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Job Loss and Infrastructure Job Creation During the Recession

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Job Loss and Infrastructure Job Creation During the Recession

Abstract

[Excerpt] After the long economic expansion that characterized much of the current decade, the nation entered its eleventh postwar recession in December 2007. The unemployment rate rose from 5.0% in that month to 6.7% in November 2008, the latest data released to date by the U.S. Bureau of Labor Statistics (BLS). A majority of those unemployed in November—some 6 out of 10 million people—had been laid off by their employers. In November 2008 alone, employment at nonfarm businesses fell by 533,000, marking the biggest one-month drop recorded by the BLS Current Employment Statistics program since December 1974.

The announcement by the Business Cycle Dating Committee in November 2008 that a recession had begun, which preceded by one week the monthly BLS *Employment Situation* release containing employment and unemployment data for November, intensified congressional interest in passage of legislation aimed at encouraging creation of new jobs and warding off the further loss of jobs. In the 110th Congress, the Senate did not act on legislation (H.R. 7110) the House passed in September 2008, which contained among other things spending on infrastructure (public works) projects to promote employment in the troubled construction industry and in industries that supply it with goods and services (e.g., concrete and steel manufacturing). To mitigate all but one recession since the 1960s, Congress has chosen to increase federal expenditures on infrastructure. This means of job creation has not been without its critics, however, chiefly because of how long it typically takes for public works projects to start up. (See CRS Report 92-939, *Countercyclical Job Creation Programs*, by Linda Levine, for more information.) This would seem to be less of an issue if the recession is a long one and if Congress passes the legislation while the recession is still taking place.

Members of Congress have spoken of having ready for the president's signature shortly after his inauguration a second economic stimulus bill that would include provisions to create and maintain jobs in the construction industry and in other infrastructure-dependent industries. A more expansive definition of public works than was used in the past is under consideration; one which includes so-called green jobs. Although no consensus definition currently exists, they appear to include jobs in the renewable energy industries (e.g., wind, solar), jobs retrofitting buildings to be more energy efficient, and jobs expanding mass transit systems. The report first examines trends in employment and job loss since the start of the latest recession. It next focuses on job creation estimates associated with increased spending on infrastructure, placing a heavy emphasis on explaining the limitations and caveats associated with the input-output methodology that often is utilized to develop the estimates. The report will be updated after the 111th Congress convenes to reflect legislation that includes "direct job creation" provisions, i.e., economic stimulus bills having the government raise demand for goods and services through increased federal spending for the purpose of creating and preserving jobs. It will not discuss stimulus measures that give consumers more money in the hope they will spend rather than save it and that provide income support such as extension of unemployment benefits. (Information on these forms of fiscal stimulus can be found in CRS Report RL34349, *Economic Slowdown: Issues and Policies*, by Jane G. Gravelle et al.)

Keywords

job loss, job creation, infrastructure, recession, public policy

Comments

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Job Loss and Infrastructure Job Creation During the Recession

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Summary

After the long economic expansion that characterized much of the current decade, the nation entered its eleventh postwar recession in December 2007. The unemployment rate rose from 5.0% in that month to 6.7% in November 2008, the latest data released to date by the U.S. Bureau of Labor Statistics (BLS). A majority of those unemployed in November—some 6 out of 10 million people—had been laid off by their employers. In November 2008 alone, employment at nonfarm businesses fell by 533,000, marking the biggest one-month drop recorded by the BLS Current Employment Statistics program since December 1974.

The announcement by the Business Cycle Dating Committee in November 2008 that a recession had begun, which preceded by one week the monthly BLS *Employment Situation* release containing employment and unemployment data for November, intensified congressional interest in passage of legislation aimed at encouraging creation of new jobs and warding off the further loss of jobs. In the 110th Congress, the Senate did not act on legislation (H.R. 7110) the House passed in September 2008, which contained among other things spending on infrastructure (public works) projects to promote employment in the troubled construction industry and in industries that supply it with goods and services (e.g., concrete and steel manufacturing). To mitigate all but one recession since the 1960s, Congress has chosen to increase federal expenditures on infrastructure. This means of job creation has not been without its critics, however, chiefly because of how long it typically takes for public works projects to start up. (See CRS Report 92-939, *Countercyclical Job Creation Programs*, by Linda Levine, for more information.) This would seem to be less of an issue if the recession is a long one and if Congress passes the legislation while the recession is still taking place.

