EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS

THE ECONOMIC IMPACT OF THE

AMERICAN RECOVERY AND REINVESTMENT ACT OF 2009

SECOND QUARTERLY REPORT

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EXECUTIVE SUMMARY

As part of the unprecedented accountability and transparency provisions included in the American Recovery and Reinvestment Act of 2009 (ARRA), the Council of Economic Advisers (CEA) was charged with providing to Congress quarterly reports on the effects of the Recovery Act on overall economic activity, and on employment in particular. In this second report, we provide an assessment of the effects of the Act through the fourth quarter of 2009.

Evaluating the impact of countercyclical macroeconomic policy is inherently difficult because we do not observe what would have happened to the economy in the absence of policy. And the sooner the evaluation is done, the less data one has about key economic indicators. Any estimates of the impact of the ARRA must therefore be regarded as preliminary and understood to be subject to considerable uncertainty. Because of the inherent difficulties in the analysis, we approach the task of estimating the impact of the Recovery Act from a number of different directions, and supplement our estimates with those of numerous outside analysts.

Among the key findings of the study are:

- As of the end of December 2009, $263.3 billion of the original $787 billion, or roughly one-third of the total, has been outlayed or gone to American households and businesses in the form of tax reductions. An additional $149.7 billion has been obligated for projects and activities, which means that the money is available to recipients once they make expenditures.

- Following implementation of the ARRA, the trajectory of the economy changed materially toward moderating output decline and job loss. Indeed, real GDP began rising in the third quarter of 2009, and job losses in the fourth quarter were one-tenth their size in the first quarter. The decomposition of the GDP and employment change by component or sector suggests that the ARRA has played a key role in this change of trajectory.

- The two CEA methods of estimating the impact of the fiscal stimulus suggest that the ARRA added between 2 and 3 percentage points to real GDP growth in the second quarter of 2009; between 3 and 4 percentage points in the third quarter; and between 1½ and 3 percentage points in the fourth quarter. These estimates are broadly similar to those of a wide range of other analysts.

- The CEA estimates that as of the fourth quarter of 2009, the ARRA has raised employment relative to what it otherwise would have been by 1½ to 2 million.

- For the third quarter of 2009, we now have direct reports on jobs created or saved from a subset of recipients of ARRA funds. These reports identify 640,000 jobs that would not have existed but for the Recovery Act. Our review of this additional data source shows

that the recipient reporting estimate is broadly consistent with more comprehensive estimates for the third quarter, once one takes into account the limited scope of the recipient reports.

- A special section of the report focuses on the clean energy provisions of the ARRA. Our analysis shows that roughly $90 billion of the total budget impact of the Recovery Act falls into this category. Of this total amount, roughly $5 billion has been outlayed (or received as tax cuts), and another $26 billion has been obligated as of the end of December. We estimate that these components of the ARRA have directly saved or created approximately 52,000 clean energy jobs as of the fourth quarter of 2009, and supported another 11,000 jobs of all types throughout the economy.

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I. INTRODUCTION

The American Recovery and Reinvestment Act of 2009 (ARRA) is the boldest countercyclical fiscal expansion in American history. It was enacted at a time when U.S. real GDP was contracting at an annual rate of more than 6 percent and employment was falling by about 700,000 jobs per month. The Act was designed to cushion the fall in demand caused by the financial crisis and the subsequent decline in consumer and business confidence, household wealth, and access to credit. Together with policies to stabilize the financial system, increase liquidity and credit, and stem the tide of foreclosures, the ARRA was part of a comprehensive policy response to the economic turmoil that gripped the United States and the world economy in the fall of 2008 and early 2009.

As 2010 opens, the American economy is dramatically improved from a year ago. Financial markets are much more stable and real GDP appears to be growing solidly. Employment loss in the fourth quarter of 2009 was one-tenth the level it was in the first quarter of the year, and early indicators of labor market improvement, such as the hiring of temporary workers, are showing encouraging signs. Of course, with the unemployment rate still at 10 percent, the American economy is far from healthy. But, there is little question that the economy is on the road to recovery.

As part of the unprecedented accountability and transparency provisions included in the Recovery Act, the Council of Economic Advisers (CEA) was charged with providing quarterly reports to Congress on the effects of the Recovery Act on overall economic activity, and on employment in particular. In this second report, we provide an assessment of the effects of the Act through the fourth quarter of 2009.

As discussed in our first report, identifying the impact of policy actions is inherently difficult, and the estimates must be understood to be subject to large margins of error. For this reason, the CEA prepares estimates of the impact of the ARRA from two approaches, and reports estimates from a wide range of private analysts and from the Congressional Budget Office (CBO).

This multifaceted analysis indicates that the ARRA had a substantial positive impact on real GDP growth in the second, third, and fourth quarters of 2009. The CEA estimates suggest that the Act contributed between 2 and 3 percentage points to real GDP growth in the second quarter; between 3 and 4 percentage points in the third quarter; and between 1½ and 3 percentage points in the fourth quarter. The estimates imply that as a result, it has raised the level of GDP at the end of 2009 by about 2 percent, relative to what otherwise would have been. The Act has also increased employment in each quarter relative to what otherwise would have occurred. As

of the fourth quarter of 2009, the CEA estimates that the ARRA has raised employment relative to the baseline by between 1½ and 2 million. The CEA estimates for both the effects on GDP and employment are similar to those of respected private forecasters and government agencies.

The report begins with a summary of the spending and tax reductions that have occurred under the ARRA over its first three quarters. Section II shows that as of the end of December 2009, $263.3 billion of the original $787 billion included in the Act has been outlayed or has gone to American households and businesses in the form of tax reductions. An additional $149.7 billion has been obligated for projects and activities but not yet outlayed, which means that the money is available to recipients once they make expenditures. In many instances, such as highway projects, economic activity can occur once funds are obligated. That recovery funds have gone out rapidly certainly increases the probability that the Act has been effective in its first three quarters.

Section III examines the behavior of GDP and employment in detail. We find that the trajectory of the economy has changed dramatically: output declines have been replaced by substantial increases and job losses have slowed sharply. We also find that the decomposition of GDP and employment by components or sector suggests that the ARRA has played a key role in the change of trajectory.

The first way that we attempt to measure the impact of the ARRA is through a comparison of the behavior of GDP and employment with a plausible, statistically-determined baseline. This analysis in Section IV finds that actual behavior is substantially better in the last three quarters of 2009 than would have been predicted based on the past behavior of the two series. This analysis strongly suggests that the range of policy actions taken early in the year, including the ARRA, has had a substantial impact on economic conditions. In the course of this analysis, we use a variety of straightforward statistical procedures to allocate the estimates of job creation and retention to particular sectors and states. This analysis provides an estimated breakdown of the industrial and geographic impact of the Recovery Act.

In Section V, we consider estimates of the impact of the ARRA from standard economic models. We incorporate the data on actual outlays and tax changes under the Act in the second, third, and fourth quarters of 2009 into the multiplier analysis used by the CEA to estimate the impact on GDP and employment. We compare our results with those of prominent private sector and public sector analysts. This analysis indicates that much of the change in macroeconomic behavior in the last three quarters is attributable to the ARRA.

Beginning with the third quarter of 2009, a subset of the recipients of ARRA funds were required to report on the number of jobs created or saved as a result of the funds. These data were released at the end of October, six weeks after our first quarterly report. In Section VI, we

examine the recipient reporting data, and discuss their strengths and limitations. We find that given the fraction of ARRA funds that are subject to recipient reporting, the reports are consistent with an overall employment effect of the ARRA that is at least as large as our other estimates.

Section VII of the report focuses on a particular kind of stimulus in the Recovery Act. The ARRA included a wide range of spending and tax credits to jumpstart the adoption and expansion of clean energy and foster job creation in this area. In all, more than 10 percent of the total ARRA budget impact is devoted to alternative energy, energy efficiency, and other clean energy initiatives. The report documents this categorization of spending and estimates the number of jobs created or saved that can reasonably be classified as clean energy jobs. Our estimate as of the fourth quarter of 2009 is that these components of the ARRA have directly saved or created approximately 52,000 clean energy jobs and supported another 11,000 jobs throughout the economy. These effects are expected to increase substantially as ARRA spending on energy and conservation rises over the next few quarters.

II. THE PROGRESS OF SPENDING AND TAX REDUCTIONS UNDER THE RECOVERY ACT

The first step in evaluating the effects of the ARRA is to analyze the data on spending and tax reductions that have occurred under the Act. It is certainly possible that the Act could have effects even if no spending or tax changes had yet occurred. For example, its passage could have affected confidence, and expectations of a tax cut in the future could affect spending today. But, it is far more likely that the Act has had significant impact if funds have actually been spent and tax cuts have actually reached consumers.

Data on both spending and tax relief are available on the Recovery.gov website. The outlays and obligations by agency are available weekly and the tax reduction data are available monthly.[1] Outlays represent payments made by the government. Those funds represent spending that has already occurred. Obligations represent funds that have been made available but not necessarily outlayed, such as for a highway project where the builder must complete the work properly to be fully reimbursed by the Federal government. In many instances, obligations

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[1] The outlays and obligations data are based on weekly reports by the relevant agencies. To ensure that our report is as up-to-date as possible, we use the agency Financial and Activity Reports provided directly by the Office of Management and Budget. These reports are posted on Recovery.gov with a short lag. The tax reduction estimates are based on the Department of the Treasury Office of Tax Analysis (OTA) tax simulation model for the effect of the ARRA tax provisions. The OTA will not have comprehensive data on the 2009 tax filings until June 2010. Since the CEA first quarterly report, OTA has prepared revised estimates of the monthly (and hence the quarterly) pattern of the tax effects of the ARRA. The Recovery.gov website will reflect the revisions in the cumulative number for December 2009, but will leave the estimates for the earlier months unchanged. To provide the most accurate quarterly estimates of the impact of the ARRA, however, we report and use the revised tax estimates for all quarters.

can generate economic activity because recipients may begin spending as soon as they are certain funds are available.

Table 1 shows outlays, obligations, and tax reductions as of the end of each quarter of 2009 (March, June, September, and December). As of the end of the fourth quarter, the sum of outlays and tax cuts was $263.3 billion, with an additional $149.7 billion obligated but not yet outlayed. The original estimate by CBO for the total size of the Act at the time of passage was $787 billion. Thus, as of the end of 2009, approximately one-third of the total fiscal stimulus had been spent or received as tax cuts. This is similar to the fraction projected to have been spent by this point according to CBO.[2] Additionally, the sum of spending, obligations in excess of spending, and tax cuts exceeds $400 billion.

Table 1. Outlays, Obligations, and Tax Reductions

| | Through the end of | | | |
	Q1 (March[a])	Q2 (June[b])	Q3 (September[c])	Q4 (December[d])
	Billions of Dollars			
Outlays	8.6	56.3	110.7	164.2
Obligations	31.5	157.8	256.3	313.9
Tax Reductions	2.4	36.8	68.2	99.1
Sum of Outlays and Tax Reductions[e]	11.0	93.1	178.9	263.3

Sources: Agency Financial and Activity Reports to the Office of Management and Budget; simulations from the Department of the Treasury (Office of Tax Analysis) based on the FY2011 budget.
Notes: a. Data on outlays and obligations are for March 27.
b. Data on outlays and obligations are for June 26.
c. Data on outlays and obligations are for September 30.
d. Data on outlays and obligations are for December 31.
e. Items may not add to total due to rounding.

The categorization of stimulus into outlays versus tax reductions follows accounting conventions, but in a broader sense is somewhat arbitrary. For example, the Making Work Pay tax credit, which reduced taxes for 95 percent of working families, is treated as a tax cut, while the $250 extra payment to seniors and veterans is treated as an outlay. Yet, both are thought to affect economic activity by putting more money into the hands of consumers. For this reason, it is useful to consider a more functional decomposition. The decomposition is not only interesting in its own right, but is necessary for our later model-based analysis of the impact of the program.

We divide the total dollars of stimulus expended to date into six categories: individual tax cuts and similar payments; the tax cut associated with the adjustment of the Alternative Minimum Tax (AMT); business tax incentives; state fiscal relief; aid to those most directly hurt by the recession; and direct government investment spending. The first three are tax changes of

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[2] CBO (2009a) projected that $184.9 billion would have been spent in fiscal year 2009 (that is, through the third quarter), and $399.4 billion in fiscal 2010. Assuming that the fiscal 2010 budget impact was spread evenly across the four quarters yields total projected spending of $284.8 billion by the end of calendar year 2009.

some kind and were established at passage to be roughly one-third of the total package; the second two represent emergency measures and were again estimated to be roughly one-third of the total; the last encompasses a range of direct spending and covers the remaining one-third of the total. At passage, it was anticipated that the tax changes and emergency measures would occur more quickly and direct government spending would be a larger fraction of later expenditures.

