IPES assets increase by 2,156 percent since 1980, while the next fast growing asset type grew by just 69 percent. The typical bank, for example, did not increase its investments in computers by over 2,000 percent in the last 30 years. It might have gotten 2,000 times the processing power, but it didn't in any real sense increase its capital investment to that degree. To put it plainly, these numbers are completely misleading. They do not correspond to the real world.

Therefore, in order to gauge the trends in U.S. investment properly, we adjust the growth in IPES assets. To do this, we set the IPES assets to grow at their "nominal" (or "historical," to be precise) rates—that is, the rates of growth they have without the changes the government makes for quality and quantity. Figure 27 shows the effect of our adjustment on IPES assets: investment in IPES assets continues to grow rapidly relative to other assets, but instead of growing 2,156 percent between 1980 and 2011, they grow 681 percent over the period—admittedly, still a very fast rate of growth.

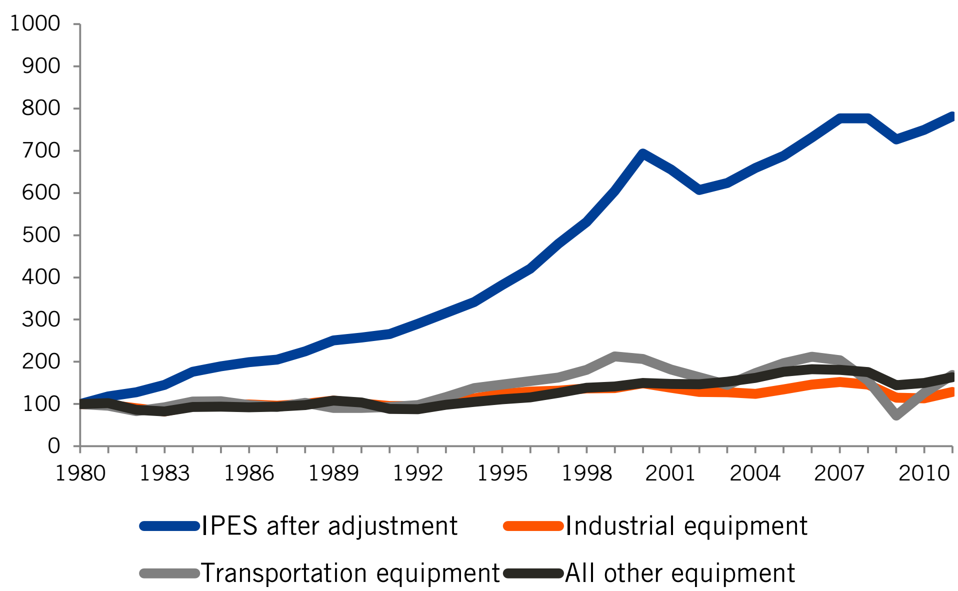

Figure 27: Nonresidential Fixed Investment by Major Asset Type, Quantity Indexes After Adjustment (1980=100), 1980–2011[95]

After adjusting the growth of IPES assets, we then combined our IPES growth rates with the government's growth rates for non-IPES assets to produce the investment aggregates, such as "total nonresidential fixed investment in equipment, software and structures" or "nonresidential fixed investment in equipment and software." Figure 28 shows the effect on total investment. We employed a similar methodology on the net stock statistics. (See Appendix B for more detail.)