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The report first examines trends in employment and job loss since the start of the latest recession. It next focuses on job creation estimates associated with increased spending on infrastructure, placing a heavy emphasis on explaining the limitations and caveats associated with the input-output methodology that often is utilized to develop the estimates. The report will be updated after the 111th Congress convenes to reflect legislation that includes "direct job creation" provisions, i.e., economic stimulus bills having the government raise demand for goods and services through increased federal spending for the purpose of creating and preserving jobs. It will not discuss stimulus measures that give consumers more money in the hope they will spend rather than save it and that provide income support such as extension of unemployment benefits. (Information on these forms of fiscal stimulus can be found in CRS Report RL34349, *Economic Slowdown: Issues and Policies*, by Jane G. Gravelle et al.)

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After the long economic expansion that characterized much of the current decade, the nation entered its eleventh postwar recession in December 2007. The unemployment rate, which is a lagging economic indicator, did not start to rise until May 2008 when it jumped 0.5 percentage points to 5.5%. Since then it has risen another 1.2 percentage points, reaching 6.7% in November 2008, according to the latest data to date from the U.S. Bureau of Labor Statistics (BLS). In November 2008 alone, employment at nonfarm businesses fell by 533,000 – the biggest one-month drop recorded by the BLS Current Employment Statistics program (CES) since December 1974.

The Business Cycle Dating Committee of the National Bureau of Economic Research, the official arbiter of peaks and troughs in the business cycle, announced at the end of November 2008 that a substantial and widespread decline in economic activity had begun a year earlier. December 2007 marks both the end of the 73-month economic expansion that began in March 2001, and the beginning of the latest recession. As part of its announcement, the committee noted that it “views the payroll employment measure, which is based on a large survey of employers, as the most reliable comprehensive estimate of employment. This series [the CES] reached a peak in December 2007 and has declined every month since then.” Employment is one of several measures of economic activity that the committee examines to reach its determinations.

The committee’s announcement, which preceded by one week the monthly BLS *Employment Situation* release containing employment and unemployment data for November,¹ has intensified congressional interest in passage of legislation aimed at encouraging creation of new jobs and warding off the further loss of jobs. In the 110th Congress, the Senate did not act on legislation (H.R. 7110) the House passed in September 2008, which contained among other things spending on infrastructure (public works) projects to promote employment in the troubled construction industry and in industries that supply it with goods and services (e.g., concrete and steel manufacturing). To mitigate all but one recession since the 1960s, Congress has chosen to increase federal expenditures on public works. This means of job creation has been subject to criticism, however, chiefly because of the length of time it typically takes public works projects to start up. (For more information see CRS Report 92-939, *Countercyclical Job Creation Programs*, by Linda Levine.) This would seem to be less of an issue if the recession is a long one and if Congress passes the legislation while the recession is still in progress.

Members of Congress have spoken of having ready for the president’s signature shortly after his inauguration a second economic stimulus bill that would include provisions to create and maintain jobs in the construction industry and in other infrastructure-dependent industries. A more expansive definition of public works than was used in the past is under consideration; one which includes so-called green jobs. Although no consensus definition currently exists, they appear to include jobs in renewable energy industries (e.g., wind, solar and geothermal), jobs retrofitting buildings to be more energy efficient, and jobs expanding mass transit systems.

