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PUBLIC INVESTMENT, INDUSTRIAL POLICY AND U.S. ECONOMIC RENEWAL

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ABSTRACT

The U.S. economy faces enormous questions and challenges as it attempts to recover from the collapse of 2008-09. Some of the most pressing questions are a series of longer-term, structural challenges: Can we establish a growth engine driven by something other than financial bubbles? Can we renew the automobile industry and, more generally, reestablish a healthy manufacturing sector? Can we accomplish these various tasks while also rebuilding the economy on a new foundation of clean energy as opposed to fossil fuel energy sources? Addressing these longer-term challenges is the overarching theme of this paper.

Following an introductory discussion, in Section 2 we consider the overall evidence on the need for public investment in the traditional areas of transportation, energy, and water management. We then address the issue of financial crowding out. To do this, we examine evidence on how much of the U.S. economy's financial resources have been flowing into productive private investments over time, as opposed to financial speculation. In Section 3, we then examine the U.S. ad hoc industrial policy, as it has been practiced both at the level of general manufacturing policies, such as with the auto bailouts, and in terms of technology incubation through the Pentagon. We consider ways of channeling these policy tools into supporting a strong technological base on a sustained basis. In Section 4, we bring together our discussions on public investment and industrial policies to sketch a policy approach for supporting the revival of the U.S manufacturing sector, including the U.S. auto industry. In particular, we focus on the prospects for investments in public transportation: —to create an expanding market for U.S. automakers who are willing to convert part of their production lines to manufacturing buses and trains; to lower the costs of transportation for lower-income households; and to help advance the construction of a clean-energy economy in the United States.

JEL Classifications: H4, O2, O25

1. INTRODUCTION

The U.S. economy faces enormous questions and challenges as it attempts to recover from the collapse of 2008-09. Some of the most pressing questions are short-term and cyclical: When will unemployment start falling? When will banks start lending at reasonable levels for productive purposes? At what level will the housing market stabilize and foreclosures fall off? Can an overall economic upswing be sustained?

But equally daunting are a series of longer-term, structural challenges: Can we establish a growth engine driven by something other than financial bubbles? Can we renew the automobile industry and, more generally, reestablish a healthy manufacturing sector? Can we accomplish these various tasks while also rebuilding the economy on a new foundation of clean energy as opposed to fossil fuel energy sources?

Addressing these longer-term challenges is the overarching theme of this paper. Our specific approach is to examine these questions within the context of debates around public investment and industrial policy, as these policy measures have been practiced within the U.S. economy. Within this context, the aim of our discussion is to shed light on the potential at present for public investments and industrial policy to undergird a long-term U.S. economic revival.

In fact, all of the economy's longer-term challenges amount to variations on a single broader question: whether the U.S. can begin to mobilize its enormous human, material, technical and financial resources into more effectively promoting productive investment activity throughout the economy. Few observers of any political persuasion dispute the idea that productive investments are a driving force—if not the single most important engine—of economic progress. This is because any economy that aspires to long-run gains in average living standards must develop effective means of promoting productive investments—that is, the investments in physical plants and machinery that can raise overall productivity and deliver technical innovations into the everyday stream of economic activity.

However, beyond this basic point of agreement on the centrality of productive investments for building and sustaining a viable economy, the consensus breaks down immediately in considering the most effective ways that economic policies can promote productive investments. For example, sharp disagreements exist over the extent to which infrastructure investments undertaken through the public sector either inhibit or encourage private investments—whether public investments either "crowd out" or "crowd in" private investments, as these terms are commonly used within the debates among economists. There are parallel debates over the effectiveness of industrial policy as a way for governments to assist private businesses in bringing new technologies into commercial use and to support the competitiveness of U.S. firms.

For the past generation, the dominant view among economists was that giving businesses a free hand—that is, little regulation and low taxes—was the most important contribution governments could make to encouraging productive investments. The corollary to this view was that, as much as possible, overall investments in the economy should be undertaken by the private sector, as opposed to by any sort of government entity. After all, according to this view, the private sector is where innovation occurs. Moreover, private investment decisions have to meet the test of the market. Sound

investment decisions are rewarded by high levels of market demand and healthy profits, while bad investment decisions are punished by failure. By contrast, public investments are dominated by slow, ineffective, bureaucratic decision-making, and are not subject to the test of the market. To the contrary, public investments are financed by tax revenues. This means that tax burdens have to rise to pay for public investments. These considerations undergird the view that public investments "crowd out" private investments, since funds spent on public investments will drain away money, people and equipment that could be better utilized by private business firms.

The case for private investment over public investment has a parallel in discussions around industrial policy—whether the U.S. government should be actively engaged in promoting technologies and business competitiveness. The argument against industrial policy is that governments are not capable of "picking winners," certainly not on a consistent basis. Industrial policy is therefore just another way for governments to distort both the investment decisions of private businesses and the primary role of competition to separate winners from losers in the investment market.

Serious counterarguments and contrary evidence to these firmly pro-private business perspectives have always been voiced. The first important point from this alternative perspective is that a strong public infrastructure is a necessary foundation for promoting private sector productivity—that public investments do not in fact "crowd out" but actually "crowd in," private investments. The second, and related point, is that industrial policy is the instrument through which we incubate new technologies and help private businesses bring these innovations to where they can be effective in the marketplace.

These alternative perspectives long languished along the fringes of economic policy debates in the United States. But in the past few years, the real world has intervened dramatically to make the case in behalf of public investment and industrial policy far more effectively than could have been accomplished through any other means.

To begin with, a wide range of people had for years recognized that the stock of public infrastructure in the U.S. was deteriorating badly, and that this was holding back productivity advances. But the breaching of New Orleans' water levees in 2005 in the wake of Hurricane Katrina and the collapse of the I-35W bridge in Minneapolis in 2007 offered tragic testimony to this neglected reality. After all, the New Orleans levees were never built to withstand more than moderately strong hurricanes and were not constructed adequately to meet even that middling durability standard. The Minneapolis bridge was declared structurally deficient in 1990, but the problems were never fixed. Amid these events, it became difficult to continue insisting that public infrastructure investments are a misuse of funds that could be deployed more effectively by private business investors.

In addition, the Wall Street collapse of 2008-09 made clear that private investors, left to their own devices, do not allocate the economy's financial resources effectively. The 2008-09 crisis was the culmination of a generation of financial deregulation measures in the U.S. supported by Democratic and Republican policymakers alike, following the claim that private financial managers, operating in a competitive market, will channel the economy's financial resources more effectively on their own than could be done through following government regulations and priorities. But the crisis demonstrated that the dazzling rewards of casino capitalism will always become irresistible to Wall Street operators relative to the slow, steady efforts required to nurture the economy's productive invest-

ments. That is, government regulations are needed for the economy's financial resources to be crowded into productive investments as opposed to being squandered on hyperspeculation.

The collapse and bailout of General Motors and Chrysler in 2009 underscored a third, related point—that, rhetoric aside, both the federal government, as well as state-level governments, are now, and have long been, practicing something that closely resembles a U.S. industrial policy. For example, the federal government first bailed out Chrysler in 1979 to prevent the firm from collapsing then. More generally, auto companies and other large manufacturers have regularly received favorable tax treatment and related concessions from state governments as a means of attracting the companies to their states. The problem with this approach to industrial policy is not the fact that it is being practiced per se, but rather than it is undertaken in an ad hoc manner—responding haphazardly amid crises, as with the auto companies in 2009; or seeking to promote jobs and economic growth in one state by attracting businesses away from locating in neighboring states.

At the same time, the U.S. federal government does also practice a long-term consistent industrial policy to promote U.S. commercial technology. But this industrial policy is conducted primarily through the Pentagon. Indeed, a long, steady flow of new technological developments have been heavily supported by the Pentagon, then turned over to private business firms when these technologies had matured to the point where they could be successfully applied commercially. Such arrangements have led to some spectacular successes, including the development and commercialization of jet airplanes and the internet. But the programs that produced these breakthroughs have been tied, at least formally, to military priorities. There have been similar successes with industrial policy in the U.S. in the health care and agriculture sectors. The National Institutes of Health and the agricultural extension colleges, respectively, have provided major support both for long-term basic research projects in the areas of health and agriculture, and for bringing the results of this research to the point where they are usable by private businesses.

A final crucial real world consideration forcing new thinking on the questions of public investment and industrial policy is global warming. The real and present threat of global warming has raised the stakes dramatically as to the importance of channeling our economy's resources into productive investments. And here we can be quite specific in referring to "productive investments." We mean channeling a significant share of the economy's resources into investments in energy efficiency and renewable sources of energy and to move the economy away from its current dependence on oil, coal and natural gas. The threat of global warming means that we do not have the luxury to wait and see whether private investors, on their own, will sufficiently embrace the project of shifting investments out of fossil fuel energy sources and into clean energy. The case for public investments that will crowd private investors into clean-energy investments, and for industrial policies that will nurture new forms of energy efficiency and affordable renewable energy supplies appears straightforward here.

With the passage of the American Recovery and Reinvestment Act (ARRA) in February 2009, the Obama Administration and U.S. Congress gave an overwhelming endorsement on behalf of the central importance of public investment. Of the total $787 billion in stimulus funds, about $80 billion is devoted to clean-energy investments and another $65 billion to traditional infrastructure improvements, including roads and bridges, the electrical grid, and water management systems. The initial jolt

of this spending is scheduled to occur over 2009-2010, with most of the infrastructure and energy spending completed by 2015. Broadly defined, these are all crowding-in initiatives, designed to get private investors back in the businesses of spending money on productive investments as opposed to financial speculation. Thus, at least for the current moment, at the level of policymaking, the arguments on behalf of public investment and crowding in, have received new life.

At the same time, despite the enormous amount of money being committed, the ARRA is designed mainly as a short-run stimulus program, implemented under extraordinary economic circumstances. Within a longer-term framework, major questions remain open: how much of taxpayers' money should flow into public investments; how much, if at all, should the public sector actively support new technologies and a domestic manufacturing sector; and what are the appropriate levels of public spending and private-sector incentives needed to achieve a clean-energy transformation over the next 20-30 years? Moreover, these issues are clearly interrelated. To take the single most pressing matter in terms of the long-run: to build a clean-energy economy will certainly require sustained high levels of public investment, the channeling of a high level of private financial resources into productive clean-energy investments, and government support for rapid technical innovations in energy efficiency and clean energy. What are the best ways to accomplish this with the resources and policy tools at hand?