We divide the outlays and tax reduction data into these functional categories as follows. Individual tax cuts include the Making Work Pay tax credit, the child tax credit, and a number of smaller individual tax reductions. We also include direct payments that were made in lieu of a tax cut to certain groups. These include payments of $250 distributed to individuals who receive Social Security and Supplemental Security Income, Railroad Retirement benefits, or veterans' benefits. The business tax incentives and AMT relief are calculated directly by the Office of Tax Analysis as part of its simulation process.[3]

We define state fiscal relief to include just the two main programs in this category: a substantial increase in the Federal government's matching percentage for Medicaid spending (FMAP), and formula grants to state governments for education through the State Fiscal Stabilization Fund. Aid to those directly impacted by the recession includes the increase and extension of unemployment benefits, increased funds for nutritional assistance, and increases in the Temporary Assistance to Needy Families (TANF) program. Similarly, the government's subsidy of continuing health insurance benefits under COBRA, which is technically a business tax cut, is treated as aid to directly impacted individuals for our classification in Table 2.

Government investment outlays include everything else. The obvious components are spending on infrastructure, health information technology, research on renewable energy, and other forms of direct spending excluding transfers. Also included here are tax credits for particular types of private spending, such as weatherization, advanced energy manufacturing, or research and experimentation, since these credits are functionally similar to the direct government spending.

Table 2 shows our breakdown of aggregate outlays and tax relief into these functional categories. The table shows an important change over time in the composition of the fiscal stimulus. As was anticipated at the time of passage, the individual tax cuts and the state fiscal relief were the first items that could be put into effect. For this reason, they comprised a large fraction of total spending in the second quarter. By the fourth quarter, the distribution of expenditure across the different types of stimulus has evened out greatly. Government investment outlays, in particular, have increased notably, rising from just $6 billion at the end of

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[3] The quarterly estimates of AMT relief are from unpublished analysis by the OTA. The direct payment data are from the agency Financial and Activity Reports, available on Recovery.gov.

the second quarter to $41 billion at the end of the fourth quarter. Reflecting the severity of the unemployment problem, aid to directly impacted individuals has also increased substantially over time.

Table 2. Fiscal Stimulus by Functional Category

| | Through the end of | | | |
	Q1 (March[a])	Q2 (June[b])	Q3 (September[c])	Q4 (December[d])
	Billions of Dollars			
Individual Tax Cuts	2.3	28.7	42.8	56.3
AMT Relief	0.0	7.2	12.7	15.9
Business Tax Incentives	0.1	13.1	24.0	33.3
State Fiscal Relief	8.5	28.2	43.8	59.3
Aid to Directly Impacted Individuals	0.0	9.8	32.1	57.5
Government Investment Outlays	0.0	6.1	23.6	41.1
Total[e]	**11.0**	**93.1**	**178.9**	**263.3**
Change in Total (from the End of the Previous Quarter)	**11.0**	**82.1**	**85.8**	**84.4**

Sources: Agency Financial and Activity Reports to the Office of Management and Budget; simulations from the Department of the Treasury (Office of Tax Analysis) based on the FY2011 budget.
Notes: a. Data on outlays and obligations are for March 27.
b. Data on outlays and obligations are for June 26.
c. Data on outlays and obligations are for September 30.
d. Data on outlays and obligations are for December 31.
e. Items may not add to total due to rounding.

For the impact on the economy, what matters is less the cumulative level of expenditures under the Act, but rather the amount spent each quarter. For this reason, Table 2 also reports the change in the total budgetary impact from the end of the previous quarter. One can see that the total outlays plus tax cuts have stabilized at around $85 billion per quarter (or an annual rate of $340 billion).

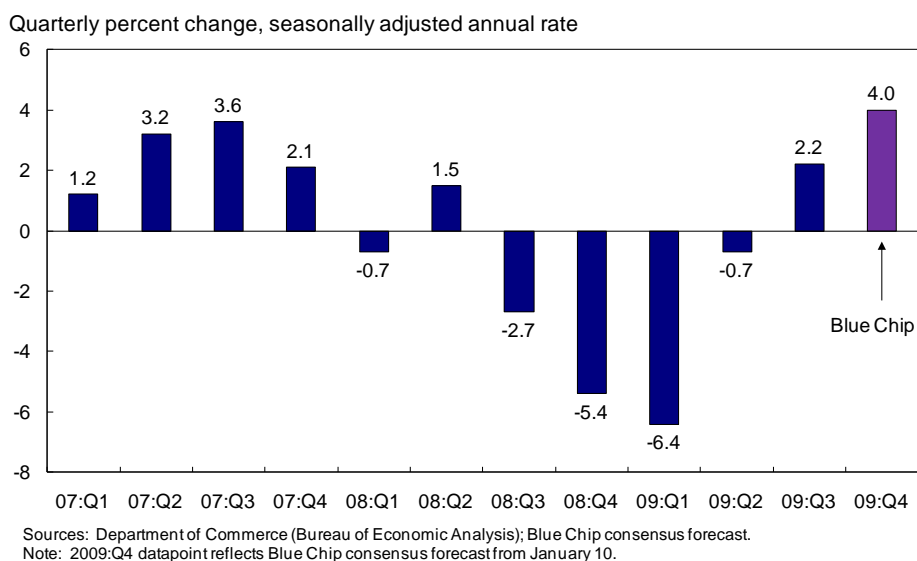## III. EVIDENCE OF EFFECTS FROM THE BEHAVIOR OF GDP AND EMPLOYMENT

The first way that we investigate the impact of the ARRA is to consider the behavior of real GDP and employment. Are the changes that we have observed in these two key indicators over the past three quarters consistent with the Recovery Act having a substantial effect?

Before looking at the data, it is important to acknowledge once again that three quarters is a short period of time for macroeconomic analysis. The only official GDP data that we have under the program are for the second and third quarters of 2009. Two observations, while obviously instructive, are not enough to reliably identify a trend. For employment, we have monthly data only through December 2009. These data, like the GDP statistics, are subject to revision, and analysts are well aware that the monthly employment series has a substantial margin of error simply due to inherent sampling difficulties.

A. Real GDP Growth

Figure 1 shows the growth rate of real GDP. After falling considerably and, indeed, progressively more deeply in each of the three quarters from the third quarter of 2008 to the first quarter of 2009, the fall in GDP moderated greatly in the second quarter of 2009. After declining at an annual rate of 6.4 percent in the first quarter of 2009, GDP fell at a rate of 0.7 percent in the second quarter, and rose at a rate of 2.2 percent in the third quarter. Figure 1 also shows the January 10 Blue Chip Consensus forecast for real GDP growth in the fourth quarter. That forecast is 4.0 percent (Blue Chip Economic Indicators, 2010).

Figure 1. Real GDP Growth

Quarterly percent change, seasonally adjusted annual rate

Sources: Department of Commerce (Bureau of Economic Analysis); Blue Chip consensus forecast.
Note: 2009:Q4 datapoint reflects Blue Chip consensus forecast from January 10.

The economy is obviously still far from healthy. Real GDP is far below its previous peak level and millions of Americans are out of work. But economies do not switch from rapid decline to robust growth all at once. Given what we now know about the frightening momentum of economic decline in the first quarter, it would have been hard for the economy to stabilize much faster than it has.

The timing of the change in trajectory in real GDP growth is certainly suggestive of an important role for the ARRA. The economy was in freefall in the months before the ARRA, stabilized dramatically in the quarter after, and began growing again two quarters after the stimulus began.

The behavior of key components of GDP is also consistent with the ARRA playing a causal role. Figure 2 shows the contributions of each of the main components of GDP to overall growth in the first, second, and third quarters of this year.

Figure 2. Contributions to Real GDP Growth

Percentage points
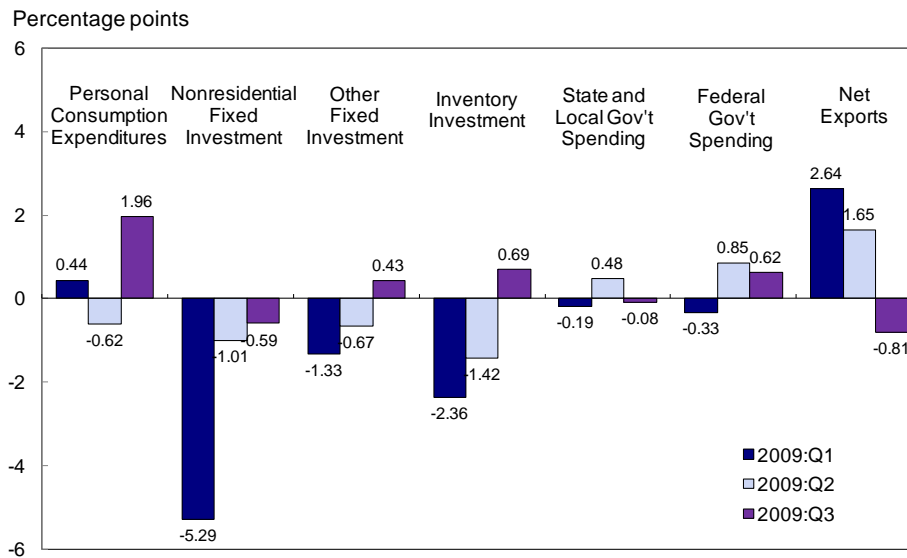
Source: Department of Commerce (Bureau of Economic Analysis).
Note: Bars sum to quarterly change in GDP growth (-6.4% in Q1; -0.7% in Q2; 2.2% in Q3).

The role of the Recovery Act can be seen in several areas. One is in personal consumption expenditures. The Making Work Pay tax credit and the aid to individuals directly affected by the recession meant that households did not have to cut their consumption spending as much as they otherwise would have. Consumption was little changed in the first two quarters of 2009, and then rose at a healthy rate in the third quarter. The rise in consumption in the third quarter was particularly strong in part because of the very popular "Cash for Clunkers" car rebate program. However, the rise of both nondurable goods and services is likely attributable to the general tax relief and the general rise in confidence.
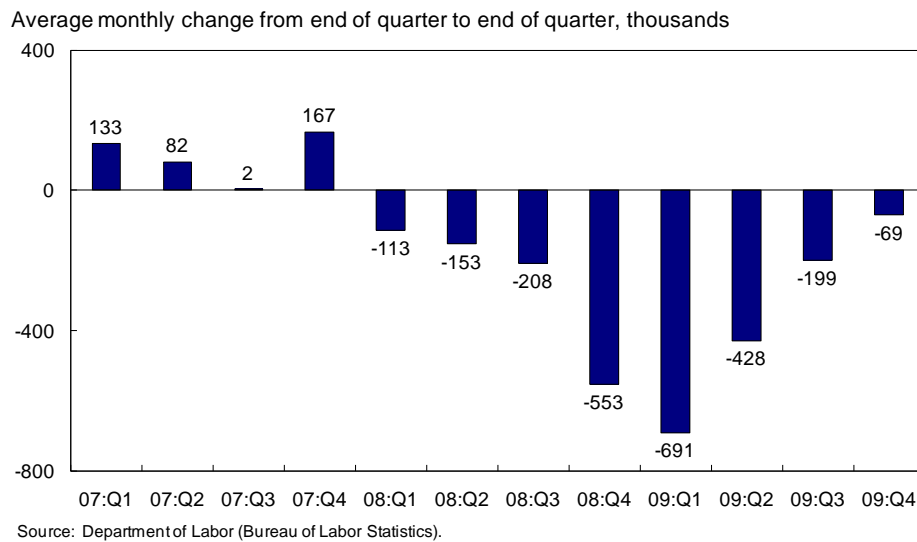
Another area where the role of the ARRA seems clear is in nonresidential fixed investment – firms' purchases of everything from machines to software to structures. A key source of the stabilization and eventual growth of GDP is that this type of investment, which fell at a devastating 39 percent annual rate in the first quarter, fell at smaller and smaller rates in the second and third quarters. One important component of the Recovery Act was investment incentives, such as bonus depreciation. Businesses received about $13 billion of this type of tax relief in the second quarter, $11 billion in the third quarter, and $9 billion in the fourth quarter. This may have contributed to slower investment decline.

It is also likely that the relative stability of state and local government spending is due to the Recovery Act. Despite the dire budgetary situations of state and local governments, their purchases rose at the fastest pace in more than five years in the second quarter, and were little changed in the third quarter. This behavior almost surely could not have occurred in the absence of the fiscal relief to the states.

