

Did the Fiscal Stimulus Work?

Billions were spent to recover from the Great Recession. How can we know whether taxpayers got a decent bang for the buck?

BY GERALD A. CARLINO

More than seven years after the enactment of the American Recovery and Reinvestment Act, economists, legislators, and the American people continue to debate the effectiveness of the measure. The largest U.S. fiscal stimulus since the 1930s, the Recovery Act pumped hundreds of billions of dollars of federal spending and tax cuts into the economy in an effort to stem the massive job losses and steep drop in economic output that characterized the Great Recession. The projected impact of the stimulus on the federal budget through 2019, when the program is set to end, amounts to \$832 billion. More than 90 percent of that total was realized by the end of 2011.

Did the Recovery Act work? Answering that question requires knowing more than whether employment and output increased after the stimulus began. It requires quantifying how much of the improvement was the result of the stimulus and determining whether the gains were greater than the cost. The central questions are: How can we know whether the economy surpassed the growth it would have attained in the absence of the stimulus? And even if it did, would it have grown even more with a different type of stimulus?

For many economists, the most effective fiscal response to a recession remains an open question. The idea that a timely infusion of government assistance can save jobs and shorten a recession gained credence during the Great Depression. Based on the views of the British economist John Maynard Keynes, the theory holds that when private demand slumps, the government can stimulate the economy

by spending more on public projects and cutting taxes for households and firms.

Although strict Keynesian theory no longer dominates economic thinking, fiscal policymakers have continued to respond to recessions by passing stimulus packages. Research into how, when, and indeed whether stimulus programs work

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has generated a wide range of estimated effects. Economists have sought to calculate the fiscal multiplier — the ratio of a change in economic measures to the change in government spending — through three main methods: macroeconomic models of the economy, variations in stimulus allocations from state to state known as cross-state studies, and economywide observations of economic data over time, or time series studies.

One reason for the disparate findings is that stimulus measures can take various forms. The Recovery Act, for example, mainly involved three distinct interventions: temporary tax cuts for individuals and businesses, additional federal funding for state and local governments in the form of project and welfare aid transfers, and direct federal expenditures. In order to achieve the maximum economic impact — that is, to generate the largest fiscal multiplier — lawmakers need to know the optimal form, timing, and target of the aid.¹

Robert Inman and I have zeroed in more narrowly on the form that stimulus measures have taken, and we find

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that it matters greatly who receives the aid. We also find that for federal funds going to the states, it matters greatly what types of programs the money is spent on.

To weigh all this evidence requires a basic grasp of some simple theory behind fiscal multipliers and how these studies can be designed to tease out the role of the stimulus. Armed with this understanding, we will see how a different mix of stimulus forms might have been more effective at helping the economy recover.

RIPPLE EFFECT: THE FISCAL MULTIPLIER

The striking feature of the economic stimulus package passed by Congress and signed into law in February 2009 by President Barack Obama was its size. Recovery Act spending will total an estimated \$832 billion through 2019. Excluding a \$69 billion patch for the alternative minimum tax, the act provides \$763 billion in fiscal support. This support can be grouped into three broad categories — tax incentives for households and businesses, fiscal relief to state and local governments, and direct federal expenditures on infrastructure and other things.

In the first category, the Recovery Act allocated \$425

billion for tax incentives, such as tax cuts for households and firms. Second, the act provided \$208 billion of general government spending, including \$144 billion for state and local governments, more than 90 percent of which went to Medicaid and education transfer payments. The remaining \$130 billion was earmarked mainly for direct federal expenditures on projects such as transportation, communication, wastewater and sewer infrastructure improvements; an extension of federal unemployment benefits; and scientific research. Of this \$130 billion, \$48 billion went to state and local governments.²

Its size notwithstanding, the Recovery Act resembles all fiscal stimulus measures since World War II in that it relies on basic Keynesian macroeconomic theory, which holds that, during economic downturns, the federal government can offset a decline in private spending by increasing public spending or cutting taxes in order to save jobs and stem further economic weakness. Multiplier analysis is at the core of Keynesian theory. The multiplier for a given stimulus program, such as an increase in federal government spending or a cut in federal income taxes, tells us how much gross domestic product (GDP) is increased per stimulus dollar allocated to the program.

