

bad, it's potentially as bad in the United States, especially in the absence of action.

One would assume that after the U.K. industrial sector sank as far as it did, elites would have woken up and sounded the clarion call for action. But even today it is not widely accepted that the United Kingdom suffered a serious decline. Even some who have studied the issue remain in denial. After all, they assert, Britain is still richer today than some other nations. Rex Pope, author of *The British Economy since 1914: A Study in Decline?* reflects this view when he states, "However we measure U.K. economic condition and well-being in relation to the G7 nations or the other members of the European Commission, we should remember that these are clubs containing the richest of the world's states. The gap between the U.K. and those within these groups with stronger economies is much less than that between the U.K. and the great majority of the world's nations."⁶⁸ Should the United States fail to turn around its economic ship of state, such sentiments will likely be standard fare in the 2020s. You can almost hear the neoclassical economist-inspired *New York Times* editorial board stating: "Even though we no longer have much manufacturing and even though our per capita income growth has slowed to a crawl, we are still richer than the Zimbabweans."

These views—excuses, really—are all too prevalent today in America and are a central barrier to action. For, just as Alcoholics Anonymous famously states that the first step to overcoming alcoholism is to admit being an alcoholic, the first step to reversing America's slide in the race for global innovation advantage is to admit that our nation is slipping.

Why Do So Many Refuse to See U.S. Structural Economic Decline?

Given how clear it is that the United States is losing the race for global innovation advantage, why isn't this regularly the subject of op-eds, conferences, and congressional hearings? The simple answer is that notwithstanding the occasional report or op-ed,¹ most U.S. pundits, policymakers, and economists have steadfastly refused to heed the abundant warning signs of long-term structural U.S. economic and competitive decline. For example, in a 2008 report prepared for the Bush administration, the RAND Corporation reviewed key indicators to evaluate the current state of U.S. science and technology (S&T) competitiveness.² The report contended that the "clarion call" of concern about threats to the state of U.S. S&T competitiveness was alarmist and overblown, despite the fact that many of the indicators they presented actually did suggest significant decline in the U.S. position. But, as we have seen, there is ample room for concern about the current state of the U.S. economy, its S&T enterprise, and the country's future ability to compete.

Excuses for Ignoring Competitiveness Decline

Whether it comes to individuals, organizations, or nations, admitting defeat or decline is difficult. It's much easier and more comforting to profess that all is well. As we discuss in chapter 3, that's what much of the U.K. elite did for decades. In both the United Kingdom and the United States, "apostles of denial" emerged to preach a comforting—but ultimately counterproductive—gospel of good news.³ There are at least eleven major reasons why the United States has been so slow to recognize its structural economic decline. The first six relate to a denial of the problem, the last five to the belief that we are doing better than we really are.

Excuse 1: The United States Always Has Led in Innovation, and Always Will

There's no question that in the half century after World War II (WWII), the United States boasted the world's leading economy and dominated the innovation landscape. Indeed, in the decades following WWII, an ingrained attitude developed that the U.S. economy was so superior that no other country could conceivably match it. President Harry Truman boasted that "American industry dominates world markets and our workmen no longer need fear the competition of foreign workers."⁴ In 1953, the President's Advisory Board for Mutual Security called for the unilateral elimination of U.S. tariffs on automobiles and consumer electronics imports because "U.S. producers are so advanced no one can touch them." Secretary of State John Foster Dulles advised the Japanese to concentrate on exporting to Southeast Asia and forget about the U.S. market because "Japan could not make anything Americans would be interested in buying." The chief U.S. negotiator with Japan from 1954 to 1955, C. Thayer White, even emphasized that it would be stupid for Japan to build an auto industry and that it should instead import cars from America. Clyde Prestowitz notes that State Department attitudes in the 1950s were well captured by one official who stated that "the U.S. trade surplus is a serious problem and we must become really import-minded."⁵ The State Department even took the extraordinary step of instructing its officers abroad to promote foreign ex-

ports to the U.S. market (but not for automobiles, of course, since others could never make them as well as we did). While American officials were looking down on Japanese economic capabilities, they were at the same time encouraging them to export to America so as to help their economy and thereby keep Japan from "going Red."⁶

The default view that the United States must by right continue to lead the world in innovation persists to this day. Economist Irwin Stelzer forthrightly declares: "America remains the source of most of the world's innovations and the home of most of its great entrepreneurs."⁷ RAND confidently affirmed that "despite perceptions that the nation is losing its competitive edge, the United States remains the dominant leader in science and technology worldwide."⁸ A U.S. senator reflected this prevailing wisdom in a May 2010 Senate Energy Subcommittee hearing, proclaiming: "We know that America is second to none in innovation."⁹

Most commentators assume as a matter of faith that the United States leads in research and innovation *prima facie* and will continue to do so indefinitely. *New York Times* columnist David Brooks asserts that if you're a member of the global creative class, whether in 2010, 2025, or 2050, you'll want to come to America "because American universities lead the world in research and draw many of the best minds from all corners of the earth."¹⁰ Indeed, there is a widely held view that the United States must certainly lead in terms of university-based research, given our institutions such as MIT, Stanford, and the California Institute of Technology. But in fact, America ranks just twenty-second out of thirty major nations in university research and development (R&D) funding as a share of gross domestic product (GDP).¹¹ Even the Council on Competitiveness, the organization that presumably should be at the forefront in sounding the alarm, does the opposite, telling us that "America is better positioned than perhaps any other country to benefit from the forces that are reshaping the global economy."¹²

In his book *The Post-American World*, Fareed Zakaria asserts that the United States is not even really in direct competition with other nations because America's true economic power exists at different levels of the global supply chain. He argues that whereas Chinese manufacturers and Indian software technicians can take market share in the production phase of the supply chain, at the R&D back end and the commercialization front

end—where the money is—the United States has irrefutable market dominance. Zakaria dismisses Asia, saying its countries cannot compete with the U.S. education system, and Europe, in part because its population is aging too quickly. And he asserts that no other country comes close to the United States when it comes to tomorrow's big innovations in emerging technologies like nanotechnology or biotechnology. While the United States certainly has strengths in these areas, as Greg Tassef of the National Institute of Standards and Technology (NIST) observes, "The growing global capability to innovate is casting doubt that past U.S. first-mover advantages will continue to be realized in the future. As a result of global convergence, nanotechnology will be the first emerging technology for which multiple economies are competing on equal footing to be first movers."¹³ Moreover, as we see from *The Atlantic Century II* report, the United States is rapidly losing ground in innovation-based competitiveness.¹⁴

In short, during the past half century, the United States has developed an attitude that we always have led in innovation and always will. This has fostered an entitlement mentality which assumes that policies that were good enough to assure U.S. innovation leadership in the past will be sufficient in the future. And, even worse, this mentality believes that we can afford to abandon the successful policies of the past, such as robust funding for government R&D or the R&D tax credit. But the United States cannot simply leave its science, technology, and innovation enterprise on autopilot and expect it to continue to deliver the same level of success it produced in the past.

Excuse 2: We're Not Really Behind; The Data's the Problem

Some skeptics insist that the United States is not really lagging in innovation competitiveness, contending that some reports show America still maintaining an innovation lead, that the data or methodology used in the Information Technology and Innovation Foundation's (ITIF's) *Atlantic Century* reports (or similar ones) are faulty, or that the countries cited as innovation leaders don't count because they are smaller or have different political structures.

For example, skeptics cite reports like the World Economic Forum's (WEF's) *2009–2010 Global Competitiveness Report* or the *2008–2009 Global Innovation Index*, released by INSEAD and the Confederation of Indian Industry, which both rank the United States as first in innovation, as proof that the United States is doing just fine.¹⁵ However, what's interesting is that the 2011 updates of both of these reports also show the United States' rank in innovation falling, from first to fourth in the *WEF Global Competitiveness Report* and from first to seventh in the *Global Innovation Index*.¹⁶

But, in reality, it is the methodology behind these reports that is seriously flawed, because more than two-thirds of the *Global Competitiveness Report* indicators are derived from opinion surveys. These ask business leaders questions such as "How would you rate the protection of property rights, including financial assets, in your country?" For the report's innovation subsection, only one of the indicators—patents per million citizens—is based on hard data. As another example, the 2010 WEF report ranked the United States first in venture capital and third for corporate investments in R&D out of 133 countries, based solely on executive opinion. However, among just thirty-seven nations, the actual data showed that the United States ranked fifth in both venture capital and corporate R&D.¹⁷

To their credit, some commentators have recognized the discrepancy between reputation and fact. For example, in response to an ITIF critique of *The Post-American World*, *Newsweek* columnist Fareed Zakaria acknowledged:

I'd always viewed the rankings that routinely show America on top [in innovation] as authoritative. But they may be misleading. Most traditional competitiveness studies use polls—of CEOs, scientists, investors—as a key part of their measurements. For example, The World Economic Forum report relies upon surveys for almost two thirds of its data. But two studies of global innovation [the aforementioned ITIF and Boston Consulting Group studies] have been released this year, both comprehensive, and both relying entirely on government statistics and other hard data. In both, the United States does considerably worse, coming in eighth in the BCG study and sixth in ITIF's. Like a star that still looks bright in the farthest reaches of the universe but has burned out at the core, America's reputation is stronger than the hard data warrant.¹⁸