B. Change in Payroll Employment

Figure 3 shows the change in payroll employment over the recession. A key indicator of the severity of this recession is the fact that in the first quarter of this year, we lost nearly 700,000 jobs per month. In the second quarter, we lost an average of 428,000 jobs per month; in the third quarter, 199,000. Statistics released on January 8, 2010 show that job loss in the fourth quarter was 69,000 per month, roughly one-tenth the rate in the first quarter. While this is still a substantial distance from the robust job growth needed to bring down the unemployment rate quickly, the change does suggest that we are on the right trajectory.
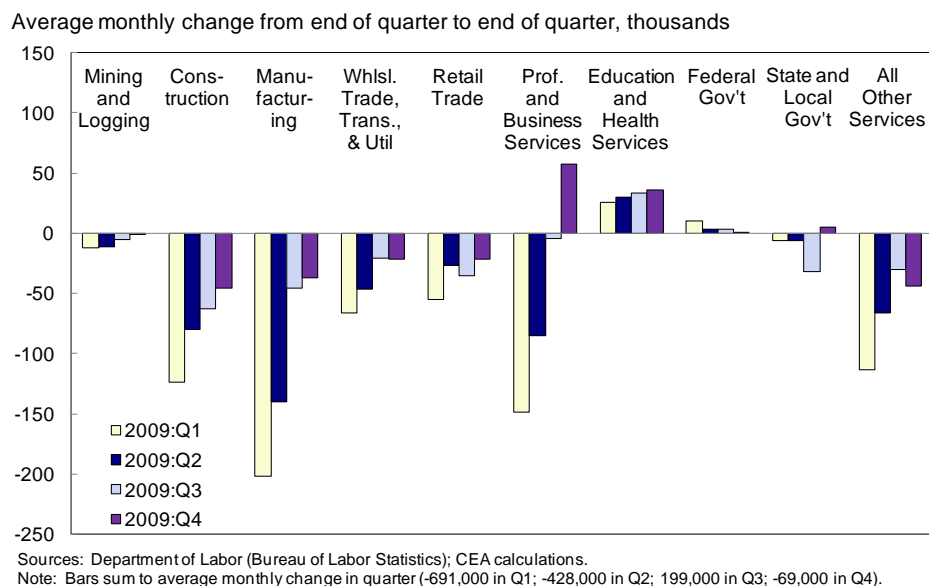
Figure 3. Payroll Employment Growth

Average monthly change from end of quarter to end of quarter, thousands

Source: Department of Labor (Bureau of Labor Statistics).

As with real GDP, the timing of the change in employment behavior is suggestive of a key role for the ARRA and other stabilizing measures taken in February and March. Job losses moderated in the quarter after Recovery Act spending and tax cuts began. They then continued to slow greatly in the subsequent two quarters.

Further suggestive evidence is provided by considering the changes in the sectoral composition of job loss over the first, second, and third quarters of 2009. Figure 4 shows the contribution of the change in employment for each quarter in ten key sectors of the economy.

Figure 4. Contributions to Changes in Employment

Average monthly change from end of quarter to end of quarter, thousands

Sources: Department of Labor (Bureau of Labor Statistics); CEA calculations.
Note: Bars sum to average monthly change in quarter (-691,000 in Q1; -428,000 in Q2; 199,000 in Q3; -69,000 in Q4).

The largest swings in job loss from the first to the fourth quarters have been in manufacturing and in professional and business services (which includes temporary employment agencies). Indeed, temporary help employment increased by an average of 48,700 per month over the fourth quarter. Since manufacturing and professional and business services are among the most cyclical industries, this is the pattern one would expect if the ARRA and other policy actions were moderating the cyclical decline. The pronounced decline in manufacturing job loss could also reflect the effect of business tax incentives on investment.

Another place where there is evidence of the Act's role is in the absence of any acceleration of job losses in state and local government. The conjunction of sharp revenue declines and state balanced budget requirements created enormous pressures on state and local governments to cut spending and lay off workers. But, as Figure 4 shows, overall state and local government employment declined relatively little through the third quarter compared with other sectors, and then rose in the fourth quarter. The obvious candidate explanation for this relatively good performance is the nearly $60 billion of state fiscal relief provided by the ARRA through December.

Similarly, the construction industry, where job losses have moderated substantially despite the fact that the recession has in many ways been centered in residential real estate, could suggest a role for the Recovery Act spending in infrastructure and the First-Time Homebuyer Tax Credit. Some of the moderation of job losses in this sector presumably also reflects other policy actions, such as the Administration's programs to help distressed homeowners and the Federal Reserve's efforts to support the mortgage market.

IV. ESTIMATES OF EFFECTS FROM COMPARISON TO A STATISTICAL BASELINE FORECAST

The previous analysis has used the timing and sectoral composition of changes in GDP and employment to suggest an important role for the ARRA. One limitation of this analysis is that it does not attempt to specify what would have happened in the absence of the fiscal stimulus and other recovery actions. It implicitly assumes that in the absence of stimulus, no change would have occurred. To address this issue, in this section we present a sensible statistical forecast of the likely path of GDP and employment in the absence of stimulus. We can then interpret the discrepancy between this forecast and actual developments as an estimate of the impact of policy.

A. Effects on GDP

There are many ways to construct a statistical baseline forecast. The particular method that we use is to estimate a vector autoregression (or VAR) using the logarithms of real GDP (in billions of chained 2005 dollars) and employment (in thousands, in the final month of the quarter) over the period 1990:Q1-2007:Q4. We include four lags of each variable. Because the estimation ends in 2007:Q4, the coefficient estimates used in the prediction are not influenced by developments in the current recession. Rather, they show the usual joint short-run dynamics of the two series over an extended sample. We then forecast GDP and employment in the second, third, and fourth quarters of 2009 using actual data through the first quarter of the year. Data through the first quarter include the monetary response to the current crisis, but not the fiscal stimulus or other actions that took effect after the first quarter. We have experimented with a variety of other ways of projecting the no-stimulus path of GDP and employment. The results of those exercises are similar to those we report below.

Figure 5 shows the results of this forecasting exercise for real GDP. Past history predicts that real GDP would continue to decline at a substantial rate in the second quarter. The projected decline (at an annual rate) is 3.3 percent. In the third quarter, real GDP would also be projected to decline, but at the more modest rate of 0.5 percent. In the fourth quarter, normal dynamics suggest that GDP would increase at an annual rate of 1.3 percent.

Figure 5. Real GDP: Recent and Projected Levels

Billions of 2005 dollars, seasonally adjusted annual rate

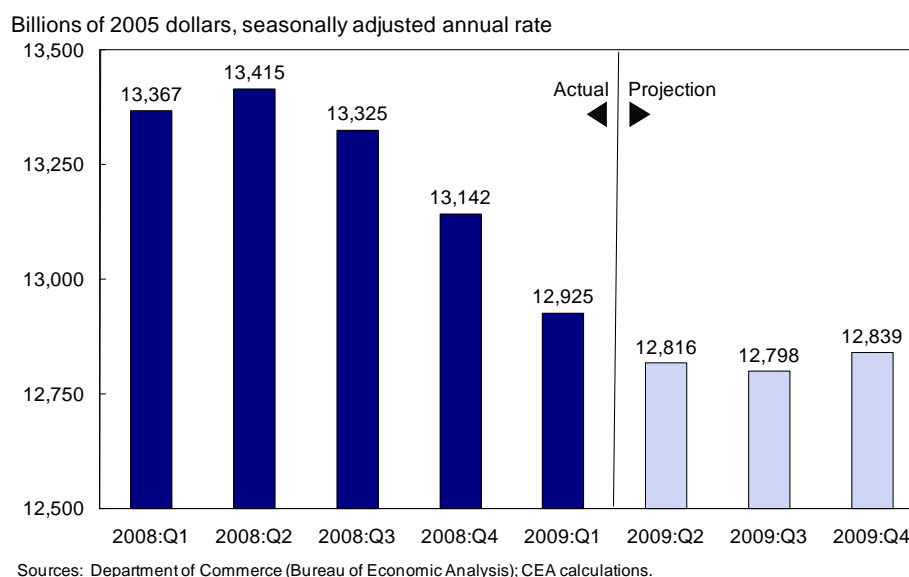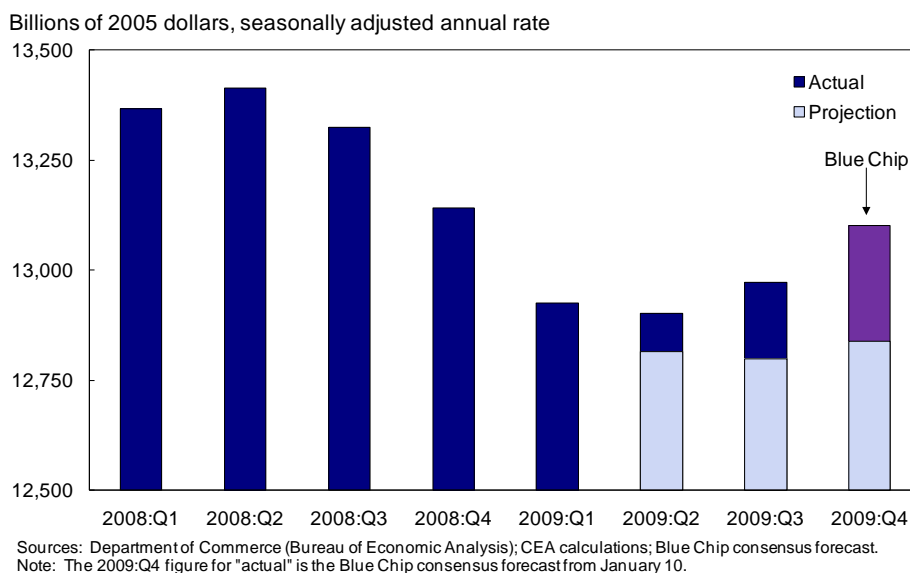Sources: Department of Commerce (Bureau of Economic Analysis); CEA calculations.

Figure 6 superimposes the actual GDP outcome in 2009:Q2 and 2009:Q3 and the consensus forecast outcome in 2009:Q4 on the projections based on past history. The figure shows that real GDP growth in the second quarter, which was -0.7 percent, was 2.6 percentage points higher than the usual time-series behavior would have led one to expect; real GDP growth in the third quarter was 2.2 percent, or 2.8 percentage points higher than the projection.[4] If GDP growth in the fourth quarter matches the Blue Chip consensus estimate of 4.0 percent, GDP growth will be 2.7 percentage points higher than the statistical baseline prediction. These estimates again suggest that policy actions taken in the winter made large positive contributions to GDP growth.

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[4] The 2.8 figure differs slightly from 2.2 minus -0.5 because of rounding.

Figure 6. Real GDP: Recent and Projected Levels

Billions of 2005 dollars, seasonally adjusted annual rate

Sources: Department of Commerce (Bureau of Economic Analysis); CEA calculations; Blue Chip consensus forecast.
Note: The 2009:Q4 figure for "actual" is the Blue Chip consensus forecast from January 10.

B. Effects on Employment

Figure 7 shows the forecast of employment changes using this procedure. The baseline forecast implies further substantial job loss in the second, third, and fourth quarters of 2009. Indeed, the projected average monthly decline in the absence of the Recovery Act is nearly 600,000 jobs in 2009:Q2, just over 500,000 jobs in 2009:Q3, and 379,000 in 2009:Q4.

Figure 7. Payroll Employment: Recent and Projected Changes

Average monthly change from end of quarter to end of quarter, thousands

Sources: Department of Labor (Bureau of Labor Statistics); CEA calculations.
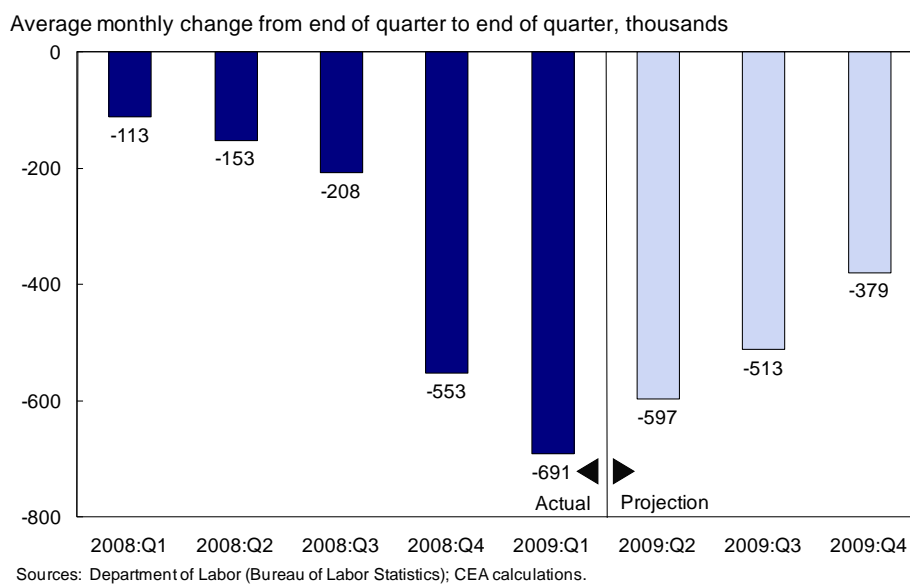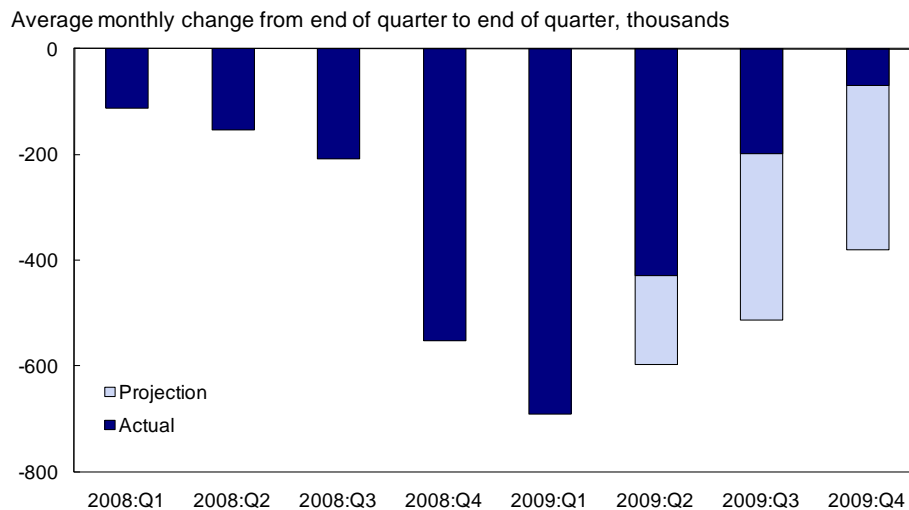
Figure 8 shows that the actual job loss in the second, third, and fourth quarters came in substantially lower than projected.

