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Public policy, community ownership and clean energy

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This paper considers policies for promoting productive investments in the USA, especially as regards the project of building a clean energy economy. The four main policies examined are (i) expanding public investments throughout the economy and gaining the crowding-in benefits that will accrue from such investments, (ii) refocusing the successful but ad hoc, US model of industrial policies, (iii) advancing this agenda of public investments, industrial policy and cooperative/community ownership in ways that benefit all regions of the US equitably and (iv) promoting cooperative and community-based ownership forms, as alternatives to the private corporation.

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Introduction

The financial collapse and Great Recession of 2008–2009 made clear that relying on Wall Street to establish the pace and direction of the country's economic activity is both highly undesirable as well as economically and ecologically unsustainable. But reaching this conclusion then raises a series of difficult questions in envisioning workable paths for long-term economic revival.

Perhaps, the most challenging overarching question is what are some viable alternative models for promoting productive investment activity throughout the economy, as opposed to continuing to rely on financial bubbles to undergird growth? However, considering ways to 'undergird growth' requires us to address the environmental constraints on growth, with global climate change being the most urgent such environmental matter. We therefore need to also examine ways in which we can rebuild the economy on a new foundation of clean energy, including investments to dramatically increase energy efficiency as well as making renewable energy cost competitive and widely accessible.

Another fundamental question that flows readily out of the wreckage created by 2008–2009 Wall Street crisis is what should be done with the currently dominant business model, the publicly traded but privately owned corporation, as the economy's primary source of productive investment activity? Put somewhat differently, it is evident that we need to examine the prospects for public investment and industrial policy interventions as compliments to private business investment, to expand productive investments in general and clean energy investments

in particular. We also need to explore the potential benefits of collective private ownership forms as a viable private sector alternative to corporate ownership.

This paper begins by pursuing these questions within the general context of debates around public investment and industrial policy as these policy measures have been practiced within the US economy. The second section starts with a brief review on the long-standing question as to whether public investments in the traditional areas of transportation, energy and water management divert scare resources that would otherwise be available to private investors or whether these public investments create a nurturing environment that encourages more spending by private investors. I conclude from our review of this evidence that a large-scale commitment to public investment projects that are well-designed and implemented do indeed provide a crucial foundation supporting the healthy long-term growth of private investment. Public investment can also serve as the leading edge in building a clean energy infrastructure throughout the USA.

In the third section, I review similar issues regarding industrial policies—that is, policies to promote research and development, moving the technical innovations from R&D investments into commercial use and raising productivity and competitiveness by getting businesses to adopt these innovations as rapidly as possible. Opponents of industrial policies in the US context have long argued that government policymakers are singularly incapable of 'picking winners' in the areas of technological innovations that will become commercially successful. But the historical record tells us that the US government—and particularly the US military—have been instrumental in developing all the most important commercially successful technologies of the last century, including jet aviation, the computer, the Internet and bioengineering. An industrial policy framework outside the Pentagon could serve as a primary incubator for advancing green energy technologies that are not yet cost competitive, such as most forms of solar energy.

To make the public investment and industrial policies viable within the US political and economic context, they must be seen as providing benefits equitably across all regions of the country. This issue, which I take up in the fourth section, is especially critical in considering a transition from a fossil fuel to a clean energy-based economy. The clean energy transition could generate major regional disparities, including substantial losses for fossil fuel producing regions as well as disproportionate gains for regions with natural advantages in generating renewable energy, such as an abundance of sun or wind. If large-scale programmes of public investment and industrial policy are going to succeed over time in the US context, they will need to incorporate measures to attenuate such disparate regional impacts.

In the fifth section, I consider how cooperative and collective private ownership can serve to promote industrial renewal, in particular towards building a new clean energy foundation. As we will review, the energy sector is a fertile area for examining such questions. This is because, worldwide, it has long operated under a variety of ownership structures. This is certainly the case for renewable energy projects in Western Europe. Indeed, cooperative and collective ownership forms have been highly successful in various Western European countries in building renewable energy sectors, and innovative approaches are also operating successfully in the USA.

In the conclusion, I provide a brief review of proposals for moving forward with the project of reviving productive investment in the USA and especially on the epoch-defining project of creating a new economic foundation powered by clean energy.

While this paper covers a wide range of interrelated issues, it also leaves aside equally important topics in the interests of space and maintaining focus. In particular, trade policy, managing the dollar, the regulation of financial markets and the fiscal deficit are all issues that are closely associated with the main themes of the paper. I also consider only in passing the effects of the various proposals on employment. These are all topics that I have addressed elsewhere and will continue to explore in future work.[1]

US 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 US infrastructure system, in other words, has always been a joint venture of the public and private sectors, refuting, as an initial observation, any notion that private initiative alone is the wellspring of US prosperity. It will certainly be the case that creating a clean energy-based economy will also involve an effective combination of public and private ownership forms.