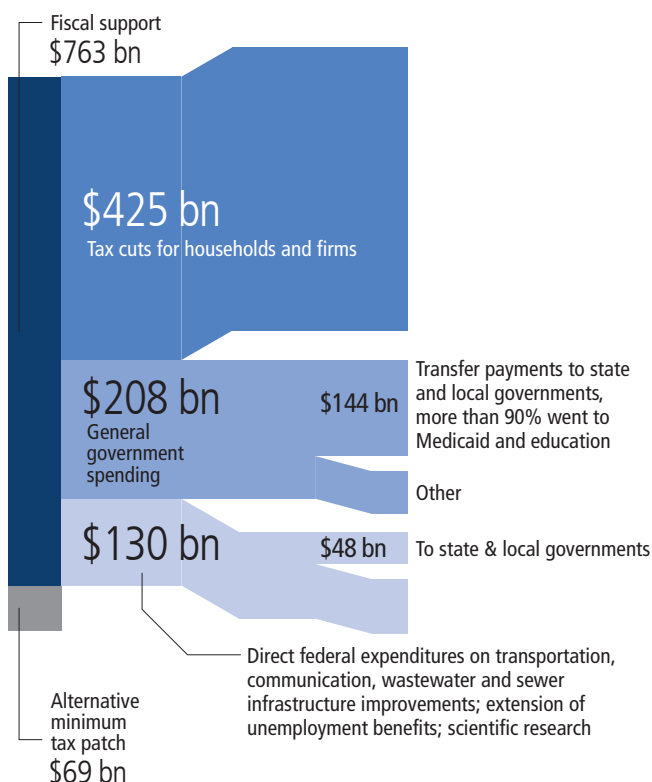
To see how multiplier analysis works, assume that when people receive an extra dollar of income they spend 80 cents of that dollar and save 20 cents. This means the marginal propensity to consume out of an extra dollar of income is 0.8. When the government increases spending by \$1, this dollar becomes income for household A, which spends 80 cents of it. That 80 cents becomes income for household B, which spends 64 cents ($0.8 \times 0.8 = 0.64$). In turn, the 64 cents becomes income for household C, which spends 51 cents (0.8×0.64). This spending process repeats itself over and over, and the resulting change in GDP is the sum of all rounds of spending ($1 + 0.8 + 0.64 + 0.51 +$ all the additional rounds of spending).

Notice that the sum of all the subsequent spending has a larger effect on GDP than the original dollar spent by the government. The sum of this spending follows a geometric series that results in a multiplier of 5 when the marginal propensity to consume is 0.8. That is, a \$1 increase in federal spending results in a \$5 increase in GDP. This example of the government spending multiplier assumes no taxation of income received by households. If the government imposed a proportional tax equal to 20 percent of every dollar received by households, the multiplier would fall from a value of 5 to a value of 2.8.

FIGURE 1

Structure of the Fiscal Stimulus Package

How the \$832 billion was allocated.



While traditional thinking held that households would spend a high proportion of the extra money to which they had access through stimulus programs, the ripple effect might be significantly less than basic multiplier theory suggests. Contemporary macroeconomic theory recognizes that many individuals tend to be forward-looking and will save much or all of a tax cut in anticipation of higher future taxes to pay for the increased deficit. For example, the Recovery Act was deficit financed, meaning the government will have to borrow to finance the resulting deficit. In the future, the government will have to repay, with interest, what it borrowed today, implying that taxes will rise in the future.

Many economists believe that people have rational expectations about future economic conditions because they base their expectations on an intelligent examination of all the available economic data.

People's expectations today about their future tax liabilities will lead them to save rather than spend some or all of a tax cut today, counteracting the fiscal initiative to some degree.

Some economists believe in the *Ricardian equivalence* proposition, which says that the positive effect of a tax cut on income today will be offset entirely by the negative effects of anticipated tax increases on future income and that therefore tax cuts will have no effect on consumption.³ The Ricardian equivalence proposition requires assumptions that have been challenged by economists. For example, lower-income households with little ability to borrow or save will spend much or all of any tax cut they receive today, regardless of whether they anticipate future increases in their tax liabilities. There is some evidence that the Ricardian equivalence proposition may be overstated. Thomas Meissner and Davud Rostam-Afschar tested the proposition in a laboratory-based experiment where a tax cut was implemented in early periods, financed by a tax increase of the same size in later periods. They found that the behavior of about two-thirds of the subjects they studied was inconsistent with the Ricardian hypothesis in that tax changes had a strong and significant effect on consumption.

Contemporary theory also recognizes that fiscal policy and monetary policy can influence one another. The multiplier might be smaller than the basic model suggests in normal times because monetary policy tends to increase interest rates in an attempt to maintain price stability. But higher interest rates can damp investment spending,

which can counteract the fiscal measure. In severe recessions, however, the multiplier can be larger because consumers and states are less likely to save. Also, when the economy is weak, monetary policymakers might not react to the fiscal stimulus in the same way that they would in normal times.⁴

At the time the Recovery Act began, policy and academic discussions were rife with disagreements about the size of the federal expenditure and revenue multipliers. In addition, there was little evidence regarding the likely national economic impact of federal transfers to state and local governments. Some of the disputes arose because no single multiplier can summarize the broad economic consequences of fiscal policy. Rather, the impact of policy varies depending on the type of policy being implemented: tax cuts versus direct federal expenditures versus federal

transfers to households and to state and local governments. Multipliers also are affected by, among other things, the stage of the business cycle when a policy is implemented, the stance of monetary policy, and how a deficit is financed. The uncertainty about the size of the relevant multipliers led to a number of new studies comparing what would

happen to GDP and employment under the Recovery Act with what likely would have happened in its absence.⁵

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WHAT'S THE EVIDENCE?