Figure 8. Payroll Employment: Recent and Projected Changes

Average monthly change from end of quarter to end of quarter, thousands

Sources: Department of Labor (Bureau of Labor Statistics); CEA calculations.

The differences between the predicted and actual changes in GDP and employment over these three quarters can be cumulated to show the difference in the level of the two series as of the fourth quarter. Table 3 shows this calculation. For real GDP, growth was 2.6 percentage points higher than predicted in 2009:Q2; 2.8 percentage points higher in 2009:Q3; and likely about 2.7 percentage points higher in 2009:Q4. This implies that the level of GDP in 2009:Q4 is approximately 2 percent higher than a sensible statistical baseline forecast.[5]

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[5] The reason the figure is about 2 percent rather than 8.1 percent is that the figures for quarterly GDP growth are expressed at an annual rate.

Table 3. Estimates of the Effect of the ARRA Using CEA Statistical Projection

	2009:Q2	2009:Q3	2009:Q4
	GDP Growth[a]		
Actual GDP Growth	-0.7%	2.2%	4.0%[b]
Baseline Projection	-3.3%	-0.5%	1.3%
Difference	+2.6 p.p.	+2.8 p.p.	+2.7 p.p.
Estimated Cumulative Impact of Policy on Level	+0.67%	+1.36%	+2.04%
	Employment Change[a]		
Actual Employment Change	-428,000	-199,000	-69,000
Baseline Projection	-597,000	-513,000	-379,000
Difference	+169,000	+314,000	+310,000
Estimated Cumulative Impact of Policy on Level[c]	+338,000	+1,134,000	+2,068,000

Sources: Department of Commerce (Bureau of Economic Analysis); Department of Labor (Bureau of Labor Statistics); CEA calculations.
Notes: a. Items may not add to total due to rounding.
b. Blue Chip, January 2010.
c. Middle month of the quarter.

For employment, the average change in each of the three months of the second quarter was 169,000 less than the baseline forecast. This implies that the level of employment near the middle of the quarter (that is, as of May) was 338,000 higher than the baseline forecast predicted.[6] The level at the end of the quarter was 507,000 higher than predicted. For each month of the third quarter, actual employment loss is estimated to be an average of 314,000 less than projected. This implies that as of August, employment relative to the projection was another 627,000 higher than at the end of the second quarter.[7] Therefore, the level of employment as of August is 1,134,000 higher than the statistical baseline forecast. As of the end of the third quarter, employment was 1,448,000 higher than projected.[8]

For each month of the fourth quarter, the actual employment change is estimated to be 310,000 greater than the baseline projection. This implies that as of the middle of the quarter, employment is 2,068,000 greater than the baseline projection. The number for the end of the quarter is 2,378,000. This implies that as of December 2009, employment is more than 2 1/3 million higher than one would have predicted using a sensible statistical projection.

This projection methodology provides one way of estimating the impact of the ARRA on employment and the economy. It shows that using the past history of GDP and employment and actual data through the first quarter of 2009, one would have predicted that employment as of the middle of the fourth quarter would be about 2 million lower than it actually was. To ascribe much of this difference to the ARRA, the key policy action taken in the first quarter, is certainly plausible. However, other policy actions, such as the Financial Stability Plan, monetary policy,

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[6] We report middle of the quarter estimates of the effect on employment to be roughly consistent with other estimates, which are quarterly averages.
[7] The numbers do not add to the total exactly because of rounding.
[8] The numbers do not add to the total exactly because of rounding.

and the Federal Reserve's program of buying agency debt and long-term U.S. government bonds, surely contributed to the difference. Also, any other factors not captured by the past history of GDP and employment, such as unusual moves in foreign demand or asset prices, would also be captured in the difference.

Importantly, there is no reason to assume that the overall effect of the policies other than the ARRA together with non-policy factors was to contribute positively to actual GDP and employment growth. For example, while the various actions to improve financial conditions have surely had a positive impact, the continuing stringency in credit conditions is a development likely to be holding down actual outcomes relative to usual cyclical patterns. Thus, the forecast residuals could either overestimate or underestimate the impact of the ARRA.

C. Sectoral Decomposition of the Estimated Impact on Employment

The previous analysis provides an estimate of the impact of the ARRA on employment relative to the baseline. An obvious question is how that impact is likely to have been distributed across industrial sectors.

The most important effects of the Recovery Act on the economy to date have been through the general stimulus it has provided. For example, thus far tax cuts and support for those most directly hurt by the recession have been substantial, while direct government spending on specific projects has been smaller. Thus, the main reason the employment effects of the Act so far have not been evenly distributed across sectors is that some sectors are more sensitive to changes in overall employment than others.

The response of employment in individual sectors to changes in overall employment can be decomposed into two components. First, a rising overall level of employment tends to increase employment in each industry in proportion to its share of the overall economy. We refer to this as the "rising tide" effect. Second, some sectors are more sensitive to the state of the business cycle than are others. An example is the employment services industry, most of which is comprised of temporary help services: temporary employment tends to rise much faster than overall employment in business cycle expansions and to decline much faster in recessions. The additional employment due to the Recovery Act has therefore almost certainly produced relative expansion of such procyclical sectors, while countercyclical sectors, such as utilities, health care, and government, have seen their shares of total employment shrink relative to what would have been seen in the absence of stimulus. We refer to the resulting changes in sectoral employment as the "cyclicality effect."[9]

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[9] Formally, let $\hat{s}$ and $\hat{E}$ be the sectoral employment share and total non-farm employment, respectively, that would have obtained without the Recovery Act, and let s and E be the values that were actually observed in November 2009. Then the total impact on employment in the sector is $sE - \hat{s}\hat{E} = s(E - \hat{E}) + (s - \hat{s})\hat{E}$. The first term here is

The net effect of the Recovery Act on employment in each sector through its expansionary effects is simply the sum of the rising tide and the cyclicality effects. The rising tide effect is straightforward to measure, as each sector receives a share of the estimated 2.068 million jobs created proportional to the sector's share of overall employment. The first column of Table 4 shows the employment share of each major industrial sector and of selected sub-sectors in November 2009.[10]

Estimation of the cyclicality effect is the more complex part of the decomposition. First, the cyclicality of each sector's employment share must be estimated. Using quarterly data on employment by sector from 1990 through 2007,[11] we estimate the relationship between changes in overall employment and changes in the sectoral employment share. The second column of Table 4 shows the cyclical sensitivity of each sector's employment share. The first few entries indicate that a 1 percent increase in total employment tends to correspond to a 0.29 percent reduction in the share of employment in the mining and logging sector and 1.80 and 0.93 percent increases in the employment shares of the construction and manufacturing sectors, respectively.[12] The cyclicality factors indicate that construction and information are the most procyclical major sectors. The professional and business services and manufacturing sectors are both highly cyclical as well, driven, respectively, by the employment service and durable goods sub-sectors. The most countercyclical sectors are education and health services, government, financial activities, and other services; all of these tend to see rising employment shares when the economy contracts and falling shares when the economy expands.

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the rising tide effect and the second term is the cyclicality effect.

[10] Data are from U.S. Department of Labor (2010).

[11] Data are from U.S. Department of Labor (2009a).

[12] These cyclicality factors are the coefficients from regressions of the quarterly change in each sector's share of total non-farm employment on a constant and the quarterly change in log employment, using data from 1990:Q1 through 2007:Q4, divided by the sector's employment share in November 2009.

Table 4. Employment Effects of the Recovery Act by Sector, 2009:Q4

	Employment Share	Sector Cyclicality Factor	Effect[a] (Thousands of Jobs)			
			Cyclicality	Rising tide	Total	Share of Total
Mining and Logging	1%	-0.29	-3	11	8	0%
Construction	5%	1.80	168	94	262	13%
Manufacturing	9%	0.93	170	184	354	17%
Durable Goods	5%	1.80	200	112	312	15%
Trade, Transportation & Utilities	19%	0.16	64	395	459	22%
Retail Trade	11%	0.16	36	231	267	13%
Information	2%	1.28	56	44	101	5%
Financial Activities (FIRE)	6%	-0.51	-61	121	61	3%
Professional and Business Services	13%	0.94	246	265	510	25%
Employment Services	2%	4.28	174	41	215	10%
Education and Health Services	15%	-0.86	-260	307	46	2%
Leisure and Hospitality	10%	-0.21	-42	207	165	8%
Other Services	4%	-0.50	-42	85	43	2%
Government	17%	-0.84	-295	355	60	3%
Total Nonfarm Employment[b]	**100%**	------	------	**2,068**	**2,068**	**100%**

Sources: Department of Labor (Bureau of Labor Statistics); CEA calculations.
Notes: a. Employment effects in 2009:Q4.
b. Items may not add to total due to rounding.

The Recovery Act, by stimulating total employment, has led to increases in the employment shares of procyclical industries and reductions in the shares of countercyclical industries relative to what would have happened otherwise. The resulting cyclicality effects on sectoral employment are shown in the third column of Table 4.[13] Construction and manufacturing have each gained about 170,000 jobs relative to the baseline due to cyclicality factors, while professional and business services has gained nearly 250,000 jobs. More than all of the cyclical manufacturing growth is in the durable goods sector (which gained 200,000 jobs through this channel)[14] while the professional services growth is largely due to the employment services industry (174,000 jobs gained relative to the baseline). By contrast, education and health services and government each saw their job creation reduced by over 250,000 jobs relative to the baseline due to the cyclicality effect, and financial activities by 61,000 jobs.

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[13] These are calculated by multiplying the regression coefficient from the previous footnote by the change in log employment attributable to the Recovery Act (from the analysis in the previous section) to obtain the change in the sectoral employment share attributable to the cyclicality effect of the Act. That is, we estimate $(s - \hat{s})$ as $\beta(\ln E - \ln \hat{E})$, where β is the regression coefficient. The resulting change in the sectoral employment share is then multiplied by our estimate of the employment level that would have obtained without the act, $\hat{E} = 128.9$ million, to obtain the cyclicality effect on sectoral employment levels.

[14] The cyclicality effect on durable goods can be larger than that on all manufacturing because non-durable goods employment is (relatively) countercyclical, with declining employment shares in expansions.

The fourth column shows the rising tide effects. These are all necessarily positive, as no industry has a negative share of total employment. In each case, industries with negative cyclicality effects saw those more than offset by positive rising tide effects, leading to a net positive effect on total employment relative to the no-stimulus baseline. These net effects are shown in the fifth column, while the last column shows the distribution across sectors. All major industries were assisted, with the largest shares of jobs created by the Recovery Act in professional and business services; trade, transportation, and utilities; manufacturing; and construction.

Of course, these figures are only estimates. One factor that could cause the distribution of job creation to differ from its normal cyclical pattern is the unusual nature of the recession. For example, the fact that the recession has been unusually concentrated in construction may mean that the fraction of jobs saved or created by fiscal stimulus in this recession that are in construction is different than it usually would be.

Another factor that could cause the actual distribution to differ from our estimates is the specifics of the Recovery Act. Most obviously, because a substantial portion of spending under the Act thus far has consisted of aid to the states, estimates based on normal cyclical behavior are likely to underestimate the effects of the Act on state and local government employment.