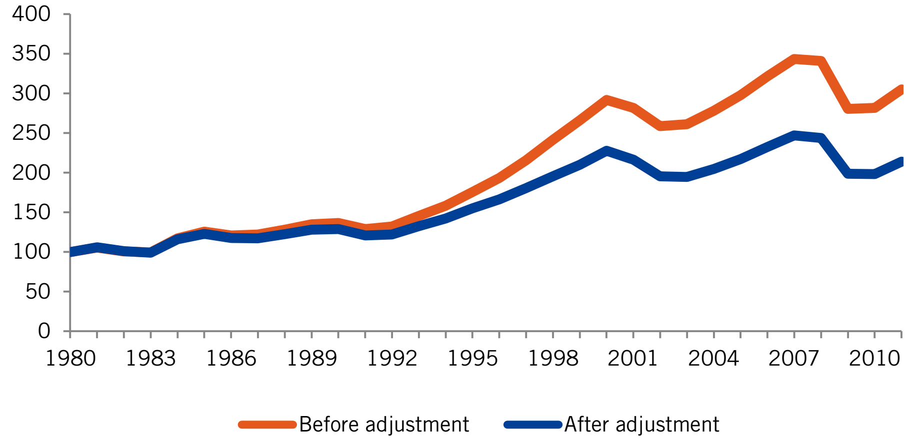

Figure 28: Total Nonresidential Fixed Investment Before and After IPES Adjustment (1980=100), 1980–2011[96]

APPENDIX B: METHODOLOGY

To adjust the growth of information and processing equipment (IPES) assets, detailed fixed assets data was obtained from the Bureau of Economic Analysis.[97] The growth rate of the price indexes for IPES assets[98] was then set to show zero growth. The aggregation of investment quantities and net stock quantities, and the calculation of investment contributions proceeded as follows.

Investment Aggregations

Constant dollar values were calculated as the quotient of the "historical" dollars series and the adjusted price indexes. Investment quantities were then aggregated over assets i and industries j using the Fisher Ideal index,[99]

$$Q(t) = Q(t-1)\sqrt{\frac{\sum_{i=1}^{n}\sum_{j=1}^{m} P_{ij}(t)C_{ij}(t)}{\sum_{i=1}^{n}\sum_{j=1}^{m} P_{ij}(t)C_{ij}(t-1)} \times \frac{\sum_{i=1}^{n}\sum_{j=1}^{m} P_{ij}(t-1)C_{ij}(t)}{\sum_{i=1}^{n}\sum_{j=1}^{m} P_{ij}(t-1)C_{ij}(t-1)}}$$

where P(t) is the price index value and C(t) is the constant dollar value at time t.

Net Stock Aggregations

Constant dollar values were calculated as the quotient of the "current" dollars series and the adjusted price indexes. Investment quantities were then aggregated over assets i and industries j using the Fisher Ideal index.

Contribution Calculations

Constant dollar values were calculated as the quotient of the "historical" dollars series and the adjusted price indexes. Contributions to percent change in investment were calculated over assets i and industries j using the formula,

$$_j(t) = \frac{(P_{ij}(t-1) + P_{ij}(t)/\Pi(t))\Delta C_{ij}(t)}{\sum_{i=1}^{n}\sum_{j=1}^{m} (P_{ij}(t-1) + P_{ij}(t)/\Pi(t))C_{ij}(t -}$$

where P(t) is the price index value, C(t) is the constant dollar value and Π(t) the aggregate Fisher price index in period t relative to period t-1.[100]