Some skeptics object that the nations identified as innovation leaders aren't really comparable to the United States. For example, skeptics argue that four of the top five nations in the first *Atlantic Century* report—Singapore, Sweden, Luxembourg, and Denmark—don't really count because of their small size and less complex government structures. They argue that the United States can be compared only to countries of comparable size. For example, in *The Post-American World*, Zakaria argues that Northern Europe is too small to compete and is of no consequence to American economic leadership.¹⁹ He considers the United States' slipping somewhat in competitiveness compared to "small northern European countries like Sweden, Denmark, and Finland (whose collective population is twenty million, less than that of Texas)" of little concern. But U.S. competitiveness with these economies matters because countries around the world are intensely competing for the highest-value-added sectors of economic activity: those that generate the highest-paying jobs and the greatest economic wealth. So when Denmark gains global leadership in wind power, Singapore in life sciences, Sweden in health information technology (IT), or Finland in mobile technologies, the United States risks losing industries, companies, and ultimately employment in these leading sectors. In other words, these countries matter because they are in competition for the kinds of high-technology, high-value-added, high-paying jobs that Americans desire. The other problem with dismissing the innovative potential of small- and mid-sized nations is that, when taken together, emerging innovative nations such as the Nordic and Baltic countries, Korea, Singapore, Taiwan, and others may create a critical mass that can rival the United States in international competitiveness.²⁰

Others claim that the United States isn't losing its lead because U.S. businesses are still at the technological frontier. Robert Shapiro, chair of the Washington, D.C., think tank New Democratic Network's Globalization Initiative, argues: "The data do not show that the United States is losing its technological edge, but rather that its technology companies are fully globalized."²¹ Shapiro points out that U.S. companies' share of the global technology market has increased compared to those of Europe and Japan. But this is not the point. While it's certainly good that U.S. companies are not losing their global technological leadership, it's also important where that activity

takes place. The key to winning the race for global innovation advantage is for a country to have a significant share of innovation-based establishments (that is, the factories, laboratories, and offices of enterprises), not just enterprises. It doesn't do as much for American workers if U.S. companies are producing high-value-added goods and services at overseas establishments (and exporting some of them to the United States) as it does if those activities are occurring at establishments inside the United States. When countries like India and China give generous subsidies or low tax rates to U.S. companies to build high-tech factories or research labs in their nations, it helps the competitiveness of U.S. companies, but it hurts the U.S. economy.

To the extent that analysts like Shapiro even admit a problem, it's that not everyone is benefiting from U.S. economic strength. As he states, "For all its strengths and successes, America's new, idea-based economy does not benefit all Americans."²² In other words, the U.S. innovation engine is fundamentally healthy, and the only problem is that the distribution of those benefits is skewed. If that's the diagnosis, there's no need for a more competitive tax code, increased government R&D investments, and other competitiveness policies. Just provide more generous unemployment insurance benefits for the millions of Americans losing their jobs when the establishments they work for shut down or downsize.

Excuse 3: Countries Don't Compete; Only Companies Do

When young boys find themselves losing a race with their buddies, they will often stop and yell, "I'm not racing!" American elites are doing much the same thing. Better to simply pretend that you aren't racing than to lose. And a central challenge for the United States is that many of its elites, particularly those who dispense economic "wisdom," do not believe that America is in global economic—and innovation—competition with other nations. In large part, this perspective results from fundamentally flawed advice from the dominant neoclassical economists who are on record as counseling that countries do not compete, only companies do. Indeed, economist Paul Krugman made the astounding—but quite conventional (at least among neoclassical economists)—contention that "the notion that nations compete is incorrect. . . . countries are not to any important degree in

competition with each other.”²³ Likewise, the lead economist at the Congressional Research Service has gone so far as to claim that international [economic] competitiveness is a “term without rigorous meaning.”²⁴ As conservative economist Kevin Hassett claimed with all-too-typical economist conceit, “Non-economists regularly appeal to competitiveness when motivating a wide array of policies, while economists protest or look the other way.”²⁵

Since the notion that “countries don’t compete, only companies do” has come to inform so much of U.S. economic and trade policy, it’s important to explore the two arguments underlying Krugman’s assertion. First, Krugman argues that because about 80 percent of the U.S. economy consists of nontraded goods and services intended for domestic use, the growth rate of U.S. living standards essentially equals the growth rate of domestic productivity, not U.S. productivity relative to competitors. He maintains that since the domestic, nontraded sectors of an economy really drive its productivity and growth, countries are not competing against one another for economic preeminence.

While Krugman is correct in stating that raising productivity in nontraded sectors (e.g., grocery stores, insurance companies, trucking companies, and so forth) is vitally important to a country’s growth, the flaw with his first argument is that it vastly underestimates how important a nation’s traded sector is to its terms of trade and to the health of its nontraded sectors. For example, there are considerable spillover effects from a healthy, high-value-added export sector because it leads to growth in domestically traded sectors. Moreover, the growth of high-value-added sectors—a predominant share of which are technology or IT jobs traded in international competition—changes the mix of sectors in an economy toward more high-value-added ones, leading to higher productivity, wages, and standards of living.

The second argument underpinning Krugman’s assertion is not just partially flawed, it’s fundamentally wrong. Krugman reasons that while companies do sell products that compete with each other, the companies and consumers in these nations are also simultaneously each other’s main export markets and suppliers of useful imports. Since (in Krugman’s view) international trade is not a zero-sum game, even if European or Asian

countries gain a larger share of global high-value-added production, this benefits the United States by providing it with larger export markets and access to superior goods at a lower price. In other words, he argues, since trade is inherently win-win in nature, even if the United States lost most of its high-value-added traded sectors (imagine Apple, Boeing, Cisco, Eli Lilly, Ford, General Motors, IBM, Intel, Merck, Microsoft, and other similar companies laying off the majority of their U.S. workforce), America would still benefit from trade because at least it would receive cheaper imports and have access to larger export markets.

But the reality is that if Boeing, Ford, or the other companies mentioned here were to lay off most of their U.S. workers, America will be worse off, not better. The fact that one even has to state this is amazing since to the average “noneconomist,” it’s obvious and right. And here noneconomists are right. While some of those laid-off workers might find jobs with equal wages and value added, the majority would not and would ultimately end up with lower-wage, lower-value-added jobs. How could they then afford to buy those goods and services now produced overseas, other than to do what the United States has been doing for a generation: borrowing the money from overseas creditors who want us to keep importing? As chapter 7 explores, many countries intentionally seek to move their economies up the value chain to higher-value-added sectors by unfairly manipulating international trade flows. Thus, Krugman’s second argument is fundamentally flawed because it drastically underestimates the impact that countries’ strategies—whether fair and consistent with global trade rules or not—can have in shifting comparative advantage in critical technology-based sectors their way. It’s almost as if neoclassical economists like Krugman tautologically believe that countries don’t compete simply because this is stipulated in the ground rules of neoclassical economics (since countries are not supposed to have any explicit policies that drive productivity or innovation), even as stark evidence that they do compete stands in plain sight.

Returning to the flaw in Krugman’s first argument, one reason so many pundits undervalue or even ignore the importance of an economy’s traded sectors is that they are regurgitating the conventional neoclassical economic wisdom that what a country makes does not matter. As Michael Boskin memorably quipped, “Potato chips, computer chips, what’s the difference? A

hundred dollars of one or a hundred dollars of the other is still a hundred dollars.”²⁶ But there is a difference, and it is profound. First, some industries, such as semiconductor microprocessors (computer chips) can experience very rapid growth and reductions in cost, spark the development of related industries, and increase the productivity of other sectors of the economy. In essence, spillover effects from computer chips make potato chip manufacturers more efficient. But the converse is not true. Cheaper potato chips don’t make Intel more productive, they just make us fat. Second, jobs producing computer chips require a higher skill level and thus pay more than jobs producing potato chips. Third, if a country loses the computer chip industry to foreign competitors, that value similarly disappears as the industry’s supply chains and industrial commons are hollowed out; the neoclassical assumption that residual assets will be redeployed to high-value-added sectors is not necessarily the case. More likely than not, many of the laid-off computer chip workers would end up working in lower-paying sectors. In fact, among the U.S. workers laid off between 2007 and 2009, about 75 percent are employed after three years, and of them, approximately 17 percent report earnings of 20 percent or more higher than their previous wages, while approximately 30 percent report earnings of 20 percent or more below their previous wages.²⁷

To be generous, this conventional view that America is not in competition may have accurately described a country’s economy before the emergence of the globalization era prior to the late 1970s. But today, it clearly no longer does. During the prior national economy era, if firms could not compete and went out of business, the only issue was making sure that their assets, including employees, were quickly redeployed to other companies that could compete successfully. And they almost always were deployed to firms in the same nation, so while individual workers and sometimes communities like Buffalo or Cleveland could be hurt, the nation as a whole only had to pay the transition costs (e.g., lost output while the worker was unemployed). When a high-wage, high-value-added steel mill closed in Buffalo but opened in Birmingham, Alabama, that production stayed in America. The new mill may have even used some of the same equipment that was moved from Buffalo. Buffalo may have been hurt, but Birmingham was helped. In today’s economy, however, knowledge is increasingly the major

factor of production and production itself is global. Today, when a software establishment closes or loses market share in America, the establishment that ends up taking that share is often located overseas. And all too often those assets, particularly knowledge, cannot be redeployed at home because they are too specialized. In other words, countries lose not only jobs but also knowledge to foreign competitors. When this happens, nations can become relatively poorer than what they would have been otherwise.

In contrast to the dominant neoclassical view, knowledge is not a free-flowing commodity held solely by individuals and traded in markets like cabbage at the grocery store. It is embedded in organizations and if organizations die, so too does a significant amount of knowledge. Moreover, there are significant spillover effects from firm activities and significant first-mover advantages, including learning effects that enable firms’ early leads to translate into dominant positions. There are also significant network effects, which mean that advancement in one industry (e.g., broadband telecommunications) can lead to advancement in a host of others (e.g., Internet video). As a result, for many parts of the U.S. economy exposed to international competition, if you lose it, you can’t easily reuse it. In these cases, foreign high-value imports often end up substituting for the defunct domestic product.

