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CFS Working Paper No. 2009/17

New Keynesian versus Old Keynesian Government Spending Multipliers*

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John B. Taylor[3], and Volker Wieland[4]

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Abstract:
Renewed interest in fiscal policy has increased the use of quantitative models to evaluate policy. Because of modeling uncertainty, it is essential that policy evaluations be robust to alternative assumptions. We find that models currently being used in practice to evaluate fiscal policy stimulus proposals are not robust. Government spending multipliers in an alternative empirically-estimated and widely-cited new Keynesian model are much smaller than in these old Keynesian models; the estimated stimulus is extremely small with GDP and employment effects only one-sixth as large.

JEL-Classifications: C52, E62

Keywords: Fiscal Multiplier, New Keynesian Model, Fiscal Stimulus, Government Spending, Macroeconomic Modeling.

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In a recent paper[1] Christina Romer and Jared Bernstein provided numerical estimates of the impact of an increase in government spending on GDP and employment in the United States. Such estimates are a crucial input for the policy making process. They help determine the appropriate size and timing of countercyclical fiscal policy packages and they help inform members of the Congress and their constituents about whether a vote for a policy is appropriate. For packages approaching $1 trillion including interest, as in 2009, the stakes are enormous. The estimated economic impacts matter.

The Romer-Bernstein estimates are based on two particular quantitative macroeconomic models – one from the staff of the Federal Reserve Board and the other from an unnamed private forecasting firm. By averaging the impacts generated by these two models, they estimate that an increase in government purchases of 1 percent of GDP would induce an increase in real GDP of 1.6 percent compared to what it otherwise would be. Their results are shown in Figure 1. Also shown in Figure 1 are the estimated effects of exactly the same policy change—a permanent increase in government purchases—as reported in another study published a number of years ago.[2]

It is clear from Figure 1 that the results are vastly different between the different models. Perhaps the most important difference is that in one case higher government spending keeps on adding to GDP "as far as the eye can see," while in the other case the effect on GDP diminishes as non-government components are crowded out by government spending.

[1] See Romer and Bernstein (2009), Appendix 1, page 12. The paper was written in early January 2009 during the transition period just before Christina Romer was sworn in as Chair of the Council of Economic Advisers and while Jared Bernstein was Chief Economist of the Office of the Vice-President.

[2] See Taylor (1993), Figure 5-8A, page 166. This is a rational expectations model with staggered wage and price setting and thus could be described as "new Keynesian" as defined below.

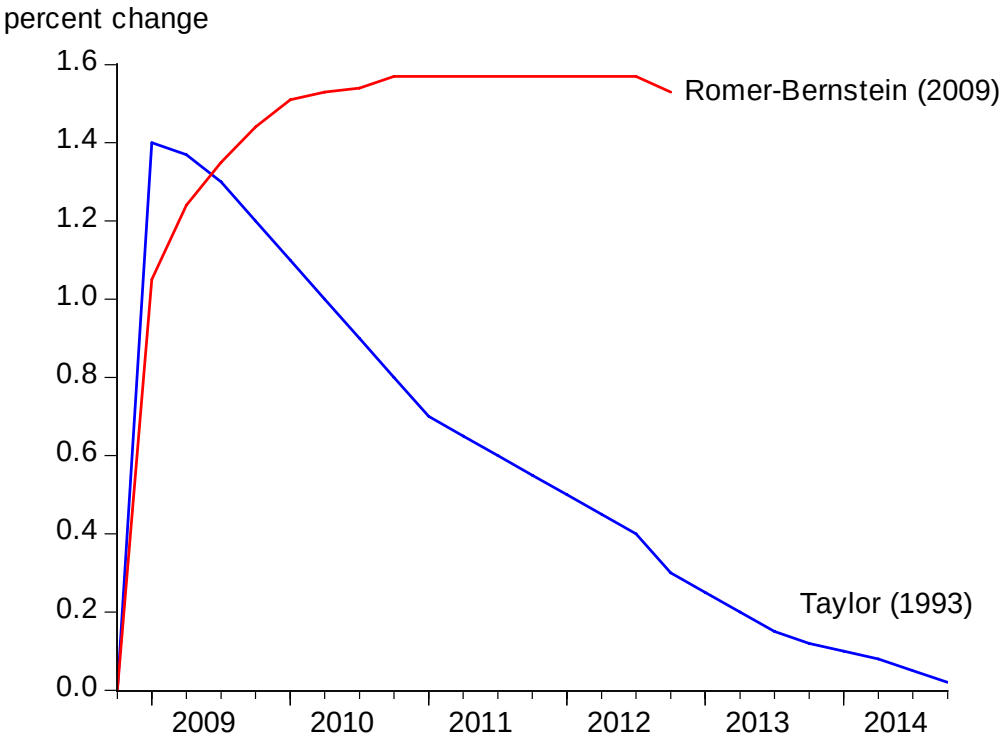

Figure 1. Estimated Impact on GDP of a Permanent Increase in Government Purchases of 1 percent of GDP