The three basic approaches to estimating stimulus effects involve U.S. macroeconomic models, cross-state data, and economywide observations over time, or time series models.

Macroeconomic Model-Based Estimates

Many government agencies use macroeconomic models to estimate the economic effects of the stimulus program. These models consist of a set of equations designed to deliver a quantitative description of the behavior of economic variables. For example, one equation describes consumer behavior, another describes investment spending, and others separately describe government spending and the government tax structure. With the model in place, historical data are used to estimate separate multipliers for each category of spending and tax provisions. The idea is that tax cuts, transfer payments, and direct federal expenditures have different effects on GDP and employment. To forecast the effects of the Recovery Act on GDP, the model-based approach applies a different estimated multiplier to

the amount of stimulus funds committed to each component of the act.

The Congressional Budget Office (CBO) and the Council of Economic Advisers (CEA) used macroeconomic models to forecast the effects of the stimulus package. The CBO found that national GDP increased by anywhere from 40 cents to \$2 for every \$1 in income transfers to households or fiscal relief to state and local governments, and by 40 cents to \$2.20 for every \$1 of infrastructure support to states and localities. The CEA followed the CBO's approach but used a different model of the national economy and concluded that GDP increased by 80 cents for every \$1 in tax cuts and \$1.10 for every \$1 of state and local fiscal relief. The council estimated that between the fall of 2009 and mid-2011, the act raised the level of GDP by 2 to 2.5 percent over what it would have been in the absence of the act.

The CBO and CEA multipliers suggest that the Recovery Act had a significant effect on GDP, but their model-based approach has a number of important shortcomings. James Feyrer and Bruce Sacerdote point out that model-based approaches provide only a forecast of the effects of policy rather than an evaluation of the actual path of output and employment resulting from the stimulus act. Another shortcoming is that economists disagree about the economic and behavioral relationships that underlie the macroeconomic models, such as anticipation of policy actions, and these relationships influence the models' estimates.

Partly as a response to these weaknesses, economists have developed macroeconomic models based on fundamentals such as consumer preferences, production technologies, and government budget constraints. Thorsten Drautzburg and Harald Uhlig developed an approach that relaxes some of the assumptions of the macroeconomic models by taking into account, for example, consumers who can't borrow or are impatient, and interest rates at the zero lower bound, among other things.⁶ In their experiment, government spending is increased for six years. They found a government spending multiplier of 0.5 in the short run, during the first year of the spending change, falling to about zero, at best, in the longer run, suggesting that government spending partially crowds out private activity in the early stages and completely crowds out private activity over longer periods.⁷

Cross-State Evidence

A number of studies have used state-level data to avoid some of the limitations of the macroeconomic models. This approach evaluates the effects of the stimulus using variations in federal spending across U.S. states. If some states received more stimulus funds than others for reasons unrelated to their economic needs, then those "excess" funds can allow for an evaluation of the effect of the stimulus on employment. Studies at the state level focus on changes in the number of jobs saved or created rather than on the level of output.

Cross-state studies must deal with the chicken-and-egg question of *endogeneity* — that is, to what extent does the economy respond to the stimulus, and to what extent does

the stimulus respond to the condition of the economy? For example, harder-hit states likely received a disproportionately greater amount of stimulus funding than those with fewer economic troubles. Cross-state studies develop differing approaches to account for endogeneity.

These studies have found a positive impact on state private and public employment in 2010, with the strongest effects coming from support for state Medicaid payments. Gabriel Chodorow-Reich and his colleagues examined

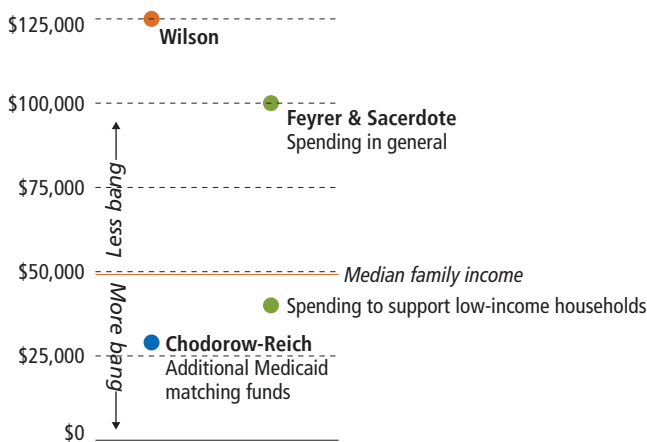
the effects on employment of the Recovery Act's Medicaid transfers to states. States administer Medicaid but share financing with the federal government. These researchers reported that of the \$88 billion dedicated to an increase in Medicaid matching funds, states had received \$61 billion by June 30, 2010. The Recovery Act temporarily increased the Medicaid expenditure match rate that the federal government paid to all states by 6.2 percentage points and increased the match rate more for states where unemployment rose significantly. The larger payments to states with higher unemployment rates made it difficult to differentiate between the extent to which a state's economy responded to the stimulus and the extent to which the stimulus responded to the condition of a state's economy.