This alternative framework—what some have termed a neoschumpeterian framework (after noted economist Joseph Schumpeter)—better describes a growing share of countries’ economies, particularly those sectors focused on technology- and knowledge-based production, than does the neoclassical commodity adjustment model. This means that losing international competitions in knowledge-based industries means losing much more than just the firms and their output. It means losing much of the value now dispersed among unemployed workers and underutilized suppliers. As innovation economist Greg Tasssey argues, “The central failure of current economic growth models is the assumption that shifts in relative prices will automatically elicit a Schumpeterian-type efficient reaction from domestic private markets—namely an adjustment involving development/assimilations of new technologies to replace offshored ones.”²⁸

Take the example of advanced aerospace. Today it is a complex technology- and knowledge-based industrial ecosystem. In the United States, it

involves original equipment makers (such as Boeing) manufacturing some of the most technologically complex products in history; a network of tens of thousands of specialized parts and component suppliers, including advanced jet engine makers; providers of specialized business services; educational institutions producing skilled workers, knowledge, and discoveries; and testing labs, standards, and other innovation infrastructures, all knit together by a complex system of interactions and relationships among the players. While Boeing is clearly the hub of this system, its health cannot be divorced from the health of the system.

If, however, innovation leadership is lost, it would be difficult and almost impossible to regain without dramatic, market-altering intervention. In the case of Boeing, Europe has long targeted U.S. leadership in commercial aircraft by funneling massive, World Trade Organization (WTO)—illegal subsidies to its champion, Airbus. This is coupled with significant European airline preferences for buying Airbus jets (as chapter 7 describes). On the other side of the world, China is seeking to build its own commercial airline industry, partly by copying, but ramping up, illegal European subsidies, but also by playing Boeing and Airbus against each other by tying the purchase of jets to the willingness of the winner to shift technology and production to China (also illegal under the WTO). And you can be sure that once China has extorted the technology it needs to gain competency in producing major passenger jets, it will not only stop buying foreign jets for its own market, but also will start massively subsidizing domestic jet sales to other nations, as it is currently doing for components of long-haul passenger jets.

The problem is that these subsidies distort global competition and represent a vast waste of global resources. Moreover, let us suppose that the worst were to occur, with Boeing going bankrupt because of these mercantilist practices. If this were to occur, the United States could not rely on market forces, including a steep drop in the value of the dollar, to later re-create a domestic civilian aviation industry. To do so would require not only creating a new aircraft firm from scratch but also the complex web of suppliers, professional associations, university programs in aviation engineering, and other knowledge-sharing organizations. With fewer aviation jobs, fewer students would become aeronautical engineers, making it dif-

ficult to rebuild capacity. If a country loses the intangible knowledge about how to build an airplane, it cannot reconstitute it without massive government subsidies and almost complete domestic purchase requirements.

But most neoclassical economists would argue that Boeing going out of business would be no big deal as long as the U.S. economy maintains its historic flexibility and doesn't restrict Boeing's assets from flowing to more productive uses. If the "market" dictates that the United States should not produce passenger jets (or even any manufacturing at all), then they would maintain it's better to redeploy these assets to more productive uses. Their assumption is that anyone smart enough to be an aeronautical engineer is smart enough to find another high-skill, high-wage job. But there are several glaring problems with this view. First, it would not be the "market" but mercantilist nations dictating the change. If anything, Boeing's global market share (and aviation jobs in America) would be significantly larger in the absence of other countries' mercantilist policies.

Second, let's suppose that somehow these assets—the workers, machinery, and financial capital—did get redeployed. Certainly, much of Boeing's tangible assets, its physical plant, would likely be redeployed. Someone (probably in China) would buy the advanced dies and other machinery Boeing uses to produce planes. (In fact, a multibillion-dollar industry has emerged in the United States that strips parts such as machinery, generators, tools, and dies from defunct American manufacturing plants and ships them to developing countries to be rebuilt, recycled, and reused.)²⁹ Amazon.com might buy the massive hangars where Boeing makes the planes to use for an e-commerce fulfillment center to sell Stephen King books and Lady Gaga videos.

But an increasing share of a nation's capital resides in intangible capital—the talent of its workers and the knowledge embedded in its organizations and industrial commons—and this is not easily reallocated. As Jon Clark, publisher of *Plant Closing News*, a newsletter that documents the 150 or more closures of American manufacturing plants each month, ruefully says about the resale business of parts from shuttered plants: "The only thing that doesn't get recycled or reused is the people."³⁰ To return to the Boeing example, the value-added per worker in the aerospace industry (that is, the amount of value that each worker adds to the materials and parts

they get) is among the highest of any industry, at \$133,000 per year. In contrast, the value-added per the average U.S. job is \$103,000 per year.³¹ But the highly trained scientific workers and technicians that Boeing employs cannot easily go to another firm and put their knowledge and skills to immediate work. Imagine the introduction: "I'd like to apply for the hedge fund trading position; I'm an aeronautical engineer specializing in carbon-fiber wing design." The newly unemployed Boeing engineer would more likely apply for a midlevel technician job at a warehouse, and make half of what he or she did before. So even if every Boeing worker and every worker at its suppliers got a new job, most of them would see a big cut in their wages and the nation would be poorer. Moreover, the closure would represent a big contractionary force in the overall economy as unemployed workers take time to get reemployed and as their spending cutbacks ripple through the economy leading to other jobs being lost.

This in a nutshell explains the race for global innovation advantage. It also explains the decline of the U.S. "rust belt," especially as the once-dominant, high-wage auto manufacturers have lost market share to global competitors. For example, whereas the Big Three (General Motors, Ford, and Chrysler) accounted for 92 percent of cars sold in the United States in the 1960s (with a large share produced in the "rust belt"), that share fell to 74 percent in 1980 and then plummeted to 44 percent by 2009.³² With Michigan's second-largest industry now tourism, much of which employs people in lower-paying jobs, Michiganders no longer enjoy the above-average standard of living they did as recently as 1994; it's now 87 percent of the national average.³³ And it's unlikely to get back to average for the foreseeable future.

The final major flaw with the neoclassical view of economic competition is that it underestimates the beneficial impact government intervention can have. In the twenty-first-century global economy, nations can no longer be indifferent to the industrial and value-added mix of their economies. With the sole exception of the United States, virtually all nations have consciously adopted national policies to "intervene in the market" so it is easier for corporations to invest in higher-value-added activities that create higher-wage jobs at home. This brings us to perhaps the most insidious effect of the "countries don't compete, only companies do" canard: the prevailing U.S.

view that any government engagement in the market must be inherently pernicious has blinded U.S. policymakers to the fact that other countries reject this belief, precisely because they see themselves in explicit competition with the United States and other nations.

These countries are not content to sit idly by to observe how the market will allocate global production, for they know that the market could very well allocate to them low-wage T-shirt factories and call centers (or even worse, ductor factories and software companies. In essence, these nations recognize that while markets can create prosperity, they don't always do so at home. The next thousand high-value-added jobs could just as easily be created or located in another nation. Recognizing the need to go beyond letting firms alone determine the location of high-value-added economic activities, they "intervene" in their economies with policies such as implementing national innovation strategies, funding basic and applied research, providing R&D tax credits, and so forth.

Moreover, these nations are not blinded by the neoclassical economics dogma that any government engagement in markets is distorting and growth-reducing. They look to support their domestic companies and industries by facilitating government-industry-university partnerships, by developing strategic technology industry road maps and allocating scarce R&D resources accordingly, and by partnering with industry in technology deployment. Accordingly, as Tassef notes, a key "underlying problem is that U.S. manufacturing firms are attempting to compete largely as independent entities against a growing number of national economies in Europe and Asia in which government, industry, and a broad infrastructure (technical, education, economic, and information) are evolving into increasingly effective technology-based ecosystems."³⁴ Or as Wayne Johnson, Hewlett Packard's director of worldwide strategic university customer relations, observes, "We in the United States find ourselves in competition not only with individuals, companies, and private institutions, but also with governments and mixed government-private collaborations."³⁵

Put simply, competition among governments has become a critical factor in determining global market share among nations. As chapters 6 and

7 explore, the measures countries take to win the race for global innovation advantage can be either constructive or destructive to both themselves and to the global economy, depending on how they implement those policies. For the moment, however, the key point is to understand that the globalization of innovation production and consumption has forced formerly dominant nations like the United States to move from being “price makers” to “price takers” in international markets. In other words, enterprises now shop the globe to find the countries with the most attractive markets—based on effective corporate tax rates, R&D tax credit generosity, workforce talent, availability of state-of-the-art digital and physical infrastructure, and the presence of technology clusters, among other factors—in which to locate their establishments performing R&D, design, production, and management activities.

For example, Intel, like virtually all multinational enterprises, shops the world to find the optimal locations for its R&D and production activities. Intel’s recent decision to locate a semiconductor manufacturing plant in China instead of the United States was driven in part by the recognition that it can cost \$1 billion more to build, equip, and operate a factory in America than it does elsewhere, with 70 percent of the cost difference accounted for by lower taxes, and 90 percent of the cost difference explained by factors other than wages. The decision was also informed by Intel’s recognition that access to science and engineering talent in China is as good as or better than in the United States.