These are the questions we address in this paper. In Section 2, we start by considering the overall evidence on the need for public investment in the traditional areas of transportation, energy, and water management. We then address the issue of financial crowding out. To do this, we examine evidence on how much of the U.S. economy's financial resources have been flowing into productive private investments over time, as opposed to financial speculation. To the extent that financial resources have flowed into speculation as opposed to productive investments, it is hard to make the case that public-sector investments in productive activities are themselves inhibiting the flow of private investments into productive activities. In Section 3, we then examine the U.S. ad hoc industrial policy, as it has been practiced, both at the level of general manufacturing policies, such as with the auto bailouts, and in terms of technology incubation through the Pentagon. We consider ways of channeling these policy tools into supporting a strong technological base on a sustained basis. In Section 4, we bring together our discussions on public investment and industrial policies to sketch a policy approach for supporting the revival of the U.S manufacturing sector, including the U.S. auto industry. We also link this discussion with the final question at hand: how to undertake most effectively the construction of a clean-energy economy in the United States.

This paper covers a wide range of interrelated questions. At the same time, there are equally important, and closely connected, matters that we have left aside in the interests of maintaining focus and keeping the length manageable. In particular, trade policy, managing the dollar, and the fiscal deficit are all issues that are closely associated with the main themes of this paper. We also consider only in passing the effects of the various proposals we examine on employment. These are topics that we have addressed elsewhere and will continue to explore in future work.[1]

[1] For references to recent work by both authors on these related themes, see the websites of the Political Economy Research Institute, where Pollin is Co-Director (www.peri.umass.edu) and the Center for Economic Policy Research (www.cepr.net), where Baker is Co-Director.

2. PUBLIC INVESTMENT: CROWDING OUT OR CROWDING IN?

Traditional infrastructure projects incorporate three broad groupings—transportation systems, energy transmission, and water management. These break down further to include, in addition to roads and bridges, airports, railroads, public transportation systems, drinking water, dams, electric grids, and pipelines moving oil and natural gas. Most of the country's infrastructure stock was created through public sector initiatives and remains publicly owned today.

At the same time, the private sector has also played a major role in creating and maintaining the country's electrical utilities, railroad track systems, airports and fossil fuel pipelines. The U.S. infrastructure system, in other words, has always been a joint venture of the public and private sectors, refuting the myth that private initiative alone is the wellspring of U.S. prosperity.

As of 2007, the value of public non-defense related assets in the overall U.S. economy was approximately $8.2 trillion. This compares with all private non-residential assets at $15.5 trillion. That is, the stock of non-military public assets amounts to over 50 percent of private assets.

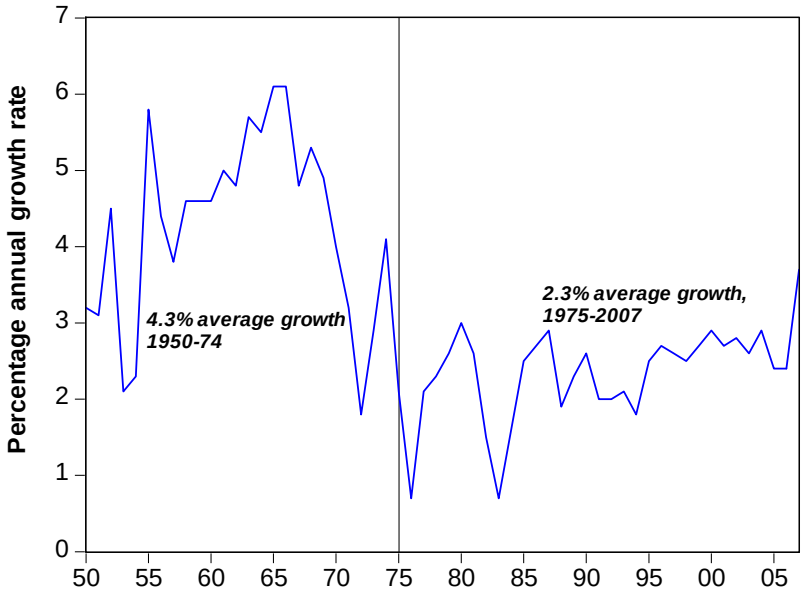
Despite this formidable stock of public assets, rates of public investment fell substantially since peaking in the mid- and late 1960s. This is because, prior to the February 2009 ARRA program, both Democratic and Republican policymakers turned a blind eye over the past generation as investments in public infrastructure crumbled. As a prime example of this, recall that when Bill Clinton first ran for President in 1992, he set the rebuilding of the country's public infrastructure as a major priority in his "Putting People First" economic program. But even before taking office, Clinton's chief economic advisors Robert Rubin and Alan Greenspan, both speaking from the perspective of Wall Street, convinced him that reducing the government's fiscal deficit was more important than restoring the country's infrastructure. Clinton never followed through on his public investment agenda.[2]

Public Investment Patterns, 1950 – 2007

Figure 1 below provides an overview of what has happened to public investments in the U.S. economy over nearly 60 years, from 1950 to 2007, i.e. just before the current recession began in 2008. As the figure shows, the rate of public investment—i.e. the growth rate of public assets—proceeds through two distinct phases, the first covering the 25 year period 1950 – 74, and the second from 1975 – 2007. Over the 1950-74 period, the growth of public investment averaged 4.3 percent per year, peaking in 1966 at 6.1 percent. By contrast, from 1975 – 2007, public investment grew at an average rate of only 2.3 percent per year. As the figure shows, the rate of investment growth remained fairly stable from the late 1980s onward, but at this relatively low level.

[2] Pollin (2004) discusses this and related Clinton-era policy decisions at length.

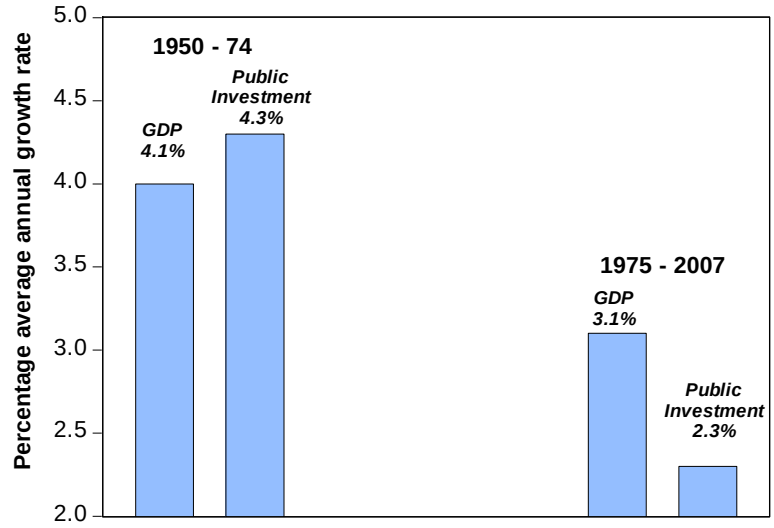
FIGURE 1: AVERAGE RATE OF U.S. PUBLIC INVESTMENT, 1950 -2007:
REAL GROWTH RATE OF U.S. PUBLIC ASSETS



Note: Figures are in real, inflation adjusted dollars. Source: U.S. Department of Commerce, Bureau of Economic Analysis

Figure 2 provides further perspective on the growth trajectory of U.S. public investment, by comparing long-run changes in GDP as well as public investment. As the figure shows, from 1950 – 74, GDP and public investment grew at basically the same relatively high rate, 4.1 and 4.3 percent respectively. From 1975 – 2007, the growth of both GDP and public investment ratcheted downward, with GDP at 3.1 percent average annual growth, while public investment fell to a 2.3 average growth rate.[3]

FIGURE 2: U.S GDP AND PUBLIC INVESTMENT GROWTH AVERAGES, 1950 -2007



Source: U.S. Department of Commerce, Bureau of Economic Analysis

[3] Details on how these figures were generated are presented in Heintz, Pollin, and Garrett-Peltier (2009).

Two important observations emerge from these data trends. The first, clearly, is the long-term shift downward in the growth of both GDP and public investment from 1975 – 2007 relative to 1950 – 74. Based on these figures alone, we are not yet able to conclude the extent to which causation runs in either direction—i.e. to what extent declining GDP growth produces declining spending on public investment or vise versa. That is, was the high rate of public investment in the 1950 – 74 period contributing to healthy overall economic growth in that period, or was it just a byproduct of the overall economic expansion? Similarly, was the slowdown in public investment from the mid-1970s onward—to a rate well below even the tepid GDP growth rate—a cause, or primarily just an effect, of the overall growth slowdown? We consider this issue below in some detail.

But a second, more straightforward point can be highlighted from these figures themselves: on average, the rate of public investment growth over 1975 – 2007 lagged behind the growth of GDP, with GDP growing at an average annual rate of 3.1 percent as against a 2.3 percent average growth rate for public investment. This is in sharp contrast with the experience over 1950 – 1979, when public investment and GDP basically grew virtually in step with one another. The point we can therefore make from these figures alone is that since the mid-1970s, the growth of the U.S. economy has been proceeding with a diminishing supply of public assets on which to foster growth.

Public Investment and Growth: Cause or Effect?

As we discussed in the introduction, the standard argument against increasing the level of public investment is that it will crowd out private investment—i.e., an increase in public infrastructure spending will be associated with an equivalent decline in private investment. The data we presented above showing the long-term trends in both public investment and economic growth do not themselves resolve this since, again, the high level of public investment between 1950 an 1974 could simply have been an outgrowth of broader forces pushing the private sector forward, with perhaps the high level of public investment even serving to slow down what might have been an even more rapid rate of private sector growth.

How could a high level of public investment actually serve to crowd out private investment? The basic argument is straightforward. Investments in infrastructure require real economic resources—materials, equipment, and human effort. They also require financial resources—money coming either from tax revenues or government borrowing. The 'crowding out' argument assumes that when the public sector consumes more of these real and financial resources, it necessarily diminishes the amount available to the private sector. Therefore, an increase in public capital expenditures results in less private sector production. The overall 'economic pie' is fixed in this view. When the government takes a bigger slice, it leaves less for the private economy.

Does this argument make sense? To begin with, just at the level of simple logic, it is important to recognize that the crowding out argument is plausible only under a specific set of narrow economic circumstances. These circumstances would be when: 1) all the economy's real resources are being fully utilized, i.e. workers are fully employed, and the economy's existing productive apparatus is being run full-tilt; 2) the economy's financial resources are, correspondingly, also being fully used up in financing productive investment projects; and 3) new public investment spending makes no contri-

bution toward expanding the economy's productive capacity—i.e. it is not succeeding in its purpose of increasing the overall size of the economic pie.

Over the 2008-09 recession, which is ongoing as we write, unemployment has reached its highest level in a generation while private banks and other financial institutions have been providing almost no loans to finance private investments. The private financial institutions have chosen instead to hoard huge cash reserves and to purchase U.S. Treasury bonds. During the recession, the private financiers have clearly decided that U.S Treasury bonds, not investments by private businesses, are the best place to channel their funds. Under these circumstances, there is no possibility of public investment projects bidding resources away from the private sector. Rather, the $65 billion in public investments included in the ARRA are expanding employment opportunities and putting to good use the financial resources that the private sector has been pouring into U.S. Treasury bond purchases.