The report first examines trends in employment and job loss since the latest recession began. It next focuses on job creation estimates associated with increased spending on infrastructure, placing a heavy emphasis on explaining the limitations and caveats associated with the input-output methodology that often is utilized to develop the estimates. Upon their anticipated introduction during the 111th Congress, the report will close with presentation of legislation that

¹ U.S. Bureau of Labor Statistics, “The Employment Situation: November 2008,” press release, December 5, 2008, <http://stats.bls.gov/news.release/empst.nr0.htm>.

includes “direct job creation” provisions, i.e., bills having the government raise demand for goods and services through increased federal spending for the purpose of creating and preserving jobs. It will not discuss stimulus measures that give consumers more money in the hope they will spend rather than save it and that provide income support such as extension of unemployment benefits. (Information on these forms of fiscal stimulus can be found in CRS Report RL34349, *Economic Slowdown: Issues and Policies*, by Jane G. Gravelle et al.)

Employment and Unemployment Through Job Loss

As shown in **Table 1**, employment on nonfarm payrolls has steadily declined since December 2007. The number of job cutbacks intensified in the last few months of 2008. Two-thirds of the more than 1.9 million jobs lost since the recession’s start occurred between September and November 2008.

Table 1. Payroll Jobs at Nonfarm Employers

seasonally adjusted employment in thousands

Year by Month	Total Employment	Private Sector Employment
2007		
December	138,078	115,745
2008		
January	138,002	115,666
February	137,919	115,557
March	137,831	115,454
April	137,764	115,363
May	137,717	115,264
June	137,617	115,154
July	137,550	115,048
August	137,423	114,909
September	137,020	114,525
October	136,700(p)	114,163(p)
November	136,167(p)	113,623(p)

Source: U.S. Bureau of Labor Statistics, data from the Current Employment Statistics program.

Notes: (p) = preliminary.

As is typical during economic downturns, employees in the goods-producing sector have been the most adversely affected. They saw their ranks shrink by almost 1.1 million between December 2007 and November 2008. (See **Table 2**.) Workers in the sector’s construction industry began experiencing job losses before the economy-wide downturn began. Nonetheless, between the recession’s onset and November 2008, construction firms cut 513,000 jobs. Across all manufacturing industries, employment fell by 604,000 over the 11-month period. Although manufacturing job losses have been widespread, two industries that produce durable goods—fabricated metal products (e.g., hardware, wire, and screws) and transportation equipment (e.g., motor vehicles and parts) – and one that produces nondurable goods – plastics and rubber

products—have been particularly hard hit. Between December 2007 and November 2008, employment contracted by 144,600 jobs in transportation equipment; 67,000 jobs in fabricated metal products; and 44,000 jobs in plastics and rubber products.²

Table 2. Number of Payroll Jobs by Industry

seasonally adjusted employment in thousands

Industry by Sector	Employment, December 2007	Employment, November 2008(p)
Goods-producing sector	21,976	20,920
Natural resources and mining	739	800
Construction	7,465	6,952
Manufacturing	13,772	13,168
Service-providing sector	116,102	115,247
Trade, transportation and utilities	26,658	25,997
Wholesale trade	6,073	5,950
Retail trade	15,488	15,046
Transportation and warehousing	4,539	4,417
Utilities	557	564
Information	3,018	2,953
Financial activities	8,252	8,110
Professional and business services	18,131	17,590
Education and health services	18,568	19,073
Leisure and hospitality	13,635	13,486
Other services	5,507	5,514
Government	22,333	22,544

Source: U.S. Bureau of Labor Statistics, data from the Current Employment Statistics program.

Notes: (p)=preliminary.

Employment in the service-providing sector overall did not begin to contract until May 2008, when losses started outweighing growth in government, education and health services, other services, and utilities. As shown in **Table 2**, these four industries reported higher employment in November 2008 than at the outset of the recession. In contrast, the financial activities industry began to lose jobs before the advent of the economy-wide downturn. This mirrors the above-mentioned trend in construction employment in part because real estate is a component of financial activities and it, like construction, has been hurt by the collapse of the housing market. Other components of financial activities, such as brokerage firms that packaged high-risk mortgages and the investors (e.g., banks) that purchased them, have been negatively affected by the housing market downturn as well.