For the U.S. economy, the implication is that the United States has become a large state—in the sense that a large share of its economy is now traded—and it competes against other nations the way U.S. states have had to compete for investment since WWII. Indeed, as we discuss subsequently, both Republican and Democratic state governors have long supported state “industrial policies.” It’s only Washington that persists in seeing the world through the rose-colored glasses of “countries don’t compete.” But if it is left to the results of market competition alone, the United States will continue to lose out in global competitions for high-value-added technology and knowledge-intensive production. In fact, a January 2012 *Harvard Business Review* survey of alumni from its business school found that when the firms they worked for had to decide whether to locate an activity (such as

R&D, production, customer service, or back-office operations) in America or elsewhere, America lost two times of three.³⁶

Excuse 4: We’ve Been Challenged Before and It All Worked Out

Many skeptics argue that concern about the state of U.S. competitiveness is just another case of alarmists “crying wolf.” After all, the United States appeared to come through competitive clashes with the Soviet Union in the 1950s and 1960s and with Japan and Germany in the late 1970s and early 1980s just fine. They maintain, therefore, that since previous warnings that U.S. competitiveness was under threat turned out to be false alarms, current warnings are the same. In October 2009, Larry Summers, then director of President Obama’s National Economic Council, reassured us that “predictions of America’s decline are as old as the republic,” comforting that “when the Soviet Union collapsed, the *Harvard Business Review* of 1990 proclaimed in every issue—every issue—in one way or another that the Cold War was over, and that Germany and Japan had won. . . . Now we are hearing the same thing with respect to China.”³⁷ On the Right, as well, many voices have long argued that fears about U.S. competitiveness are overwrought. Take, for example, Neal McCluskey, a policy analyst at the conservative Cato Institute: “Using the threat of international economic competition to bolster federal control is nothing new. It happened in 1983, after the federally commissioned report *A Nation at Risk* admonished that, ‘our once unchallenged preeminence in commerce, industry, science, and technological innovation is being overtaken by competitors throughout the world’ as well as in the early 1990s, when George Bush the elder called for national academic standards in order to better compete with Japan.”³⁸ Likewise, regarding the offshoring of jobs in the new century, Morgan Stanley’s Stephen Roach argues that “this is exactly the same type of challenge farmers went through in the late 1800s, sweatshop workers went through in the early 1900s, and manufacturing workers in the first half of the 1980s.”³⁹ Journalist Robert Samuelson agrees: “Ever since Sputnik (1957) and the ‘missile gap’ (1960), we’ve been warned that we’re being overtaken technologically.”⁴⁰

In other words, since it is claimed that the United States retained its lead in commerce, science, and technology through past challenges of

competitiveness, calls for concern are unfounded now, just as they were then. We'll prevail because market-oriented systems always prevail. But this rosy assessment ignores three key facts. First, policymakers from both sides of the aisle in the early to mid-1980s took competitive threats seriously and responded by instituting a comprehensive set of policy measures that were instrumental in strengthening U.S. competitiveness. Imagine if the response to Sputnik had been, "Well, we handled the British threat in the 1880s and the German challenge in the 1920s, so we'll just sit back and see what happens." Luckily, wiser heads prevailed and America responded.

The United States made a number of institutional changes to support the U.S. innovation ecosystem, including passing the Stevenson-Wydler Technology Innovation Act; launching the Advanced Technology Program (ATP) and Manufacturing Extension Program (MEP); establishing the Malcolm Baldrige National Quality Award; and creating new National Science Foundation programs to link industry and academic research, such as the Engineering Research Centers and Industry/University Cooperative Research Centers. Congress also passed the Bayh-Dole Act, which transformed the relationship among federal research funders, academic institutions and their researchers, and the commercial marketplace. And we shouldn't forget the states; all fifty of them established technology-based economic development policies in the 1980s.

The United States also made changes to its tax and regulatory systems. In 1981, it became the first country to introduce a research and development tax credit to spark corporate R&D activity. Laws regarding the "prudent man" rule governing institutional investors were relaxed, spurring an explosion in venture capital activity. Legal changes enacted in the 1984 National Cooperative Research Act led to an explosion of consortium-based research activity by removing a defect of antitrust law which suggested that collaborative joint research efforts among corporations were potentially collusive.⁴¹

In fact, no less a skeptic of government intervention than President Ronald Reagan adopted "a robust industrial policy aimed at competing head-on with both the Soviet Union and Japan."⁴² President Reagan supported vital U.S. industries including semiconductors, machine tools, and auto-

mobiles, and made investments of billions into future U.S. technological capability. He supported the establishment of the Semiconductor Manufacturing Technology (SEMATECH) consortium, a partnership between major semiconductor companies and the Department of Defense, which started with a focus on actually making chips but then shifted to a role of fostering the entire semiconductor supply chain. Even though he was a staunch free-trade advocate, Reagan supported a five-year Voluntary Restraint Agreement with Japan and Taiwan on imports of machine tools based on grounds of national security, arguing that the machine tools industry was "a vital component of the U.S. defense base." He also supported the creation of the National Center for Manufacturing Sciences to foster the development of an advanced machine tool and automation industry. And the Department of Defense created the Defense Manufacturing Board as a permanent entity to provide visibility to manufacturing and industrial base issues.

The second flaw in the naysayers' argument that we don't need to worry about competitiveness challenges is their suggestion that the United States emerged unscathed and largely victorious from its competitive scraps with Germany and Japan in the 1970s and 1980s. The fact of the matter is that those countries gained substantial market share from the United States in a number of high-value-added industries, including semiconductors, steel, consumer electronics, automobiles, and machine tools. While the U.S. economy was bolstered by a new engine of growth in the IT revolution beginning in the early 1990s, the reality is that the United States never recovered the market share it lost in those key sectors. Moreover, as the effects of the adrenaline shot of low interest rates and abundant capital that fueled the asset bubbles that drove much of the U.S. economy in the 2000s subsided, this revealed the actual underlying weakness of many traded sectors of the U.S. economy.

The third flaw with this argument is that it ignores the fact that the threat is now different—and much bigger. It was one thing to compete against Germany and Japan, which have a combined population of two hundred million and wage levels near or even above American wages. It's quite another to compete with China and India, which have a combined population of more than 2.5 billion people and wage levels less than 10 percent of U.S.

levels, and which, especially in the case of China, practice innovation mercantilism on an unprecedented scale.

Excuse 5: Geopolitical Aims Are More Important than Economic Competitiveness, So We Can Make Trade-offs

When you consider your economic prowess to be unassailable, you can afford to be magnanimous. And particularly since the advent of the cold war, the United States has made trade-offs that subordinated its trade and economic interests in pursuit of its geopolitical and national security objectives. The United States has cut favorable trade deals with countries we wanted as allies, provided them foreign aid and technology transfers, reduced tariffs on goods exported to America, and even encouraged U.S. companies to locate activity there, all in the great geopolitical struggle against the Soviet red menace.

For example, in the 1950s, through the U.S. Agency for International Development (U.S. AID), the United States assisted Taiwan in launching the China Productivity Center, which helped its manufacturers become more productive (and compete better with U.S. manufacturers).⁴³ Likewise, a 1969 U.S. AID report, *Expanding Exports: A Case Study of the Korean Experience*, documents how U.S. AID assisted Korea in developing its export program and was instrumental in helping Korea launch the Korean Productivity Center and the Korean Industrial Research Institute.⁴⁴ In one instance, the report describes how "U.S. AID brought in a full-time quality control advisor, Mr. John Jacobsen, who visited hundreds of Korean companies to advise them on methods. He was instrumental in organizing a quality control association, which sponsored a major public showing of quality control methods that was partially financed by AID. . . . He also organized seminars and study groups throughout the country."⁴⁵

In essence, assistance from U.S. taxpayers helped Taiwan and Korea develop their technology-oriented export machines. Of course, the United States never anticipated it was helping a competitor; all it cared about was keeping Taiwan and Korea from going Red. However, as early as 1971, the U.S. Commission on Trade and Investment Policy warned that Washington was overemphasizing geopolitical considerations at the expense of

U.S. economic interests.⁴⁶ Even then, the commission warned that the U.S. manufacturing base was declining as a result of the industry-targeting policies of other countries—and U.S. complicity with those policies. However, even today, the United States Agency for International Development continues to fund programs that train foreign workers with skills that position them to take away U.S. jobs. For example, in January 2012, U.S. AID helped fund a \$5 million grant to establish the Higher Engineering Education Alliance Program (HEEAP), which will provide a model for advancing engineering education to prepare Vietnamese engineers to work in the high-tech industry.⁴⁷

Perhaps the archetypal example of the United States favoring its geopolitical interests over its economic interests comes out of the trade conflicts with Japan in the late 1970s and 1980s, as Japan pursued a mercantilist, export-led economic growth strategy (just as China does today). Japan had implemented a number of policies designed to skew trade in their favor and to limit U.S. companies' access to Japanese markets, including placing high tariffs, import quotas, and onerous regulations, inspections, and standards requirements on U.S. products; limiting U.S. ownership of Japanese enterprises; manipulating the yen's value; and shutting U.S. companies almost entirely out of strategic markets, including autos, semiconductors, and mainframe computers, all while dumping their products on U.S. markets. For example, by 1984, Japanese companies had captured 60 percent of the U.S. semiconductor chip market.

Pressure mounted from business, labor, and Congress for the White House to file unfair trade complaints under the General Agreement on Tariffs and Trade and to declare Japan an unfair trader under then existing U.S. law. However, the U.S. policy community was torn about how much to pressure Japan, with the national security agencies (State, Defense, and the National Security Council) and neoclassical economist agencies (Treasury and the Council of Economic Advisors [CEA]) on one side, and the more pragmatic economic agencies (Commerce and the United States Trade Representative's Office [USTR]) on the other. The attitude of diplomats and military leaders was that "Japan was our unsinkable aircraft carrier" and that U.S. trade and economic interests should take a backseat to geopolitical concerns. As Assistant National Security Advisor Gaston Sigur

insisted at the time, "We must have those bases. Now that's the bottom line."⁴⁸ The economists piled on. As Alonzo McDonald, a Carter administration trade negotiator, complained about resistance from the neoclassical economists at the CEA and the Treasury for a more activist policy against Japan (exactly what they continue to do today), economists had "lost all touch with reality; it's heart surgery handled by a biologist."⁴⁹

As Clyde Prestowitz concludes, "Although negotiations [which resulted in the previously mentioned Reagan-supported voluntary import restraints on Japan] were declared a great success, most of the issues were left unresolved. Eventually a number of U.S. chip makers closed up shop, and more than one hundred thousand Silicon Valley workers lost their jobs. Even more important, the United States lost technological leadership in production of several important kinds of semiconductors."⁵⁰