But the 2008-09 recession—the most severe downturn since the 1930s Depression—is clearly an extraordinary historical moment. We need to also consider the issue of whether crowding out or crowding in is more likely to result during a typical period of economic expansion, when private sector investment is growing and unemployment is relatively low. In fact, even during such a period of economic expansion, it does not follow that public investments will necessarily crowd out private investments. That is, even when the economy is utilizing most of its productive machinery and most people have jobs, there are still good reasons for public investment to be an important part of the overall mix of public and private investment.

The basic explanation here is that public infrastructure investments will expand the economy's long-term productive capacity, with benefits flowing primarily to the private sector. Because public infrastructure investment actually increases the overall size of the economic pie, both the public and the private sectors can expand together through a complimentary, mutually-supportive growth path.

More specifically, public spending provides goods and services essential for private production, including roads, bridges, energy, water, aviation, and water transport. Infrastructure improvements can increase labor productivity—e.g. more efficient transportation systems to and from work reduce wasted time. Better infrastructure can also reduce fossil fuel consumption specifically, and overall energy consumption more generally. This reduces greenhouse gas emissions, and thus the environmental barriers to economic growth (an issue to which we return below). Overall then, these are the channels through which, even during a period of economic expansion, when the economy's workers and productive equipment are being heavily utilized, public investment can still serve to crowd in, rather than crowd out, private investment.

Examining the Formal Statistical Evidence

These arguments in support of crowding in can be convincing as a broad analytic framework. However, it is more difficult to demonstrate their validity through systematic statistical analysis. But it is crucial to be able to put these arguments to more formal tests. As we have seen, in terms of broad general perspectives, one can also construct plausible arguments in behalf of crowding out, at least during a period of economic expansion.

In considering the formal statistical evidence, we begin by introducing the important research conducted in the 1980s and early 1990s, led by Alicia Munnell and David Aschauer. Working separately, Munnell and Aschauer both suggested that public investment in the United States economy contributes to better performance of the private economy in terms of higher productivity and employment expansion (Aschauer 1989a, 1989b; Munnell 1990a, 1990b, 1992). That is, public investment actually raises the return on private investment—crowding in rather than crowding out private investment. Both Munnell and Aschauer suggested that the sharp decline in the growth of public investment, which we documented earlier, contributed to the declining trend in productivity growth in the 1970s and 1980s. A growing infrastructure deficit would drag down the productivity and competitiveness of the U.S. economy.

Numerous critiques of this earlier work were advanced, focusing on technical statistical matters. For the sake of the current discussion, it is sufficient to point out that the earlier work of Aschauer and Munnell did not fully address important properties of the data they used to generate their results, raising the possibility that the relationship they found between public investment and private economic performance was spurious.[4] Critics argued that, once these problems were addressed, the statistical findings they had derived end up falling apart.

However, Professor James Heintz has re-estimated these relationships using up-to-date data and addressing the statistical issues associated with the earlier research (see Heintz forthcoming 2010). Overall, Heintz found that sustained increases in public infrastructure investment increases the growth rate of private sector GDP by a substantial amount. Specifically, he found that a sustained one-percentage point increase in the growth rate of public infrastructure leads, over time, to an increase in the growth rate of private sector GDP of approximately 0.6 percentage points, after holding constant all the other factors that influence U.S. economic growth.

How significant is this effect when translated into our overall economy? We can illustrate this by considering the situation as of 2007. If overall public investment had grown at an average rate of 3.8 percent in the 10 years between 1998 – 2007 as opposed to the actual rate of 2.8 percent (but still well below the 4.3 percent average rate over 1950 – 74), the cumulative additions to the public investment stock would have produced an additional $64 billion in U.S. GDP in 2007. This impact on overall U.S. GDP amounts to a growth dividend of about $210 in 2007 for every resident of the United States.

Crowding Out through Financial Markets?

These results still do not explicitly address the possibility for financial crowding out. That is, by channeling financial resources to public investment, there could be fewer funds available for private investment.

Arguments about financial crowding out are longstanding. Most frequently, these arguments are presented with reference to the federal government's fiscal deficit. That is, when the federal government borrows money from financial markets to cover its deficit, then less credit becomes available for the

[4] The technical issues are reviewed in depth in Heintz, Pollin, and Garrett-Peltier (2009).

private sector. This point was advanced frequently in the 1980s, in response to the large fiscal deficits run during the Reagan presidency. For example, Professor Benjamin Friedman of Harvard wrote in Day of Reckoning, his highly influential anti-deficit tract in 1988, "The heart of the matter is that deficits absorb saving. When more of what we save goes to finance the deficit, less is available for other activities that also depend on borrowed funds" (1988, p. 164).

However, at the simple level of logic, the validity of the financial crowding out argument does not hinge on whether the government borrows money to finance its activities or pays for these activities through its tax revenues. When tax revenues, as opposed to borrowing are the source of funds, it is still the case that when these funds finance public investment, they are not then available for private investments. To evaluate whether financial crowding out is occurring, the broader consideration is therefore whether we can observe private businesses being inhibited from undertaking productive investments because public investment projects have been absorbing an excessive amount of funds.

The data presented in Table 1 present some useful perspective on this question. For nonfinancial corporations as a whole, these data show the long-term relationship between investments in productive equipment and structures and measures of how the corporations obtain the financing to purchase these investment goods (i.e. their "sources and uses" of funds). The data also show how much corporations use their overall level of available funds to acquire financial assets as opposed to purchasing new plants and productive equipment. We present these figures over two long time periods, 1950 – 79 and 1980 – 2007.

TABLE 1: LONG-TERM U.S. CORPORATE INVESTMENT PATTERNS: PROFITS, BORROWED FUNDS, AND FINANCIAL ASSET PURCHASES

	1950-79	1980-2007
Retained profits as share of investment	95.0%	98.7%
"Investment financing gap:" Borrowed funds needed to finance 100% of investment *(=100% - retained profits share of investment)*	5.0%	1.3%
Borrowed funds as share of investment	58.6%	66.5%
Financial asset purchases as share of investment	38.4%	59.5%

Sources: Flow-of-Funds Accounts of U.S. Federal Reserve System

The first row of the table shows the relationship between the level of retained profits by corporations (their "internal funds") and the amount of money the corporations spent on investments in plants and productive equipment. As we can see, over both long time periods, corporations have tended to spend money on investments in close correspondence with their level of retained profits. Thus, from 1950 – 79, an average of about 95 percent of their investment spending was covered by retained profits. Over 1980-2007, retained profits as a share of investments had risen higher, to where profits were sufficient to finance fully 98.7 percent of corporations' investments.[5]

[5] These broad patterns are consistent with the fuller analyses between corporate internal funds—or corporate saving—and current levels of investment spending. See Blecker (1996) and Feldstein and Horioka (1980).

In row 2, we show what we are terming the "investment financing gap." This is simply the share of the corporations' total financing that is not covered by retained profits. That is, over 1950 - 79, since retained profits covered 95 percent of overall investment spending, then the "financing gap"—the among of investment spending that needed to be covered by other sources of funds, borrowing in particular—had to amount to five percent of investment. Similarly, for 1980 – 2007, since retained profits accounted for 98.7 percent of investment, the amount of funds coming from other sources would have to equal only 1.3 percent of investment to cover the financing gap.

The third row of data shows how much borrowing the corporations actually did undertake, measured, again, relative to their spending on investment. For 1950-79, as we see, though the corporations' financing gap was 5 percent of investment, their level of borrowing was actually 58.6 percent of investment. This means that after the five percent investment gap was filled by borrowing, the remaining amount of borrowing, covering 53.6 percent of investment, was used for purposes other than purchasing productive equipment and plants. This disparity between the financing gap and the level of corporate borrowing is sharper still over 1980-2007. As we see, although the financing gap over these years averaged only 1.3 percent of investment, in fact, corporations' borrowing equaled 66.5 percent of investment.

The final row of data shows where most of these additional funds were channeled, beyond what the companies needed to cover their investment spending. That is, they channeled most of their additional funds into purchasing financial assets of various sorts. These financial assets include purchases of shares in foreign companies, as well as holding portfolios of stocks, bonds and derivative instruments, such as options and future contracts. We cannot say for certain how much corporations have committed to any given type of financial asset, since, unfortunately, the detailed breakdown on these figures, as presented by the Federal Reserve, is inadequate.

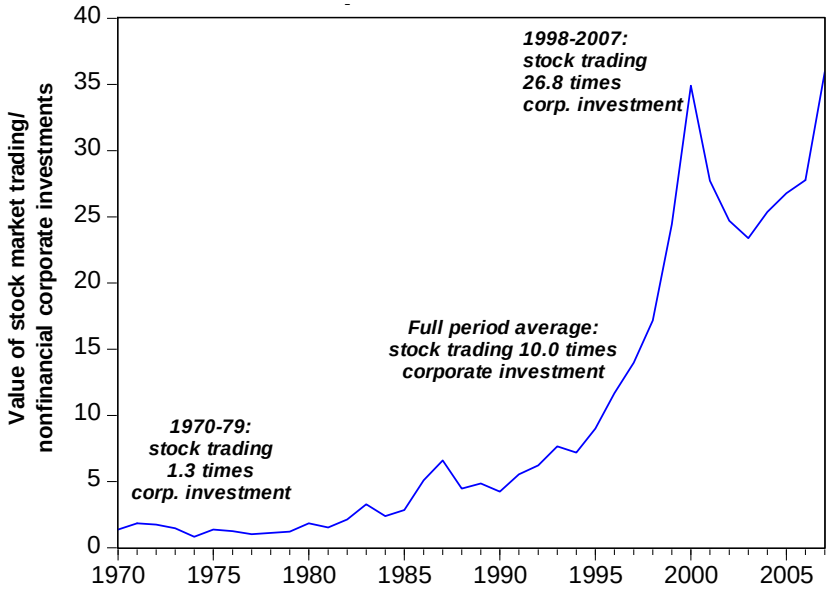
However, these figures do still shed important light on the issue of financial crowding out. Have non-financial corporations in general faced difficulties obtaining funds that they can channel into investments, perhaps because the public sector is absorbing funds to an excessive extent? As these data show, as an average over long periods of time—that is, averaging out the effects of business cycle ups and downs and other short-term adjustments—U.S. corporations borrow more than what they needed to fully fund their investment spending. What these data therefore show is that, as a long-term average, corporations do not experience a shortage of funds available to finance their investments. They are not experiencing financial crowding out. Rather, as a long-term average, corporations use the funds widely available to them not primarily to expand their investment spending, but to engage in various sorts of financial market activities.[6]

These data cannot themselves tell us the extent to which the levels of corporate borrowing, well beyond the amounts needed to close their financing gaps, are tied to Wall Street speculation. But the

[6] Of course, these long-term patterns do not preclude the possibility that within a more short-run framework, increases in public investment spending may contribute to an increase in interest rates which, in turn may perhaps discourage private sector borrowing and investment spending. The central point for our current discussion is that, on average, as a long-run trend, nonfinancial corporations are clearly not inhibited from borrowing on financial markets well beyond what is needed to fully fund their investment financing gap. See Pollin (2006) for a formal econometric examination of the long-run relationship between aggregate borrowing/lending in relation to interest rate behavior within the U.S. financial market.

data presented in Figure 3 will provide some additional perspective on this. Figure 3 plots the level of stock market trading in the U.S. markets as a share of corporations' investment spending. We report figures for the years 1970 – 2007.