ENDNOTES

1. This is why, for example, studies on the role of IT in driving growth find that only 20 percent of the growth comes from the making the computers and the software, while 80 percent comes from the use of that IT. See Robert D. Atkinson and Andrew S. McKay, *Digital Prosperity: Understanding the Economic Benefits of the Information Technology Revolution* (Washington, DC: ITIF, 2007), http://www.itif.org/files/digital_prosperity.pdf.
2. See Bureau of Economic Analysis, Fixed Assets (Private fixed assets by type; accessed September 16, 2013), http://www.bea.gov/iTable/index_FA.cfm.
3. Robert D. Atkinson, "Driving Toward The Digital Economy and Digital Manufacturing" (presentation, Siemens PLM Software Conference, November 14, 2007), http://www.itif.org/files/vvsg/michigan1.pdf.
4. Wikipedia contributors, "Warehouse Management System," Wikipedia, The Free Encyclopedia, June 27, 2013, http://en.wikipedia.org/w/index.php?title=Warehouse_management_system&oldid=561883843.
5. Advanced Control Tech, "Advanced Control Tech's New Small CNC Machine is the Most Advanced Desktop CNC Router Available," news release, PRWeb, May 31, 2013, http://www.prweb.com/releases/small-cnc-machines/desktop-cnc-routers-2/prweb10787909.htm.
6. Robert D. Atkinson and David B. Audretsch, *Economic Doctrines and Policy Differences: Has the Washington Policy Debate Been Asking the Wrong Questions?* (Washington, DC: ITIF, 2008), http://www.itif.org/files/EconomicDoctrine.pdf .
7. See Robert Solow, "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics* 70, no. 1 (1956): 65–94.
8. Michael Mandel, *Rational Exuberance: Silencing the Enemies of Growth and Why the Future is Better Than You Think* (New York: Harper Collins, 2004), pp. xii, xix.
9. See Barry Bluestone and Bennett Harrison, *Growing Prosperity: The Battle for Growth with Equity in the Twenty-first Century* (New York: Houghton Mifflin, 2000).
10. For example, see William R. Easterly, "Solow's Surprise: Investment is Not the Key to Growth" in *The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics* (Cambridge, MA: MIT Press, 2002), http://www.prweb.com/releases/small-cnc-machines/desktop-cnc-routers-2/prweb10787909.htm.
11. Paul M. Romer, "Beyond Classical and Keynsian Macroeconomic Policy," *Policy Options* (July–August 1994).
12. For example, see Easterly, "Solow's Surprise."
13. Since each additional forklift would be more valuable than the one it replaced.
14. ITIF Estimates
15. Xavier Sala-i-Martin, "15 Years of New Growth Economics: What Have We Learnt?" (speech, Fifth Annual Conference of the Central Bank of Chile: The Challenges of Economic Growth, Santiago, Chile, November 29–30, 2001).
16. Bart van Ark, "Measuring the New Economy: An International Comparative Perspective," *Review of Income and Wealth* 48 (2002): 1–14.
17. Lauren Hitt and Prasanna Tambe, "Measuring Spillovers from Information Technology Investments" (conference paper, 27th International Conference on Information Systems, Milwaukee, WI, 2006).
18. One exception might be if structures themselves have significant amounts of innovative equipment embedded in them (such as advanced HVAC systems, lighting, windows, etc.).
19. Lauren Hitt and Prasanna Tambe, "Measuring Spillovers from Information Technology Investments" (conference paper, 27th International Conference on Information Systems, Milwaukee, WI, 2006).
20. Aled ab Iorwerth, "Machines and the Economics of Growth" (working paper, Department of Finance, Ottawa, Canada, March 2005), http://www.fin.gc.ca/pub/pdfs/wp2005-05e.pdf.
21. See Robert D. Atkinson, Luke A. Stewart, Scott M. Andes and Stephen J. Ezell, *Worse Than the Great Depression: What Experts Are Missing About American Manufacturing Decline* (Washington, DC: ITIF, 2012), http://www2.itif.org/2012-american-manufacturing-decline.pdf.
22. Bureau of Economic Analysis, Detailed Data for Fixed Assets and Consumer Durable Goods (author's analysis; accessed July 1, 2013), http://www.bea.gov/national/FA2004/Details/Index.html.
23. Ibid.
24. Ibid.