² Data available at <http://stats.bls.gov/ces>.

Prospects for job growth resuming in the near-term look dim. Based on information gathered from such sources as newspapers, trade publications, and Securities and Exchange Commission filings, the outplacement firm of Challenger, Gray & Christmas reported that during 2008 companies have announced their intention to lay off increasingly large numbers of workers. Firms announced job cuts totaling more than one million between January and November 2008.³ In November, financial companies announced the largest number of jobs to be eliminated, 91,356, driven principally by Citigroup's stated intention to shed about 50,000 jobs worldwide. In addition, the Blue Chip Economic Indicators reported the consensus forecast among the nation's leading business economists that firms will not expand employment until 2010.⁴ The 50-plus economists, who are employed by major manufacturers, banks, insurance companies, and brokerage firms, also forecast that the unemployment rate will continue to rise through 2009, with some expecting the rate will peak in the second half of the year and others, in the first half of 2010.

To date, the unemployment rate has risen to 6.7% from 5.0% in December 2007, according to BLS data derived from the Current Population Survey.⁵ Workers who lost jobs have been an increasing presence among the unemployed, a group that also includes new entrants, reentrants, and job leavers. Job losers accounted for more than four of every five workers added to the ranks of the unemployed between December and November 2008. The 6.1 million laid off workers represented 58% of all unemployed workers, 10.3 million, in November 2008.

Infrastructure Spending and Job Creation Estimates

When in response to a recession Congress has acted to create jobs by raising demand for goods and services through increased federal spending it often has chosen to direct the funds to infrastructure (public works) activities. Other means of direct countercyclical job creation—employment tax credits, state revenue-sharing, and public service employment—have been relied on much less often. (See CRS Report 92-939, *Countercyclical Job Creation Programs*, by Linda Levine.)

A more expansive definition of infrastructure than was used in the past is now under consideration. Historically, public works has been synonymous with heavy and civil construction activities (e.g., road and bridge building). Today, it appears to include so-called green jobs. Although numerous studies on the emerging green economy have been released in the last several years, no consistent definition of green jobs exists at present. Green jobs seemingly are those in and related to industries that utilize renewable resources to produce their outputs (e.g., energy generated by wind and solar technologies) and jobs in and related to industries that produce energy-efficient goods and services (e.g., Energy Star appliances and equipment, mass transit).⁶ For this reason, the following discussion focuses on what is known about the job-generating impact of infrastructure spending broadly defined.

³ "Planned Job Cuts Rose Again in November to Highest Level Since 2002, Challenger Says," *Daily Labor Report*, December 4, 2008, pp. A-6.

⁴ "Recession Expected to Last 18 Months, Longest in Postwar History, Survey Finds," *Daily Labor Report*, December 10, 2008, pp. A-9.

⁵ Data from the Current Population Survey of households is available at <http://stats.bls.gov/cps>.

⁶ Related jobs include, for example, those in industries that manufacture wind turbines and install thermal-pane windows.

The section below begins with an in-depth examination of how job creation estimates usually are developed. The focus then narrows to look at two models that can be used to calculate the number of jobs dependent upon demand in the construction industry, which includes road and bridge building. The section ends by briefly reviewing the difficulties that researchers encounter in estimating the number of jobs supported by expenditures on green infrastructure and the consequent caution that should be taken when utilizing these public works job estimates in particular.

Job Creation Estimates: What Are They?

Interest in how many jobs are created by a particular type of economic activity has surfaced when the economy is in a downturn and policymakers seek to compare the relative advantages of different stimulus options. It also has arisen when policymakers want to know the impact of shifting expenditures from one federal budget category to another (e.g., away from defense and towards social services programs). Unless there is an *increase in total spending*, however, the number of jobs in the labor market would remain largely unchanged.⁷

Although there are other bases upon which to develop estimates of the number of jobs created by a given economic activity, an input-output (I-O) model of the economy often is utilized due to its cost-effectiveness.⁸ An I-O model describes the interrelationships between industries in the production process, showing how the dollar value of a sale is distributed across industries at a particular point in time. It thus reflects how much of the purchased product comes from final and supplier industries. An I-O table might show, for example, the dollar value of roof trusses produced by the veneer, plywood, and engineered wood products manufacturing industry and the dollar value of bricks produced by the clay product and refractory manufacturing industry used by the construction industry.