FIGURE 3: U.S. STOCK MARKET TRADING RELATIVE TO CORPORATE INVESTMENT



Sources: Securities Industry and Financial Markets Association Fact Sheet 2008; Flow-of-Funds Accounts of U.S. Federal Reserve

To begin with, we see that in the decade 1970-79, the overall level of stock market trading was roughly comparable to the level of investment. That is, for every dollar of new investments, about $1.30 in outstanding corporate shares were traded on the exchanges. However, beginning in the early 1980s, the figure begins rising, and accelerates sharply in the mid-1990s. This, of course, is the period of the stock market bubble. We see that trading does fall with the bursting of the bubble in 2001, but rises again thereafter. Overall, as we see, for the full decade 1998-2007, the total value of stocks traded equaled nearly 27 the amount of money corporations spent on investment. That is, $27 in stocks were traded on the U.S. exchanges for every one dollar corporations spent on purchasing new equipment and plants. This is a 20-fold increase over where this relationship between stock market trading and investment stood in the 1970s.

What becomes clear here is that, since the late 1970s, trading in corporate stocks has dramatically outstripped the amount of money that has been channeled into new investments. Clearly, financial market investors are far more attracted to the gains from buying up existing assets as opposed to spending money to create new assets.

This pattern supports our central point: considering the U.S. economy for roughly the past 30 years, there has been, in general, no shortage of funds available to corporations. The corporations have not experienced financial crowding out. Rather, credit has been abundantly available, as long as the funds were channeled into Wall Street speculation and related forms of financial asset purchases rather than into productive investments.

3. SUCCESSES AND FAILURES WITH U.S. INDUSTRIAL POLICY

What Is Industrial Policy?

The first problem one faces in considering industrial policy is being clear on what one is actually talking about. In fact, the term is commonly used with reference to two distinct types of government interventions.

In one common usage, industrial policy refers to the regulation of competition, e.g. policies on monopolies, mergers and market restrictive practices. In the other common usage, industrial policy has a broader meaning, associated closely with the concept of a "developmental state." As one key element within a developmental state, industrial policy generally focuses on promoting research and development, moving the technical innovations emerging from R&D investments into commercial use, and raising productivity and competiveness by bringing the newly-developed technologies into commercial use. It is through this combination of initiatives that industrial policy in this sense of the term connects with broad developmental goals, including increasing employment opportunities, both within a particular region or state, and for the country as a whole.[7]

In this discussion, we are clearly focused on the second meaning of industrial policy—with industrial policies as one important element of a developmental state. But even within this more narrowly-defined framework, further points still need clarification. This is because, unlike with, say, monetary or fiscal policy, there are not one or two specific policy tools that we can identify with the term industrial policy. That is, monetary policy is basically about raising or lowering short-term interest rates to impact the economy's growth rate. Fiscal policy also aims to influence economic growth via managing the government's budgetary stance between deficits and surpluses. But with industrial policy as a tool of a developmental state, a range of policy instruments and targets are put into play. These could include R&D subsidies for government, university or private business research centers. It could also include preferential tax treatment, credit opportunities, or direct subsidies for specific sectors of the economy, different regions or even individual businesses. Some types of business regulations, such as auto fuel efficiency standardsn or financial regulations aimed at channeling credit to preferred sectors or activities at subsidized rates, could also be seen as industrial policy interventions. These various forms of support or regulations could be applied narrowly within a particular region or state or industry, such as a statewide renewable energy tax credit; or they could be available throughout a country.[8]

Within this understanding of the term, we can now move to consider the conditions under which industrial policy can be applied effectively, especially, of course, in the current U.S. economic circumstances.

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[7] Pitelis (2001) provides a succinct survey these alternative meanings to the term "industrial policy." See also Graham (1992) and Bingham (1998) for more extended discussions. What confuses the issue further is that the underlying theoretical premises behind the two meanings of the term are largely opposite. As Sawyer (1994) notes, anti-trust and other pro-competition policies are "based on some perceived desirable properties of competition and the unfettered market mechanism." By contrast, the second sense of the term "relies on the view that the government can play a positive enabling role in the economy and that institutions (such as unions and employers' organizations) can have a beneficial influence on the workings of the economy" (1994, p. 177).

[8] Sawyer has argued cogently that "industrial strategy" is a more appropriate term for the wide set of activities we are describing, since this term connotes "a range of economic and industrial policies that are consistent with the overall strategy" (1994, p. 177). Though Sawyer's point is well taken, we will continue to use the more common term "industrial policy," precisely because it is more familiar in at least U.S. policy discussions.

Are Industrial Policies Defensible?

Free-Market Critique. From a free market perspective, there are basically no viable arguments on behalf of industrial policies. Rather, the free-market case against industrial policy is parallel to the arguments we have reviewed on public investment. The basic point is straightforward: governments should not be in the business of subsidizing one technology, industry, or location, much less one business firm over others. This amounts to governments "picking winners," which they are incapable of accomplishing effectively. On top of this, industrial policies of this sort force taxpayers to finance government policymakers' inept efforts at picking winners. In fact, the job of picking winners in the economy is more effective when private businesses compete in a free market to satisfy the demands of consumers. Some of the businesses' decisions will be good, and others will be bad. The point is that this will be sorted out through competitive markets, at no expense to taxpayers.[9]

A Pro-Industrial Policy Response. Against these free market positions, the case on behalf of industrial policy is also clear, but needs to be assembled in parts. The first area of focus is technology development. In our discussion below, we briefly review the history of technical innovations in the United States economy. As we discuss there, all major technical innovations within the U.S. economy have entailed huge expenses over long gestation periods. Individual business firms are unable to sustain expenses at this level on their own. This is especially the case because there is never a guarantee that those investors who assumed the initial burden of long time horizon, high-risk ventures will end up as the prime beneficiaries from such endeavors. Professor Vernon Ruttan, a leading authority on the economics of technical change, summarizes the issue as follows:

> Can the private sector be relied on as a source of major new general purpose technologies? The quick response is that it *cannot*. When new technologies are radically different from existing technologies and the gains from advances in technology are so diffuse that they are difficult to capture by the firm conducting the research, private firms have only weak incentives to invest in scientific research or technology development. (2006, p. 177; emphasis in original)

A second consideration is the relationship between technical advances and productivity growth. Though individual businesses cannot be expected to develop major new technologies on their own, the pace at which individual firms incorporate technical innovations becomes a main engine of an economy's overall rate of productivity growth. As such, industrial policies that not only help develop new technologies but that can also help move them to the stage of commercial application can also raise a country's overall level of productivity. Raising productivity within a country will, in turn, improve the country's competitiveness in global markets.[10]

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[9] Indeed, Milton and Rose Friedman (1980) argued, in the case of governments subsidizing businesses to promote a country's exports, that, paradoxically, actual beneficiaries of this government support will be consumers in importing countries. These consumers receive lower prices than they would otherwise, while the taxpayers in the exporting country will be underwriting these lower prices, since they pay the taxes that cover the business subsidies to exporting firms.

[10] In the 1990s, Paul Krugman advanced a well-known argument that the term "competiveness" properly applies only to individual business firms, not to countries as a whole. He held that, if countries as a whole are not successful as exporters, the country's currency will depreciate in value relative to other currencies. This will enhance the country's competitiveness through lowering the prices in export markets of products produced there. But as Howes and Singh (2000) point out, in fact, the relative market success of exporters—especially with high value-added products—is explained in large measure by a country's relative level of productivity. This reflects the

These considerations are relevant for a range of industries across both the manufacturing and service sectors of the U.S. economy. But the situation for manufacturing merits special attention. This is because manufacturing relies more intensively on the use of machines, and less on human effort working on its own. As such, technological developments can be captured more readily in manufacturing production than services. Thus, if a country cannot sustain a healthy manufacturing sector, it then becomes more difficult to incorporate productivity gains in its economy overall. Technological advances in the economy could then become more difficult. Moreover, if a country is not advancing technologically and transforming technical advances into higher productivity, it will not remain competitive over time in international trade. In combination, these factors provide a strong case for industrial policies that target the manufacturing sector. [11]

Overall then, major economy-wide benefits can be achieved through industrial policies, starting with technological innovations which are moved as quickly as possible into successful commercial operations. This initial step can then engender a virtuous cycle, in which technical innovation accelerates productivity growth, which in turn enhances competiveness. Job opportunities can then expand when businesses operate more successfully.[12] However, the payoffs for undertaking these projects are too diffuse to be captured by any single business firm, which is why no single firm is likely to undertake the investments at the level needed. This is the basic reason why a free market approach cannot deliver the gains in social welfare that are attainable through the successful implementation of industrial policies.

Industrial Policy in Practice

The fact that industrial policies are capable of increasing social welfare by promoting technological development, productivity growth, competitiveness, and employment opportunities does not mean that these benefits are readily attainable.

The specific details of industrial policies need to be designed, targeted and implemented well. There are many cases when industrial policies have been executed successfully, but also many failures. Just to note briefly experiences outside the U.S., the dramatic rise of Japan, then South Korea, and the other "Asian Tiger" economies—Taiwan, Thailand, Singapore, and Malaysia—were built on a foundation of successful industrial policies, especially the ability to build successful export industries through adapting existing technologies in manufacturing production. The Chinese experience fol-

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ability of businesses in the country to produce high-quality products for export. This evidence establishes a strong basis for national governments being concerned with the overall level of productivity in its economy, especially relative to that of other countries. At the same time, it does not suggest that policymakers should focus on improving productivity as a instrument of trade competiveness to the exclusion of exchange rate management. If the U.S. dollar remains significantly overvalued, this will work against all positive initiatives to promote productivity.

[11] This point was emphasized in a 9/21/09 *Business Week* cover story by Pete Engardio, "Can the Future be Built in America?"

[12] Of course, for a given sized market, if productivity rises, this will mean that production can increase through employing *fewer*, not more, workers. But one way that productivity gains can increase employment opportunities is through increasing competitiveness, which then results in a larger market for the goods and services one produces. Another channel through which rising productivity can promote employment opportunities is for the productivity gains to translate into higher wages for workers. When workers receive higher wages, this in turn will increase overall market demand, and thereby an expansion of business spending, including on hiring more workers. However, in recognizing the long-term divergence between productivity and real wage growth within the U.S. economy—with productivity growth rising while real wage growth has been basically stagnant—we cannot assume that rising productivity will by itself deliver corresponding increases in real wages. See Wicks-Lim (2009) for a recent discussion on this question.

lows roughly in this same framework, while also incorporating uniquely Chinese features.[13] However, even within the East Asian model, there have also been serious failures. For example, in the 1950s, the Japanese government famously instructed Honda to stick to manufacturing motorcycles, refusing to support Honda's plan to begin producing automobiles. The Japanese also tried and failed to build a commercial aircraft manufacturing business in the 1970s.