25. Bureau of Economic Analysis, NIPA Archive for June 26, 2013 (Section 1: Domestic Product and Income; Section 5: Saving and Investment; accessed August 7, 2013), http://www.bea.gov/histdata/NIyearAPFFiles.asp?docDir=Releases/GDP_and_PI/2013/Q1/Third_June-26-2013&year=2013&quarter=Q1.
26. Bureau of Economic Analysis, Detailed Data for Fixed Assets and Consumer Durable Goods (author's analysis; accessed July 1, 2013), http://www.bea.gov/national/FA2004/Details/Index.html.
27. It is possible to look back before 1980, because the IPES-adjustment is unnecessary for structures.
28.. 3rd-order polynomial regression.
29. "BEA Depreciation Estimates," Bureau of Economic Analysis, accessed August 20, 2013, http://www.bea.gov/national/FA2004/Tablecandtext.pdf. Author's analysis.
30. Bureau of Economic Analysis, Fixed Assets (Table 4.8. Chain-Type Quantity Indexes for Investment in Private Nonresidential Fixed Assets by Industry Group and Legal Form of Organization; accessed June 4, 2013), http://www.bea.gov/iTable/index_FA.cfm.
31. Bureau of Economic Analysis, Fixed Assets (Table 4.2. Chain-Type Quantity Indexes for Net Stock of Private Nonresidential Fixed Assets by Industry Group and Legal Form of Organization; accessed June 4, 2013), http://www.bea.gov/iTable/index_FA.cfm.
32. Bureau of Economic Analysis, Detailed Data for Fixed Assets and Consumer Durable Goods (author's analysis; accessed July 1, 2013), http://www.bea.gov/national/FA2004/Details/Index.html.
33. Ibid.
34. Ibid.
35. Bureau of Economic Analysis, NIPA Archive for June 26, 2013 (Section 1: Domestic Product and Income; Section 5: Saving and Investment; accessed August 7, 2013), http://www.bea.gov/histdata/NIyearAPFFiles.asp?docDir=Releases/GDP_and_PI/2013/Q1/Third_June-26-2013&year=2013&quarter=Q1.
36. Bureau of Economic Analysis, Detailed Data for Fixed Assets and Consumer Durable Goods (author's analysis; accessed July 1, 2013), http://www.bea.gov/national/FA2004/Details/Index.html.
37. Any periods we chose to divide up our data, which spans 32 years, would have been somewhat arbitrary. Thus we chose to base the periods upon shared aggregate growth characteristics.
38. Bureau of Economic Analysis, Fixed Assets (Table 2.1. Current-Cost Net Stock of Private Fixed Assets, Equipment and Software, and Structures by Type; accessed June 4, 2013), http://www.bea.gov/iTable/index_FA.cfm; Bureau of Economic Analysis, NIPA Archive for June 26, 2013 (Section 1: Domestic Product and Income; Section 5: Saving and Investment; accessed August 7, 2013), http://www.bea.gov/histdata/NIyearAPFFiles.asp?docDir=Releases/GDP_and_PI/2013/Q1/Third_June-26-2013&year=2013&quarter=Q1.
39. Bureau of Economic Analysis, Detailed Data for Fixed Assets and Consumer Durable Goods (author's analysis; accessed July 1, 2013), http://www.bea.gov/national/FA2004/Details/Index.html.
40. Ibid.
41. Ibid.
42. Bureau of Economic Analysis, Fixed Assets (Table 3.7E. Investment in Private Equipment and Software by Industry; accessed June 4, 2013), http://www.bea.gov/iTable/index_FA.cfm; Bureau of Economic Analysis, NIPA Archive for June 26, 2013 (Section 1: Domestic Product and Income; Section 5: Saving and Investment; accessed August 7, 2013), http://www.bea.gov/histdata/NIyearAPFFiles.asp?docDir=Releases/GDP_and_PI/2013/Q1/Third_June-26-2013&year=2013&quarter=Q1.
43. For consistency with the fixed asset figures, GDP figures are pre-July 2013 BEA National Accounts revision. See "2013 Comprehensive Revision of the National Income and Product Accounts," Bureau of Economic Analysis, http://www.bea.gov/national/an1.htm#2013comprehensive.
44. Bureau of Economic Analysis, Detailed Data for Fixed Assets and Consumer Durable Goods (author's analysis; accessed July 1, 2013), http://www.bea.gov/national/FA2004/Details/Index.html.
45. Ibid.
46. Ibid.
47. Ibid.
48. Ibid.