D. State Decomposition of the Estimated Impact on Employment

Our comparison to baseline projections suggests that the ARRA and other recovery programs have resulted in employment as of the fourth quarter of 2009 that is roughly 2 million higher than it otherwise would have been. There is obviously much interest in how these employment effects have been distributed across states. Section VI presents the state distribution of employment effects for the subset of recipients of Recovery Act funds required to report directly on the number of jobs created or saved. In this section, we make an initial attempt to provide a rough state-by-state breakdown for the effects of the entire ARRA. However, it is important to emphasize that these disaggregate estimates are inherently more speculative and uncertain.

Because there is no perfect way to measure state-level effects, we pursue three approaches to decomposing employment impacts across states. Our first method allocates jobs according to states' shares of national non-farm employment as of March 2009.[15] Georgia, for example, had 3.0 percent of all employment in the country in March, so is allocated 3.0 percent of total job creation. This is akin to the "rising tide" component of job creation discussed above.

Our second method allocates jobs according to the distribution of Recovery Act outlays

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[15] U.S. Department of Labor (2009b). We use seasonally adjusted estimates of total nonfarm employment.

through December 31, 2009. Georgia has received 3.0 percent of total outlays, so is estimated to receive 3.0 percent of total job creation. This method provides a more direct measure of where ARRA impacts are likely to be felt than does the "rising tide" method, but it has an important drawback. Only a portion of the overall Recovery Act stimulus is included in the Recovery.gov state-level figures. The most important stimulus not included in this approach are the various types of tax relief, which, as discussed earlier, comprise over one-third of total spending plus tax cuts to date. Tax cuts are likely more evenly distributed across states than are outlays, so our use of outlays likely overstates the unevenness of employment effects. Similarly, this method assumes that all of the employment effects of spending in a state are felt within the state. In fact, however, there are important spillovers across states. Thus again, this approach is likely to exaggerate the differences among states.

Our third method relies on the sectoral decomposition of employment effects from the previous subsection. We assume that any jobs saved or created in a particular industrial sector (for example, mining and logging) are distributed across states in the same way as are existing jobs in that sector.[16] Georgia has only 1.4 percent of national employment in mining and logging, so is assumed to receive only 1.4 percent of employment effects in that industry. By contrast, Georgia has nearly one-quarter of national textile product mill employment, so any employment impacts in that industry are assigned disproportionately to Georgia. Summing across 42 industries, we obtain the total impact on Georgia employment.[17] The procedure is repeated for each state to obtain the distribution across states.

None of these three approaches does a perfect job of measuring the geographic distribution of employment effects, and each has advantages and disadvantages relative to the others. Thus, to obtain a reasonable estimate of state-level job impacts, we average the three approaches. This average indicates that the ARRA has saved or created over 60,000 jobs in Georgia, 3.0 percent of the national total. Estimates for all fifty states, plus the District of Columbia, are reported in Table 5.

Of course, simply because their populations are larger, we estimate that larger states have seen larger jobs impacts. Similarly, because their employment is more cyclically sensitive,

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[16] Employment by state and industry is drawn from data published by the U.S. Department of Labor (2009b). We use data from the March 2009 Current Employment Statistics to determine state employment shares and data from the 2008 Quarterly Census of Employment and Wages to determine state-by-industry employment. Because of limitations in the available data, some of the analysis here uses data beginning in 1990:Q2.

[17] For this analysis, we use a finer disaggregation of industries than was reported in Table 4. Manufacturing is divided into 21 sectors (for example, fabricated metal products). Trade, transportation, and utilities are divided into four sectors (wholesale trade, retail trade, utilities, and transportation/warehousing); financial activities into two (finance/insurance, and real estate/rental/leasing); professional and business services into five (professional/technical services, management of companies, employment services, other administrative/support services, and waste management/remediation); education and health into two (educational services and health care/social assistance); leisure and hospitality into two (arts/entertainment/recreation and accommodation/food services). For data sources and methods used in the sectoral decomposition, see the previous subsection.

industrial states are estimated to have had larger employment effects relative to their populations. Finally, both because of their industrial composition and because state fiscal relief and aid to individuals directly impacted have been larger in states hit harder by the recession, we estimate that states with higher unemployment rates at the time of passage have seen larger employment effects of the ARRA relative to their populations.

Table 5. Estimated Impact of the ARRA on Employment by State, 2009:Q4

State	Jobs Impact	State	Jobs Impact
	Thousands		Thousands
Alabama	27	Montana	7
Alaska	5	Nebraska	11
Arizona	43	Nevada	20
Arkansas	17	New Hampshire	9
California	256	New Jersey	65
Colorado	33	New Mexico	12
Connecticut	26	New York	141
Delaware	6	North Carolina	62
District of Columbia	10	North Dakota	5
Florida	112	Ohio	79
Georgia	63	Oklahoma	23
Hawaii	8	Oregon	28
Idaho	10	Pennsylvania	84
Illinois	96	Rhode Island	8
Indiana	48	South Carolina	28
Iowa	23	South Dakota	6
Kansas	19	Tennessee	40
Kentucky	27	Texas	147
Louisiana	26	Utah	18
Maine	10	Vermont	5
Maryland	36	Virginia	48
Massachusetts	53	Washington	45
Michigan	69	West Virginia	10
Minnesota	41	Wisconsin	44
Mississippi	17	Wyoming	4
Missouri	40		

Source: CEA estimates based on data from the Current Employment Statistics and the Quarterly Census of Employment and Wages.
Notes: Entries sum to the estimated cumulative impact of policy on level in Table 3 (2,068,000 jobs impacted).

V. ESTIMATES OF EFFECTS FROM ECONOMIC MODELS

This section examines estimates of the output and employment effects of the ARRA from macroeconomic models of the effects of various types of fiscal stimulus. The first part of the section describes the estimates using the CEA's version of this approach. We then consider the estimates from a range of public and private forecasts and analysts.

A. CEA Model-Based Estimates of the Effect of the ARRA

A natural way to estimate the effects of the ARRA on employment and GDP is to use existing estimates of the macroeconomic effects of fiscal policy. This was one approach used by the CEA to estimate the likely effects of the Act based on the information available soon after the Act was passed.[18] This methodology uses mainstream estimates of economic multipliers for the effects of fiscal stimulus. The version of the model used here is identical to that used in the September report.[19]

As in the September report, we use figures on actual outlays and tax relief under the Recovery Act. Because the spending data used for the third quarter were incomplete at the time of the CEA's first quarterly report, the numbers presented for the third quarter differ slightly from those in the first report. Also, as discussed above, the Office of Tax Analysis of the Department of Treasury has prepared revised estimates of the tax effects of the Act. These numbers are slightly different for both the second and third quarters, and so lead to slightly different estimates for both quarters.[20]

This exercise, like the one based on statistical projections, will obviously not yield exact figures for the effects of the ARRA. To begin with, there is uncertainty about the size of the economic effects of a "typical" increase in government purchases or a "typical" tax cut. There is even more uncertainty about the precise timing of those effects, and modest changes in timing have noticeable effects on the impact at a specific point in time. In addition, the current exceptional economic environment could make the effects of stimulus somewhat larger or smaller than normal, or could cause them to occur somewhat more or less quickly. Finally, the ARRA – appropriately – was not just typical stimulus. For types of stimulus that are used less frequently, there is even greater uncertainty about the size and timing of the macroeconomic effects.

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[18] Council of Economic Advisers (2009a).

[19] See Council of Economic Advisers (2009b, p. 23) for more details of the model.

[20] The tax estimates on the Recovery.gov website do not reflect the changes to the quarterly pattern. To provide the most accurate quarterly estimates of the impact of the ARRA, however, we use the revised tax estimates for each quarter. See note 1.

The results of this analysis are shown in Table 6. They imply that the ARRA is having a substantial beneficial effect on production and employment. Specifically, they suggest that the ARRA added roughly 2.8 percentage points to GDP growth in the second quarter; 3.9 percentage points in the third quarter; and 1.8 percentage points in the fourth quarter. The approach also suggests that the Act increased employment relative to what it otherwise would have been in the second quarter (or May) by about 385,000 jobs; in the third quarter (or August) by about 1.11 million jobs; and in the fourth quarter (or November) by about 1.77 million jobs. These estimates are broadly similar to the estimates described in Section IV obtained by comparing employment and output with projections of how those variables would have behaved in the absence of stimulus. They are also broadly similar to the estimates of many knowledgeable outside observers that we discuss below.

Table 6. Estimates of the Effect of the ARRA Using CEA Multiplier Model

	2009:Q2	2009:Q3	2009:Q4
GDP Growth (Percentage Points)	+2.8	+3.9	+1.8
Employment	+385,000	+1,111,000	+1,772,000

Source: CEA calculations.

It is important to point out that the lower estimated impact of the Act on GDP growth in the fourth quarter than in the second and third quarters was exactly what was anticipated, and in no way suggests that the effectiveness of the Act has been diminished. Fiscal stimulus has its largest impact on GDP *growth* when the stimulus is first ramping up—that is, when the rise in the quarterly stimulus is largest. As shown in Table 2 and discussed in Section II, the quarterly fiscal stimulus increased most substantially between the first and the second quarter of 2009, when it rose $71.1 billion. The quarterly stimulus rose a small amount further in the third quarter. In the fourth quarter, the quarterly stimulus remained high, but did not increase.

The reason that this steady level of quarterly stimulus in the fourth quarter is nevertheless estimated to have raised GDP growth is that the model implies that some of the fiscal impulse in the second and third quarters takes a while to affect GDP. As a result, some of this impact shows up in the fourth quarter. Also, as also discussed in Section II, the composition of the fiscal stimulus has changed substantially over time. The types of stimulus that could get out the door most quickly, in particular the tax cuts, tend to have a smaller impact on GDP growth than increases in government investment spending. By the fourth quarter, government spending was a substantially larger fraction of the total fiscal impulse than earlier. This shift in composition acted to raise GDP growth in the fourth quarter.

As time goes on, the additional impact of the stimulus on GDP *growth* will naturally wane. However, even when the contribution to growth reaches zero, the spending and tax cuts

will continue to be important to the health of the economy. Fiscal stimulus continuing at the current rate of roughly $85 billion per quarter will serve to maintain GDP (and hence employment) at a substantially higher level than it would otherwise be. Stopping the stimulus prematurely would lower GDP growth. Thus, even when the stimulus is no longer raising growth relative to what it otherwise would be, it is important to wind down stimulus only gradually as private demand is able to take its place.

B. Comparison with Other Estimates of the Effects of the ARRA

Many other economists and forecasters have estimated the likely effects of the Recovery Act. Most of those estimates are based on formal macroeconomic models. These estimates serve as a check on the reasonableness of our own estimates.

Table 7 reports estimates of the contribution of the ARRA to real GDP growth in the second, third, and fourth quarters of 2009 from an array of public and private forecasters.[21] The first row repeats the estimates from Section IV based on the comparison of actual outcomes with projections of the normal evolution of the economy, and the second row shows our model-based estimates described above. The next two rows show our interpretation of the quarterly pattern consistent with the low and high projections prepared by the Congressional Budget Office.[22] The estimates from both of our approaches are well within the CBO range, and are generally in its lower part. The remaining lines of the table show the private sector estimates that we have been able to gather. These estimates are generally similar to ours.

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[21] The sources are as follows. CBO: CBO (2009a, Table 3, and 2009b, Table 1). Goldman Sachs: Goldman Sachs (2009). IHS/Global Insight: described in IHS/Global Insight (2009); updated figures from Nigel Gault, email communication, January 11, 2010. James Glassman, J.P.Morgan Chase: Glassman (2009). Macroeconomic Advisers: Macroeconomic Advisers (2009a, 2009b); exact figures from email August 10, 2009. Moody's economy.com: described in Zandi (2010); exact numbers from Mark Zandi, email communication, December 24, 2009. Before using estimates from August or September, we checked with each forecaster to ensure their estimates of the effects of the original ARRA had not changed.

[22] CBO estimated a range for the likely effects on the level of GDP in 2009:Q3 in CBO (2009b), and through 2009:Q4 in CBO (2009a). We convert the 2009:Q3 levels into growth projections by assuming that the Recovery Act would have no impact on growth in 2009:Q1, and that the effects on growth would be split evenly between the second and third quarters of 2009. Consider, for example, CBO's low estimate that the Act would raise the level of GDP in 2009:Q3 by 1.2 percent. The constant growth rate that would generate a rise of 1.2 percent over two quarters is 2.4 percent at an annual rate. Because CBO revised up its estimate of the GDP difference from the baseline in 2009:Q3 as shown in Table 1 of CBO (2009b) by 0.1 percentage point for the low estimate, and by 0.2 percentage point for the high estimate, we raise the 2009:Q4 levels shown in CBO (2009a) by these same amounts. The fourth-quarter growth rate can then be derived. For example, the fourth-quarter difference from baseline is now estimated at 1.5 percent (1.4 percent in CBO (2009a) plus 0.1 p.p.), up from a 1.2 percent difference in 2009:Q3. The implicit growth rate is 0.3 percent not at an annual rate, and 1.2 percent annualized. If the 2009:Q4 level is not raised from that shown in CBO (2009a), then the fourth-quarter growth rates would be estimated as 0.8 percent (low) and 2.3 percent (high).