Macroeconomists remain quite uncertain about the quantitative effects of fiscal policy. This uncertainty derives not only from the usual errors in empirical estimation but also from different views on the proper theoretical framework and econometric methodology. Therefore, robustness is a crucial criterion in policy evaluation. Robustness requires evaluating policies using other empirically-estimated and tested macroeconomic models. From this perspective Figure 1 raises concerns because the Romer-Bernstein estimates are far different from existing published results of another model. For these reasons an examination of whether the Romer-Bernstein results are robust to different model and policy assumptions is in order.

I. The Need for an Alternative Assessment

We think it is best to start by conducting a fresh set of simulations with a macroeconomic model other than one of those used in Figure 1. We focus on the Smets-Wouters model of the U.S. economy.[3] The Smets-Wouters model is representative of current thinking in macroeconomics. It was recently published in the *American Economic Review* and is one of the best known of the empirically-estimated "new Keynesian" models. It is very similar to, and "largely based on" according to Smets and Wouters, another well-known empirically-estimated new Keynesian model developed by Christiano, Eichenbaum and Evans (2005). The Smets-Wouters model was highlighted by Michael Woodford (2009) as one of the leading models in his review of the current consensus in macroeconomics.[4]

The term "new Keynesian" is used to indicate that the models have forward looking, or rational, expectations by individuals and firms, and some form of price rigidity, usually staggered price or wage setting. The term also is used to contrast these models with "old Keynesian" models without rational expectations of the kind used by Romer and Bernstein.[5] New Keynesian models are commonly taught in graduate schools because they capture how people's expectations and microeconomic behavior change over time in response to policy interventions and because they are empirically estimated and fit the data. They are therefore viewed as better for policy evaluation. In assessing the effect of government actions on the economy, it is important to take into account how households and firms adjust their spending decisions as their expectations of future government policy changes.

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[3] See Smets and Wouters (2007) for a complete review of their model. It determines 14 endogenous variables: output, consumption, investment, the price of capital, the capital stock, capital services, the capital utilization rate, labor supply, the interest rate, the inflation rate, the rental rate on capital, the wage rate, the marginal product of labor, and the marginal rate of substitution between work and consumption. The 14 equations include forward looking consumption, investment, price and wage setting as well as several identities.

[4] See Woodford (2009), which also contains a useful survey of the whole "new Keynesian" literature.

[5] There is a rational expectations version of the FRB/US model. We simulated a permanent increase in government purchases in this version and found that the multipliers declined sharply over time unlike those reported by Romer and Bernstein (2009) but similar to the Taylor (1993) rational expectations model as shown in Figure1. We infer that the FRB/US model and the private sector model used by Romer and Bernstien are not new Keynesian models with rational expectations. Also, as explained below, new Keynesian models would not allow an assumption of a constant zero interest rate forever.

We first show that the assumptions made by Romer and Bernstein about monetary policy—essentially a permanent interest rate peg for the Federal Reserve—are questionable according to new Keynesian models. We therefore modify that assumption, allowing interest rates to adjust after one or two years, and look at the impacts of a permanent increase in government purchases of goods and services in the alternative model. According to the alternative model the impacts are much smaller than those reported by Romer and Bernstein.

We then consider more realistic scenarios. We look at the impact when government spending follows the fiscal policy legislation enacted in February 2008 and we look at a scenario in which monetary policy is more responsive. For these scenarios the impact with the alternative model is smaller.

II. The Problem with an Interest Rate Peg

Romer and Bernstein assume that the Federal Reserve pegs the interest rate—the federal funds rate—at the level of zero for as long as their simulations run. Given their assumption that the spending increase is permanent, this means forever. In fact, such a pure interest rate peg is prohibited in new Keynesian models with forward-looking households and firms because it produces calamitous economic consequences. As Thomas Sargent and Neil Wallace[6] pointed out more than thirty years ago, a pure interest rate peg will lead to instability and non-uniqueness in a rational expectations model. Inflation expectations of households and firms become unanchored and unhinged and the price level may explode in an upward spiral.