49. Ibid.
50. Ibid.
51. Ibid.
52. Ibid.
53. Robert D. Atkinson and Stephen J. Ezell, *Innovation Economics: The Race for Global Advantage* (New Haven, CT: Yale University Press, 2012).
54. Jesús De Juan et al., *Global Sourcing in the Postdownturn Era* (Boston: Boston Consulting Group, 2010), https://www.bcgperspectives.com/content/articles/sourcing_procurement_supply_chain_management_global_sourcing_in_the_postdownturn_era/.
55. Robert D. Atkinson and Scott M. Andes, *The Atlantic Century II: Benchmarking EU and U.S. Innovation and Competitiveness* (Washington, DC: Information Technology and Innovation Foundation, 2011), http://www.itif.org/files/2011-atlantic-century.pdf.
56. Ibid.
57. Bureau of Labor Statistics, Current Employment Statistics (manufacturing employment, seasonally adjusted; accessed March 14, 2012), http://www.bls.gov/ces/; Census Bureau, Statistical Abstract of the United States: 1941 (Washington, D.C.: 1942), http://www.census.gov/prod/www/abs/statab1901-1950.htm. Jobs figures are for January 2000 to December 2010, and 1929 to 1933. From 1929 to 1933, U.S manufacturing employment fell by 31 percent.
58. Joel S. Yudken, *Executive Summary: Manufacturing Insecurity: America's Manufacturing Crisis and the Erosion of the U.S. Defense Industrial Base* (Washington, DC: AFL-CIO, 2010), http://www.ndia.org/Divisions/Divisions/Manufacturing/Documents/119A/1%20Manufacturing%20Insecurity%20ES%20V2.pdf.
59. Foreign direct investor "outlays" differ slightly from the FDI "financial flows" used in the BEA's international transaction accounts in that financial flows are restricted only to funds flowing across the U.S. border, whereas outlays are restricted to "new" funds. For example, outlays include indirect acquisitions and establishments by a U.S. business that is already foreign owned, while financial flows exclude this, because the funding is new but does not flow across the border. Conversely, if a foreign investor provides additional funding to the U.S. business it already owns, then it is included in financial flows but excluded from outlays, because the funds flow across the border but are not new. That said, because we are only interested in new foreign dollars when it comes to Greenfield investment and because the correlation between the two series is extremely tight (+0.95), the data difference is of no consequence.
60. Luke Stewart, "The Sad Reality behind Foreign Direct Investment in the United States," The Innovation Files (blog), October 23, 2012, http://www.innovationfiles.org/the-sad-reality-behind-foreign-direct-investment-in-the-united-states/.
61. Gene Sperling, "Remarks at the Conference on the Renaissance of American Manufacturing" (speech, National Press Club, Washington, DC, March 27, 2012), http://www.whitehouse.gov/sites/default/files/administration-official/sperling_-_renaissance_of_american_manufacturing_-_03_27_12.pdf.
62. Dean Krehmeyer, Matthew Orsagh and Kurt Schacht, *Breaking the Short-Term Cycle: Discussion and Recommendations on How Corporate Leaders, Asset Managers, Investors, and Analysts Can Refocus on Long-Term Value* (Charlottesville, VA: CFA Institute, 2006), http://www.corporate-ethics.org/pdf/Short-termism_Report.pdf.
63. Ibid.
64. John Asker, Joan Farre-Mensa and Alexander Ljungqvist, "Corporate Investment and Stock Market Listing: A Puzzle?" (working paper, New York University, April 22, 2013), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1603484.
65. Bureau of Economic Analysis, National Income and Product Accounts Tables (Table 6.20; net corporate dividend payments by industry), http://www.bea.gov/national/nipaweb/Index.asp (accessed October 20, 2010); Bureau of Economic Analysis, Fixed Assets Accounts Tables (Table 3.7ES; investment in private fixed assets by industry), http://www.bea.gov/national/FA2004/Index.asp (accessed October 20, 2010).
66. Aswath Damodaran, "Dividends and Taxes: An Analysis of the Bush Dividend Tax Plan" (working paper, Stern School of Business, New York University, 2003), http://pages.stern.nyu.edu/~adamodar/pdfiles/papers/divtaxes.pdf.