As of 2007, the value of public non-defence-related assets in the overall US 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% of private assets. Despite this formidable stock of public assets, rates of public investment fell substantially since peaking in the second half of the 1960s. This is because for most of the past generation, both Democratic and Republican policymakers have taken little action to reverse the decline in the rate of public investment.[2] However, with the passage in February 2009 of the Obama economic stimulus programme—the American Recovery and Reinvestment Act (ARRA)—the Obama administration and US Congress gave a powerful endorsement on behalf of the central importance of public investment. Of the total $787 billion in stimulus funds over 2 years, about $80 billion was devoted to clean energy investments and another $65 billion to traditional infrastructure improvements. At the same time, the ARRA was a short-run stimulus programme only. Whether the commitments embedded in the ARRA will be transformed into a long-run investment agenda in both traditional infrastructure areas as well as clean energy remains as an open question.

Public investment patterns, 1950–2007

Figure 1 below provides an overview of what has happened to public investments in the US economy over nearly 60 years, from 1950 to 2007, that is, just before the Great Recession began in 2008. As the figure shows, the rate of public investment—specifically, the growth rate of public assets—proceeds through two distinct phases: the first covering the 25-year period 1950–1974 and the second from 1975 to 2007. Over the 1950–1974 period, the growth of public investment averaged 4.3% per year, peaking in 1966 at 6.1%. By contrast, from 1975 to 2007, public investment grew at an average rate of only 2.3% 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.

Figure 2 provides further perspective on the growth trajectory of US public investment, by comparing long-run changes in Gross Domestic

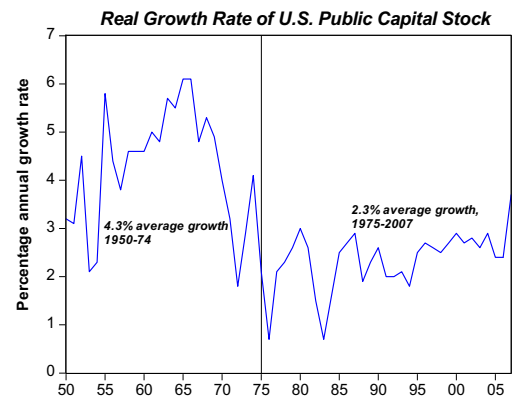

Figure 1. *Average rate of US public investment, 1950–2007.*
Source: US Department of Commerce, Bureau of Economic Analysis.
Note: Figures are in real, inflation-adjusted dollars, net of depreciation.

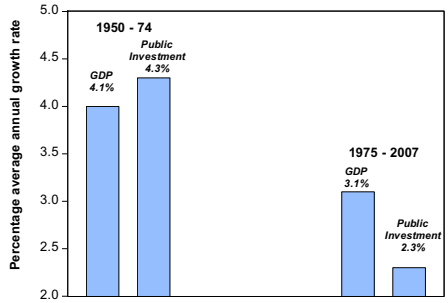

Figure 2. *US GDP and public investment growth averages, 1950–2007.*
Source: US Department of Commerce, Bureau of Economic Analysis
Note: Growth of public investment defined as the inflation-adjusted growth of public capital stock, net of depreciation.

Product (GDP) as well as public investment. As the figure shows, from 1950 to 1974, GDP and public investment grew at basically the same relatively high rate, 4.1 and 4.3%, respectively. From 1975 to 2007, the growth of both GDP and public investment ratcheted downward, with GDP at 3.1% average annual growth, while public investment fell to a 2.3% average growth rate.[3]

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 to 2007 relative to 1950–1974. Based on these figures alone, we are not yet able to conclude the extent to which causation runs in either direction—that is, 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 1950–1974 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.

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% as against a 2.3% 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 US economy has been proceeding with a diminishing supply of public assets on which to foster growth.

Public investment and growth: cause or effect?

The standard argument against increasing the level of public investment is that it will crowd out private investment—that is an increase in public infrastructure spending will be associated with an equivalent decline in private investment. The data we presented above do not themselves resolve this since, again, the high level of public investment between 1950 and 1974 could simply have been an outgrowth of broader forces pushing the private sector forward.

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 from 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.

In assessing this crowding out argument, one must begin with the recognition that, at most, it is plausible only under a specific set of narrow circumstances. These are when (i) all the economy's real resources are being fully utilized, that is,

workers are fully employed, and the economy's existing productive apparatus is being run full-tilt; (ii) the economy's financial resources are, correspondingly, also being fully used up in financing productive investment projects and (iii) new public investment spending makes no contribution towards expanding the economy's productive capacity— that is, it is not succeeding in its purpose of increasing the overall size of the economic pie.