The United States has had a long, varied history grappling with the idea and practice of industrial policy, beginning in 1791 with then Treasury Secretary Alexander Hamilton's proposal to Congress, "Report on the Subject of Manufacturers." Hamilton's proposals included measures to manage international trade, subsidies for domestic industries, and investments in infrastructure. But state governments thwarted Hamilton because they were wary then of empowering the federal government with this level of authority over the economy. Focusing on the 20th century, various forms of subsidies and preferential tax treatments were provided for agricultural producers, railroads, air carriers, as well as the automobile and housing industries. The Reconstruction Finance Corporation (RFC) was formed in 1932 by the Hoover Administration, as a means of providing subsidized credit for distressed businesses. The Roosevelt Administration substantially expanded the aims and scale of operations of the RFC over the course of the 1930s. To consider only one important example beyond the RFC experience, the suburbs could not have been built without the wide range of government programs that supported the construction of both single-family detached homes and highways.[14]

An important feature of much of the U.S. experience with industrial policies has been that these policies have been frequently implemented for purposes other than to promote technology, productivity, competitiveness, and jobs—that is, the main justifications for pursuing industrial policy, starting with Hamilton. The RFC itself was initially established primarily as a means of bailing out businesses on the brink of failure, and its scope of operations was expanded on an ad hoc basis through the 1930s.

Moving forward into the post World War II era, what have been some of the major motivations behind the use of industrial policies?

1. Bailing out the U.S. auto industry. In 2008 and 2009, General Motors and Chrysler received $65 billion in loans from the federal government. The loans were provided both by the then outgoing Bush administration in December 2008, as well as the newly installed Obama administration in March 2009. This action was taken after both automakers had testified before Congress that, without major federal assistance, they would be forced into bankruptcy. In fact, even with these government bailout funds, both firms did still proceed into bankruptcy protection in March. But because of the government support, the requirements for coming out of bankruptcy were softer, which allowed them to more easily maintain a semblance of their normal operations. These bailouts had an important precedent in the 1979 government bailout of Chrysler. In this prior case, the federal government provided $1.5 billion in loan guarantees (equivalent to about $3.5 billion in 2009 dollars) as well as

[13] Outstanding studies on industrial policies and development in Japan, South Korea and the other Asian tigers includes Johnson (1982), Amsden (1989, 2001), Chang (1994), and Wade (1990). On China, an excellent recent study is Li (2002).

[14] Bingham (1998) chapter 2 presents an overview of what he terms "America's long history of industrial policy."

"voluntary" quotas on foreign cars being imported onto U.S. markets.[15]

One can make a reasonable case for both bailouts, on the grounds that, in 1979 as well as 2009, the collapse of GM and Chrysler would have caused massive unemployment and more general economic hardship, especially in the Midwest. But when the tools of industrial policy are cobbled together amid a crisis, we cannot expect the results will be stellar, beyond preventing the firms from shutting down outright.

2. States and Municipalities Competing to Attract Businesses. Over the past four decades, states and municipalities in the U.S. have competed, sometimes intensively, among themselves to attract businesses to locate within them. The main weapon in this competition has been various types of tax incentives.[16] Foreign auto companies have been among the most favored recipients of such support, including, just since 2006: $400 million from West Pointn Georgia for Kia Motors; $141 million from Greensburg, Indiana for Honda; $300 million from Blue Springs, Mississippi for Toyta; and $577 million from Chattanooga, Tennessee for Volkswagon.[17] These efforts have achieved some success in their primary aim of attracting businesses to their location. But they have done so almost entirely on a zero-sum basis—that is, by reducing job creation in neighboring states and localities that have not offered the same incentives (see Chirinko and Wilson 2008). They have also had little success in increasing the rate of overall R&D spending. Rather, again, greater R&D spending in states offering the incentives appear to be mainly offset by reduced R&D spending in states with smaller incentive programs (Wilson 2005). These programs have also brought a declining tax base for the state or municipality offering these incentives, which in turn has meant declining budgets for state-level public investment or similar worthwhile activities.[18]

3. National Defense. By far, the most extensive use in the United States of the industrial policy tool kit has been in the area of national defense. And in this case, unlike with the auto industry bailouts and state-level tax break competitions, industrial policies have produced spectacular successes. It is not an exaggeration to say that the commercial-level use of jet aviation, computers, and the internet—all transformational technologies that define the U.S. and all other modern economies—were products of industrial policies directed and financed by the Pentagon. Because Pentagon-directed industrial policies have been so successful and so crucial to overall U.S. economic development for generations, it is important for our purposes to examine these experiences in a bit of depth.

Lessons from Pentagon-Based Industrial Policies

Military-related related research and development programs, along with military procurement poli-

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[15] Useful references on both auto bailouts are Cooney et al. (2009), Bickley (2008), Berry, Levinsohn, and Pakes (1999), and Freeman and Mendelowitz (1982). As of this writing, updated information on the 2009 bailouts is in "Update 1—Obama Expects GM, Chrysler to Repay Loans," Reuters 7/28/09, www.reuters.com/article/rbssConsumerGoodsAndRetailNews/idUSN2929560620090729?sp=true

[16] As Leroy wrote (1997, pp. 144-45), "Tax credit programs have proliferated so that states and cities now abate or credit almost every kind of corporate tax they collect: property and real estate tax, inventory, sales, corporate income, and utility taxes. They may also grant accelerated depreciation or tax credits for special activities such as research and development."

[17] The subsidy amounts have been taken from press accounts, and assembled by Good Jobs First, at: www.goodjobsfirst.org/corporate_subsidy/automobile_assembly_plants.cfm.

[18] The basic data for these revenue losses come from the Staff of the Joint Committee on Taxation, U.S. Congress, "Estimates of Federal Tax Expenditures," various years. See also Pollin and Luce (2000) for an overview on this issue.

cies, have played a central role in virtually all the major successful commercial technological developments that have occurred in the U.S. economy. This overarching point has been made for years by a wide range of researchers. Most recently, a full development of this position was presented by Vernon Ruttan, in his 2006 book *Is War Necessary for Economic Growth? Military Procurement and Technology Development.*

Ruttan begins his book by asserting that "military and defense-related procurement has been a major source of technology development across a broad spectrum of industries that account for an important share of U.S. industrial production" (p. vii). Moreover, Ruttan notes that "almost every year since WWII, defense and defense-related research and technology development expenditures have accounted for at least two thirds of all U.S. federal government research and development."

Ruttan develops these themes in discussing the central role played by military R&D and procurement in six key general-purpose technologies: 1) interchangeable parts and mass production; 2) military and commercial aircraft; 3) nuclear energy and electrical power; 4) computers and semi-conductors; 5) the internet; and 6) space industries. In short, as noted above, most of the major technologies that define our contemporary economy and society were brought into commercial use with major support from the U.S. military.

The key idea in Ruttan's work—which is central to a broader understanding of the operations of industrial policy—is how military-based R&D and procurement operated in combination to create conditions for major technologies to develop. That is, R&D alone would not have brought new technologies to the point of commercial success. It was also necessary that, over the course of decades, the military provided a guaranteed market for new technologies. This enabled the technologies to incubate over time without having to prematurely face the test of the market.

The development of the internet illustrates this point clearly. As Ruttan documents, the Defense Department commissioned the first work related to the idea of the internet in the early 1960s. The first electronic information routing system was completed in 1969. The internet was then initially demonstrated at an international conference on computer communication in 1972. The Defense Department then maintained responsibility for developing the internet until 1990. It wasn't until 1994 that Netscape introduced the first easy-to-use commercial internet browser. In short, the span of time from conception of the idea to its successful commercialization was roughly 40 years. The Defense Department underwrote advances in the technology throughout that 40 year period.

The enormous success of Pentagon-based industrial policy in the U.S. raises the basic question: is the only way U.S. policymakers can manage industrial policies successfully is for the Pentagon to be in charge? As we have emphasized, the key factor of Pentagon-centered industrial policy is the combination, on a massive scale and over a sustained time period, of R&D investment spending plus the maintaining of a guaranteed market through procurements. In principle, this combination could be replicated under some auspices other than the Pentagon, such as a clean-energy investment agenda.

Indeed, to a considerable extent, the combination that worked within the Pentagon has already been replicated successfully in the area of biotechnology, with applications both in health care and agriculture. The biotechnology revolution followed the same basic trajectory as the internet, with R&D

support sustained over decades until pharmaceutical and agricultural industries entered the field in the 1970s. A major recent example of this was the Human Genome Project that was actually initiated within the Department of Energy in the late 1980s. Under the leadership of the DOE, as well as, later, the National Institutes of Health, the logic of the Human Genome Project, as Fred Block writes "was to mobilize the energies of the scientific community around the specific task of mapping the genome as a way to accelerate the discovery of commercially viable products" (p. 14).

The major question is whether the government can justify the combination of large-scale R&D spending and procurement over a sustained time period; and the only basis on which this can occur is in terms of some standard of broadly-shared social welfare. Professor Ann Markusen, a leading analyst of Pentagon-centered industrial policies, emphasizes this point, writing that "What made defense such a powerful underwriter of innovation and a reliable market for incipient high-tech industries was the consensus that national defense was in the public interest, providing a public good not achievable through purely market mechanisms" (p. 135).

The issue of developing an effective set of industrial policies around an agenda of clean energy, transportation and manufacturing at this point becomes political. That is, can a strong enough political movement be mounted to mobilize the government's capacities in a manner similar to what it has already accomplished so spectacularly through the Pentagon, as well as, on a somewhat smaller scale, with biotechnology?

Not surprisingly, reaching that level of political influence poses numerous challenges of its own. To begin with, few people outside elite policymaking circles in the U.S. appreciate the extent to which the federal government has been successful in conducting industrial policies. Instead, as Block argues, U.S. industrial policies have operated as what he terms a "hidden developmental state," under the umbrella of the Pentagon's national security agenda, not as an open and fully legitimized public policy effort to advance technical innovation, productivity, competitiveness, and jobs.

In Block's view, the fact that U.S. industrial policies have operated at a remove from the normal channels of policy discussion and implementation provides both a basis for optimism and a set of formidable challenges for achieving success in the future. On the optimistic side, the reality that that Pentagon-based industrial policies in the U.S. have been so successful demonstrates that this kind of economic intervention is by no means beyond the scope or capacity of U.S. policy makers and institutions.