With the denouement of the cold war, the Clinton administration signaled a new strategic approach that would elevate economic concerns to stand alongside geopolitical and national security concerns. Clinton secretary of state Warren Christopher told the Senate Foreign Relations Committee that "among the three pillars of the new administration's approach to foreign policy, economic growth ranked first." As Andrew Bacevich observes in *American Empire*, in the new conventional wisdom emerging in the post-cold war era, "national economic interests would not be considered 'secondary' or subordinated to national security interests." "Broadly construed" national security would henceforth include "both economic and geopolitical concerns."⁵¹ President Clinton created the National Economic Council (NEC) as a counterpart to the National Security Council to facilitate this reordering of priorities, and Robert Rubin, the NEC's first chair before becoming Clinton's Treasury secretary, observed that "the big change" with Clinton's approach was that "the economic component of any problem gets on the table at the same time as other issues." Or, as Mickey Kantor, Clinton's chief trade negotiator put it, "Trade and international economics have joined the foreign policy table." As Bacevich writes, "Traditional distinctions between the nation's physical security and its economic well-being were among the barriers that globalization swept aside."⁵²

But the temporary economic boom of the second half of the 1990s put these concerns on the back burner. And September 11, 2001, firmly ele-

vated geopolitical and national security concerns back to the top of the agenda, and once again the United States returned to emphasizing geopolitical and national security concerns at the expense of economic ones. In his autobiography, *Decision Points*, former president George W. Bush writes that preventing another terrorist attack was his chief concern. Yet when Bush asked China's president Hu Jintao what kept him up at night, Jintao replied, "Creating 25 million new jobs a year."⁵³ While countries such as China place laserlike focus on economic growth, the United States continues to place primary focus on geopolitical and national security concerns. And while some of these goals are certainly inviolable, such as preventing another 9/11, others are elective, like focusing on human rights issues in China more than on U.S. economic concerns with China. In fact, the number one item President Obama spoke about with Chinese president Hu Jintao when Jintao visited the United States in January 2011 was Chinese human rights. In essence, President Obama was more concerned about securing human rights for Chinese citizens than he was about using his scarce political capital to press the Chinese on their rampant mercantilist practices that harm the economic rights of U.S. workers. The visit was declared a success, though: Jintao promised that he would try to get his own government agencies to quit using pirated U.S. software.⁵⁴ Yet, by the end of 2011, the Chinese government had made no progress on this issue.

Another example comes from President Obama's November 2009 visit in China with President Jintao, during which President Obama pledged closer technical collaboration and accelerated safety approval of China's planned ARJ21 commuter jet.⁵⁵ It's not clear why the president promised to help China develop commercial jetliners—one of the few high-value-added manufacturing industries in which the United States retains a strong trade surplus. But the most likely reason is that he extended this as a concession to secure China's assistance in negotiating with the recalcitrant North Korean and Iranian regimes, or perhaps to soften the blow of recent U.S. arms sales to Taiwan. But while the United States makes such deals with geopolitical concerns top of mind, the focus of China and other nations is squarely on gaining economic advantage, which they parlay into military advantage. Indeed, months before the United States agreed to provide China technical assistance in developing a commercial jetliner, in a speech entitled "Let the

Large Aircraft of China Fly in the Blue Sky," Chinese prime minister Win Jinbao had articulated a Chinese vision for developing and producing its own commercial jets in direct competition with Boeing, even though China could readily afford to buy all the Boeing jets it needs and more from its \$200 billion annual trade surplus.⁵⁶

After fifty years, it's still the same story. All too often, U.S. policymakers continue to trade U.S. economic interest for global foreign policy concerns because, just like the rich person who can afford to be altruistic, the U.S. establishment thinks its economic position is so secure that it can afford to make concession after concession. The cumulative effect of so often trading economic interests for geopolitical ones has only further contributed to long-term structural U.S. economic decline, which ironically over time will only weaken our relative military security.

Excuse 6: The Massive U.S. Trade Deficit Is Our Own Fault; We Don't Save Enough

One key indicator of America's competitiveness challenge is its chronic trade deficit. As noted, during 2000–2010, the United States accumulated an astounding \$5.5 trillion negative trade balance in goods and services. Yet, the story told by most conventional (that is, neoclassical) economists is that the trade deficit is a simple accounting function: low U.S. savings requires overseas borrowing, which by definition requires running a trade deficit. Former George W. Bush economist Greg Mankiw reflects this conventional view when he writes: "My view is that the trade deficit is not a problem in itself but is a symptom of a problem. The problem is low national saving."⁵⁷ The Council on Competitiveness agrees, stating: "These threats [e.g., the trade deficit] stem from global financial imbalances rather than from the inability of American companies or American workers to compete in global marketplaces."⁵⁸

The United States has among the highest corporate tax rate in the world, fails to match many foreign nations in investment in research, and has deteriorating infrastructure. But, by definition, these factors can have no effect on the ability of business establishments in the United States to thrive in international markets because that is determined solely by our savings

rate. By this definition, there is no trade deficit of any size that can be evidence of competitiveness failure.

But as non-neoclassical economist Robert Blecker states, "This identity does not prove causality, and is consistent with other causal stories about the trade deficit."⁵⁹ In other words, what the conventional story fails to recognize is that savings is a function of national competitiveness. If, for example, the Chinese stopped manipulating their currency, the U.S. trade deficit would fall and the Chinese would buy less of our government debt. The result would be a rise in both U.S. exports and interest rates. And both would spur more savings. Higher interest rates would lead more Americans to save. More exports (and relatively fewer imports) would boost U.S. corporate savings. And more jobs and higher wages through exports (exporting firms pay 9.1 percent more than jobs in firms that export less)⁶⁰ would boost individual savings and reduce the budget deficit.

Excuse 7: We're Doing Well on Some Things, So Don't Worry about Competitiveness

One reason it's difficult to have a national dialogue about U.S. innovation competitiveness is because parts of the U.S. economy are in fact doing well, and the apostles of denial point to these to support their claim that all is fine. As discussed previously, an economy can be divided into its traded and nontraded sectors. The United States has very innovative and productive nontraded sectors and some still-competitive traded sectors such as software, biotechnology, pharmaceuticals, aviation, medical devices, movies, video games, and instruments. But to argue that strength in these sectors alone will be enough to sustain a vibrant U.S. economy is akin to a coach saying his team is doing great and the players don't need extra practice or new plays because they win more than half of their games. If the United States is to win the race for global innovation advantage, it can't be content with a record slightly over .500; it needs to win most of the time, in most traded and nontraded sectors.

A representative example of this type of thinking comes from Adam Segal, a senior fellow at the Council on Foreign Relations. In his book *Advantage: How American Innovation Can Overcome the Asian Challenge*, Segal

argues that Asia's science and technology sectors, principally in China and India, will probably catch up to and overtake the United States in what he calls the "hardware" of innovation—quantifiable factors such as the number of Ph.D.s awarded, investments in product innovation, number of patents obtained, facilities, and so forth.⁶¹ However, he believes that the United States will continue to maintain a competitive advantage in innovation due to American advantage in the "software" of innovation, pertaining to the political, social, and institutional factors that move ideas from the lab to the marketplace. He argues that America's cultural values of individualism, social mobility, entrepreneurship, and limited barriers to market access will provide such a significant advantage as to make up for the United States falling behind on the "hardware" of innovation. Segal goes so far as to state that U.S. inability to compete in hardware innovation is actually a positive that could fuel U.S. growth.

While the "software" of innovation certainly is important, and the United States does have advantages there, to say that U.S. decline in the "hardware" of innovation is actually good requires a particular take on reality. For one, America's past world leadership in innovation has rested on both U.S. advantages in the "hardware" and "software" of innovation. Moreover, as the United States sees other countries catch up to and surpass it in leadership in the "hardware" of innovation, nothing in this should suggest to us that these countries won't also catch up in the "software" of innovation, or that America is somehow special and destined to lead in innovation "software." America needs both.

This is not to diminish the strengths America retains. Productivity growth in the nontraded sectors has been high compared to that of many developed nations. ITIF's *Atlantic Century* report finds that the United States boasts the second-highest rate of corporate investment in IT as a percentage of GDP in the world.⁶² In fact, the superior use of IT by U.S. firms and industries has been found to directly explain differences in productivity levels between the United States and Japan and many European Union (EU) economies.⁶³ And America is actually pretty good in sectors like retail, hotels, insurance, and logistics. The problem is that these sectors, by and large, aren't traded.

And while the United States has lost competitive advantage in many traded industries, it still leads in some, such as life sciences and biotechnology. From 1995 to 2007, the U.S. share of global life sciences value-added increased 6 percent, while Europe's stayed flat and Japan's decreased by almost 15 percent. During that time frame, the life sciences share of U.S. exports increased by 5 percent, while the electronics share dropped by 10 percent. Seventeen percent of U.S. R&D is conducted in the life sciences field, double the percentage in Germany or Japan.⁶⁴ And the U.S. life sciences industry has produced a number of breakthrough products, from personalized gene therapies to synthetic skin to cures for certain types of cancer. (Much of the U.S. strength in life sciences has resulted from the American government providing more R&D funding, through the National Institutes of Health, to this sector than any other in the economy.)

Nevertheless, U.S. strength in some sectors has given rise to "tastes great/less filling" thinking and debates, with each side tending to take all-or-nothing propositions. Some agree with Steve Rose, who insists in his book *Rebound: Why America Will Emerge Stronger from the Financial Crisis* that the United States is doing great. Others argue, like Earl Fry in his book *Lament for America: Decline of the Superpower, Plan for Renewal*, that the United States is in very rough straits. To effectively manage the challenges of the present and future, policymakers and pundits need to recognize that America has two economies: a nontraded economy that by international standards is fairly productive and innovative and a traded sector that, with the exception of some key strengths, faces major competitive challenges. Without strength in both parts, no economy can reach its full potential.