Amid the aftershocks of the 2008–2009 recession, which is ongoing as I write, unemployment has continued at its highest level in a generation, while private banks and other financial institutions having extended few new credit lines to finance productive investments. The private financial institutions have chosen instead to hoard huge cash reserves and to purchase US Treasury bonds. During the recession, the private financiers had clearly decided that US Treasury bonds, not investments by private businesses, are the best place to channel their funds (see Pollin et al., 2011, for a review of this pattern). Under these circumstances, there is no possibility of public investment projects bidding scarce resources away from the private sector. Rather, under such circumstances, the $65 billion in public investments included in the ARRA was expanding employment opportunities and putting to good use the financial resources that the private sector had chosen to channel primarily into US Treasury bond purchases.

But the 2008–2009 recession and its aftermath clearly constitute an extraordinary historical experience. We need to also consider the issue of whether crowding out or crowding in is more likely to result when private sector investment is growing and unemployment is relatively low. In fact, even during such periods, 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 labour productivity—for example, 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.

Moreover, as long as public investments are supporting the growth of an economy's productive capacity, there also will not be any significant financial constraints on the expansion of either public or private investment. There are two reasons for this. The first is that successful productive investments will generate an increasing return flow of savings capable of underwriting further investment opportunities. But even more to the point, the supply of credit in a complex financial system such as that in the USA is not, in any case, significantly constrained by the economy's saving rate but rather by the willingness of private lenders and government policymakers to support investment projects that they deem as worthy.[4]

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.

These broad analytic arguments recognizing the benefits of public investment are also supported by formal econometric evidence. Most recently, Heintz (2010) built on an earlier literature developed most prominently by Munnell (1992) and Aschauer (1989) in addressing this issue. Heintz found that sustained increases in public infrastructure investment raises the growth rate of private sector GDP by a significant 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% points, after holding constant all the other factors that influence US 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% in the 10 years between 1998 – 2007 as opposed to the actual rate of 2.8% (but still well below the 4.3% average rate over 1950–1974), the cumulative additions to the public investment stock would have produced an additional $64 billion in US GDP in 2007. This impact on overall US GDP amounts to a growth dividend of about $210 in 2007 for every resident of the USA.

Green economy public investment opportunities

There are at present major opportunities for public investment projects in the USA tied to building a green economy. One important project would be to upgrade the electrical grid transmission system, to create 'smart grid' systems. A priority here would be to reduce the amount of energy that is lost when electricity is transmitted over the grid. Energy loss now roughly equals two-thirds of the total energy generated at electrical power plants. Another purpose would be for the grid system to be able to effectively handle storage of wind and solar power. This would reduce the inherent problem of intermittency with wind and solar—the fact that we cannot control when the wind blows or the sun shines.[5]

Yet, the most straightforward example of a large-scale public investment opportunity with the green economy is with retrofitting existing government-owned buildings to significantly increase efficiency in their energy consumption. The case for advancing this particular public investment programme is overwhelming, given that (i) buildings both consume and waste more energy than any other sector of the US economy; (ii) the technologies for achieving efficiency gains in buildings of 30% or more are available and demonstrated to be cost effective, typically achieving full paybacks in 3 years or less and (iii) the federal government owns and manages more buildings than any other landlord in the country. In addition, this investment project has already been mandated by the US Congress, as part of the 2007 Energy Independence and Security Act (EISA). This law requires federal government agencies to retrofit 75% of the US government's stock of buildings, to reduce energy use in these buildings by 30% as of 2015. This programme was actually signed into law in 2007 by then President George Bush but has been stalled in implementation ever since. A major benefit of implementing this energy efficiency public investment project would be to serve as a major promotion for private building owners to also invest in efficiency retrofits. The federal government's investments in this project would greatly expand attention to the available opportunities for cost savings as well as environmental benefits.[6]

Successes and failures with US industrial policy

What is industrial policy?

The term 'industrial policy' is commonly used to refer to two distinct types of government interventions. In one usage, industrial policy refers to the regulation of competition, for example policies on monopolies, mergers and market restrictive practices. In the other usage, industrial policy has a broader meaning, associated closely with the concept of a 'developmental state'—that is, a state that plays an active, if not dominant role in guiding the development trajectory of a country's economy.[7]

In this discussion, we are focused on the second meaning of industrial policy—with industrial policies as one important element of a developmental state. But with industrial policy as a tool of a developmental state, a range of policy instruments and targets are put into play, which also need to be explicitly recognized. These could include R&D subsidies for government, university or private business research centres. It could also include

preferential tax treatment, credit opportunities or direct subsidies for specific sectors of the economy, such as manufacturing or the green economy, or even more specifically, energy-efficiency building retrofits. Some types of business regulations could also be seen as industrial policy interventions. Raising automobile efficiency standards is an example of a regulation that will be crucial for building a clean energy economy in the USA. These various forms of support or regulations could then be applied narrowly within a particular region or state or industry 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 in the current US economic circumstances.