Chodorow-Reich and his coauthors responded to the identification challenge by isolating the component of Medicaid transfers to each state that was unrelated to changes in the state's economic circumstances. They found that between December 2008 and July 2009, additional Medicaid matching funds increased employment by 3.5 jobs per \$100,000 of spending, a cost per job of about \$29,000 (Figure 2).

To what extent does the economy respond to the stimulus, and to what extent does the stimulus respond to the condition of the economy?

Other studies have found more modest effects. Feyrer and Sacerdote looked at variations in employment at the state and county levels. Public finance economists believe that states with longer-serving members in Congress receive more government funds per person than other states because senior members of Congress generally have greater influence in decision-making. Feyrer and Sacerdote posited that congressional seniority is unrelated to a state's economic conditions and therefore that differences in average seniority across states can help to identify stimulus spending that is unrelated to a state's underlying economic conditions. They found that for the 20 months between February 2009 and October 2010, about \$100,000 in stimulus spending was needed to create one additional job. They also found that the impact on employment differs by type of program. Spending supporting low-income households created 2.5 jobs per \$100,000 spent, a cost per job of \$40,000.

FIGURE 2
Mostly Small Effects Found via Cross-State Studies
 Cost per job.



Sources: Chodorow-Reich et al. (2012), Feyrer and Sacerdote (2012), Wilson (2012).

Dan Wilson also found moderate effects associated with Recovery Act spending at the state level. Because the stimulus funding a state received may depend on its economic conditions, Wilson looked at stimulus spending in 2009 that was allocated to states according to statutory formulas such as the miles of federal highway lanes in a state or the proportion of young people in a state's population. His estimates indicated that an additional \$1 million in stimulus funds to a state led to only about eight new jobs a year. The implied

cost was about \$125,000 per job. Put another way: Because the median family income in the U.S. was just under \$50,000 in 2010, the federal government presumably paid more than twice the typical wage for each job it created.⁸

It is tempting to conclude from such cross-state studies that the stimulus was not very effective in job creation, at least from a cost perspective. However, this type of analysis fails to account for cross-state spillovers. Job gains in one state most likely produce job gains in neighboring states that are not counted in state-by-state analysis. Such spillover effects could substantially reduce the estimated cost per job, and ignoring the impact of spillovers makes it more difficult to judge the effect of the stimulus on any particular state. The cross-state studies make the heroic assumption that the impact of these spillovers is essentially zero.⁹

Time Series Evidence

The starting point for analyzing the effects of fiscal policy actions on the U.S. economy is the formulation of an empirical model. Several considerations come into play. First, as we have noted, it is well known that changes in economic activity in a state spill over and affect activity in other regions, especially neighboring ones. These cross-state effects may arise from interstate input-output linkages — for example, when an industry in one state depends on intermediate goods or services produced in another state — or from interstate demand relationships in which stimulus spending boosts demand for out-of-state products. Thus, a useful model should account for these interstate spillovers. Second, economic shocks such as fiscal policy actions affect activity immediately but can affect activity in subsequent periods as well. That is, once the policy change occurs, it often takes time for firms, workers, and state government officials to adjust to the new circumstances.

Inman and I used a vector autoregression, or VAR, to estimate the total effects of the fiscal stimulus on real per capita GDP at the national level from 1960 to 2010 using quarterly data. A VAR is a widely used modeling technique for gathering evidence on business cycle dynamics. VARs typically rely on a small number of variables expressed as past values of the dependent variable and past values of the other variables in the model. Each variable in the VAR is considered to be part of a system in which all variables are jointly determined. For example, changes in government spending affect GDP growth, which in turn affects tax revenue. Moreover, after the initial effect, the VAR permits continuing feedback effects among of all variables, with

the subsequent effects becoming smaller and smaller over time and eventually disappearing.¹⁰

VARs have been used widely to estimate fiscal multipliers. Standard VAR fiscal modeling typically includes three real per capita variables: U.S. GDP; federal, state, and local government revenue less intergovernmental transfers; and federal, state, and local government expenditures. Thus, the standard approach lumps intergovernmental transfers to state and local governments in with transfers to households and firms. In contrast, in my study with Inman, we count intergovernmental aid as a separate form of stimulus and develop a VAR that includes four variables in real per capita terms: U.S. GDP, federal tax incentives, direct federal expenditures, and federal grants-in-aid transfers to state and local governments.