A permanent increase in government spending as a share of GDP would eventually raise the real interest rate. This is the mechanism by which other shares of spending (consumption, investment, and net exports) would be reduced to make room for the increased

[6] See Sargent and Wallace (1975). Though the Sargent and Wallace model assumes perfectly flexible prices the same results hold in models with sticky prices.

government share. With the Fed holding the nominal interest rate constant at a value near zero, the lower real rate would cause inflation to rise and accelerate without limit. Thus the combination of a permanent increase in government spending and the Fed setting the interest rate at zero would lead to hyperinflation.

If the combination of a permanent government spending increase and a zero interest rate peg were assessed by the Smets-Wouter model or, for that matter, any of the new Keynesian models, the economy's projected performance would reflect the aforementioned consequences. To achieve stability of output and inflation in such a model one must instead assume that, at some point, the federal funds rate is allowed to move above zero and respond to the state of the economy rather than be held fixed.

For the simulations presented here we therefore assume that the Federal Reserve only keeps the federal funds rate constant for a finite period of time after which it moves the interest rate depending on what is happening to the economy. We begin by assuming that it keeps the interest rate equal to zero and constant through 2009 and 2010 and then follows a standard monetary policy rule thereafter. Thus, in 2011, nominal interest rates will change somewhat and forward-looking households and firms will incorporate this monetary policy response in their decision making. Keeping interest rates constant for two years still does not seem very realistic and would likely result in an increase in inflation, but it is certainly more realistic than pegging the interest rates at zero forever, or even for four years.

III. Government Spending Multipliers: New Keynesian versus Old Keynesian

Table 1 shows the response of real GDP to a permanent increase in government purchases of 1 percent of GDP in the new Keynesian model and contrasts these with the average of the two models of Romer and Bernstein. The simulations are done using a new database of macroeconomic models designed explicitly with the purpose of doing such policy

evaluation and robustness studies.[7] The increase in government spending is assumed to start in the first quarter of calendar 2009. The forward looking models require explicit assumptions about what household's and firms expect. Our assumption is that, as of the first quarter of 2009, people expect the government spending increase to continue permanently (as in the Romer-Bernstein policy specification), and that the spending increase is initially debt-financed. The Smets-Wouters model assumes that any increase in debt used to finance the increased government spending is paid off with interest by raising taxes in the future. We assume that these taxes are "lump sum" in the sense that they not affect incentives to work, save or invest. They do, however, lower future after tax earnings and thereby wealth. If we took such incentive effects into account the increase in government spending would eventually reduce real GDP. Hence, our assumptions err on the side of overestimating the size of the impact of government spending on real GDP.

Table 1: Impact of a Permanent Increase in Government Spending by 1 Percent of GDP (federal funds rate set to zero throughout 2009 and 2010)

Percentage increase in real GDP					
	2009Q1	2009Q4	2010Q4	2011Q4	2012Q4
Romer/Bernstein	1.05	1.44	1.57	1.57	1.55
Smets/Wouters	1.03	0.89	0.61	0.44	0.40

Observe that the Smets-Wouters model predicts a much smaller boost to GDP than the estimates reported by Romer and Bernstein. The Smets-Wouters multiplier is smaller throughout the whole simulation period, and by 2011 is only about one-third the size of the Romer-Bernstein multiplier. The Smets-Wouters model also shows a rapid reduction in the size of the impact over time. Overall the Smets-Wouters impacts are very similar in size and

[7] The model database is described in Wieland, Cwik, Mueller, Schmidt and Wolters (2009) and used in a model comparison exercise by Taylor and Wieland (2008).

timing to those found in the Taylor (1993) model shown in Figure 1. In sum, the Romer-Bernstein estimates are much more optimistic in their GDP estimates than the alternative model considered here.

The Smets-Wouters model predicts that the increase in GDP by the end of 2009 is smaller than the increase in government expenditures itself; that is, the multiplier is less than one. Thus, the model predicts that government "stimulus" quickly produces a permanent contraction in private sector investment and/or consumption. Note that the magnitude of the contraction grows over time. By the end of 2012, for each dollar of "stimulus", the flow of goods and services produced by the private sector falls by sixty cents.

IV. Alternative Assumptions about Monetary Policy

Table 2 shows what would happen if the length of time for which the federal funds rate is anticipated to remain constant is shorter and extends only through the end of 2009. In other words we now assume that the Fed starts following its feedback rule for policy starting in 2010 rather than waiting until 2011.