Are industrial policies defencible?

From a free market perspective, there are basically no viable arguments on behalf of industrial policies. In fact, 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. More generally, free market proponents hold that economic outcomes established through market competition, in the absence of government interference, will always produce the most efficient allocation of an economy's productive resources and the highest level of overall economic welfare.

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. As Ruttan (2006) and other leading analysts of technological development in the US economy have made clear, virtually all major technical innovations within the US 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 endeavours. Ruttan (2006) summarized the matter 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, 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. And here, we refer both to productivity as conventionally defined— that is, output per hour—but also the broader capacity to undertake R&D and successfully incorporate these innovations into production processes. 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.[9]

These considerations are relevant for a range of industries across both the manufacturing and

service sectors of the US 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.[10]

Overall then, major economy wide benefits can be achieved through industrial policies, starting with technological innovations that 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.[11] 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.

The challenges facing the creation of an economically viable solar energy industry provide a clear example of how this dynamic works. According to the most recent estimates of the US Energy Information Agency (EIA), producing electricity from solar energy is not close to being cost competitive with electricity generated by the conventional fossil fuel sources, coal and natural gas. Specifically, the EIA estimates that, as of 2016, generating electricity from solar power will range between two and five times more expensive than conventional coal or natural gas. At the same time, burning natural gas and especially coal to produce electricity generates major environmental costs through emitting greenhouse gases into the atmosphere, while solar electricity can be produced without emitting any greenhouse gases.[12]

Thus, if one holds that creating a viable solar electricity industry is imperative for controlling climate change, then the federal government will need to pursue three types of industrial policy measures: (i) support R&D to bring down the costs of solar power; (ii) subsidize solar power generation at its current level of development, thereby enabling the industry to achieve economies of scale and become more capable of incorporating new technologies and (iii) impose taxes or hard caps on the burning of coal and natural gas that reflect their environmental costs. Clearly, without such industrial policy interventions—that is, under something more akin to a free market setting—electricity produced from coal and natural gas will easily outcompete solar electricity, regardless of their negative environmental impacts.

US industrial policy in practice

The USA 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.'[13] Focusing on the post World War II era in the USA, what have been some of the major motivations behind the use of industrial policies?

Bailing out the US 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 by 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. The government financial support allowed both companies

to access restructuring credit in a period when private financing was unavailable to them. This enabled the companies to proceed rapidly through a court-supervised restructuring that shed certain liabilities (especially debt and unwanted productive facilities), while preserving the companies' overall capacity to re-emerge as viable businesses.

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). 'Voluntary' quotas on foreign cars being imported onto US markets followed soon thereafter.[14] 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.

States and municipalities competing to attract businesses

Over the past four decades, states and municipalities in the USA have competed, sometimes intensively, among themselves to attract businesses to locate within their borders. The main weapon in this competition has been various types of tax incentives. Foreign auto companies have been among the most favoured recipients of such support, including, just since 2006: $400 million from West Point Georgia for Kia Motors; $141 million from Greensburg, Indiana for Honda; $300 million from Blue Springs, Mississippi for Toyota and $577 million from Chattanooga, Tennessee for Volkswagon.[15] 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 neighbouring 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 programmes (Wilson, 2005). These programmes 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.[16]

National defence

By far, the most extensive use in the USA of the industrial policy tool kit has been in the area of national defence. 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 US 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 US economic development for generations, it is important for our purposes to examine these experiences further.

Lessons from Pentagon-based industrial policies

Ruttan (2006) provides an important in-depth exploration of the role of Pentagon-based industrial policies for advancing technical progress throughout US history. 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 private market.

The enormous success of Pentagon-based industrial policy in the USA raises the basic question: is

the only way US policymakers can manage industrial policies successfully is to place the Pentagon in charge of the operation? In fact, 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.

At the same time, conducting industrial policies in the USA on the basis of a model developed by the Pentagon has meant that the military has exercised disproportionate influence over what passes as legitimate aims of such policies and over the 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.[17]

This raises a more general principle: that for private businesses to receive desirable government contracts and subsidies, they have to expect to operate in ways consistent with the society's broader welfare aims. Here then, is the overarching challenge in trying to design industrial policies to advance, among other goals, a renewed manufacturing sector and a rewired energy system based on clean energy sources. As a technical matter, we do already have the policy apparatus to successfully implement such policies. But we lack the experience, administrative capacity and political will to advance this agenda outside of the Pentagon.