The output requirements from each industry must then be converted to employment requirements. Employment requirements are derived from productivity estimates for each industry at a particular point in time. The total employment requirement associated with a given type of final demand (e.g., a water reuse program) is the employment in the industry producing the final product or service and in the supplier industries. In other words, it is an approximation of both the direct and indirect employment dependent upon/supported by the economic activity. It commonly is expressed as the number of jobs per billion dollars of expenditures valued in a particular year's dollars.

Like an I-O table, an employment requirements table is a matrix of hundreds of columns and rows. Each column displays the number of jobs supported in each of the industry rows by an expenditure of one billion dollars in the column industry. For example, one billion dollars spent in the construction industry supports (direct) employment in the various components of that industry (e.g., residential and commercial building, highway and bridge building) and (indirect) employment in many other industries that supply their goods and services to the construction industry (e.g., asphalt shingle manufacturing, fabricated metal bridge section manufacturing). An

⁷ Small differences in the total number of jobs could occur at the same spending levels if the economic activities to (from) which funds were being shifted were more (less) capital-intensive, for example.

⁸ Another basis for estimating the impact of policy and other changes on the economy is conducting surveys. According to the U.S. Bureau of Economic Analysis (BEA), the advantage of the I-O approach to making impact estimates is the accessibility of the data sources required to develop the I-O model.

employment requirements table thus permits estimation of the varying impact of an expenditure on different industries and the varying impact of different kinds of expenditures.

Some Caveats

I-O models freeze technology and productivity at a particular point in time. Thus, the job-generating potential of an economic activity undertaken today could differ from that of an earlier period if there were technological and productivity improvements in the intervening years. Similarly, the estimates often are stated in terms of the number of jobs created for every billion dollars of expenditures, but a billion dollars spent in one year could buy less (more) than a billion dollars spent in another year depending on changes in price levels over time.

There also could be differences in estimated versus actual job creation because I-O models assume that resources are unlimited. If, for example, the economy was performing at a fairly high level with plants operating near full capacity and with fairly few workers unemployed, the actual number of new jobs might fall short of the estimate due to capital and labor constraints. This is less likely to matter during a broad-based economic downturn.

Further, I-O tables do not necessarily differentiate between imported and domestically produced goods. As a consequence, the domestic employment impact of expenditures might be overstated to the extent that inputs are imported. Similarly, I-O tables typically do not express employment in terms of full-time equivalents (i.e., both full-time and part-time jobs are counted equally). Thus, programs which draw upon industries that rely relatively more on part-time workers (e.g., retail trade) might appear to create more jobs than programs that draw to a greater extent on industries employing relatively more full-time workers (e.g., manufacturing).

The Multiplier Effect

A complete estimate of the number of jobs created by a particular type of economic activity has three components, namely,

- the number of jobs directly attributable to the activity,
- the number of jobs indirectly attributable to the activity, and
- the number of jobs induced throughout the economy as a result of the activity.

Induced jobs are those dependent upon the purchases of persons in direct and indirect jobs. For example, workers who are directly or indirectly employed as the result of a highway construction program might spend some portion of their wages in their communities at grocery stores, auto repair shops, and movie theaters.

Estimates of induced jobs or the multiplier are considered tenuous. To calculate the multiplier effect, one must estimate how much of the additional money earned by directly and indirectly employed workers will likely be spent versus saved. The actual number of jobs created by this added spending will further depend on economic conditions (e.g., the availability of labor, the inflation rate). As a result, there are widely varying estimates of the multiplier effect and those job creation studies that include induced employment utilize different multipliers.