Table 7. Estimates of the Effects of the ARRA on GDP Growth

	2009:Q2	2009:Q3	2009:Q4
	Percentage Points, Annual Rate		
CEA: Projection Approach	+2.6	+2.8	+2.7
CEA: Model Approach	+2.8	+3.9	+1.8
CBO: Low	+2.4[a]	+2.4[a]	+1.2
CBO: High	+6.5[a]	+6.5[a]	+3.1
Goldman Sachs	+2.2	+3.3	+2.0
IHS/Global Insight	+2.1	+2.5	+2.2
James Glassman, J.P.Morgan Chase	+4.5	+2.2	+3.1
Macroeconomic Advisers	+2.1	+2.0	+1.5
Mark Zandi, Moody's Economy.com	+2.8	+3.2	+2.0

Sources: See text for details.

Note: a. Second- and third-quarter effects show the average for these quarters.

Taken together, the estimates suggest that the ARRA has added 2 to 3 percentage points to real GDP growth in the second quarter of 2009; slightly more in the third quarter; and somewhat less in the fourth quarter. Given that actual GDP growth was -0.7 percent (at an annual rate) in the second quarter and +2.2 percent in the third quarter, these estimates suggest that most forecasters believe that in the absence of the ARRA, GDP would have contracted sharply in the second quarter, and continued to decline in the third. If growth comes in as high, or higher, than the Blue Chip Consensus in the fourth quarter, this will be the first quarter where the forces of private recovery would have led to positive growth in the absence of the Recovery Act. Even so, growth would have been considerably more anemic without the fiscal stimulus.

Fewer estimates of the employment effects of the Recovery Act are available. Those that we have been able to gather are reported in Table 8, together with the estimates from our two approaches.[23] Again, our estimates are within the range of other projections, though somewhat above the median.

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[23] The sources are the same as in Table 7. For CBO, we parallel the treatment in Table 7. Specifically, for both the low and the high estimate, we assume that half of the impact on the level of employment in 2009:Q3 shown in CBO (2009b) occurred in 2009:Q2, and we revise the 2009:Q4 level shown in CBO (2009a) by the amount CBO revised its estimate of the employment effect in 2009:Q3 in CBO (2009b). If we did not revise the 2009:Q4 level, the fourth-quarter low estimate would be unchanged and the high estimate would be 2,300,000.

Table 8. Estimates of the Effects of the ARRA on Employment

	2009:Q2	2009:Q3	2009:Q4
CEA: Projection Approach	+338,000[a]	+1,134,000[b]	+2,068,000[c]
CEA: Model Approach	+385,000	+1,111,000	+1,772,000
CBO: Low	+300,000	+600,000	+800,000
CBO: High	+800,000	+1,600,000	+2,400,000
IHS/Global Insight	+228,000	+688,000	+1,248,000
Macroeconomic Advisers	+248,000	+623,000	+1,057,000
Moody's Economy.com	+500,000	+1,008,000	+1,586,000

Sources: See text for details.
Notes: a. Datapoint reflects an estimate for May.
b. Datapoint reflects an estimate for August.
c. Datapoint reflects an estimate for November.

This discussion shows that the CEA's estimates of the impact of the Recovery Act on GDP growth and employment are consistent with a broad consensus of numerous professional forecasters. The fact that such a range of public and private forecasters broadly agree with our assessment should increase confidence that the Act is having a substantial stimulative effect.

Given the widespread agreement that the ARRA is contributing strongly to the change in employment, it is natural to wonder why employment continued to fall so strongly after the Act was passed. The answer rests in the baseline trajectory of the economy. The contractionary shocks that hit the U.S. and world economy last fall and winter were so strong that they set in motion an economic decline of nearly unparalleled proportions. Indeed, the downward trajectory was more severe than most forecasters predicted and than economic indicators suggested at the time the ARRA was proposed and passed. These declines have been particularly strong in the employment situation. In an economy in a severe downward slide, fiscal stimulus naturally first manifests itself as a smaller contraction. Only once recovery is firmly established and GDP is growing steadily do the effects show up in employment gains.

VI. EVIDENCE OF EFFECTS FROM RECIPIENT REPORTING

One hallmark of the Recovery Act has been an unprecedented commitment to providing timely, transparent, and accountable information about the Act's progress, allowing the public to "follow the dollar" as it is spent. In pursuit of this goal, the Act requires every prime recipient of ARRA funds subject to Section 1512 of the Act to file quarterly reports estimating the number of jobs created or saved as a result of ARRA funding. The recipient reports are designed to reflect an estimate of individual, identifiable jobs and to provide a source of independent evidence of the effects of the ARRA.

Such a method of measuring employment effects of a broad fiscal stimulus has never been tried before. The Office of the Vice President, the Office of Management and Budget

(OMB), the independent Recovery Accountability and Transparency Board, and individual government agencies have designed a reporting system, complete with new definitions and guidelines, even as the activity to be reported upon was taking place. The process of assembling and reporting the data in real time has been described as "building the airplane while flying it."

A. Overview of Recipient Reporting

Section 1512 of the Recovery Act requires prime recipients of ARRA funds for "projects and activities" to file quarterly reports on the jobs created or saved as a result of the funding. There are no recipient reports associated with the components of ARRA that consist of tax reductions (including the Making Work Pay tax reduction and supplemental Social Security payments). Similarly, many categories of spending, including unemployment insurance benefits and aid to states under the temporary Medicaid FMAP increase, are not covered by the reporting requirement. Altogether, funds subject to the recipient reporting requirement comprise about 35 percent of the total funding of the Act.

The first recipient reports were filed in early October and described activity through September 30. After being submitted, the roughly 57,000 reports by prime recipients were reviewed for data quality. Given that the reports were submitted by thousands of individual recipients, it is not surprising that there were some errors. While many of these were detected in the brief time available for data quality review before the resulting data were released at the end of October, some were not. These missed errors, such as cases where recipients misstated their Congressional districts or misunderstood the guidance, garnered considerable media attention. However, the impact of these errors on the overall picture provided by the reports was small.

Until the recipient reporting process began, the only method for gauging the impact of the ARRA on employment was via aggregate analyses, such as those described in Sections IV and V of this report. Recipient reporting provides a method of measuring jobs effects that is independent of the assumptions that drive the aggregate analyses. As described in detail below, the recipient reporting figures do not provide a complete and fully accurate measure of the overall impact of the Recovery Act. But, the reasons that the estimates from the recipient reporting data are not completely accurate are of a quite different nature than the sources of error in macroeconomic estimates. Both statistical theory and common sense tell us that several different ways of looking at the same phenomenon are better than a single way. Thus, now that the first round of recipient reports is available, they can be used as another check on the reasonableness of the macroeconomic estimates described in Sections IV and V.

Feedback from recipients and data users after the first round of reporting pointed to two aspects of the process as sources of difficulty. First, recipients were asked to make complex judgments about whether a job would have been filled "but for" funding under the Recovery Act. Second, jobs were to be reported as cumulative averages since the beginning of the project under the Act, making it difficult to interpret the reports as indications of employment effects at a point

in time. In response to feedback, OMB has modified its guidance for the reports. Future recipient reports will count jobs that are funded by Recovery Act funds in the current quarter, without regard to whether they would have existed or not in the absence of the Act and without regard to funding and jobs in previous quarters. This simplifies the tasks faced by recipients. The second quarterly reports, characterizing activity between October 1 and December 31, are being filed in January.

B. What Do the Recipient Reports Say?

The first recipient reports reflect information from recipients about jobs created or saved through September 30, the end of the third quarter. The reports indicated a total of 640,000 full-time-equivalent jobs (FTEs) created or saved. The distribution of these jobs across states is shown in Table 9.

Table 9. Job Creation and Retention by State, Recipient Reports

State	Average FTEs 2009:Q3	State	Average FTEs 2009:Q3
Alabama	4,884	Montana	6,427
Alaska	2,315	Nebraska	2,840
Arizona	12,283	Nevada	5,667
Arkansas	3,742	New Hampshire	3,528
California	110,185	New Jersey	24,109
Colorado	8,094	New Mexico	5,230
Connecticut	7,551	New York	40,620
Delaware	1,170	North Carolina	28,073
District of Columbia	2,274	North Dakota	1,293
Florida	29,321	Ohio	17,095
Georgia	24,681	Oklahoma	8,747
Hawaii	1,545	Oregon	9,653
Idaho	2,103	Pennsylvania	7,427
Illinois	24,448	Rhode Island	2,012
Indiana	18,876	South Carolina	8,147
Iowa	5,323	South Dakota	2,198
Kansas	5,935	Tennessee	9,548
Kentucky	4,202	Texas	19,572
Louisiana	9,136	Utah	6,598
Maine	1,613	Vermont	2,030
Maryland	6,748	Virginia	8,617
Massachusetts	12,374	Washington	34,517
Michigan	22,514	West Virginia	2,409
Minnesota	14,315	Wisconsin	10,073
Mississippi	3,433	Wyoming	860
Missouri	15,149	**Total**	**640,329**

Source: Recovery.gov.
Notes: Jobs are assigned to the primary performance location for the award. Total includes 18,829 jobs reported with missing project primary performance location or location in Puerto Rico or U.S. territories.

C. Interpreting the Recipient Reporting Data

The recipient reports contain a great deal of valuable information about the uses and effects of Recovery Act funds. At the same time, there are many reasons that the figures from the recipient reporting data do not provide a comprehensive, perfect accounting of the jobs created or saved by the Recovery Act. Here, we discuss some of the most important reasons.

One key difference has already been mentioned: the scope of the programs covered. As noted above, the reporting requirements only apply to about one-third of the overall funding under the Act. For the very short-run effects of the Act, the fraction is even smaller. The direct spending components of the Act were expected to spend out more slowly than other components, and to play an important role in providing support to the economy over an extended period. As a result, spending subject to the reporting requirements has been only a relatively small fraction of the total stimulus so far.

Table 10 shows the progress of obligations, outlays, and tax reductions as of September 30 (the end of the third quarter of 2009) and December 31 (the end of the fourth quarter), both for the ARRA as a whole and for the subset of programs subject to recipient reporting requirements. Only 14 percent of the stimulus – outlays and tax cuts – through September 30, and only 16 percent of the stimulus through December 31, was covered by recipient reports.

Table 10. ARRA Spending Covered by Recipient Reporting

	Through the end of	
	Q3 (September[a])	Q4 (December[b])
	Billions of Dollars	
ARRA Total		
Outlays	110.7	164.2
Obligations	256.3	313.9
Tax Reductions	68.2	99.1
Outlays Plus Tax Reductions[c]	178.9	263.3
Subject to Recipient Reporting Requirement		
Outlays	25.3	43.4
Obligations	159.5	174.6
Tax Reductions	0.0	0.0
Outlays Subject to Reporting Requirement as Percent of Outlays Plus Tax Reductions	14.1%	16.5%

Sources: Agency Financial and Activity Reports to the Office of Management and Budget; simulations from the Department of the Treasury (Office of Tax Analysis) based on the FY2011 budget.
Notes: a. Data on outlays and obligations are for September 30.
b. Data on outlays and obligations are for December 31.
c. Items may not add to total due to rounding.

A second limitation concerns the jobs impacts that are considered. Economic stimulus spending has several effects on the economy. First, people are hired directly by the government

or its grantees and contractors to do the work paid for by the stimulus – research new energy efficiency technologies, build bridges, and so forth. These are referred to as direct jobs. Second, additional people are hired by suppliers to and subcontractors of the original recipients to provide the inputs needed for the project; these are indirect jobs. Third, the workers hired in the first two steps use their extra earnings to spend more – buy more groceries and newer cars, make rent and mortgage payments, and so on. This additional expenditure creates jobs for farmers, grocery store clerks, autoworkers, and homebuilders, known as induced jobs.

Reporting by ARRA recipients covers only jobs that they created or saved themselves and those created or saved by sub-recipients and vendors. Recipients were instructed not to include jobs created at their materials suppliers or those corresponding to support positions (for example, clerical workers), and to not include any estimates of jobs created by the additional spending by the workers employed on the project.[24] Thus, the reports only capture direct jobs and some indirect jobs. Many indirect jobs are excluded, and induced jobs are beyond the scope of the data collected.

Third, what is central to the employment effects is not the number of employees whose wages were paid out of recovery funds, but the difference between the firm's employment and what employment would have been without the funds. The initial reporting instructions asked recipients to estimate this difference. But, recipients understandably found it difficult to do so, since this requires determining what employment would have been in a hypothetical scenario that did not occur. Thus, in many cases the figures were surely only approximate estimates of this difference. As noted above, future reports will no longer require recipients to estimate this difference, and instead will simply report job activity funded by the ARRA. While this updated methodology will provide important data, it will not provide an estimate of jobs that would not otherwise have existed without the Act.