Regional equity with public investments and industrial policies

Public investments and industrial policy should properly be seen as economy wide endeavours. At the same time, all such initiatives are also necessarily tied to specific locations. Some specific localities and regions gain when they are the beneficiaries of public support, while other localities and regions lose if they are not selected to receive public policy support. This raises the question: how can public investment projects and industrial policies be advanced in ways that are equitable across regions and that do not waste money through inter-regional rent-seeking competition for funds?

Especially as regards a clean energy investment agenda, this may seem to present significant challenges. To begin with, it is clear that some regions and states will have built-in advantages tied to climate, topography or geography, including areas that are more sunny or windy or capable of producing agricultural products as feedstocks for the next generation of biofuels. But obvious political problems would arise to the extent that US policymakers were to privilege certain regions with disproportionate shares of public investment and industrial policy support based on these advantages, while other regions were providing financial support for such projects without receiving a reasonable share of immediate benefits. But beyond such purely political considerations, it is also true that on analytic grounds alone, it would be difficult to establish clear criteria for giving disproportionate benefits to any given region or state based purely on climate or geography. For example, Arizona is very sunny but is that natural resource more deserving of receiving investment support than, say, the fact that parts of Minnesota are very windy?

It is also important to consider this same problem from the opposite perspective—that is, from the view of regions that are currently heavily invested in various sectors of the fossil fuel industry and therefore will be disproportionately impacted negatively by public investments and industrial policies targeted at boosting the clean energy industry. This will include oil-producing states, such as Texas, Louisiana and Oklahoma, and coal-producing regions such as the Appalachian region and Montana. Again, purely political concerns aside, what would be the proper approach to weighing public investments and public policies that would help

compensate these regions for the economic losses they will experience?

In fact, there is a straightforward approach to resolving such issues. It builds from the fact that crucial elements of the clean energy agenda will require large-scale investments in all regions. The most obvious example of this is the project to retrofit the country's entire existing building stock to increase energy efficiency, starting, as described above, with the entire federal government's own building stock. Similarly, expanding public transportation systems and upgrading electrical grid transmission lines will need to be undertaken in all parts of the country, regardless of any particular geographic or climatic advantages or disadvantages.

As such, the most straightforward approach for allocating public investment funds and subsidies tied to industrial policy will be through a simple formula through which all regions benefit equivalently. For example, in previous work (Pollin et al., 2009), my coauthors and I have proposed a formula for allocating funds that distributes clean energy investment support based equally on a state's share of total national GDP and its share of total population. Distributing funds on the basis of each state's share of total GDP means assigning proportions of total spending based on existing patterns of financial investments and levels of development. This provides an accurate measure of how clean energy investment would flow if they followed current levels of economic development across states. Distributing the funds based on each state's population assumes a more egalitarian approach, with each person in the country effectively receiving an equal dollar claim on an overall pool of public support and investment funds.

Within this framework, to then address the disproportionately negative impacts on fossil fuel-dependent regions, the simplest approach is to allow that states with larger-than-average fossil fuel industries will also be given compensation that will focus on adjustment and relocation issues, but equally on advancing the elements of a clean energy agenda that are most appropriate for that area. For example, Texas and Montana could receive additional support on behalf of building a wind energy industry in those areas, while the Appalachian region could receive extra support for upgrading the energy efficiency of their building stock and electrical grid transmission system.

In fact, distributing public investment and industrial policy subsidies equitably on a regional basis is an approach with which US policymakers have long been familiar. Spending by the Pentagon is already distributed on a basis of reasonable parity across all states.[18] This, moreover, has been crucial in the ability of the military to maintain public support. Whatever the merits of this in terms of the efficient allocation of the Pentagon's enormous resources, it does at least demonstrate that for other areas of public investment and industrial policy, where equitable distribution is a major issue, a viable system can readily be developed.

The role for alternative ownership forms

The 2008–2009 global financial crisis and Great Recession offered dramatic evidence of the severe problems with the private for-profit corporate ownership form as the primary framework for promoting long-term productive investments, as opposed to short-term speculative financial engineering.