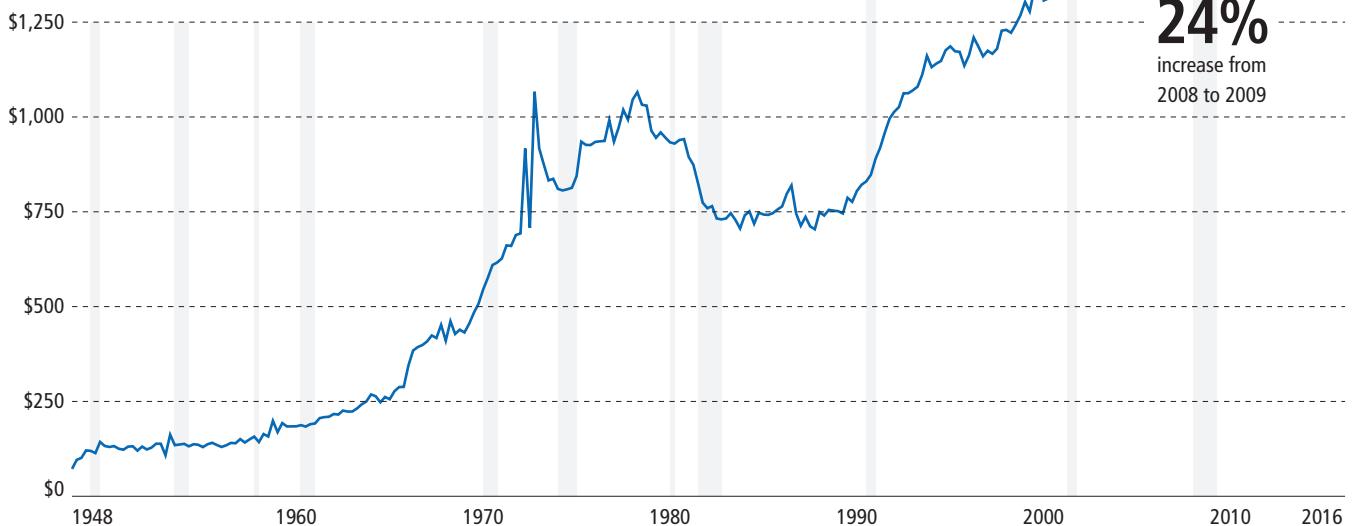
A typical way to summarize the impact of fiscal policy on per capita GDP — and one that captures all dynamics — is the impulse response, which shows how the level of real per capita GDP changes over time because of a fiscal policy surprise. Such surprises are measured by unanticipated changes in federal expenditures, revenue actions such as tax increases or cuts, and intergovernmental transfers. The Recovery Act is an example of a policy surprise. The Senate version of the bill was introduced on January 6, 2009, and became an amendment to the House version, which was introduced on January 26. The Recovery Act was signed into law on February 17. The remarkably quick legislative process left the public little time to form expectations about

the timing and magnitude of the stimulus package and its possible effect on their lives.¹¹

The federal government used long-standing grant-in-aid programs to transfer the Recovery Act funds to state and local governments. These transfers are funded with federal tax revenue and used to support health care programs, primarily Medicaid; income security, such as unemployment benefits; education; and transportation. Federal grants to state and local governments have grown rapidly during the past 50 years (Figure 3). Federal grants-in-aid under the Recovery Act swelled to \$2,017 per person at the end of 2009 from \$1,631 per person at the end of 2008 — a 24 percent increase.

Inman and I looked at the history to see how these transfers affected economywide GDP.¹² Using an impulse response function, we found an economywide GDP multiplier for federal transfers to states and local governments of only about 50 cents for each dollar of general aid during the first quarter that the policy was in effect, increasing to about 70 cents during the first year before declining to about 40 cents over the first three years (shown by the green bars in Figure 4). The implication is that states and

FIGURE 3
Federal Transfers to States Have Swelled Since 1960s
Postwar trend in real federal grants-in-aid to states per capita.



Source: Bureau of Economic Analysis via Haver Analytics.

local governments initially stashed away most of the federal funds and spent the money slowly in later years. The finding is bad news for policymakers who want the economy to recover rapidly.

We also looked at how economywide spending changed as a result of federal tax cuts for households and firms and how the economy responded to a boost in direct federal expenditures. Inman and I found that national GDP increased by \$2 to \$3 for every \$1 in federal tax cuts, while GDP increased by 60 cents for every \$1 in direct federal expenditures (Figure 4).