A fourth important difference between the concepts used in recipient reports and in aggregate models concerns the timing of the employment effects. The analyses presented in Sections IV and V are designed to estimate the effect as of a point in time. By contrast, recipients were asked to report the average number of FTEs supported over the entire lifetime of the ARRA project (for projects that started before 2009:Q3) or over the quarter (for projects that started in Q3).[25] The exact guidance about the first quarter's computation varied slightly from

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[24] For OMB's guidance to recipients of ARRA funds, see
http://www.whitehouse.gov/omb/assets/memoranda_fy2009/m09-21.pdf.

[25] OMB's guidance instructed recipients to report job impacts in terms of "full-time equivalents" (FTEs). That is, a part-time worker is counted as only a fraction of a job, in proportion to the fraction of a full-time schedule that he or she works. A project that is staffed by two half-time workers would thus report one FTE. This proportionality is also applied to short-term workers: a project that employed three workers on full-time schedules for just one month would report one FTE for the quarter.

agency to agency.[26] For the most part, it seems reasonable to interpret each recipient-reported job in the first round of quarterly reports as representing the equivalent of one worker on a full-time schedule for the entire period from July 1 through September 30.[27]

In short, for these and other reasons, the recipient reporting data cannot be used directly to estimate the overall impact of the ARRA on employment in the economy. At the same time, the reporting data provide a useful check on the estimates from the aggregate approaches described in Sections IV and V.

One simple way to perform this check is to note that the funds subject to the reporting requirements were only 14 percent of total outlays and tax cuts as of the end of the third quarter, but the estimate of job creation from the recipient reports is substantially more than 14 percent of the estimates as of the third quarter from the projection and model approaches. Thus, this comparison suggests that the jobs estimates from the aggregate approaches are, if anything, somewhat low.

In the case of the model approach, we can improve on this simple comparison by asking what the approach implies about the jobs impact as of 2009:Q3 not from all of the Recovery Act, but only from an amount of government spending equal to the amount subject to the recipient reporting requirement. Further, we can adjust the multipliers used in the model to omit "induced" jobs, and so bring them closer to what the recipients were asked to report. This comparison again yields a smaller estimate from the model approach than from the recipient reporting data, and so suggests that the model is not overstating the jobs effects.

Thus, the recipient reports are support the view that the ARRA has had large, rapid impacts on employment – impacts that have been, if anything, larger than those projected at the time of the Act's passage and larger than are indicated by the CEA's economic and statistical models.

VII. THE ARRA AND THE CLEAN ENERGY TRANSFORMATION

A central piece of the ARRA is more than $90 billion in government investment and tax incentives to lay the foundation for the clean energy economy of the future.[28] This investment will help create a new generation of jobs, reduce dependence on oil, enhance national security,

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[26] The guidance mainly differed in the time period over which to calculate the baseline number of hours worked by a full-time worker. See Government Accountability Office (2009, p. 61) for examples of how the guidance differed across agencies.

[27] If anything, this is likely to understate the employment impact as of the end of September. For a project that began on September 1, for example, three workers would need to be employed on full-time schedules for the month of September to yield one FTE according to the OMB guidance.

[28] Past estimates have placed the clean energy investment in the Recovery Act at around $80 billion. The higher figure primarily reflects a new estimate of the cost of the clean-energy-related tax credits.

and improve the environment. Ultimately, the investments could help transform the United States into a global clean energy leader.

A. Clean Energy Investments under the Recovery Act

The Recovery Act pursued a multifaceted approach to clean energy. Undertaking a broad range of investments in energy efficiency, clean energy, and new technologies will allow us to make the transformation to a clean energy economy smoothly and effectively. The ARRA investments in the clean energy transformation fall into eight categories:

1. *Energy Efficiency*. The ARRA is promoting energy efficiency through investments that reduce energy consumption in many sectors of the economy. For instance, the Act appropriates $5 billion to the Weatherization Assistance Program to pay up to $6,500 per dwelling unit for energy efficiency retrofits in low-income homes. The program begins with an energy audit to identify the most cost-effective ways to reduce a household's energy bills. This information is then used to weatherize the home by sealing ducts, installing insulation, and upgrading heating and cooling systems. The ARRA also appropriates $3.2 billion to the Energy Efficiency and Conservation Block Grant program. The vast majority of this funding (over $2.7 billion) has been appropriated by formula for U.S. states, territories, local governments, and Indian tribes to fund projects that improve energy efficiency, reduce energy use, and lower fossil fuel emissions; almost $2 billion has been awarded to date. In December, groups submitted applications to the "Retrofit Ramp-Up" program, which will competitively award $390 million to perform whole-neighborhood energy upgrades.[29]

2. *Renewable Generation*. The ARRA is making investments in renewable generation that are leading to the installation of wind turbines, solar panels, and other renewable energy sources. For instance, the ARRA adds $4 billion to the Department of Energy's (DOE) Loan Guarantee Program for a variety of projects, including renewable energy and advanced biofuel. This amount covers the estimated long-term subsidy cost to the government of offering guarantees on private loans. The DOE estimates that this additional funding will result in about $32 billion in loan guarantees. (As we discuss below, our analysis of the economic impact of the ARRA's clean energy provisions considers only the $4 billion Federal subsidy.[30]) Additionally, the ARRA extends an existing 2 cents per kilowatt-hour (in 2008 dollars) production tax credit for wind, geothermal, and hydroelectric generation and a 1 cent per kilowatt-hour production tax credit for biomass and landfill gas. The Energy Information Administration projects that the amount of electricity generated from renewable

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[29] The energy efficiency category also includes Recovery Act funding for the General Services Administration (GSA), which is allocated to transition the GSA inventory toward High Performance Green Buildings, although not all the activities funded are directly energy-related.

[30] Reflecting estimates of the distribution of projects funded under this program, we assign $3.5 billion of the $4 billion total subsidy to the renewable generation category and $500 million to grid modernization.

energy will grow due to the renewal of Federal tax credits and the funding of new loan guarantees through the ARRA. By 2012, wind generation capacity is expected to be more than double what it would have been without the Recovery Act. Geothermal and biomass capacity are also projected to grow substantially due to the Act (U.S. Department of Energy, Energy Information Administration, 2009).

3. *Grid Modernization*. As the United States transitions to greater use of intermittent renewable energy sources such as wind and solar, the Act is helping to finance the construction of new transmission lines that can support electricity generated by renewable energy. Storage and monitoring of electricity use will also become even more important. A crucial step in this transformation will be the development of the so-called "smart grid" – sophisticated electric meters, high-tech electricity distribution and transmission grid sensors, and energy storage that will improve the reliability, flexibility, and efficiency of the nation's electricity grid. The ARRA provides about $10.5 billion to support projects that will modernize the electric grid, enhance the efficiency of the U.S. energy infrastructure, and ensure reliable electricity delivery, largely through smart grid projects and interconnection transmission planning. In October, the Federal government announced that it had awarded $3.4 billion in smart grid investment grants to support 100 projects nationwide. These projects range from the installation of about 2.2 million smart meters in Houston, Texas designed to help reduce demand during peak hours to investment in the smart grid manufacturing industry. Recently, $60 million in funding was announced to support better planning and integration of smart grid technologies into the nation's three major transmission networks, while another $620 million in funding was awarded to support 32 smart grid and energy storage demonstration projects throughout the country. Moreover, the ARRA also increases the borrowing authority of the Bonneville and Western Area Power Administrations (two of the four regional power marketing agencies in DOE) by $3.25 billion each, providing financing for further investments in transmission. Both have already used a portion of their new borrowing authority to fund new transmission lines.

4. *Advanced Vehicles and Fuels Technologies*. The ARRA is funding research on and deployment of the next generation of automobile batteries, advanced biofuels, plug-in hybrids, and all-electric vehicles, as well as the necessary support infrastructure. For instance, the President announced in March that $2.4 billion in grants from the ARRA would be made available to U.S. firms to support domestic manufacturing of advanced batteries and other components needed for electric vehicles and plug-in hybrids. In addition, the ARRA funds a tax credit for plug-in electric vehicles of up to $7,500 per vehicle when they become available on the U.S. market. These efforts are expected to reduce the nation's dependence on oil in the transportation sector.

5. *Traditional Transit and High-Speed Rail.* The Recovery Act is providing grants that will lead to upgrades in the reliability and service of public transit and conventional intercity railroad systems. The Act provides $8 billion to improve existing or build new high-speed rail in 100 to 600 mile intercity corridors. In addition, it has made $1.3 billion available to support Amtrak, the national railroad passenger corporation. These funds will help repair and upgrade key railroad infrastructure, expand railroad capacity, and improve passenger safety and security. The ARRA also provides about $7 billion in grants to support a wide variety of capital spending for public transit, including purchases of buses and vans; maintenance of rail track, tunnels, and other structures; and construction of maintenance facilities. Taken together, these investments in high-speed rail and public transit will increase energy efficiency by improving both access and reliability, which will make it possible for more people to switch to rail or public transit from less energy efficient forms of transportation.

6. *Carbon Capture and Sequestration.* One strategy for limiting greenhouse gas emissions is to prevent the carbon released by fossil fuel combustion from entering the atmosphere. The abundance of coal reserves in the United States makes the development of such technologies a particular priority. The ARRA is funding crucial research, development, and demonstration of carbon capture and sequestration technologies. In particular, it provides $3.4 billion to support initiatives that range from characterizing the carbon sequestration potential of geologic formations, to cost-sharing agreements to demonstrate advanced carbon capture and storage technologies for coal and industrial sources. This investment aims to support carbon capture facilities of a sufficient scale that, once demonstrated, they can be replicated and deployed commercially in the electric power industry and other industries with significant stationary source carbon dioxide emissions.

7. *Green Innovation and Job Training.* The ARRA is investing in the science and technology needed to provide the foundation for the clean energy economy. For instance, a total of $400 million has been allocated to the Advanced Research Projects Agency - Energy (ARPA-E) program, which funds new, creative research ideas aimed at accelerating the pace of innovation in advanced energy technologies. A key objective of the program is to fund research that would not be funded by industry due to technical or financial uncertainty. To date, $151 million – nearly 40 percent of the funding – has been awarded to researchers working on 37 projects in 17 states. The projects include liquid metal grid-scale batteries, bacteria for producing solar hydrocarbon biofuels, carbon capture using artificial enzymes, and low-cost crystals for LED lighting. The Recovery Act is also funding the training of workers for jobs in the energy efficiency and clean energy industries of the future. This training will help to produce the labor force necessary for transitioning to a cleaner energy economy. The ARRA includes $500 million for competitive grants to state agencies and non-profits to support programs to train and place workers in jobs in these sectors. It also

includes $100 million for training and hiring workers in the utility and electrical manufacturing sectors with the aim of furthering implementation and knowledge of a smarter, cleaner energy grid system.

8. *Clean Energy Equipment Manufacturing*. The ARRA is increasing our capacity to manufacture wind turbines, solar panels, electric vehicles, batteries, and other clean energy components domestically. Transitioning the United States to a cleaner energy economy will create demand for advanced energy products, and these investments help American manufacturers to participate in supplying the needed goods. For instance, the ARRA authorizes a 30-percent tax credit for investments in advanced energy manufacturing projects, including renewable energy generation, energy storage, advanced transmission, energy conservation, renewable fuel refining or blending, plug-in vehicles, and carbon capture and storage. This will provide estimated government funding of over $1.6 billion to support capital investments of over three times this amount.

To describe the breakdown of the clean energy investments in the ARRA among these categories, we begin with a list of 56 projects and activities – including those discussed above – that are related to the clean energy transformation. This list includes 45 spending provisions with a total appropriation of $60.7 billion and another 11 tax incentives that will cost $29.5 billion through fiscal year 2019, according to the Office of Tax Analysis, for a total investment of over $90 billion. In some cases, a relatively small amount of Federal investment leverages a larger amount of non-Federal support. Throughout this section, we count toward the appropriation only the expected subsidy cost of the Federal investment.[31] For example, the DOE Loan Guarantee Program discussed above is estimated to support about $32 billion in loan guarantees at a cost to the Federal government of $4 billion; only the $4 billion is counted toward the clean energy appropriations from the ARRA.

Figure 9 illustrates the distribution of this $90 billion investment across the eight categories of clean energy projects discussed above, along with a ninth "other" category containing programs that do not fit in elsewhere. The largest investments are in renewable energy generation, energy efficiency (for example, weatherproofing), and transit (including high-speed rail).

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[31] We make an exception for borrowing authority granted to the Bonneville and Western Area Power Administrations. Because of the public nature of these agencies, we count the projected drawdown of the borrowing authority as the ARRA appropriation.