The problems with the private corporate ownership form have been recognized long before the 2008–2009 crisis, even within the mainstream economics literature (Pollin, 1995 provides a brief survey of this literature). For the present discussion, the most important matter at stake is that the traditional private corporate enterprise operates with a strong bias supporting shorter time horizons by managers in evaluating the viability of new investments. This short-term bias is tied to the need to maximize shareholder value, by achieving ambitious share-price and dividend benchmarks on a quarterly basis. This bias is reinforced by the fact that the compensation of top managers depends on hitting such short-term benchmarks.[19]

Of course, recognizing these problems with private non-financial corporations as an ownership form does not necessarily mean that alternative ownership forms will create a more effective set of incentives to promote long time horizons and,

specifically, a stronger commitment to long-term investments tied to creating a clean energy economy. However, one can conclude from the relevant literature that alternative ownership structures, such as various forms of cooperatives and community-owned enterprises, may well create a more supportive environment with respect to advancing such major structural changes in the economy. But what also emerges from the literature is that it is most appropriate to pursue this question in terms of a specific set of issues relating to specific industries. This is certainly the conclusion that Hansmann (1996) reached in his classic survey of the relative merits of alternative ownership form. Hansmann writes:

> As a general matter, one cannot say that one form of ownership is superior to another. Ownership by any group of a firm's patrons—whether investors, consumers, workers, or other suppliers—can be efficient in the appropriate context, and the same is true of nonprofit firms. Each type of ownership has its appropriate niche in the economy (287).

In short, for the purposes of promoting commercialization of clean energy technologies and building broad public support for these transformational changes within a range of communities, there is certainly a case worth considering on behalf of ownership forms other than the traditional non-financial corporation.[20]

Alternative ownership forms in the energy sector

The energy sector is a fertile area for examining this question since worldwide, it has long operated under a variety of ownership structures, including public/municipal ownership and various forms of private cooperative ownership in addition to private corporate entities. The alternative ownership forms operate in all areas of the energy industry, including with both the conventional fossil fuel energy sources and within the renewable sectors. The European industry, in particular, operates with a high proportion of cooperative ownership forms, and the relative performance of these non-corporate business enterprises has generally been quite favourable relative to the traditional corporate firms. Two areas where we can observe this clearly are with research and development across the electricity sector and in the emergence of various sorts of community-based wind farms.

Research and development in electricity

Of course, the project of building a clean energy economy will entail large-scale commitments for R&D and innovative approaches to commercialization of new technologies. With this in mind, the study by Sterlacchini (2010) is significant for examining the relationship between spending on R&D in the advanced industrialized economies the field of energy/electricity between 1990 and 2004 and changes in the predominant ownership structures in the industry. In particular, Sterlacchini finds that

> Within the most developed areas of the world, R&D investment in the field of energy/electricity has declined dramatically over the last decades. Although even public research has been reduced, the key area of concern rests on the behaviour of the electricity supply industry. Investment in energy R&D by US utilities fell by 72 percent between 1990 and 2004. Over the same period, the electric companies of the EU reduced R&D expenditures by 62 percent (2010, 2).

Further, Sterlacchini concludes that this drastic decline in R&D spending resulted primarily from the widespread movement to privatize the electricity market, beginning in the 1990s. According to Sterlacchini, privatization in electricity has ''increased competitive pressures to cut costs and those concerned with R&D have been particularly vulnerable. In particular, electric utilities have abandoned the long-term research projects concerned with fundamental and general-purpose technologies'' (2).

Community-owned wind farms

Bolinger (2001, 2005) has conducted comparative studies of 'community ownership forms' in the wind energy industry specifically, in both Europe

and USA. Bolinger defines 'community wind' as ''locally owned utility-scale wind development that is interconnected to the grid on either the customer or the utility side of the meter.''[21] Bolinger reports that, at the end of the year 2000, roughly 80% of all wind power capacity in four northern European countries—Germany, Denmark, Sweden and the UK—could be considered community-owned. Moreover, because these four countries accounted for roughly half of the world's installed wind power capacity at that time, this means that community-owned projects accounted for roughly 40% of world wind power development at the end of 2000. In the USA, by contrast, the development of community ownership in the wind industry has been negligible to date. Virtually, all wind-energy projects have been large-scale corporate-owned wind farms. At the same time, there is some evidence that community wind projects are advancing, especially in Minnesota, Wisconsin, Iowa and Massachusetts, where both the physical and the legal environments are relatively supportive (see also Kinzel and Kildegaard, 2009).

Bolinger describes four important advantages to community ownership structures in the wind industry relative to traditional corporate ownership forms. These include:

Lower costs of capital Community-based wind projects in Europe have been able to rely on a wide array of relatively smaller scale local investors. In the USA, community wind projects could have access to the capital market for 'socially responsible' investing, which Bolinger estimates as being in the range of $2 trillion overall. Moreover, a study by Wiser and Pickle (1997) estimated that the costs of wind power could fall by 22% if the investors' required rate of return could fall from, say, 18 to 12%.

Increased public support Direct community ownership of wind projects has raised public awareness in Europe and increased the number of local people who have direct financial stakes in such projects. Among other things, this has reduced community resistance to projects at the planning and permitting stages.