67. See Clayton W. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* (Cambridge, MA: Harvard Business Review Press, 1997).
68. Steve Denning, "Clayton Christensen: How the Pursuit of Profits Kills Innovation and the U.S. Economy," *Forbes*, November 18, 2011, http://www.forbes.com/sites/stevedenning/2011/11/18/clayton-christensen-how-pursuit-of-profits-kills-innovation-and-the-us-economy/.
69. See Aspen Institute, *Business and Society Program, Overcoming Short-Termism: A Call for a More Responsible Approach to Investment and Business Management* (Washington, DC: Aspen Institute, 2009), http://www.aspeninstitute.org/sites/default/files/content/images/Overcoming%20Short-termism%20AspenCVSG%2015dec09.pdf.
70. See P. Alexander Quimby, "Addressing Corporate Short-termism through Loyalty Shares," *Florida State University Law Review* 40, no. 2 (2013): 389–413; and Kristina Peterson, "Loyalty Shares—It's a Long Story," *Wall Street Journal*, May 10, 2011, http://online.wsj.com/article/SB10001424052748703864204576315533522453932.html.
71. See Sir George Cox, *Overcoming Short-termism within British Business: The Key to Sustained Economic Growth* (London: Labour Party, 2013), http://www.mbsportal.bl.uk/taster/subjareas/accfinecon/labour/144083overcomingshorttermism13.pdf.
72. Ben S. Bernanke, "The Determinants of Investment: Another Look," *American Economic Review* 73, no. 2 (1983): 71–75.
73. Austan Goolsbee, "Investment Tax Incentives, Prices, and the Supply of Capital Goods," *Quarterly Journal of Economics* 113, no. 1 (February 1998): 121–148.
74. Lawrence H. Summers and Alan J. Auerbach, "The Investment Tax Credit: An Evaluation" (working paper, National Bureau of Economic Research, November 1979), http://www.nber.org/papers/w0404.pdf.
75. Jess Edgerton, "The Effects of Taxation on Business Investment: New Evidence from Used Equipment" (working paper, Federal Reserve Board, January 2011), http://edge.marginalq.com/new_usedAssets.pdf.
76. Alan J. Auerbach and Kevin Hassett, "Recent U.S. Investment Behavior and the Tax Reform Act of 1986: A Disaggregate View" (working paper, National Bureau of Economic Research, February 1991), http://www.nber.org/papers/w3626.
77. PricewaterhouseCoopers Vienna, *Tax Aspects of Industrial Investment in Austria* (Vienna: Austrian Business Agency, 2009), http://www.pwc.com/de_AT/at/publikationen/steuern-und-recht/tax-aspects-of-industrial-investment-in-austria.pdf.
78. Deloitte, *Malaysia International Tax and Business Guide* (New York: Deloitte, 2012), http://www.deloitte.com/assets/Dcom-Malaysia/Local%20Assets/Documents/Tax/Malaysia%20Country%20Tax%20Guide%202012.pdf.
79. Deloitte, *Taxation and Investment in the United Kingdom 2013* (New York: Deloitte, 2013), http://www.deloitte.com/assets/Dcom-Global/Local%20Assets/Documents/Tax/Taxation%20and%20Investment%20Guides/2013/dttl_tax_guide_2013_UnitedKingdom.pdf.
80. Deloitte, *Taxation and Investment in Singapore 2012* (New York: Deloitte, 2012), http://www.deloitte.com/assets/Dcom-Global/Local%20Assets/Documents/Tax/Taxation%20and%20Investment%20Guides/2012/dttl_tax_guide_2012_Singapore.pdf.
81. Thomas Dalsgaard, "Japan's Corporate Income Tax—Overview and Challenges" (working paper, International Monetary Fund, March 2008), http://www.imf.org/external/pubs/ft/wp/2008/wp0870.pdf.
82. "Archived - Tax Expenditures and Evaluations 2010," Department of Finance Canada, December 14, 2010, http://fin.gc.ca/taxexp-depfisc/2010/taxexp1004-eng.asp.
83. Rob Atkinson, "Could a Fed Under Larry Summers Worsen America's Investment Drought?," *Ten Miles Square* (blog), *Washington Monthly*, September 9, 2013, http://www.washingtonmonthly.com/ten-miles-square/2013/09/could_a_fed_under_larry_summer046790.php.
84. Jane G. Gravelle, "What Can Private Incentives Accomplish? The Case of the Investment Tax Credit," *National Tax Journal* 46, no. 3 (1993): 275–290.
85. This is a net cost with approximately $34 billion of offsetting savings coming from eliminating the current Modified Accelerated Cost-Recovery System (MACRS). The methodology incorporates the additional cost from the induced increase in investment. See Robert D. Atkinson, *An Innovation and*