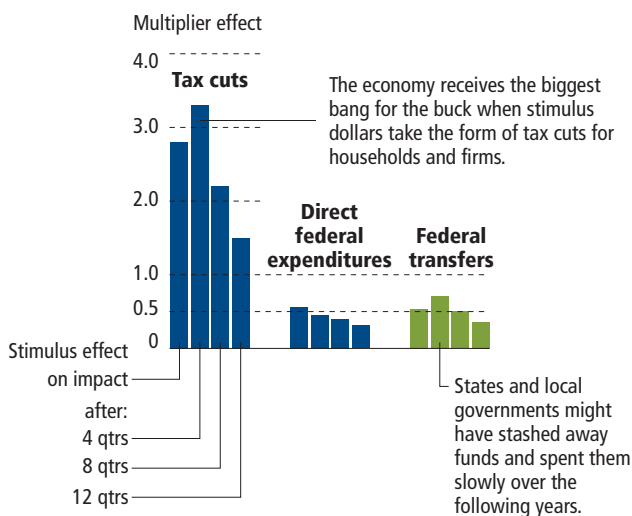
Our findings for the multipliers for federal expenditures and tax cuts are broadly similar to those reported by authors of other time series studies. In a recent survey of the literature on national multipliers, Valerie Ramey reported federal expenditure multipliers ranging from 0.6 to 1.5, in line with the estimates we found in our study. Her government revenue multipliers ranged from -0.6 to -3.0 .¹³ Our finding for the government revenue multiplier is in the upper range of those reported by Ramey, although she indicated that the most recent research supported tax multipliers in the range of -2 to -3 . This means that every \$1 increase in tax revenue implies a \$2 to \$3 decline in the value of output, and every \$1 decrease in tax revenue implies a \$2 to \$3 increase in output.¹⁴

Different types of federal aid transfers to state and local governments may have varying effects on the economy. While states administer Medicaid, the federal government

helps finance it. The federal government transfers its portion of the cost of Medicaid and other welfare services only after states spend their share. The prior-spending requirement provides an incentive for state governments to spend such funds quickly. Other types of aid, such as for highway and bridge construction, have no similar requirement. One facet of the Recovery Act temporarily increased the federal government's share of the financing already provided by states. The federal government's contribution rate was increased by 6.2 percentage points, and the contribution rate was increased further for states with relatively high unemployment rates.

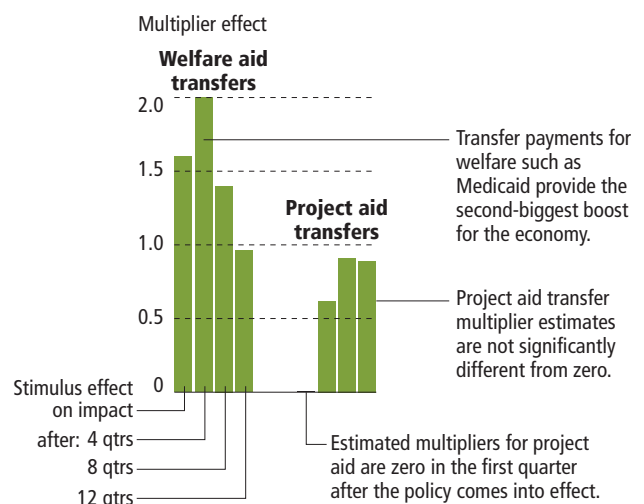
Matching aid transfers will stimulate the economy more quickly than project aid transfers for two reasons: First, states have an incentive to spend matching aid quickly. Second, lower-income households are likely to spend a larger fraction of any transfer payment they receive. It is difficult for lower-income households to maintain their standard of living by borrowing during hard times. We think it's important to further decompose total aid transfers into project aid — for example, transfers for infrastructure projects and urban renewal — and matching welfare aid — transfers associated with the Medicaid program. Federal welfare aid is indirectly a transfer payment to lower-income households. We find a bigger bang per buck associated with welfare aid (Figure 5). We find that economywide GDP expands by about \$1.60 for each \$1 of welfare aid during the quarter when the policy is implemented, peaking at around

FIGURE 4
States, Local Governments Slow to Spend Transfers
Average change in GDP in response to fiscal policy, 1960 Q1–2010 Q3.



Source: Adapted from Carlino and Inman (2016).

FIGURE 5
Greater Initial Response to Welfare Aid Transfers
Average change in GDP by category of federal transfers, 1960 Q1–2010 Q3.



Source: Adapted from Carlino and Inman (2016).

\$2 during the first year before declining to about \$1 after three years. In contrast, estimated multipliers for project aid range from zero during the first quarter that the policy is in effect to just under \$1 and are statistically insignificant (Figure 5).

In sum, the economy receives a bigger boost when federal stimulus dollars take the form of tax cuts to households and firms and when stimulus dollars are earmarked for transfer payments such as Medicaid that benefit lower-income households compared with direct federal expenditures and federal project aid transfers to state and local governments. It's important to note that these findings only indicate which types of fiscal stimulus programs typically provide the biggest bang per buck and do not speak to the merits of any particular program.

Why does welfare aid to states have a bigger and more immediate effect? Inman and I find that, on average, state governments save about half of the federal project aid they receive but spend all of matching welfare aid on lower-income assistance. As a consequence, welfare aid has a stronger, more immediate, and longer-lasting impact on the private economy.¹⁵

Policy Analysis: Is There a Better Way?