Job Estimates and Construction Spending

The Federal Highway Administration

Perhaps the most widely known estimate of the employment impact of federal spending on our nation's roads comes from the Federal Highway Administration (FHWA). Although the FHWA twice updated its 1997 analysis, which estimated that \$1 billion of federal-aid highway expenditures plus a \$250 million state match supported 47,575 jobs, some proponents of stimulating job growth through increased federal spending on infrastructure continue to use this figure. The most recent update by the FHWA to 2007 indicates that a \$1.25 billion dollar expenditure on highway construction consisting of \$1 billion from the federal government and \$250 million from state government could support 34,779 jobs. If a state match is not required, "then \$1 billion in Federal funds supports 27,800 jobs."⁹ The jobs number has decreased over time in part because of increases in the price of inputs, such as asphalt and diesel fuel.

The FHWA breaks down the estimate of 27,822 jobs per billion dollars of federal spending on highways as follows:

- 9,536 construction-oriented jobs (i.e., jobs at construction companies working on the projects and at businesses that provide direct inputs to the projects such as asphalt, concrete, and guard rails);
- 4,324 jobs in supporting industries (i.e., employment at firms that provide inputs to the industries directly providing the materials and equipment utilized in highway construction such as producers of sheet metal who supply the manufacturers of guard rails); and
- 13,962 induced jobs (i.e., jobs throughout the economy dependent upon consumer expenditures from the wages of workers in "construction-oriented" and "industry-supporting" jobs).

Thus, the multiplier effect accounts for one-half of the total estimate.

The FHWA notes one caveat about I-O analysis in addition to those mentioned above, that is, the job estimate "utilizes the national average mix of construction materials and labor inputs. Specific projects and local utilization ratios will alter the estimated number of jobs supported."¹⁰ For example, a different combination of materials and number of workers might be required for road resurfacing projects compared to bridge building or commuter rail projects.

The FHWA also states that

The employment figures have recently been used as a justification for including highway spending in an economic stimulus package. But with the exception of short-term resurfacing and preservation projects, highway funds spend out slowly, with only 27% of a project, on average, outlaying in the first year.¹¹

⁹ U.S. Department of Transportation, Federal Highway Administration, *Employment Impacts of Highway Infrastructure Investment*, pp. 1, <http://www.fhwa.dot.gov/policy/otps/publications.htm>.

¹⁰ U.S. Department of Transportation, Federal Highway Administration, *Employment Impacts of Highway Infrastructure Investment*, p. 2, <http://www.fhwa.dot.gov/policy/otps/publications.htm>.

¹¹ U.S., *Employment Impacts of Highway Infrastructure Investment*, U.S. Department of Transportation, Federal (continued...)

BLS Employment Requirements Table

In recognition of the fact that “people want to assess the impact on employment of different policies or actions,” the U.S. Bureau of Labor Statistics (BLS) makes available electronically free-of-charge to the public the employment requirements tables it develops as part of its employment projections program.¹² I-O and employment requirements tables developed and utilized by others often are proprietary and not made widely available.

The employment requirements tables are based on the official I-O tables for the nation that the U.S. Bureau of Economic Analysis (BEA) develops every five years. BLS takes the latest national I-O table available from BEA – in this case, 1997 – and updates it to reflect more recent production and distribution technologies. It then utilizes the updated I-O table and recent labor productivity data to develop an employment requirements table. Because the base year for the most recently published employment projections is 2006, the latest employment requirements table reflects 2006 technologies of production and distribution as well as labor productivity.

The BLS employment requirements table provides information for the construction industry as a whole. The construction industry, according to the North American Industry Classification System, is composed of three major subdivisions:

- construction of buildings (residential and nonresidential),
- heavy and civil engineering construction (highway, street, and bridge construction), and
- specialty trade contractors (foundation, structure, and building exterior contractors; building equipment and finishing contractors).