Potential for distributed generation benefits The relatively smaller size of community-owned projects creates the potential to site projects closer to where the turbines are sited and the energy is generated. This creates the possibility for significant reductions in the costs of transmitting energy over the grid. In Europe, clusters of wind turbines are often connected into the grid without requiring any additional grid reinforcements. Such benefits are more likely to be available when community wind projects are established in more densely populated areas. For example, in Copenhagen as of 2005, two community-owned wind projects were operating within the city limits.

Electricity price stability Community-owned wind projects operate at arms length from the two forces that are most responsible for creating instability in energy prices generally and electricity prices specifically—that is the global market for oil and the speculative commodities futures market for energy, including electricity. Indeed, it was the deregulation of the electricity market in the USA in 2000 that enabled the Enron Corporation to take control of the market and cause a huge run-up in prices at that time (as well as, 3 years later, the demise of Enron itself).[22] Because, by their basic ownership structure, community-based wind projects will continue to operate independent of the global price of oil as well as the commodities futures markets, this should create long-term conditions supportive of electricity price stability.

Against these built-in advantages of community-based wind projects, Bolinger notes disadvantages as well. The most significant is the greater difficulty with such projects in capturing economies of scale. Community-owned projects will tend to be smaller in scale than corporate-owned wind farms, though they do not necessarily have to operate on a small scale. This is precisely because they are tied to specific communities and local financing sources. Large-scale corporate wind farms are thus better equipped to spread the fixed costs of any given project, including permitting and legal costs and the full range of construction and transmission costs.

As Bolinger emphasizes, there will be conditions under which the benefits of economies of scale outweigh those of community-owned projects. But the reverse will also certainly be the case in many

instances. The experiences in Germany, Denmark, Sweden and the UK make clear that community-based ownership structures can succeed in the wind industry. It is also true that the incentive structure and regulatory environment in Europe are more supportive of a community-based model. The most important factor here is the prevalence of 'feed-in' laws in Europe. The feed-in laws guarantee access to the grid for small-scale producers and also establish a guaranteed price at which utilities must purchase electricity from wind and other renewable energy producers. But feed-in laws and similar incentives for renewable energy development were initially popularized in the USA, especially in California in the 1980s. Such laws could of course be reestablished within the USA. They would constitute one significant measure for advancing a clean energy investment agenda tied to community ownership standards.[23]

Conclusions

The historic severity of the 2008–2009 Great Recession and its aftermath make clear the need for a new policy framework in the USA to promote a focus on productive investments over Wall Street speculation as the economy's central engine of forward progress. In addition, the reality of global climate change requires that one fundamental element of any such new growth engine will be the transition from the current fossil fuel-based economy to one powered by clean energy.

The main conclusion of this paper is that advancing a new growth model will require both public investments and industrial policies operating on a large scale throughout the US economy. The discussion here focuses on how both public investment and industrial policies have been successful historically within the US economy in raising productivity and promoting technical innovation—often, as with the cases of jet aviation, the computer and the Internet—to spectacular effect. These past advances in productivity and technical innovation have then created a nurturing environment for successful private sector investments. As I review here, it is simply not true that, on balance, these policy measures have been failures. Specifically, it is not true that public investments in the USA have mainly served to 'crowd out' more efficient private investors or that industrial policies have mainly entailed government bureaucracies ineptly attempting to 'pick winners.'

Moreover, I argue here that public investment and industrial policies will be necessary for delivering a clean energy economy over the next generation. Indeed, the development of a clean energy economy will advance fitfully, if at all, if the federal government does not, for example, invest in energy efficiency retrofits for its own entire building stock and provide major support for the solar energy industry.

We have also discussed the need for a commitment to regional equity in pursuing both public investments and industrial policies throughout the USA. If regional equity is not established at the outset as the norm—for example, in supporting a clean energy transition—the project will almost certainly collapse for lack of broadly based political support. But the case for regional equity is not merely a matter of political expediency. In again considering the clean energy transition as a case in point, it is certainly true that areas which are unusually windy or sunny will stand to benefit more, while areas tied to the fossil fuel economy will be hurt disproportionately, unless efforts are made to counterbalance these built-in advantages or disadvantages. Such countervailing measures could include differential levels of public investment in building retrofits, renovations of the electrical grid or public transportation systems to keep the overall levels of public support in relative balance by regions.

Finally, I argue that building a new growth engine around productive investments in general and clean energy in particular cannot rely on traditional non-financial corporations to the overwhelming degree that has been done in the Wall Street-dominated economy of the past generation. As we have discussed, the private corporate model tends to promote short-termism—that is, to focus excessively on short-term financial manipulations to the detriment of long-term development of productive assets and activities. An economy newly grounded

in productive activity will benefit through being more closely tied to cooperative- and community-based models of private business. Aside from the intrinsic benefits of broadening opportunities for democratic decision making over major economic matters, the specific case of the energy sector makes clear that there can be more narrowly defined economic benefits from a community/cooperative-based business enterprises. These include lower cost-of-capital, increased public support and electricity price stability.