On the other hand, conducting industrial policies in the U.S. in this way has meant that the military has exercised disproportionate influence over what passes as legitimate aims of such policies, and over managerial apparatus to conduct the policies. And precisely because Pentagon-based industrial policies have been so removed from the standard procedures of policy formation and management, there does not yet exist an adequate system of carrots and sticks to regulate the private businesses that benefit most directly from these policies through contracts and subsidies. The egregious non-competitive, gold-plated, cost-plus contracts handed out to weapons suppliers are the most well-known examples of this broader problem.[19]

[19] Nick Schwellenback of The Center on Public Integrity produced a useful report in April 2009 on waste and fraud in Pentagon procurement, www.publicintegrity.org/articles/entry/1243/.

But we also refer here to a more general principle that needs to be established: that for private businesses to be receiving desirable government contracts and subsidies, they have to expect to operate in ways consistent with the society's broader welfare aims. As Block puts it, "society would continue to invest heavily to support business innovation, but firms would be expected to act as social partners to help achieve environmental protection, improved employee welfare, and the creation of more resilient communities" (p. 31).

Here then, is the overarching challenge in trying to design industrial policies to advance clean energy, a reconfigured transportation system, and a renewed manufacturing sector. As a technical matter, we do already have the policy apparatus to successfully implement such policies. But we lack the experience and political will to advance this agenda outside of the Pentagon. The challenge then will be to build such capacities over time.

4. DESIGNING EFFECTIVE PUBLIC INVESTMENTS AND INDUSTRIAL POLICIES TODAY

Is the U.S. economic policymaking apparatus capable now of mounting an effective combination of public investments and industrial policies to meet the fundamental challenges at hand—that is, a stable long-term recovery from the recession; a revival of our domestic auto industry and manufacturing sector more generally; and the construction of a new energy and transportation infrastructure on the foundations of investments in efficiency and renewable energy sources? Could this epoch-defining set of challenges also serve as a long-term engine of decent employment opportunities in the U.S? We have seen from the previous sections covering both the broad analytic arguments and the historical evidence that a public investment/industrial policy agenda is quite viable in principle and has demonstrated its effectiveness in widely varying circumstances, in the U.S. and elsewhere.

The February 2009 ARRA program represented an important step in the right direction, following a full generation in which the country's public investment needs were neglected and industrial policy initiatives became increasingly hidden from public view. But the ARRA is a short-run stimulus program. Almost by definition, a public investment/industrial policy agenda can be effectively implemented only on the basis of longer-term commitments. In this closing section, we offer some observations and brief proposals on how to proceed with such a longer-term agenda.

Meeting Public Infrastructure Needs

Considering some of the specifics of the public investment component of the ARRA is a good place to begin. As mentioned above, within the overall $787 billion program, about $64 billion was dedicated to traditional infrastructure projects in the areas of transportation, water management, and construction of public buildings. Another $80 billion was directed into clean-energy investments, in the areas of "smart grid" electrical transmission systems and building retrofits as well as for environmental clean ups.

How do these spending amounts match up against our long-term public investment needs? It is more straightforward to draw this comparison with respect to the traditional infrastructure projects

in transportation, water management, and public buildings, since there is a higher level of certainty about the types of projects and the costs for the work that needs to be done. With the clean-energy projects, the level of investment needed and the costs of these investments are generally uncertain, given that much of the investment activity will be aimed at developing new technologies as opposed to working with mature technologies. We return to this point below.

In recent years, various federal governmental and quasi-governmental agencies have developed assessments of the long-term infrastructure investments needed to close the gaps created by inadequate investment levels over the previous 30 years. Focusing on their specific areas of jurisdiction, these agencies include the U.S. Department of Transportation, the Association of American Railroads, the Federal Aviation Administration, Army Corps of Engineers, Environmental Protection Agency, and Energy Information Agency. In Table 2, we summarize the assessments made by these various agencies. The figures we report are for infrastructure investment needs over and above the investment which we would have expected to have taken place, given current patterns of spending.[20] These investments would come primarily from the public sector, but private infrastructure investments would also be important in the areas of railways, aviation, the electrical grid and natural gas pipelines.

TABLE 2. INFRASTRUCTURE INVESTMENT NEEDS IN TRADITIONAL TRANSPORTATION, WATER AND ENERGY AREAS

Annual Incremental Spending Levels over 20 Years Based on Government Agency Assessments

	Annual spending levels (billions of dollars)	Primary Source of Funding
Transportation		
Roads and bridges	$8.5 – $61.4	Public
Rail	$5.3	Private
Aviation	$3.2	Public/private
Mass transit	$3.2 – $9.2	Public
Inland waterways	$6.2	Public
Total Transportation	*$26.4 - $85.3*	---
Water		
Drinking water	$8.0	Public
Wastewater systems	$7.4	Public
Dams	$0.8	Public
Total Water	*$16.2*	---
Energy		
Electricity (including renewables)	$22.5	Private
Natural Gas	$3.2	Private
Total Energy	*$25.7*	---
Total Incremental Infrastructure Investment Needs	*$68 - $127 billion*	---

Sources: See Heintz, Pollin and Garrett-Peltier (2009)

[20] The figures reported in the table are based on research in Heintz, Pollin, and Garrett-Peltier (2009).

As the table shows, our estimate of total infrastructure investments per year to meet the assessed needs in these priority areas—including both public and private-sector spending—is between $68 billion and $127 billion. These, again, are incremental investments above the trend levels for the past 30 years. Clearly, the needs assessments vary widely in some areas, most notably for road and bridge construction. But despite this range of assessments, the central point that emerges is that, even with the lower-end figure of $68 billion per year, the needs are large. Moreover, to adequately fill the gaps in investment as established by the various governmental assessments, we would need to sustain this level of additional public investment over a period of twenty years. The total incremental investment required over a two decade period would then be between $1.5 and $2.6 trillion.

From these figures, we can now gauge how far the 2009 ARRA program goes in meeting the economy's long-term infrastructure needs. In fact, the total of $65 billion in the ARRA for these traditional infrastructure spending projects roughly matches our low-end figure of assessed needs of $68 billion. However, the ARRA spending levels are for public investments only, whereas our needs assessment figure includes both public and private infrastructure investments. On the other hand, our figure based on needs assessment is a one-year level of spending, while the stimulus program budget is a figure for multiple years.[21] In addition, we derived our figure on the assumption that this level of spending would be sustained over 20 years. At present, the U.S. government has made no commitment to increase public investment beyond the two-year funding levels incorporated into the stimulus program.

In short, addressing the long-term gaps in traditional infrastructure investment areas will require a level of spending roughly equal to that in the ARRA that would be sustained for 20 years.

Public Transportation and the Clean-Energy Transformation

Of course, in meeting the U.S. economy's long-term needs, we cannot simply frame the issue in terms of maintaining the existing priorities in public infrastructure. It is even more imperative that the next generation of public and private infrastructure be constructed on a clean-energy foundation. Our public investments also need to be targeted at reviving our manufacturing sector and auto industry, in particular.

One obvious initiative that is capable of combining these aims is dramatically increasing investments in public transportation systems. The environmental benefits of public transportation are strong. To transport people via public transportation as opposed to private cars produces a net reduction in carbon emissions of about 45 percent per passenger mile. Increasing the availability of public transportation can also substantially reduce overall household spending needs, since, on average it costs a passenger about 22 cents to travel one mile by public transportation, while a private car costs about 54 cents per mile. That is, on average, public transportation is about 54 percent cheaper for passengers than traveling by private car.[22]

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[21] Though the ARRA is designed as a two-year short-run stimulus, most of the traditional infrastructure and clean-energy investments are carried out over a longer-time period, in many cases up to five years. Data relating to this are presented in Pollin, Heintz, and Garrett-Peltier (2009), p. 8.

[22] The material in this and the following two paragraphs are taken from Pollin, Wicks-Lim, and Garrett-Peltier (2009) pp. 31-33, including full citations for the data presented. We report the comparative figures of costs to passengers, as opposed to the full costs of main-

Despite these advantages of public over private transportation, public transportation accounts for an extremely low share of total travel in the United States. As of 2007, the average U.S. household spent about 94 percent of its total transportation budget on private automobiles, and only six percent on public transportation. This is even after including air travel as a component of households' overall public transportation budget. The share of public transportation spending by lower-income households is even less, with lowest 20 percent income group spending only five percent, and the 21-40 percent income group spending a still lower four percent of their respective transportation budgets on public transportation.[23]

There has been a notable rise in public transportation ridership over the past two years with, for example, overall ridership rising by about four percent in 2008 relative to 2007. This increase was initially sparked by the sharp rise in oil prices. But even as oil prices fell beginning in the fall of 2008, public transportation use continued to rise. The main factor here is almost certainly that households are attempting to reduce costs during the recession.

But this more recent pattern still begs the broader question of why haven't U.S. residents, especially those at lower income levels, relied more on public transportation over time? The answers provided through formal surveys are not surprising. The main factor is that public transportation is much less convenient than driving—i.e. access is bad, off-peak hours service is limited, and transferring is difficult. This makes public transportation particularly difficult for low-income people who, as part of their regular routine, often need to commute between multiple jobs, as well as transport children to child care and school.

Investments in public ground transportation break down into two broad categories: various sorts of rail systems, including subways, light rail, and inter-city high speed trains; and bus systems, which also include smaller public-use vehicles like minivans and trolley cars.

Upgradied rail systems are crucial for meeting the country's long-term transportation needs, since they are both the cleanest and most efficient transportation mode. The ARRA did include major new investments in rail transport upgrades.

At the same time, particularly within a shorter-run framework, there are problems with relying too heavily on rail systems as the primary focus of public transportation investments. The most evident shorter-term concern is that these systems require years of planning and spending before they come on line and communities enjoy the benefits. But in addition, the United States, at present, has virtually no capacity to build mass transit systems and vehicles. Subway cars used in the U.S. are supplied by French, German and Japanese companies. Other kinds of mass transit vehicles are built either in South Korea or Germany. As Jonathan Feldman (2009) reports, the U.S. was once a technological

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taining public versus private transportation systems, since these figures are not easy to establish on a comparative basis. For example, the costs included in private auto transportation do not include the costs to maintain roads, gas stations, or auto repair shops. However, the full costs of maintaining public transportation systems include maintenance of passenger stations, tunnels, and track systems, along with vehicle maintenance operations.

[23] Part of the reason the figure is lower for lower-income households is that their spending on air travel is well below that for higher-income groups. But the key point here is that, considering lower-income households by themselves and not simply in comparison with upper-income groups, their transportation budget are so heavily weighted toward the private automobile.

leader in this field, and could become so again. But this will take years of steady support in terms of research and development as well as public procurement contracts.

Finally, to the extent that overall transportation funding is shifted to rail systems, this would represent an additional blow to the U.S. auto industry. While the transition away from the auto is needed, this has to be accomplished in a way that creates the least amount of harm to working people and communities that have already been suffering as a result of the auto industry and manufacturing sector crisis.