Figure 9. Clean Energy Appropriations by Category

Billions of $

Source: See Table 11.
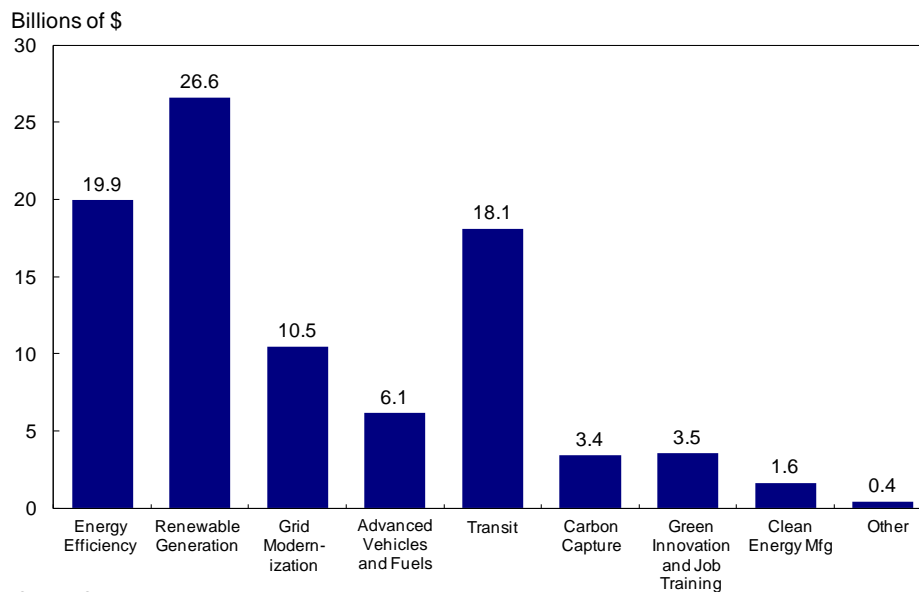
Because most of the clean energy investments occur through grants and contracts that require that proposals be reviewed before funds are expended, not all of the money appropriated for these investments could be spent quickly. Thus, as with the ARRA more generally, only a portion of the appropriation has been spent to date.

Table 11 presents three measures of the investment in each of the eight categories discussed above. Column 1 shows the appropriations values from Figure 9. Columns 2 and 3 present obligations and outlays as of December 31, 2009 in each of the categories of clean energy programs in the ARRA.[32] They show that over $30 billion has been obligated to date and over $5 billion has been outlayed.

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[32] Expenditures are tracked by Treasury Account Financial Symbol (TAFS). In some cases, clean energy and non-clean energy programs are grouped into the same TAFS and no information is available about the composition of obligations and outlays to date. To estimate clean energy expenditures, we allocate obligations and outlays to date using the clean energy share of the total appropriation for the TAFS. This will overstate clean energy spending to date if non-clean energy projects began faster than clean energy projects and will understate clean energy spending if the clean energy projects began faster. We make one exception to our usual procedure for green job training programs administered by the Department of Labor (DOL). In this case, DOL reported to the CEA that $55 million of the obligations to date and none of the outlays to date from the relevant TAFS account pertain to training programs for green and clean energy occupations, and we adjust our allocation accordingly. For tax provisions, we include the Office of Tax Analysis's estimate of the total cost through fiscal year 2019 in column 1, and its estimate of the cost to date in both columns 2 and 3.

Table 11. Clean Energy Spending by Category

	Appropriations[a]	Through the end of December	
		Obligations[b]	Outlays[b]
		Millions of Dollars	
Energy Efficiency	19,935	11,913	1,162
Renewable Generation	26,598	1,513	1,479
Grid Modernization	10,453	2,666	72
Advanced Vehicles and Fuels Technologies	6,142	3,149	450
Traditional Transit and High-Speed Rail	18,113	8,834	1,805
Carbon Capture and Sequestration	3,400	425	4
Green Innovation and Job Training	3,549	2,197	123
Clean Energy Equipment Manufacturing	1,624	14	14
Other	408	148	12
Total[c]	**90,222**	**30,861**	**5,121**

Sources: Appropriations estimates from the Office of Management and Budget (OMB); agency Financial and Activity Reports to OMB for December 31, 2009; simulations from the Department of the Treasury (Office of Tax Analysis) based on the FY2011 budget.

Notes: a. Appropriations include estimated cost of tax provisions through 2019:Q3.

b. Obligations and outlays include estimated costs of tax provisions through 2009:Q4.

c. Items may not add to total due to rounding.

Table 12 presents a different look at clean energy spending under the ARRA, categorizing it by agency rather than by functional category. Not surprisingly, the bulk of the appropriation went to the Departments of Energy and Transportation, with another large portion to tax provisions that are not allocated to individual agencies.

Table 12. Clean Energy Spending by Agency

	Appropriations	Through the end of December	
		Obligations	Outlays
		Millions of Dollars	
Commerce	6	1	0
Defense and Veterans Affairs[a]	922	354	46
Energy	35,235	16,608	712
Environmental Protection Agency	300	294	28
General Services Administration	4,800	1,980	387
Housing and Urban Development	850	608	84
Interior	41	7	1
Labor	500	55	0
National Science Foundation	77	64	3
Transportation	17,968	8,774	1,745
Tax Provisions[b]	29,523	2,115	2,115
Total	**90,222**	**30,861**	**5,121**

Sources: See Table 11.

Notes: See notes to Table 11.

a. "Defense and Veterans Affairs" also includes Army, Navy, and Air Force.

b. Tax reductions through December 31, 2009.

B. The Short-Run Macroeconomic Effects of the Clean Energy Investments

The ARRA investments in clean energy will lay the foundation for a clean energy economy that will create new industries, reduce our energy dependence, and counter climate change. These ARRA investments are also improving the current economic situation. Given the subject matter of this report, here we focus on the short-run jobs impact of the investments.

To estimate the short-run economic impact of the ARRA's clean energy investments, we use the CEA macroeconomic model described in Section V. We take estimates of the actual outlays and tax reductions related to clean energy in each quarter and then use the model to simulate the impact of these expenditures on GDP and employment. The first column of Table 13 shows the estimated total impact on employment (of all types) as of 2009:Q4, by category. Since the investment components of the Act were intended to spend out gradually, the estimated number of jobs created or saved so far is relatively small. We estimate that the ARRA clean energy investments have saved or created about 63,000 jobs as of the fourth quarter of 2009. The largest impacts derive from the transit, renewable generation, and energy efficiency categories. We refer to the total employment effects as "jobs supported by clean energy programs."

Table 13. Clean Energy Jobs by Category

	CEA Model[a]		
	Jobs Supported by Clean Energy Programs[b] (2009:Q4)	Clean Energy Jobs[c] (2009:Q4)	Total Job-Years through 2012[d]
Energy Efficiency	14,500	12,100	179,000
Renewable Generation	16,900	13,200	192,900
Grid Modernization	1,000	800	80,600
Advanced Vehicles and Fuels Technologies	5,800	4,700	37,000
Traditional Transit and High-Speed Rail	22,900	18,900	158,200
Carbon Capture and Sequestration	100	--	26,500
Green Innovation and Job Training	1,700	1,500	32,200
Clean Energy Equipment Manufacturing	200	200	9,500
Other	200	200	3,700
Total[e]	**63,200**	**51,700**	**719,600**

Sources: CEA analysis of agency Financial and Activity Reports to the Office of Management and Budget (OMB) through December 31, 2009, estimates of appropriations and spending projections from OMB, and simulations from the Department of the Treasury (Office of Tax Analysis) based on the FY2011 budget.

Notes: a. Job numbers are rounded to the nearest 100. A double dash indicates fewer than 50 jobs.

b. This column includes induced jobs that might themselves not be considered clean energy jobs.

c. Clean energy jobs are direct and indirect jobs created by clean energy spending.

d. Job-years represent all jobs supported by the clean energy provisions in the ARRA through 2012:Q4. A "job-year" is one person employed for one year.

e. Items may not add to total due to rounding.

Of course, not all of the jobs supported by clean energy programs are directly related to clean energy. There are also induced jobs throughout the economy. For example, the earnings

that weatherization workers derive from their ARRA-supported work might allow them to purchase automobiles, adding to employment in that industry. Importantly, these induced jobs are not necessarily any more closely related to the clean energy transformation than are other jobs in our economy.

To estimate the number of jobs that are directly related to clean energy programs, we adjust the multipliers to exclude induced jobs, as we did for the comparison of the recipient reporting data and the model-based estimates in the previous section. The result, which we call "clean energy jobs," is shown in column 2. Our estimates imply that roughly 52,000 jobs, or about 80 percent of those supported by clean energy outlays and tax reductions so far, are clean energy jobs.

As discussed in Section VI, the recipient reports provide a check on the CEA model. Recipients reported a total of 26,642 jobs associated with the clean energy programs in the third quarter.[33] These are not directly comparable to the numbers in columns 1 and 2 of Table 13 for several reasons. One is that the numbers in columns 1 and 2 represent employment effects in the fourth quarter of 2009, while the recipient reports refer to effects in the third quarter. CEA's model indicates that the ARRA created 30 percent more clean energy jobs in the fourth quarter than in the third quarter. This ramp-up explains much of the difference between the recipient reports and column 2. Another important difference is that over one-third of the clean energy appropriations are not covered by recipient reporting. When these differences are accounted for, the numbers in Table 13 echo the conclusion from Section VI that the recipient reports indicate, if anything, more job creation due to the ARRA than does the CEA model.

Spending at a point in time leads gradually to increases in GDP and employment, beginning with the direct employment effects and then, later, extending to the induced effects. Column 3 of Table 13 shows the total job-years estimated to be saved or created by the clean energy provisions of the ARRA through the end of 2012. A job-year is the equivalent of one worker employed for one year. This measure shows the cumulative impact of the provisions on employment. To put these numbers in perspective, the CEA estimated in May that the ARRA would save or create 3.5 million jobs as of 2010:Q4, and 6.8 million job-years through the end of 2012 (CEA 2009a). Column 3 shows that the clean energy provisions will create about 720,000 of these job-years through 2012.[34] Approximately two-thirds of the job-years reported in column

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[33] As with obligations and outlays, recipient reports are categorized by the TAFS through which the program is funded. We again assume that the clean energy share of recipient reported jobs is the same as the clean energy share of the total appropriation for the TAFS (again excepting the green job training program discussed in note 32).

[34] This number is obtained by dividing the anticipated spending on clean energy programs through the end of 2012 – about 75 percent of the total appropriation to these programs – by $92,136, as discussed in CEA (2009a). This may overstate the near-term job creation potential of these programs, as the clean energy programs in the ARRA have slightly slower spendout than the average ARRA spending program; thus a smaller fraction of these jobs occurs in the next few years than for the Act as a whole. When we take account of the actual and projected spendout rates for

3 represent clean energy jobs, while the remainder are induced jobs. The reason this fraction is smaller than the 80 percent figure for the effect in 2009:Q4 is that the induced jobs occur more slowly.

Of course, these figures are only estimates. The margin of error for estimates for specific programs from the CEA model is relatively large, and the number of clean energy jobs – either in 2009:Q4 or over the life of the Act – could be somewhat smaller or larger than is indicated here. Nevertheless, it is clear that the Act is creating tens of thousands of jobs for people who will help our economy transform to its clean energy future.

VIII. CONCLUSION

This report continues the Council of Economic Advisers' assessment of the economic impact of the American Recovery and Reinvestment Act of 2009. It reflects our attempt to monitor the progress of the Act and the response of the economy as of the fourth quarter of 2009.

Our analysis indicates that the Recovery Act has played a key role in the turnaround of the economy that has been occurring over the past three quarters. Real GDP is growing again, in large part because of the tax cuts and spending increases included in the Act. Employment, after falling dramatically for many months, appears to have almost stabilized. As of the fourth quarter of 2009, we estimate that total employment is 1½ to 2 million higher than otherwise would have been.

As we have emphasized, measuring what a policy action has contributed to growth and employment is inherently difficult because we do not observe what would have occurred without the policy. Therefore, it must be understood that our estimates are subject to substantial margins of error. The results, however, are strong enough and clear enough that we are confident that the basic conclusions are solid. That a wide range of private and government analysts concur with our estimates adds a reassuring check on our analysis.

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the clean energy programs using the model developed in the CEA report, we estimate job creation through 2012 about 8 percent below what is indicated in column 3 of Table 13.

In most cases, projected Federal outlays through the end of 2012 include the bulk of expected expenditures. In a few cases, however, programs are scored as having budgetary impacts spread over many years. For example, the Advanced Energy Manufacturing Tax Credit (also known as "48c," from the relevant section of the Internal Revenue Code) will reduce Federal revenues for several years after 2012 as companies using the credit apply it against their future tax liabilities. For this credit, only about half of the cost (and half of the estimated jobs impact) will be incurred by the end of 2012. Counting all costs through 2019, our calculation yields over 17,000 job-years, 9,500 of which come from spending through the end of 2012.

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