Our time series framework can be useful for policy analysis. How would GDP have changed without the stimulus package — the counterfactual projected path for GDP — compared with the projected path with the stimulus program? Inman and I re-estimated our time series model using quarterly data for 1960 through the first quarter of 2009. Based on these estimates, we simulated the economy's performance through the rest of 2009. A comparison of the simulations with the actual mix of Recovery Act programs (the actual allocations shown in Figure 6) suggests that growth in real GDP per person would have been 2 percent higher by the end of 2009 compared with the baseline of no stimulus.

As we have shown, programs vary widely in their effectiveness. Would a different mix of fiscal policies be more expeditious? Our research suggests that a mix of fiscal policies, one emphasizing the two most effective programs — direct tax relief to households and intergovernmental transfers to states targeted for assistance to lower-income households (the counterfactual allocation shown in Figure 6) — would have increased per capita GDP growth by 2.6 percent instead of 2.0 percent by the end of 2009 compared with the growth that resulted from the actual mix of policies.

FIGURE 6

How Would a Different Mix Affect the Economy?

Estimates of GDP's simulated path under actual vs. counterfactual federal outlays, 1960 Q1–2009 Q1.

| Type of Stimulus | Actual* | Counterfactual |
|---------------------------------|-------------|----------------|
| Tax cuts | \$45.2 bn | \$57.0 bn |
| Direct federal expenditures | 11.8 | 0.0 |
| Project aid transfers | 27.5 | 0.0 |
| Welfare aid transfers | 37.0 | 64.5 |
| Increase in GDP growth** | 2.0% | 2.6% |

*Source: The actual allocations were gathered from Recovery.gov, a website that has since been taken down but whose information persists at least in part at <https://web.archive.org/web/20140714154009/http://www.recovery.gov/arra/Pages/default.aspx> and <https://web.archive.org/web/20140709175719/http://www.recovery.gov/arra/Transparency/RecoveryData/Pages/RecipientSearch.aspx>.

** Adapted from Carlino and Inman (2016).

This is a 30 percent improvement in GDP growth compared with the actual Recovery Act mix of policies. In contrast, policies that emphasize either direct federal expenditures or project aid transfers to state and local governments would have increased per capita GDP growth by just 0.3 percent by the end of 2009 compared with the growth that resulted from the actual mix of policies.

CONCLUSION

Did the Recovery Act work? The evidence suggests the economy did indeed grow more than it would have without the stimulus but likely not as much as it might have with a different type of stimulus. In particular, the evidence suggests that direct measures — tax relief for households and firms, and programs such as Medicaid that target families with low incomes, little wealth, and a limited ability to borrow — have contributed more to GDP growth than direct federal expenditures or project aid to state and local governments.

To the extent that the federal government implements its stimulus spending through transfers to state and local governments, perhaps that aid should target lower-income households and states that bear the brunt of the economic downturn. Emi Nakamura and her coauthor found that local multipliers are largest in areas that have greater slack in their local labor and capital markets. Areas with relatively higher unemployment rates and greater poverty could be targeted to receive more stimulus dollars. However, Christopher Boone and his colleagues found that the Recovery Act's funds were distributed relatively equally across states. Perhaps the equal distribution of stimulus money

was necessary to gain passage of the legislation. As a result, poorer urban states received additional welfare aid, richer and more rural states got additional infrastructure aid, and all states received more discretionary funding for public

education. In the case of the Recovery Act, reallocating all the money spent on direct federal expenditures to federal tax relief and all intergovernmental project aid transfers to welfare transfers would have improved GDP growth.

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NOTES

¹ This article focuses only on which types of stimulus programs typically provide the most impact per dollar spent and not on the merits of any particular program.

² For a breakdown of spending reported as of July 9, 2014, see <https://web.archive.org/web/20140709164207/http://www.recovery.gov/arra/Transparency/fundingoverview/Pages/fundingbreakdown.aspx>. For further information, see related postings by the Bureau of Economic Analysis, “Effect of the ARRA on Selected Federal Government Sector Transactions,” <http://www.bea.gov/recovery/pdf/arra-table.pdf>; the Treasury Department, <https://www.treasury.gov/initiatives/recovery/Pages/recovery-act.aspx>; the White House, <https://www.whitehouse.gov/recovery>; and the Council of Economic Advisors, “The Economic Impact of the American Recovery and Reinvestment Act Five Years Later,” <https://www.whitehouse.gov/administration/eop/cea/factsheets-reports>; and <https://www.whitehouse.gov/administration/eop/cea/factsheets-reports>.

³ Ricardian equivalence holds only when the government raises revenue through lump-sum taxation that is a fixed amount. A car registration fee is an example of a lump-sum tax because it’s the same regardless of the income of the vehicle owner.

⁴ Alan Auerbach and Yuriy Gorodnichenko found that fiscal multipliers are considerably larger during recessions than in expansions, ranging from 0 to 0.5 in economic expansions and between 1.0 and 1.5 during recessions. The multiplier is larger in contractions than in expansions because there is more slack in labor and capital markets during downturns than when the economy is closer to its full potential.