Table 2: Impact of a Permanent Increase in Government Spending By 1 Percent of GDP
(federal funds rate set to zero throughout 2009)

Percentage increase in real GDP					
	2009Q1	2009Q4	2010Q4	2011Q4	2012Q4
Romer/Bernstein	1.05	1.44	1.57	1.57	1.55
Smets/Wouters	0.96	0.67	0.48	0.41	0.40

The impacts in Table 2 are uniformly smaller through 2011 than those in Table 1 because interest rates can begin to increase earlier (in 2010 rather than 2011) accelerating the crowding out process in the new Keynesian model. Note that the differences between the Smets-Wouters simulations in Table 1 and 2 are not nearly as large as the differences between

either of these and the Romer-Bernstein impacts. In what follows we will continue with the assumption that the Fed can start to increase interest rates if necessary in 2010.

V. A More Realistic Path for Government Purchases

Although a permanent increase in government purchases of goods and services is a good way to understand the properties of a model, it is not a realistic description of the fiscal policy packages under consideration in the United States and other countries recently nor of the final $787 billion fiscal stimulus package enacted and signed into law[8] on February 17, 2009. For example, about half of that fiscal stimulus package consists of transfer payments for unemployment assistance, nutritional aid, and health and welfare payments, and temporary tax cuts. In addition, the package does not provide for an immediate *permanent* increase in government purchases of goods and services. Most of the purchases authorized by the law are one-time and phased in, with the lion's share of the purchases completed within four years.

Table 3 shows the U.S. fiscal stimulus package's impact on the federal deficit and federal government purchases in billions of dollars. The government purchases column corresponds to the permanent increase in government purchases simulated and reported in Tables 1 and 2 except of course that it is not permanent. Observe that $21 billion or just 2.6 percent of the total $787 billion increase in the deficit spending occurs in fiscal year 2009, which is when the economy is expected to be weakest.[9] Federal purchases then increase in 2010, stay relatively steady for two years, and then begin to decline again in 2012. Since the stimulus bill is a mixture of increased transfer payments, tax refunds, and higher government purchases, the path for the deficit is different from the path of the increase in government purchases.

One component of federal government transfers—certain transfers going to state and local governments—is similar to federal purchases in that the funds are to be used by the

[8] The official name of the legislation is The American Recovery and Reinvestment Act of 2009.
[9] The U.S. government's 2009 fiscal year runs from October 1, 2008 to September 30th, 2009.

states to purchase goods and services. These intergovernmental transfers, which consist mainly of funds for education and public safety activities, are shown in the third column of Table 3. During the first three years, these government transfers exceed federal purchases. It is difficult to determine how much of the transfers to states and localities will ultimately result in an increase in spending on goods and services. States and localities might use some or all of the funds to avoid raising taxes or increasing borrowing. To the extent that they do, the transfer would not produce a net increase in government purchases of goods and services. Romer and Bernstein (2009) assume that 60 percent of these transfers go to purchases of goods and services. In keeping with that assumption, we consider in what follows the impact on GDP of an increase in government purchases equal to column 2 plus 60 percent of column 3 in Table 3. We assume that the path of purchases is constant for all the quarters within a fiscal year and that, as assumed by Romer and Bernstein (2009), there is a one quarter lag in the effect of the increase of transfers to states and localities on their purchases of goods and purchases. We also experimented with other interpolation schemes but the results were not substantially different and we focus here on the simple constant level assumption.

Table 3. Increased Deficit, Federal Government Purchases, and Transfers to State and Local Governments for Purchases of Goods and Services in the February 2009 Stimulus Legislation (billions of dollars)

Fiscal Year	Increase in Federal Purchases	Increase in Transfers to States, Localities	Increase in Federal Deficit*
2009	21	48	184
2010	47	107	400
2011	46	47	134
2012	36	8	36
2013	25	4	27
1014	27	0	22
2015	11	0	5
2016	-2	0	-8
2017	-3	0	-7
2018	*-2*	*0*	*-6*

Source: Authors' calculations derived from Congressional Budget Office, "Cost Estimate for Conference Agreement for H.R.1", February 13, 2009

*Excludes impact of interest payments on the public debt incurred to finance the stimulus package.

Figure 2 presents the results of the simulation. The bar graph shows the increased government purchases as a share of GDP, and the line graph shows the impact of the increase in purchases on real GDP according to the Smets-Wouters model. The quarters in Figure 2 refer to the calendar year rather than the fiscal year. We show the results through 2013 even though we simulate the impacts over the full ten years.