Excuse 8: We Are the Innovators, They Are Copiers

Part of America's challenge is that for so many years after WWII it didn't have any serious competition, so it adopted a "shining city on the hill" attitude, captured brilliantly in Truman's proclamation that U.S. workers would never again need fear foreign competition. The United States would be the exemplar and eventually others would learn from us and emulate our sterling ways. So what if other countries began to aggressively pursue

mercantilist, beggar-thy-neighbor policies designed to gain unfair advantage in international markets? We didn't care; in fact, there was an attitude that whatever we do, let's not get down in the mud to fight them. This notion of American exceptionalism—or as a July 2010 article in the *Economist* put it, the sense that “greatness is part of America’s birthright and lexicon”—is still a powerful legacy that keeps us from competing.⁶⁵ Besides, if we keep to our lofty principles, eventually these wayward mercantilists will see the error of their ways and become like us.

Moreover, when it comes to innovation, the notion of American exceptionalism manifests itself in the mythology that we are a nation of tinkers, inventors, and innovators, while others are just imitators or copiers. While this belief has played an important role in America’s history, it becomes self-destructive if it blinds us to the very real innovation capabilities of foreign competitors, whose workforces and enterprises, as we have seen, are increasingly highly skilled and innovative.

However, where this claim might have had some merit—in the past—was in the 1960s and 1970s, when East Asian countries did pursue an “imitative catch-up” strategy designed specifically to catch up with Western economies. Japan and Korea implemented policies targeting specific industries—namely automobiles, steel, shipbuilding, and consumer electronics—through which they sought to reach technological parity and then comparative advantage over Western countries. Justin Lin and Celestin Monga of the World Bank note that Korea is a particularly good exemplar of a country that looked to achieve “industrial upgrading” through its “imitative catch-up” strategy. They observe that “in electronics, Korea’s focus was initially on household appliances, such as TVs, washing machines, and refrigerators, and then moved to memory chips, the least technologically complex segment of the information industry” and then further “upgraded into such industries as automobiles and semiconductors.”⁶⁶

Of course, a number of high-tech consumer electronics and IT products—including compact disc players, high-definition television (HDTV), dynamic random access memory (DRAM) chips, and other products—were originally conceived, researched, and developed in the laboratories of U.S. universities and corporations. But then, in each case, Asian companies and countries took the underlying technology and developed and refined it into mass-

manufactured, exportable products. More recently, the technological discoveries behind lithium-ion batteries, compact fluorescent lightbulbs, and solar panels were pioneered in the United States, after which scaled manufacturing of these products was taken over predominantly by Korean, Chinese, and Japanese companies. This would seem to reinforce the stereotype that we are the innovators and they are the copiers.

But the first problem with that perspective is that winning the race for global innovation advantage means producing—not just innovating—advanced products, and the United States has been outperformed by Asian competitors on that score. While innovation is important, it is not enough for a nation like the United States to be able to balance its trade on the exports of knowledge alone. The greater fallacy is that the countries America competes against today have moved far beyond the imitative stage. They are innovating too, making new scientific discoveries and their own technical innovations outright. Japan has moved ahead of the United States in crystalline and polycrystalline silicon solar cells, inverters, and power semiconductor for solar panels. While the United States is still in the game for next-generation thin-film solar cells, it is at best on an even footing with Asian countries for the next generation of photovoltaics. Asian and European countries are competing on an equal footing with the United States for leadership in nanotechnology, and in fact there’s evidence that China has taken a lead over the United States in nanotechnology research (at least as measured by the number of scientific publications on the subject).⁶⁷ Taiwan, Korea, and Japan lead in electrophoretic displays for e-readers and next-generation “electronic paper” displays for portable devices such as e-readers, retail signs, and advertising displays. And East Asian countries increasingly lead in production of advanced ceramics and composites and are at the technological frontier in developing the next generation of carbon composite components for aerospace and wind energy applications.⁶⁸

In fact, these countries are even pioneering new forms of innovation. In India and China, companies utilize an approach called “reverse innovation,” which strips down full-featured products originally designed for developed economies to their core features and functions. They then tweak them to meet the needs of citizens in emerging market economies and sell them at much lower price points (often to mass markets). For example, the

nonprofit organization Embrace, whose mission is to help the millions of vulnerable babies born every year in developing countries, has designed critical-care infant incubators for neonates that cost \$200 instead of the typical \$20,000.

And, in an interesting turn of “double-reverse innovation,” Western companies are increasingly recognizing that de-featured products designed to meet the needs of emerging markets often meet the core requirements of customers in developed countries, presenting enormous market opportunities at home. For example, in the early 2000s, General Electric (GE) served the Chinese ultrasound market with conventional ultrasound machines developed in the United States that cost \$100,000 or more, but the bulky, expensive devices sold poorly in China and India.⁶⁹ So a local GE team in China developed a portable ultrasound machine (using a laptop computer enhanced with a probe and sophisticated software) that cost just \$15,000 but had the essential functionality needed for use in rural Chinese clinics. Recognizing that such a mobile ultrasound product could be used by ambulances and emergency rooms everywhere, GE took the product back to the developed world and, in the process, created a global portable ultrasound marketplace that grew from \$4 million to \$278 million between 2002 and 2008. Other “reverse innovations” that began in China or India and have since migrated back to developed markets include handheld electrocardiogram devices and scaled-down automobiles such as the Smart Car, whose template was the Tata Motors Nano.

It’s also worth noting that the notion of a distinct American culture of invention ignores that many technologies were developed roughly contemporaneously by inventors around the world. While Alexander Graham Bell received the patent for the telephone over Elisha Gray in 1876, Italians Antonio Meucci and Innocenzo Manzetti, German Philipp Reiss, and Frenchman Charles Boursel were demonstrating working prototypes of telephones, or “speaking telegraphs,” as early as 1864. While most people credit the Wright brothers with the first manned flight, in Brazil and France, Alberto Santos-Dumont is still considered the inventor of the airplane for test flights he took from 1898 to 1905. Even Orville Wright, in *How We Invented the Airplane*, credits a number of other American and foreign inventors as instrumental to the brothers’ success, including: Leonardo, Cayley, Maxim,

Bell, Lilienthal, Langley, and Chanute. Indeed, throughout history, the same innovation often has been introduced nearly simultaneously by separate individuals in different countries (think of Newton and Leibniz’s near-simultaneous discovery of calculus), in large part because virtually all innovations build upon the same infrastructure of knowledge and prior innovation.⁷⁰ So while the United States surely has a storied legacy of innovation and invention of which it should be most proud, we should not assume there is something innate to Americans that endows them with preternaturally superior innovation capacity.

Related to the myth that we in the United States will be the innovators is the notion that we also will be the managers. As one prominent Silicon Valley venture capitalist told us, “We don’t worry about U.S. competitiveness, because America is incredibly innovative. Our firm finds start-ups in which to invest in the United States, and those firms outsource everything—R&D, design, manufacturing, and even marketing—to lower cost locations overseas. So you see, we are incredibly innovative. And the firms we invest in will do just fine.” The small number of U.S. owners and managers of these firms may do well, but what about the thousands or tens of thousands of workers they didn’t hire in the United States?

Excuse 9: The United States Will Be Okay If It Loses Manufacturing Because It Can Migrate Up the Value Chain to Services Sectors

Perhaps no canard has been more damaging to U.S. competitiveness than the notion that the United States will be okay if it gives up its manufacturing industries because it can seamlessly “migrate up the value chain” to knowledge-based services industries. While services industries do account for the majority of most developed countries’ economic activity and are important components of a nation’s competitiveness, this does not mean that a large country’s economy can thrive without globally competitive manufacturing sectors.

Yet many economic pundits have long contended that America does not really have to have an industrial base. Kenneth Green, a resident scholar at the conservative American Enterprise Institute (AEI), has written: “As long

as China is selling us the products we need, the location of manufacturing isn't really that critical for the economy."⁷¹ When asked how much manufacturing the United States could really lose and still be economically healthy, the head of one Washington, D.C.-based international economics think tank replied: "Really? Really we could lose it all and be fine." Columbia University's Jagdish Bhagwati goes so far as to dismiss anyone who says manufacturing is important as suffering from a "manufacturing fetish."⁷² Christina Romer, former head of the Council of Economic Advisors for President Obama, dismissed the president's very own manufacturing policy (after she left the White House) claiming that manufacturers didn't need "special treatment," that there is no convincing rationale to treat manufacturing any different than services like haircuts, and that any claim as to why manufacturing is different is based on "sentiment."⁷³ These pundits make such claims because, like the "potato chips-computer chips" view, they believe in the "car manufacturing-car rental, what's the difference?" view. It's hard to succeed in a global economy exporting haircuts. But as we saw earlier, these neoclassical economists don't even care about the trade deficit or competitiveness, so how can they think manufacturing (and traded-sector industries generally) is any different than barber shops (or other nontraded sectors).

They also assume that the United States can effortlessly move up the value chain from manufacturing to services-oriented activities and sectors because the United States supposedly has a natural comparative advantage at more knowledge-intensive activities (such as R&D, product design, marketing, and finance). For example, economists Jonathan Eaton and Samuel Kortum have argued that because the United States has a comparative advantage over foreign countries in the performance of R&D, the globalization of innovation activity will actually be good for America and lead to more R&D activity here, as research activity naturally concentrates in the country that performs it best.⁷⁴ As AEI economist Kevin Hassett argues, "Any economist can tell you that this decline (in manufacturing) is not necessarily a cause for concern. . . . We have become an ideas economy."⁷⁵ In other words, the United States should feel fine about losing manufacturing because the R&D, design, headquarters, and financing functions will stay here.