The BLS employment requirements table shows 11,768 jobs directly and indirectly dependent upon one billion dollars of spending on construction. A majority of the jobs are in the construction industry itself (i.e., 6,925 direct jobs).

The figure from the BLS employment requirements table for construction expenditures (11,768) is somewhat lower than the direct and indirect jobs figure for highway expenditures from the FHWA (13,860). Potential explanations for the disparity include differences in industry definition, data sources, method of updating the model, and time period.

Neither the employment requirements available from BLS for the nation nor the employment requirements available from the BEA by state,¹³ breaks out other types of construction that have been discussed as part of a federal job creation package (e.g., public school construction). BLS formerly conducted surveys to estimate full-time year-long employment associated with a variety of different construction activities, including new schools, hospitals, water and sewer facilities,

(...continued)

Highway Administration, p. 2, <http://www.fhwa.dot.gov/policy/otps/publications.htm>.

¹² U.S. Bureau of Labor Statistics, *Layout and Description for 201-order Employment Requirements Tables*, Washington, D.C., December 2007, p. 3, <http://stats.bls.gov/emp/empind4.htm>.

¹³ Employment requirement estimates at the national level are not available from the BEA. For a fee to most parties, the BEA’s Regional Input-Output Modeling System (RIMS II) produces estimates by state of the number of jobs dependent upon a given economic activity.

roads, mass transit, and maintenance and repair construction. The survey information was last updated a few decades ago, however.

Job Estimates and Green Infrastructure Spending

Estimating the number of jobs dependent upon green infrastructure activities presents a greater challenge than estimates related to infrastructure projects as traditionally defined. The basis for most data collection by U.S. statistical agencies is the North American Industry Classification System (NAICS). It currently does not identify separately so-called green industries (e.g., those that utilize renewable resources to produce their outputs, those that manufacture goods which minimize energy use). Within NAICS, the electric utility industry is disaggregated into hydroelectric, fossil fuel, nuclear, and other power generation, transmission, and distribution. Such renewable sources of energy production as wind, solar, and biomass are not uniquely recognized; they are included in the “other” category. If harnessing the wind to produce electricity and plant material to produce biofuel requires a substantially different mix of inputs than relying on coal and gasoline, for example, the conventional I-O model does not seem well-suited as a basis for estimating the number of jobs supported by these green activities. Similarly, within NAICS, building construction industry does not have a unique category for retrofitting (e.g., installing additional insulation, fluorescent lighting, or energy-efficient heating and air-conditioning systems). Retrofitting likely requires a combination of inputs from supplier industries that differs from the mix for the top-to-bottom construction of buildings, once again making use of conventional I-O models problematic.

This recognized difficulty generally is either not mentioned, or how it is dealt with is not described, in the analyses of green job creation. One study, commissioned by the Center for American Progress that is discussed in more detail below, does address the problem. The researchers explain that because “the U.S. government surveys and accounts that are used to construct the input-output tables do not specifically recognize wind, solar, biomass, building retrofitting, or new mass transit as industries in their own right,” they created *synthetic industries* by combining parts of industries for which data are available. The researchers provided an example in the case of the biomass “industry:” they constructed it by combining the farming, forestry, wood products, and refining industries; then they “assigned relative weights to each of these industries in terms of their contributions to producing biomass products.”¹⁴

Further complicating the matter is the context and manner in which estimates of green jobs generally are presented. Studies often develop employment projections based on differing sets of assumptions and time horizons. For example, the number of direct and indirect jobs some 10 or more years in the future supported by an assumed increase in the demand for energy that is met by an assumed shift during the projection period from coal to wind and geothermal power generation. Some reports also include induced employment, but this is not always made clear. In addition, some analyses relate to a particular state. Their results may not be generalizable to other areas because state economy’s have different mixes of industries and may not be able to provide any or all of the inputs for a particular green output. The analyses also may express job estimates per unit of power generated by renewable resources and saved by increased demand for energy-efficient products and equipment, rather than per dollar of investment in green activities.