Creating a new framework for productive investments will obviously entail major challenges. However, the history of the most recent financial collapse and recession makes clear that there are no alternatives to facing these challenges, given that the Wall Street model for economic growth is unsustainable as well as undesirable, and is likely to again yield disastrous results as long as we continue to rely on it.

Endnotes

[1] For references to recent work on these related themes, see the website of the Political Economy Research Institute, www.peri.umass.edu. A companion paper that develops specific policy proposals for US manufacturing, especially in the area of bus manufacturing to expand public transportation, is Pollin and Baker, 2010.

[2] 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 programme. But Clinton never followed through on his public investment agenda (Pollin, 2004 discusses the Clinton experience at length).

[3] Details on how these figures were generated are presented in Heintz et al. (2009).

[4] Pollin (1997) explores this issue at length.

[5] See Chupka et al. (2008) for an overview of long-term investment opportunities in upgrading the US electrical grid system.

[6] A short survey of the current status of the efficiency provisions of EISA is in Leanne Tobias, 'Three Sure-Fire Green Solutions Obama Should Put in His Jobs Speech,' *GreenBiz.com*, 9/7/11. The major opportunities for both cost savings and environmental gains through investments in building retrofits are surveyed well in National Academy of Sciences (2010).

[7] Pitelis (2001) provides a succinct survey these alternative meanings to the term 'industrial policy.'

[8] Sawyer (1994) 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, 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 US policy discussions.

[9] 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 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 an instrument of trade competiveness to the exclusion of exchange rate management. If the US dollar remains significantly overvalued, this will work against all positive initiatives to promote productivity.

[10] Howes and Singh (2000) effectively review the long-standing literature, including the key contributions by Kaldor and Verdoorn, on the centrality of technical innovation in manufacturing for achieving and sustaining export competitiveness. This point was well captured in a recent press story, 'Can the Future be Built in America?' by Pete Engardio in a 9/21/09 *Business Week* cover story.

[11] 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 US 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.

[12] According to the US Energy Information Agency (2011), electricity from solar energy will cost between $211 and $312 per megawatt hour in 2016, while natural gas and coal will cost, respectively, $65 and $95 per megawatt hour. The greenhouse gas emissions from natural gas and coal are, respectively, 52 and 95 million metric tons per quadrillion BTUs of energy.

[13] Bingham (1998) Chapter 2 presents an overview of what he terms ''America's long history of industrial policy.'' Of course, other countries have had a wide range of experiences, and, in some cases, spectacular successes in advancing innovative growth trajectories though industrial policies. Outstanding studies on industrial policies and development in Japan, South Korea and other Asian tigers include Johnson (1982), Amsden (1989, 2001) and Wade (1990).

[14] Useful references on both auto bailouts are Cooney et al. (2009), Bickley (2008) and Freeman and Mendelowitz (1982). As it happened, the loan guarantee feature of the bailout packages were never needed, and the US government were repaid in full for the loans they extended.

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

[16] The basic data for these revenue losses come from the Staff of the Joint Committee on Taxation, US Congress, 'Estimates of Federal Tax Expenditures,' various years.

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

[18] See 'Federal Government Expenduture, Per Capita Amounts by State, By Major Agency, Fiscal Year 2009', http://www.census.gov/prod/2010pubs/fas-09.pdf

[19] One of the most valuable studies on this problem, based on interviews with corporate CEOs in the USA, Europe and Japan, is Poterba and Summers (1995).

[20] Michie (2010) reaches the same conclusion in his recent analysis of alternative ownership structures within the financial services industry.

[21] He further defines 'locally owned' to mean that one or more members of the local community have a direct financial stake in the project and that 'utility scale' refers to new projects consisting of one or more turbines of 600 kW or greater in nameplate capacity or older projects in excess of 50 kW.

[22] See, for example, UNCTAD (2009) for a description of the deregulation of the market for trading in electricity supply that led to the collapse of Enron.

[23] The province of Ontario, Canada, is currently implementing an innovative policy agenda along these lines, the Green Energy Act. This measure provides for a rich feed-in tariff programme for solar, wind and other green electricity sources, with mandated minimum levels domestic content in qualifying investments. The measure also provides somewhat more favourable rates for projects undertaken by community-based non-profit forms of development. Pollin and Garrett-Peltier (2009) provides an assessment of this programme, especially in terms of its capacity to generate increased employment opportunities in the region.

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