Likewise, Harvard Business School's David Yoffe counsels perspective and the preeminence of services, maintaining: "The loss of some manufacturing in a high-cost country such as the United States is inevitable and need not lead to a decline in competitiveness. Indeed, the future of U.S. competitiveness in high-tech industries such as computers, software, communications, and electronics may depend more on the transition to services than on trying to retain the country's manufacturing base."⁷⁶ Yoffe's argument reflects the dominant logic of original equipment manufacturers (OEMs) of IT products (such as computers, telephones, and semiconductors) in the United States in the 1980s, as they began to outsource the manufacture and assembly of printed circuit boards (PCBs) to specialist contractors in Korea, China, and Taiwan. U.S. OEMs did so because the contractors offered significant cost savings, partly because they were located in low-wage countries and partly because of the economies of scale the contractors achieved by serving many OEMs. At the time, the OEMs did not see the move as risky because they retained the critical intellectual property (IP) and design skills and because manufacturing PCBs wasn't a source of competitive advantage for them.

But as competition intensified among the Asian contractors and they sought to improve upon razor-thin margins, they began to move up the value chain, seeking higher-value-added work from the OEMs. First, they persuaded the American OEMs to allow them to assemble a greater share of the overall product, then they took over complete product assembly, ultimately assuming supply-chain management responsibilities from the OEMs, a logical step given that many of the component parts were sourced from Asian suppliers anyway.⁷⁷ But as Harvard's Willy Shih and Gary Pisano recount in "Restoring American Competitiveness," the contractors quickly began to take over high-value-added design functions as well: "Then came design. Initially, these firms took over design-engineering tasks on a contract basis. The OEM typically would provide the high-level conceptual design and specifications, contracting with the Asian supplier to do the detailed engineering. Eventually, though, the suppliers took over these activities as well for products like notebooks, which require designers to interact frequently with manufacturing. The result: These 'original design

manufacturers,' as they describe themselves, ended up designing and manufacturing virtually all Windows notebook PCs.⁷⁷

Just like that, the United States lost global comparative advantage in the service-based activity of designing notebook computers, and soon for designing desktop computers, cellular phones, tablet computers, and e-readers. This, then, is the fundamental flaw in the belief that the United States can give away the manufacturing but keep the high-value-added services: The notion that we can separate out the design and R&D value-add components from the manufacturing of a technology-based product is fundamentally wrong. In reality, as Shih and Pisano point out, "The outsourcing did not stop with low-value tasks like simple assembly or circuit-board stuffing. Sophisticated engineering and manufacturing capabilities that underpin innovation in a wide range of products have been rapidly leaving too."⁷⁹

Greg Tassef likewise excoriates the received wisdom that the United States can outsource manufacturing but keep the higher-value-added service activities at home, observing that this view fundamentally misunderstands the nature of technology development, especially across current and subsequent technology life cycles:

When technological advances take place in the foreign industry, manufacturing is frequently located in that country to be near the source of the R&D. The issue of co-location of R&D and manufacturing is especially important because it means the value-added from both R&D and manufacturing will accrue to the innovating economy, at least when the technology is in its formative stages. Thus, an economy that initially controls both R&D and manufacturing can lose the value-added first from manufacturing and then R&D in the current technology life cycle—and then first R&D followed by manufacturing in the subsequent technology life cycle. This is the economics of decline.⁸⁰

In fact, examples abound of the United States losing technology leadership in one product life cycle with the result that it falls behind in subsequent technology life cycles. America lost leadership in rechargeable battery manufacturing technology years ago, largely because most innovation in batteries in recent decades has been driven by increasing demands in consumer electronics for ever more power in smaller packages.⁸¹ When U.S. companies largely abandoned the "mature" consumer electronics business,

the locus of R&D manufacturing—not just for the laptops and cell phones but also their batteries—shifted to Asia. And lo and behold, as U.S. and global attention has turned toward developing energy-efficient vehicles using advanced electric batteries, Japan's and Korea's strong battery and car industries have given them an advantage over U.S. companies in developing electric and hybrid vehicles. Hence, GM has had to source the advanced battery for its Chevy Volt from a Korean supplier. Likewise, the migration of semiconductor foundries to Asia has caused a sharp decline in silicon processing and thin film deposition capabilities in the United States. But now that thin film deposition turns out to be a critical process in manufacturing photovoltaic solar cells, the United States increasingly risks falling behind in the manufacture and development of solar cells.

Another complication is that, before the emergence of a globalized economy with increasingly sophisticated competitors, shifts in technology life cycles were less likely to shift global competitive advantage between countries. For example, when the United States was the dominant technology-based economy, both the old and new industries were likely domestic; U.S. semiconductor firms replaced U.S. vacuum tube firms, or emerging U.S. biopharmaceutical firms took market share from the dominant U.S. pharmaceutical firms. But in an integrated world with increased global trade, domestic transfers of market leadership are increasingly less likely to occur. More global players mean that more potential first movers will come from an increasingly large pool of technology-based economies. Thus, shifts in the locus of global competitive advantage across technology life cycles will occur with increasing frequency.⁸²

A related failure in this regard is an assumption by neoclassical economists that, as current technologies age, most products devolve into pure commodities whose production should be offshored to other nations. Princeton University economist Alan Blinder recently wrote: "The TV manufacturing industry really started here, and at one point employed many workers. But as TV sets became 'just a commodity' their production moved offshore to locations with much lower wages. And nowadays the number of television sets manufactured in the United States is zero. A failure? No, a success."⁸³ Losing an industry is a success? Blinder was right that the old black-and-white and then color cathode-ray tube television sets had become

commodities where competition was based largely on production cost, but this assumption of “technological stasis” betrays a stunning inability to understand dynamic technologies and how product life cycles regularly renew themselves. Once the United States took the neoclassical economists’ advice and allowed the TV industry to disappear, it lost out entirely as televisions evolved from cathode-ray tubes to high-definition, flat-screen TVs—first using liquid crystal display (LCDs) and then light-emitting diode (LED) displays—and as these technologies have been deployed across a wide range of products, from digital advertising signage systems to large-scale video displays. Or do we really still think that American workers are better off not manufacturing the multimillion-dollar, jumbo-screen displays found in ballparks across the country, or the thousand-dollar Asian-manufactured high-definition televisions (HDTVs) found in living rooms from coast to coast (which are increasingly coming to market as converged devices with computing and connectivity features, 3-D capabilities, and soon ultra-HD resolution)?

In summary, as George W. Bush’s President’s Council of Advisors on Science and Technology (PCAST) has written, “The proximity of research, development, and manufacturing is very important to leading-edge manufacturers.”⁸⁴ Or as Susan Houseman of the Institute for Employment Research states, “The big debate is whether we can continue to be competitive in R&D when we are not making the stuff that we innovate. I think not; the two cannot be separated.”⁸⁵ Put simply, the continuing shift of manufacturing outside the United States is beginning to also pull high-end design and R&D capabilities out of the country. In fact, 90 percent of all electronics R&D now takes place in Asia, in part because firms need volume production to be able to afford general R&D.⁸⁶ This shift is also evident in the fact that from 1998–2008, U.S. corporate R&D expanded 2.7 times faster overseas than all corporate R&D in the United States.⁸⁷ And it’s evident in Georgia Tech’s 2008 *High-Tech Indicators* study, which found that China improved its technological standing by nine points (on a scale of one hundred), moving the nation ahead of the United States in technological capability for the first time.⁸⁸ Likewise, a survey of scientific researchers in thirty-eight countries conducted by *R&D Magazine* for the

2011 Global R&D Funding Forecast” finds the researchers believing that China will lead the world in technical strength by 2015, with the United States slipping to third, behind both China and Japan.⁸⁹ Nevertheless, many continue to discount China’s growing technological prowess. As Michael Levi, senior fellow for Energy and the Environment at the Council on Foreign Relations, argued in December 2010, “The reality is that China still tends to take the expensive stuff from elsewhere and adds a little value to it before stamping “Made in China” on the product.”⁹⁰ While this may have been the case in the past, it’s getting increasingly difficult to dismiss China’s ability to develop cutting-edge, high-tech products with a simple wave of the hand.

The net effect is the deepening erosion of the U.S. industrial base, the hollowing out of advanced production supply chains, and the loss, for many U.S. industries, of their “industrial commons”—the R&D know-how, advanced process development, engineering skills, and manufacturing competencies related to a specific technology. As Pisano and Shih conclude, “decades of outsourcing manufacturing have left U.S. industry without the means to invent the next generation of high-tech products that are crucial to rebuilding its economy.”⁹¹ This message was forcefully driven home when we recently spoke with the CEO of a leading U.S. high-tech company about a major new product line it was introducing. When we asked where the very advanced display that was being incorporated in the device was sourced, his response was: “We looked long and hard around the United States to see if we could source it here. But we couldn’t find any company with the capability of producing here, so we ended up sourcing it in Taiwan” (where, it should be noted, the Taiwanese government funded R&D programs designed precisely around supporting this capability).

Excuse 10: Manufacturing Losses Are a Sign of Strength, Not Weakness

Without a manufacturing sector, it’s flat-out impossible for most nations, unless they are endowed with oil or other natural resources, to balance their trade. The United States’ current trade performance, with about

a \$646 billion goods deficit and scant \$146 billion services surplus in 2010, is not tenable going forward.

Yet, many continue to believe that the migration of mature manufacturing industries away from developed countries like the United States is just part of a healthy, natural process of economic evolution that allows resources to be redeployed to new, higher-potential businesses. As Harvard's Yoffe argues, "Maybe the most important point to make is that the United States has been moving towards a service economy for the last 100 years."⁹² Harvard sociologist Daniel Bell's 1976 book, *The Coming of Post-Industrial Society*, outlines a new kind of society that would be information-led and service-oriented and that would replace the economics of goods that had previously existed.⁹³ *The Economist* writes: "Deindustrialization—the shrinkage of industrial jobs—is wrongly perceived as a symptom of economic decline, when it is really a stage of economic development, because as a country gets richer, it is inevitable that a smaller proportion of workers will be needed in manufacturing." This is a bit like saying that a digestive disease that leads someone to lose weight to the point of anorexia is a sign of health. As we demonstrate in chapter 2, the loss of U.S. manufacturing jobs has not been just a story of high productivity leading to fewer jobs—as was the case with U.S. agriculture over the last century (a clear case of success). Nor is it a story of the "natural" growth in services as countries get rich. In fact, in constant dollars, the consumption of manufacturing products (not output) as a ratio of consumption of services has been unchanged since the early 1970s. Rather, it's also been a story of decline in output and competitiveness, with U.S. manufacturing producing 11 percent less than it did in 2000, while the overall economy grew around 16 percent.