¹⁴ Robert Pollin, Heidi Garrett-Peltier, and James Heintz, et al., *Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy*, Center for American Progress, Washington, D.C., September 2008, p. 20, <http://www.americanprogress.org>.

And, the assumptions and methodologies underlying the job creation estimates often are not clearly articulated, which makes thoughtful review of the results very difficult. For these reasons, policymakers considering which if any green infrastructure programs to fund to create and preserve jobs in the near term to mitigate the recession's impact on U.S. workers may not find helpful many green economy studies.

It should be noted that many of the studies by green economy proponents were not conceived for the purpose of quickly stabilizing or increasing the number of jobs in the nation or in industries particularly hard hit by the current recession. Job creation estimates from two organizations that have proposed broad-based green economy strategies intended in part to stimulate the deteriorating labor market are briefly described below.

- The September 2008 report, *Green Recovery: A Program to Create Jobs and Start Building a Low-Carbon Economy*, was commissioned by the Center for American Progress (a research and educational institute). It represents an acceleration of a 10-year program included in a 2007 report (*Capturing the Energy Opportunity: Creating a Low-Carbon Economy*). The 2008 report's authors at the Department of Economics and Political Economy Research Institute (University of Massachusetts – Amherst), who relied on I-O analysis, estimate that almost 2 million jobs (935,200 direct jobs, 586,000 indirect jobs, and 496,000 induced jobs) could be created or preserved by a 2-year \$100 billion “green economic recovery program.” The program involves retrofitting buildings with energy-efficient products and equipment, extending the reach of mass transit and freight rail networks, constructing “smart” electric-grid transmission systems, increasing the use of wind and solar resources in power generation, and developing next-generation biofuels. Of the \$100 billion total, \$46 billion would be in the form of federal spending for such activities as public building retrofits, mass transit and freight rail expansion, and smart electrical grid development. Much of the remainder would be in the form of tax credits to encourage businesses and homeowners to retrofit commercial and residential buildings. The authors acknowledge that not all of the green activities

can contribute equally to a short-term green economic recovery program. Some ... strategies are clearly capable of delivering within a year, while others will require as long as two years to be implemented.¹⁵

- In December 2008, the Apollo Alliance (a coalition of labor, environmental, business and community leaders) proposed *The Apollo Economic Recovery Act*. It is an initial step toward achievement of a 10-year \$500 billion program to create 5 million green-collar jobs, which had been released in September 2008. The new initiative calls for federal spending of about \$50 billion to create or maintain more than 650,000 direct jobs and 1.3 million indirect jobs. The derivation of these job creation figures is not always clear, appearing to rely much of the time on spending-to-jobs relationships estimated by other organizations (e.g., Surface Transportation Policy Project, FHWA , and

¹⁵ Robert Pollin, Heidi Garrett-Peltier, and James Heintz, et al., *Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy*, Center for American Progress, Washington, D.C., September 2008, p. 5, <http://www.americanprogress.org>.

Cambridge Systematics). A selection of the proposed allocation of federal funds and associated job estimates follows.

1. \$6 billion retrofitting buildings: 267,600 direct and indirect jobs in the construction, manufacturing, and other industries
2. \$10 billion to improve the efficiency and reliability of the electric transmission grid: 131,000 direct and indirect jobs
3. \$6 billion on ready-to-go public transit projects: “would create or retain more than 246,000 jobs, including 59,000 direct jobs and more than 162,000 indirect jobs¹⁶”
4. \$8 billion to repair roads and bridges: 278,000 direct and indirect jobs
5. \$8 billion to encourage localities to replace aging buses and trains with U.S.-made clean-energy vehicles: 37,600 direct jobs in vehicle manufacturing and 167,000 indirect jobs

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¹⁶ Apollo Alliance, *Data Points: Economic Outcomes of The Apollo Economic Recovery Act*, 2008, p. 3, <http://apolloalliance.org/apollo-14/data-points-the-new-apollo-program-fact-sheet/>.