Competitiveness Centered Deficit Reduction Approach (Washington, DC: ITIF, forthcoming) and Matthew Stepp and Robert D. Atkinson, *An Innovation Carbon Price: Spurring Clean Energy Innovation while Advancing U.S. Competitiveness* (Washington, DC: ITIF, 2011), http://www.itif.org/files/2011-innovation-carbon-price.pdf.

86. Tom Neubig, "Where's the Applause? Why Most Corporations Prefer a Lower Tax Rate," *Tax Notes*, April 24, 2006.
87. Bureau of Economic Analysis, NIPA Archive for June 26, 2013 (Section 1: Domestic Product and Income; Section 5: Saving and Investment; accessed August 7, 2013), http://www.bea.gov/histdata/NIyearAPFFiles.asp?docDir=Releases/GDP_and_PI/2013/Q1/Third_June-26-2013&year=2013&quarter=Q1.
88. Bureau of Economic Analysis, Fixed Assets (Table 2.8. Chain-Type Quantity Indexes for Investment in Private Fixed Assets, Equipment and Software, and Structures by Type; accessed August 7, 2013), http://www.bea.gov/iTable/index_FA.cfm.
89. Ibid.
90. Jack Triplett, *Handbook on Hedonic Indexes and Quality Adjustments in Price Indexes* (Paris: OECD, 2006), http://browse.oecdbookshop.org/oecd/pdfs/free/9306081e.pdf.
91. Bureau of Economic Analysis, GDP-by-industry Accounts (Chain-Type Quantity Indexes for Value Added by Industry; accessed August 22, 2013), http://www.bea.gov/iTable/index_industry.cfm.
92. Bureau of Economic Analysis, GDP-by-industry Accounts (Contributions to Percent Change in Real Gross Domestic Product by Industry; accessed August 22, 2013), http://www.bea.gov/iTable/index_industry.cfm.
93. See Aktinson et al., *Worse than the Great Depression*, 33.
94. Milton Friedman, *Essays in Positive Economics* (Chicago: University of Chicago Press, 1953).
95. Bureau of Economic Analysis, Detailed Data for Fixed Assets and Consumer Durable Goods (author's analysis; accessed July 1, 2013), http://www.bea.gov/national/FA2004/Details/Index.html.
96. Ibid.
97. See Bureau of Economic Analysis, Detailed Data for Fixed Assets and Consumer Durable Goods, http://www.bea.gov/national/FA2004/Details/Index.html.
98. IPES asset codes: EP1A, EP1B, EP1C, EP1D, EP1E, EP1F, EP1G, EP1H, ENS1, ENS2, ENS3, EP20, EP34, EP35, EP36, EP31, and EP12.
99. See Irving Fisher, *The Making of Index Numbers* (Boston: Houghton-Mifflin, 1922).
100. See Karl Whelan, "A Guide to the Use of Chained Aggregated NIPA Data" (working paper, Federal Reserve Board, June 2000), http://irserver.ucd.ie/bitstream/handle/10197/253/whelank_workpap_032.pdf.

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The Information Technology and Innovation Foundation (ITIF) is a Washington, D.C.-based think tank at the cutting edge of designing innovation strategies and technology policies to create economic opportunities and improve quality of life in the United States and around the world. Founded in 2006, ITIF is a 501(c) 3 nonprofit, non-partisan organization that documents the beneficial role technology plays in our lives and provides pragmatic ideas for improving technology-driven productivity, boosting competitiveness, and meeting today's global challenges through innovation.

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