Thus, as a short-term agenda, the most effective approach to expanding investments in public transportation would be to give immediate focus to markedly improve public bus services throughout the country. This project should be undertaken in conjunction with the continued strong commitment to also expanding rail services, as initiated with the ARRA. Over time, the most effective mass transit systems are those that integrate bus and rail systems. Thus, public investment over time should target the goal of building combined rail/bus public transportation systems.

But in the short term, it will be important to show tangible progress in raising support for public transportation. This can be done, first of all, by simply getting more buses available for service and out on the street. This would enable people to rely less heavily on their cars. It would also entail large-scale procurement contracts with the government. These procurement orders could also create a major sales boost for the U.S. auto companies as well as the firms that have traditionally manufactured buses in the U.S. It will be useful to sketch out these possibilities for a short-term agenda in a bit of detail.

Bus Procurement Proposal

As of the most recent 2007 data, about 65,000 buses are operating in the United States. A program to significantly improve public transportation service would entail increasing the number of buses in operation by, say, 50 percent. That would mean raising the total number of buses serving U.S. public transportation consumers to about 100,000. It would be reasonable to allow this 50 percent expansion of available bus service to occur over five years. Table 3 presents some of the key data relevant for evaluating the costs and impact of a U.S. bus procurement program of this magnitude.

TABLE 3. FIGURES ON EXPANDING U.S. BUS TRANSPORTATION SERVICES AND MANUFACTURING ORDERS

A) Production Costs

Number of buses in service throughout U.S. (approximate for 2007)	65,000
Average bus manufacturing costs in U.S. (2007)	$425,000
Total costs for manufacturing 100,000 buses	$42.5 billion
Total costs per year of five-year 100,000 bus procurement program (20,000 buses per year)	$8.5 billion/year
Costs per year of procurements net of replacement purchases (7,000 buses per year)	$3 billion/year

Source: American Public Transit Association Vehicles Database

B) Impact on Manufacturers' Sales

Sales increase for existing U.S. bus manufacturers for 5,000 bus procurement orders	+ 38.9% from 2007 levels
For auto manufacturers: average manufacturing costs for conventional gas-fueled car (2007)	$13,000
Ratio of production costs for autos relative to buses	33 autos/1 bus
Sales increase for U.S. auto producers for 15,000 bus procurement order	+ 5.2% from 2008 levels

Sources: American Public Transit Association Vehicles Database; Arthur D. Little (2002)

C) Impact on Employment

	Manufacturing employment	Total employment
Employment creation from $8.5 billion bus procurement order (produces 20,000 buses)	29,050	79,900
Employment creation from $8.5 billion military armed vehicles/tanks	35,501	70,210

Source: IMPLAN

This is not the place to explore the details of what this expansion in service would mean in terms of accessibility of public transportation in communities throughout the U.S. Suffice it to say that something on the order of a 50 percent improvement in accessibility would represent a major benefit, especially for lower-income families. Millions of lower-income families would be able to significantly reduce their reliance on auto transportation, saving them up to around $2,000 per year in overall transportation expenses—that is, up to a 10 percent reduction in their total household expenditures.[24]

The program would also be focused on improving the energy efficiency and quality of the operating bus fleet. The average bus in service is designed to operate for about 7.5 years. If the entire existing fleet of 65,000 buses were to be replaced within 7.5 years, that would mean a bit fewer than 9,000 old buses would be replaced per year with new vehicles. In fact, however, the fleet has been aging significantly since the level of orders peaked in 2001 at about 8,100 new buses. In 2007, only about 3,600 new buses were produced in the U.S.

An ambitious but reasonable aim of the new program would be to replace the entire fleet within the next five years, while also expanding the total number of buses in operation to 100,000. This would then mean a procurement order of 100,000 buses over the next five years, or 20,000 new bus orders per year for five years.

As the top panel of Table 3 shows, as of 2007, the average cost to produce a bus in the United States was $425,000. Thus, the overall cost to build 100,000 new buses would be about $42.5 billion, or $8.5 billion per year for five years. But only 35,000 of the new purchases would be for expanding beyond the existing supply of buses—that is, about $15 billion total, or $3 billion per year over five years. The remaining $5.5 billion per year in expenditures would represent a somewhat accelerated depreciation expense, most of which would already have been incorporated into the budgets of the government agencies administering the country's various public transportation systems.

[24] This figure is derived in Pollin, Wicks-Lim, and Garrett-Peltier (2009), p. 33.

How would such an initiative impact the overall situation in the auto and bus production industry, and manufacturing more generally?

The Buy America Act requires that all federally-funded transit investments be built with at least 60 percent of their components produced in the U.S. and that the assembly also be performed within the U.S. As such, any initiative such as this to expand bus production and bus service throughout the United States would necessarily mean most of the production will be done by U.S. workers.[25]

At present, the major suppliers of buses in the U.S. are the U.S. companies Gillig and North American Bus, and Canadian companies with major U.S. operations, New Flyer and Orion. Given that these existing companies produced only about 3,600 buses in 2007, it would be unrealistic to assume they could expand up to 20,000 buses per year in a brief period of time. As a rough estimate, we assume that the existing producers could at most increase their rate of production by 50 percent above their 2007 level, to 5,400 buses per year. For simplicity, we assume the existing bus manufacturers would increase their production to 5,000 buses per year, i.e. 25 percent of the overall procurement order of 20,000.

The remaining roughly 15,000 new buses per year would then be built by the automobile manufacturers in the U.S. To begin with, we include here all 13 companies manufacturing cars in the U.S. as potentially eligible to undertake this project of converting part of their auto production operations into building buses. Of these firms, the U.S. firms General Motors, Ford, and Chrysler accounted for 60 percent of all cars built in the U.S. as of 2007. The remaining manufacturers producing in the U.S are Japanese, German, and South Korean firms. With auto companies in general facing a severe slump—with a high percentage of both their productive equipment and labor force sitting idle or underutilized—we would anticipate that at least some of the companies would eagerly compete to obtain a major government procurement order, even if fulfilling the order means converting some of their production facilities from autos to buses.

What would be the impact for the car companies of receiving a procurement order to produce 15,000 buses per year for the next five years? To estimate this, we have to compare the production costs of the average bus, at $425,000, with those to produce the average automobile, which are about $13,000 (as shown in the middle panel of Table 3). This means that producing one bus would have an impact on domestic manufacturing equal to producing about 33 new autos. For simplicity, we round this cost difference at 30-to-one.

Based on this roughly 30-to-1 cost differential between buses and autos, for auto manufacturers to receive a procurement order of 15,000 buses per year would be the equivalent of 450,000 new automobile production orders. Total U.S. auto production in 2008 was 10.8 million in 2007 but fell to 8.7 million in 2008. Therefore, an order of 450,000 new cars would be the equivalent of an increase in car orders of about five percent relative to the 2008 level. It would mean that the equivalent of about 9.2 million cars would be produced, which would still be 1.6 million fewer than in 2007.

[25] For details on the provisions of the Buy America standards, see www.fta.dot.gov/about/about_FTA_464.html.

This level of orders would clearly provide a major boost to U.S. manufacturers. For example, it would have a far greater positive effect over time than the "Cash for Clunkers" program, which enabled people to trade in older, low-efficiency cars for new cars and receive a $4,500 rebate for their new car purchase. Amid great fanfare, the program generated a short-term car sales surge a when it was in effect over July-August 2009, at a cost of $3 billion to the federal government—an amount equal to the cost net of replacement of our proposed bus procurement program. But at the time of writing, industry analysts expect that sales will subsequently dip down over the course of the full year, with no net gain in overall sales.[26] Over the longer term, expanding bus service as the first stage of a broader public transportation agenda, including expanding rail service as well, will have a far greater positive impact both on the environment and lowering overall living costs for low-income households.

In short, depending on details, the program could provide a major increase in sales for the car companies as well as the existing bus manufacturers. It could also encourage the auto companies to focus on the idea of converting a segment of their overall operations to manufacturing products other than automobiles. Moreover, once they have obtained experience in converting part of their production line to buses, they should then be better equipped to undertake additional conversion projects—for example, into rail production or even clean energy generating equipment, such as wind turbines and various sorts of solar energy systems.

Manufacturing 20,000 new buses per year would also generate a total of about 80,000 jobs, including nearly 30,000 in manufacturing, as we show in the lower panel of Table 3. Of course, spending $8.5 billion per year on anything will produce thousands of jobs. Moreover, as Table 3 shows, the overall impact on employment of manufacturing buses would not be significantly different than putting the same amount of money into producing tanks or missile components for the U.S. military. But the overall economic impact would obviously be dramatically different—for the environment, for low-income households, as well as for reviving our manufacturing base through conversion to clean-energy investments. The point therefore is that, all of these additional benefits will accrue without experiencing any loss in employment opportunities throughout the economy.

Manufacturing Renewable Energy Equipment

The connections we have seen between bus procurement as a shorter-term public investment focal point, combined with rail investments as a longer-term project, also offers useful parallels for advancing U.S. manufacturing opportunities in the area of renewable energy.

It is clear, to begin with, that the U.S. needs to build a competitive renewable energy manufacturing sector. Over the long-term, the U.S. is going to be a major consumer, perhaps the largest market in the world, of manufactured renewable energy products. These products will be a cornerstone of the clean-energy economy.

At the same time, similar to the situation with the rail sector, U.S. producers at present are well behind European and Asian manufacturers as competitive suppliers.

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[26] See, for example, the Associated Press story for 8/25/09, "Cash for Clunkers a Jolt for Car Sales, Not a Fix," www.google.com/hostednews/ap/article/ALeqM5hL5fUBpVOB7W6IjNX3uODAVIHLYgD9A9KL700

For example, at the major new wind and solar energy projects developed in the states of Washington and Nevada, all the major capital equipment was imported from Europe and Southeast Asia. Of course, the installation work on these projects could only be handled on site. Still, roughly half of the jobs directly associated with these projects occur at the manufacturing stage.[27] Therefore, for renewable energy to serve as an engine of U.S. job creation, it needs to also be focused on reviving manufacturing activity within the U.S.

As described by George Sterzinger (2009), preliminary efforts being undertaken now to develop the offshore wind potential of the Great Lakes demonstrates the enormous opportunities available here. The National Renewable Energy Lab estimates that, technically, up to 250,000 megawatts of wind power can be developed in the Great Lakes. This represents 12 times the amount of already installed wind energy capacity throughout the U.S. The level of investment needed to develop the site ranges between $500 billion and $1 trillion. Assuming the work would be conducted over about 10 years, the total number of jobs per year that would be generated would range between about 660,000 (spending $50 billion/year for 10 years) and 1.3 million jobs (spending $100 billion/year for 10 years). These figures include both the jobs directly associated with the project, as well as the "indirect" job creation, jobs created for businesses supplying materials for the project, and "induced" job creation, the job expansion that occurs when workers who are newly employed by the project spend their additional income. The total number of manufacturing jobs generated—including direct, indirect, and induced job creation—would range between about 165,000 (at $50 billion/year in spending) and 325,000.