Even if apologists admit that U.S. manufacturing is suffering, they assert that the situation is no different elsewhere. For example, as Larry Summers argued in December 2010, "We are moving towards a knowledge and service economy. You don't succeed by producing exactly the same thing that other people are producing in the same way just at a lower cost. . . . There is no going back to the past. Technology is accelerating productivity in mass production to the point where even China has seen manufacturing employment decline by more than ten million jobs over the most recent decade for which data is available."⁹⁴ As Senator Pat Moynihan used to be fond

of saying, you are welcome to your own opinions but not your own facts. And Summers's facts are flat-out wrong. China's manufacturing employment actually rose by an astounding 11 million workers between 2002 and 2006, creating as many manufacturing jobs in four short years as exist in the United States.⁹⁵

Moreover, during the last decade, many nations, including ones with higher manufacturing wages than the United States, have seen either stable or increasing manufacturing output as a share of GDP. For example, during the 2000s, Austria, Germany, the Netherlands, and Norway all have seen stable manufacturing shares, while other nations actually have seen their manufacturing sectors grow as a share of their economy, by 5 percent in Switzerland, 13 percent in Finland, 39 percent in Korea, and 68 percent in the Slovak Republic.⁹⁶ America's loss of manufacturing output and competitiveness is not a reflection of some iron law of development and is certainly not progressive.

Figure 4.1 graphically illustrates the U.S. fall and corresponding, almost equivalent, Chinese rise in share of world manufacturing output from 1970 to 2008.⁹⁷ (The U.S. share declined by 12 percent, from 28.6 to 17.9 percent, while China's share rose 13 percent, from 3.8 to 17.2 percent.) But the U.S. fall was not inevitable. Japan and Germany have maintained their global manufacturing share (despite ups and downs and despite having a slower-growing population and workforce) over this period, avoiding the precipitous decline the United States experienced. Thus, deindustrialization of high-wage economies is not preordained; something happened differently in the United States than in Germany and Japan to explain its decline.

In conclusion, it's worth noting that the neoclassical dogma "we don't need manufacturing" is so strong that the United States has even tried to get other nations to follow our folly and favor services industries at the expense of manufacturing. A May 2009 *Financial Times* editorial advised Japan to follow the U.S.-U.K. strategy of largely giving up on manufacturing in the interest of "supporting high-paying research and management jobs" in the domestic economy.⁹⁸ This is great advice to give other nations if we want to win the race for global innovation advantage, as long as we ignore it and they don't. Finally, to be clear, this is not about choosing old-line manufacturing over new-era innovation jobs. Much of manufacturing is at

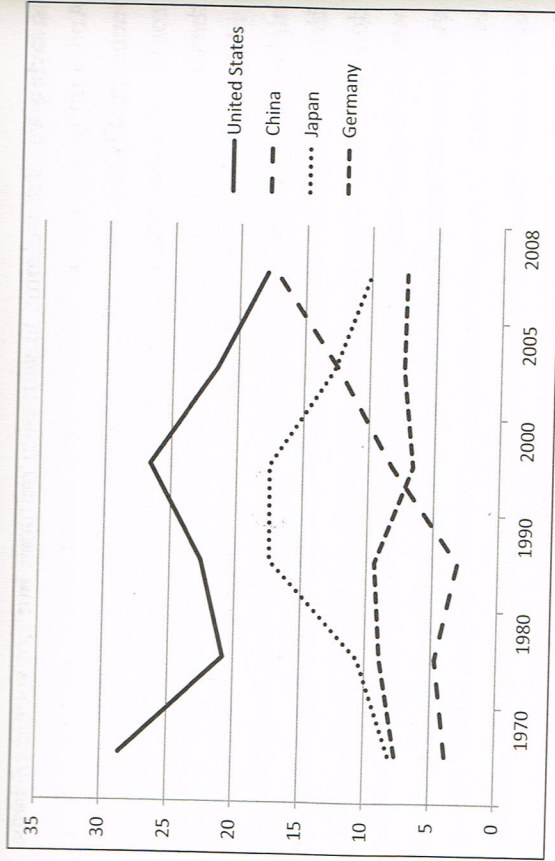


Figure 4.1 Country Share of World Manufacturing Output, 1970–2008
 Source: Based on information and statistics from the United Nations Conference on Trade and Development.

the cutting edge of technology. Moreover, the United States needs to further build on its strengths in design, research, intellectual property, and marketing. But these strengths, as important as they are, are not enough.

Excuse 11: Cleantech Will Save Us

In the last half of the 2000s, “cleantech” (clean technology) became the great green hope, particularly among the Left. This was seen as the sector that will put America back in the race, creating millions of jobs and reindustrializing economically devastated regions. David Fenton, writing in *The Nation*, claimed that “clean energy transformation is the best—perhaps the only—path to economic and job growth, including rebuilding our industrial base and competitiveness.”⁹⁹ The liberal Center for American Progress wrote: “The transformation of our antiquated energy infrastructure can be the great engine for American innovation, productivity growth, and job creation in the coming decades.”¹⁰⁰ Both urged Obama administration officials and fellow clean energy advocates to come out swinging for the cause.

Many advocates have touted overly optimistic figures for potential job growth from cleantech as a driver of American economic transformation, including the cleantech advocacy group Apollo Alliance, which promised that cleantech will create five million green jobs. David Foster, executive director of the BlueGreen Alliance, has written: “For years, the U.S. pursued a trade policy that resulted in the loss of millions of jobs and decimated the manufacturing base in this country. Now we have an opportunity to rebuild that base and create good jobs in all sectors of the American economy.”¹⁰¹ *New York Times* columnist and author Thomas Friedman made the well-known prediction that clean energy could be the next “industrial revolution” and has drawn comparisons between clean energy and the IT revolution,¹⁰²

One reason for this enthusiasm, beyond the Left’s inclination to only like “good” industries like cleantech, is that the clean energy sector has exhibited growth during the past several years. In fact, according to the Brookings Institution, the cleantech economy—including firms in photovoltaic, wind, fuel cell, smart grid, and biofuel industries developing new technologies to solve energy-related challenges—grew at 8.3 percent annually from 2003 to 2010 and accounted for three hundred thousand U.S. jobs in 2010.¹⁰³ However, assumptions about the long-term potential of the clean energy sector also must be tempered due to cold hard reality: even if we properly structure our domestic energy innovation policies and perfect our ability to invent, develop, and support radical new energy technologies, the clean energy sector—while vitally important—won’t be enough by itself to counteract job losses from other sectors and act as the single engine propelling the American economy forward.

The problem is that green energy-producing jobs will mostly just displace ones in dirty industries such as oil, gas, and coal. Energy is a commodity: substituting electrons generated by coal with electrons generated by solar power is inherently meaningless in terms of the work performed because electrons are electrons. Moreover, clean energy does not inherently make the work it performs more productive. Because energy expenditures as a share of the overall economy have tended to remain flat—and because carbon-emitting energy sources must be reduced in the long run—we would expect clean energy to supplant the current energy system, not augment it. This means that most future clean energy jobs will be created in

lieu of, or in replacement of, fossil fuel jobs, not in addition to them. Likewise, capital that perhaps would have gone toward fossil fuel investment will instead go toward clean energy investment. This is a story about asset redirection, not expansion.

Exports of clean energy products do hold the potential to boost U.S. employment and competitiveness, but here too aspirations run against logic and facts. First, why would we automatically expect that America can win in this industry when it's losing in so many others? No doubt, world energy demand will see massive growth in the coming decades, but much of this growth will occur in non-Organization for Economic Cooperation and Development (OECD) nations, where the United States tends to be at a disadvantage in terms of cost to manufacture energy technology. Second, as we note in chapter 2, the United States is already experiencing a trade deficit in renewable energy technologies. Moreover, none of our overseas competitors are likely to cede any ground to a reawakened cleantech industrial behemoth. According to a report from Harvard's Belfer Center, China's investment in energy R&D stood at \$11.8 billion in 2008, while six up-and-coming nations—China, India, Brazil, Russia, South Africa, and Mexico—are out-investing the major economic powers in energy research.¹⁰⁴ Moreover, as ITIF explained in its report with the Breakthrough Institute, *Rising Tigers, Sleeping Giant*, Asia's rising clean energy tigers—China, Japan, and Korea—have already surpassed the United States in the production of virtually all clean energy technologies (save carbon storage and sequestration), and from 2008–2012, the governments of these nations are expected to out-invest the United States three to one in these sectors, by \$509 billion to \$172 billion. This public investment gap will allow Asian nations to attract a significant share of private investment that will total into the trillions. And as we pointed out previously, the significant high-profile bankruptcies or downsizing of U.S. solar firms in the face of Chinese competition does not bode well for future trade dominance. At this moment, the jobs, tax revenues, and other benefits of clean energy are positioned to overwhelmingly accrue to Asia's cleantech tigers, not to the United States.¹⁰⁵

While cleantech is not the salvation to America's competitiveness woes, one area where it could provide real opportunity to boost U.S. employment is if the United States can displace foreign imports of oil with clean alter-

natives, such as biofuels or electric vehicles (or, more likely, a mix of the two). Imports of foreign crude and other petroleum products account for roughly half of our international trade deficit, and replacing this through domestic suppliers would boost American jobs and reduce the massive transfer of wealth driven by the oil trade.