⁵ Most of the studies discussed in this article calculate short-run multipliers because they look at changes in GDP in the same period, or within a few periods, as the change in fiscal policy. Andrew Mountford and Harald Uhlig in 2009 and Thorsten Drautzburg and Uhlig in a forthcoming article calculated long-run multipliers as the present value of a stream of changes in GDP over some horizon relative to the change in fiscal policy over that horizon. Drautzburg and Uhlig found that long-run multipliers are smaller or in some cases slightly negative compared with short-run multipliers.

⁶ The zero lower bound occurs when the short-term nominal policy interest rate is at or near zero, limiting monetary policymakers’ ability to stimulate economic growth by lowering short-term rates.

⁷ Drautzburg and Uhlig calculate the long-run multipliers as the cumulative effects of policy over time.

⁸ A number of cross-state studies have estimated local fiscal multipliers using data unrelated to the Recovery Act stimulus programs. The multipliers from these studies provide a useful comparison with the findings from the studies that specifically looked at the effects on local employment associated with the Recovery Act. For example, Daniel Shoag used cross-state variation in state government spending and found a cost per job of \$35,000, similar to the cost per job found by James Feyrer and Bruce Sacerdote. See the article by Gabriel Chodorow-Reich, Laura Feiveson, Zachary Liscow, and William Woolston for a discussion of the cross-state studies.

⁹ One exception is the cross-county study by Juan Carlos Suárez Serrato and Philippe Wingender, who looked at federal spending at the county level. (Spending related to the Recovery Act was outside their sample period.) They allowed for economic spillovers among neighboring counties and found a cost of \$25,000 per job created. Similar to Shoag, Suárez Serrato and Wingender found a cost per job created of \$30,000 when they did not account for these spillovers, suggesting that the spillovers were positive and economically significant. Robert Inman and I in 2013 used a sample of the 48 contiguous U.S. states for the period 1973–2009 and found interregional spillovers from local macroeconomic fiscal policies that were significant, both statistically and quantitatively.

¹⁰ There are important differences between a VAR and the macroeconomic models used by the CBO and the CEA. A VAR does not require as much knowledge about the forces influencing a variable as does a macroeconomic model with its many underlying equations. The only prior knowledge required by a VAR is a list of variables that can be hypothesized to affect each other over time. Importantly, the Carlino and Inman VAR analyzed the effects of the types of programs used by the Recovery Act *ex post*, or after the economy had responded to those types of Recovery Act programs, whereas the macroeconomic models produced an *ex ante* forecast of the likely effects of the act.

¹¹ Typically, legislative deliberations about fiscal policy actions are much more drawn out than the process was for the Recovery Act, and the longer deliberations have important implications for determining the ultimate effectiveness of these initiatives. Once an administration has recognized the need for fiscal policy action, it must propose the appropriate legislation to Congress. Any legislation must be considered by both branches of Congress. Congress must approve the legislation and the president must sign it into law before the policy initiatives can be implemented. The process can be quite lengthy. The long legislative process provides the public with clear signals regarding impending changes in fiscal policy. People may act today in anticipation of future changes in policy. Economists refer to the anticipation of future fiscal policy initiatives as fiscal foresight. For example, Valerie Ramey showed that increases in government spending are anticipated several quarters before they actually occur and that failure to account for these anticipation effects can lead to biased estimates of fiscal multipliers. One way researchers have attempted to deal with the problem of fiscal foresight is by examining the narrative history (using magazines such as *Business Week* and other periodicals) of government revenue and spending news to determine when private agents could have reasonably anticipated a policy change. This approach has the advantage of isolating the approximate date at which agents form their expectations of future changes in government spending. A disadvantage of the narrative approach is that often there is only a small number of events.

¹² Since it is possible for state policymakers to anticipate future changes in intergovernmental grants, Inman and I in 2013 constructed narrative measures based on the legislative record of federal grants-in-aid programs beginning with the Federal Highway Act of 1956 and continuing through the Recovery Act of 2009. We used the narrative measures of federal grants-in-aid programs to directly account for fiscal foresight. The findings of our paper are summarized in this article.

¹³ Although Figure 4 shows positive or absolute values for the tax revenue multipliers, the tax multiplier is actually negative, because a tax cut leads to an increase in GDP.

¹⁴ Alberto Alesina and Silvia Ardagna in 2010 looked at fiscal stimulus policy in 21 advanced economies and found that “fiscal stimuli based on tax cuts are more likely to increase growth than those based on spending increases.”

¹⁵ Instead of using economywide data, a number of studies have used household-level data and found that federal income tax rebates, especially to lower-income households, can be an effective way to stimulate consumer spending. In a 2006 study, David Johnson, Jonathan Parker, and Nicholas S. Souleles looked at changes in household consumption spending resulting from the 2001 recession-era federal income tax rebates. They found that a considerable percentage of the rebates was quickly spent, especially by lower-income or credit-constrained households.