In short, a project like this could serve as a major new engine of job creation throughout the Midwest. But this can happen only if there are business firms in the Midwest capable of building the needed equipment. These business firms could certainly include, among others, today's auto manufacturers. Of course, major challenges would have to be overcome in converting the auto production lines into building wind turbines, just as there would be comparable challenges in converting the auto lines into manufacturing buses, subway cars and trains. We would expect that converting auto production lines into manufacturing competitive renewable energy products would proceed relatively slowly—less like converting to bus production and more similar to producing various sorts of rail cars and equipment.

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As we have discussed, the basic outlines of how to proceed with such large-scale initiatives has already been developed and proven successful by U.S. policymakers, particularly within the Pentagon. That is, the U.S. government needs to be committed to providing support for research, development and commercialization for these projects. The government also needs to ensure that robust markets are ready and waiting through their own procurement orders. Without each of these levels of support, the overall enterprise could face insurmountable obstacles.

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[27] To measure *total*, as opposed to *direct* job creation through these, or any other kinds of investments within the U.S. economy, we would also need to account for *indirect* and *induced* job creation. Indirect job creation refers to jobs generated when suppliers to the investment project under consideration receive additional orders. Induced job creation results when the workers who are newly employed—either through the direct or indirect employment effects—in turn spend their additional income. See, e.g., Pollin, Heintz, and Garrett-Peltier (2009) for a detailed discussion of these distinct effects.

Such large-scale industrial policy projects also need to be advanced together with a broader commitment to public investment. As we have seen, public investments in our transportation, water management, and energy infrastructure raise overall productivity and encourage economic growth. As such, public investment, properly managed, crowds in private investment. Presumably, another Hurricane Katrina or Minneapolis-like bridge collapse will not be necessary to sustain the commitment to public investment that was initiated in the February 2009 American Recovery and Reinvestment Act. By the same token, as we have seen, every dollar that flows into public investment is not money lost to private sector investors. The evidence rather shows that, on average, private corporations undertake productive investments in close correspondence with their own inflow of profits. They do also borrow heavily on financial markets. But to a major extent, these funds have been diverted away from productive investments and into the Wall Street casino.

In reflecting on the achievements of public investments and industrial policy and as practiced through the Pentagon—leading to, as Ruttan documents, the commercialization of jet aviation, the computer and the internet, among other breakthroughs—it was clearly necessary to establish their public purpose and social welfare payoffs. Without these, it would not have been possible for these projects to be nurtured over the long periods of time and at the level of funding they required. The overarching point then is that reviving the U.S. manufacturing sector and auto industry will also require major commitments of public investment and industrial policy. These commitments, in turn, will have the greatest likelihood of success through becoming firmly bound to the epoch-defining imperative of transforming the United States into a clean-energy economy.

REFERENCES

Aschauer, David A. 1989a. "Is public expenditure productive?" *Journal of Monetary Economics* 23(2): 177-200.

———. 1989b. "Does public capital crowd-out private capital?" *Journal of Monetary Economics* 24(2): 171-188.

Amsden, Alice (1989) *Asia's Next Giant: South Korea and Late Industrialization*, New York: Oxford University Press.

Amsden, Alice (2001) *The Rise of "The Rest": Challenges to the West from Late Industrializing Economies*, NewYork: Oxford University Press.

Berry, Steven, James Levinsohn and Ariel Pakes (1999) "Voluntary Export Restraints on Automobiles: Evaluating a Trade Policy," *American Economic Review*, June, 400-430.

Bickley, James M. (2008) "Chrysler Corporation Loan Guarantee Act of 1979: Background, Provisions, and Cost," *Congressional Research Service Report for Congress*, December 17.

Bingham, Richard D. (1998) *Industrial Policy American Style: From Hamilton to HDTV*, Armonk, NY: M.E. Sharpe.

Blecker, Robert (1996) "Policy Implications of the International Saving-Investment Correlation," in Robert Pollin ed., *The Macroeconomics of Saving, Finance, and Investment*, Ann Arbor, MI: University of Michigan Press, 173-230.

Block, Fred (2008) "Swimming Against the Current: The Rise of a Hidden Developmental State in the United States," *Politics and Society,* 36:2, 169-206.

Chang, Ha Joon (1994) *The Political Economy of Industrial Policy*, London: Macmillan.

Chirinko and Wilson (2008) "State Investment Tax Incentives: A Zero-Sum Game?" *Journal of Public Economics,* 92, 2362-2384.

Cooney, Stephen, James M. Bickley, Hilda Chaikind, Carol A. Petit, Patrick Purcell, Carol Rapaport, and Gary Shorter (2009) "U.S. Motor Vehicle Industry: Federal Financial Assistance and Restructuring, *Congressional Research Service Report for Congress*, January 30.

Engardio, Pete (2009) "Can the Future Be Built in America?" *Business Week,* 9/21/09, 46-51.

Feldman, Jonathan (2009) "From Mass Transit to New Manufacturing," *The American Prospect*, March, www.prospect.org/cs/articles?article=from_mass_transit_to_new_manufacturing

Feldstein, Martin and Charles Horioka (1980) "Domestic Saving and International Capital Flows," *Economic Journal* 90, 314-29.

Freeman, Brian and Alan I Mendelowitz (1982) "Program in Search of a Policy: The Chrysler Loan Guarantee Program," *Journal of Policy Analysis and Management*, 1:4, 443-453.

Friedman, Benjamin (1988) *Day of Reckoning. The Consequences of American Economic Policy Under Reagan and After,* New York: Random House.

Friedman, Milton and Rose Friedman (1980) *Free to Choose: A Personal Statement*, New York: Harcourt Brace Jovanovich.

Graham, Otis L. Jr. (1992) *Losing Time: The Industrial Policy Debate*, Cambridge, MA: Harvard University Press.

Heintz, James, (2010, forthcoming) "The impact of public capital on the U.S. private economy: new evidence and analysis," *International Review of Applied Economics.*

Heintz, James, Robert Pollin and Heidi Garrett-Peltier (2009) *How Infrastructure Investments Support the U.S. Economy: Employment, Productivity, and Growth,* Political Economy Research Institute and Alliance for American Manufacturing, January, www.peri.umass.edu/236/hash/efc9f7456a/publication/333/.

Howes, Candace, and Ajit Singh (2000) "Introduction: Competitiveness Matters," in Candace Howes and Ajit Singh eds., *Competiveness Matters: Industry and Economic Performance in the U.S.*, Ann Arbor, MI: University of Michigan Press, 1-30.

Johnson, Chalmers (1982) *MITI and the Japanese Miracle: The Growth of Industrial Policy, 1925-75*, Stanford, CA: Stanford University Press.Joint Committee on Taxation, (various years) *Estimates of Federal Tax Expenditures,* Washington, DC: U.S. Congress, U.S. Government Printing Office.

LeRoy, Greg (1994) *No More Candy Store: States and Cities Making Job Subsidies Accountable*, Washington, DC: Good Jobs First, www.goodjobsfirst.org/pdf/nmcs.pdf.

Li, Minqi (2002) *Three Essays on China's State-Owned Enterprises: Towards an Alternative to Privatization*, Ph.D. Dissertation, Department of Economics, University of Massachusetts, Amherst.

Little, Arthur D. Inc. (2002) *Guidance for Transportation Technologies: Fuel Choice for Fuel Cell Vehicles*, Cambridge, MA: Arthur D. Little, www1.eere.energy.gov/hydrogenandfuelcells/pdfs/fuel_choice_fcvs.pdf.

Markusen, Ann (2000) "Can Technology Policy Serve as Industrial Policy?" in Candace Howes and Ajit Singh eds., *Competiveness Matters: Industry and Economic Performance in the U.S.*, Ann Arbor, MI: University of Michigan Press, 127-144.

Munnell, Alicia H. 1990a. "Why has productivity growth declined? Productivity and public investment." *New England Economic Review* Jan/Feb. 3-22.

———. 1990b. "How does public infrastructure affect regional economic performance?" *New England Economic Review* Sep/Oct. 11-32.

———. 1992. "Infrastructure investment and economic growth," *Journal of Economic Perspectives*, 6(4): 189-198.

Pitelis, Christos (2001) "Industrial Policy," in Jonathan Michie, ed., *Reader's Guide to the Social Sciences, Volume 1*, Chicago: Fitzroy Dearborn Publishers, 797-799.

Pollin, Robert (1996) "Financial Intermediation and the Variability of the Saving Constraint," in R. Pollin ed. *The Macroeconomics of Saving, Finance, and Investment*, Ann Arbor, MI: University of Michigan Press, pp. 309-365.

Pollin, Robert (2003) *Contours of Descent: U.S. Economic Fractures and the Landscape of Global Austerity*, New York: Verso.

Pollin, Robert and Stephanie Luce (2000) *The Living Wage: Building a Fair Economy*, New York: The New Press.

Pollin, Robert, James Heintz, and Heidi Garrett-Peltier (2009) *The Economic Benefits of Clean-energy Investments,* Political Economy Research Institute and Center for American Progress, www.peri.umass.edu/economic_benefits.

Pollin, Robert, Jeannette Wicks-Lim, and Heidi Garrett-Peltier (2009) *Green Prosperity: How Clean-Energy Policies Can Fight Poverty and Raise Living Standards in the United States*, Political Economy Research Institute, Natural Resources Defense Council, and Green for All, www.peri.umass.edu/green_prosperity.

Ruttan, Vernon (2006) *Is War Necessary for Economic Growth? Military Procurement and Technology Development*, New York: Oxford University Press.

Sawyer, Malcolm (1994) "Industrial Strategy and Employment in Europe," in Jonathan Michie and John Grieve Smith, eds., *Unemployment in Europe,* New York: Academic Press, 177-187.

Schwellenbach, Nick (2009) "Fraud Cases Fell while Pentagon Contracts Surged," Center for Public Integrity, April, www.publicintegrity.org/articles/entry/1243/.

Sterzinger, George (2009) "Beyond Sunny Hopes and Windy Rhetoric," *The American Prospect,* March, www.prospect.org/cs/articles?article=beyond_sunny_hopes_and_windy_rhetoric.

Wade, Robert (1990) *Governing the Market: Economic Theory and the Role of Government in East Asian Industrialization*, Princeton, NJ: Princeton University Press.

Wicks-Lim, Jeannette (2009) "Creating Decent Jobs in the United States: The Role of Unions and Collective Bargaining," Political Economy Research Institute, www.peri.umass.edu/fileadmin/pdf/published_study/PERI_Unions_ DecentJobs_August09.pdf.

Wilson, Daniel (2005) "Beggar Thy Neighbor? The In-State vs. Out-of-State Impact of State R&D Tax Credits," Federal Reserve Bank of San Francisco Working Paper No 2005-08, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=741265.