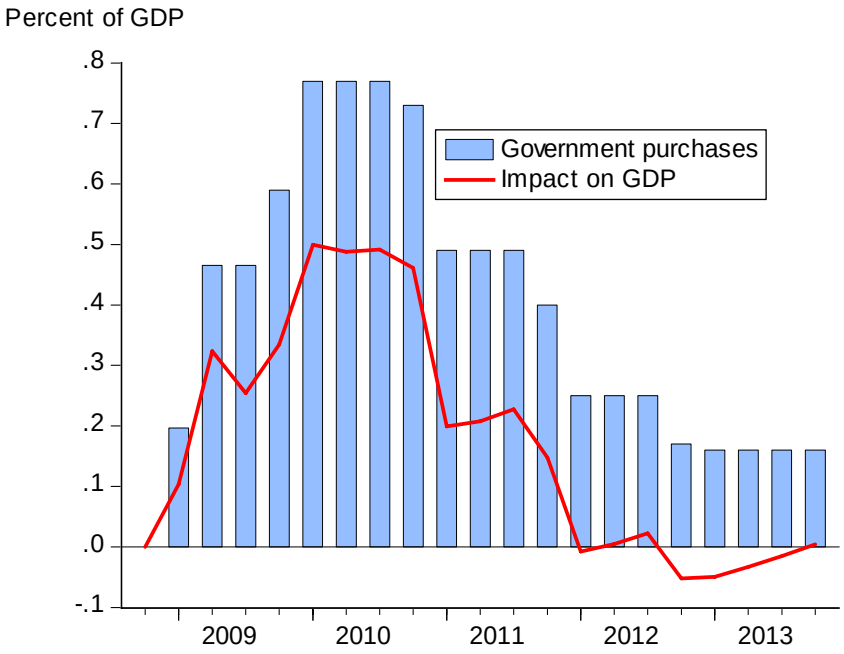

Figure 2. Estimated Output Effects of Government Purchases in the February 2009 Stimulus Legislation. (Government purchases equal federal purchases plus 60 percent of transfers to state and local governments for purchases of goods and services)

VI. Estimated Impacts

According to the Smets-Wouters model, the impacts of this package on GDP are very small. But particularly worrisome is that during the first year the estimated stimulus is minor and then even turns down in the third quarter. Why the very small effect in the first year?

The answer comes in part from the timing of the government expenditures and the forward-looking perspective of households. The small amount of government spending in the first year is followed by a larger increase in the second year. Households and firms anticipate the second year increase during the first year. They also anticipate that ultimately the expenditures will be financed by higher taxes. The negative impact of the delayed government spending and the negative wealth effect on private consumption of higher

anticipated future taxes combine to reduce the positive impact of the stimulus. As a result, the first-year GDP impact is initially small and turns down.

In the Smets-Wouters model there is also a strong crowding out of investment. Hence, both consumption and investment decline as a share of GDP in the first year according to the Smets-Wouters model. This negative effect is offset, as shown in Figure 1, by the increase in government spending in the first year, but it causes the multiplier to be below one right from the start. Figure 3 shows the impact on consumption and investment.

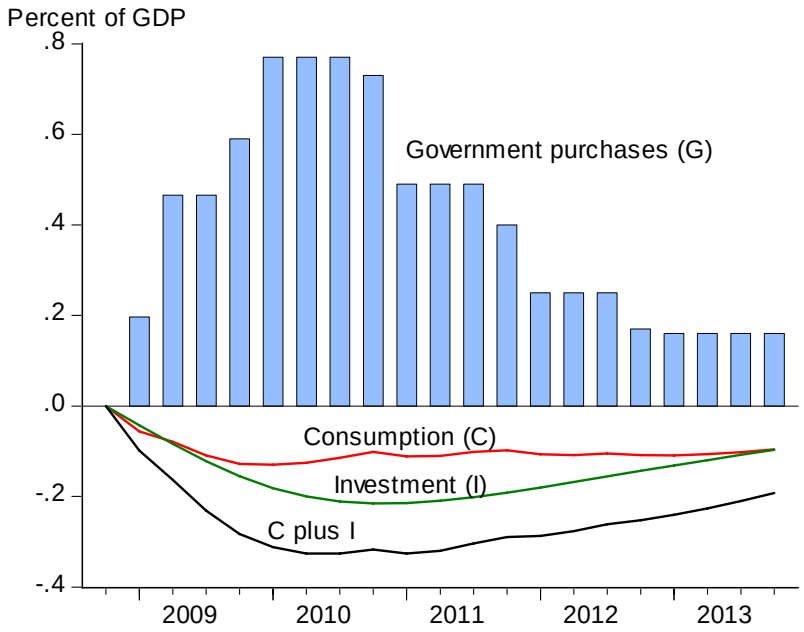

Figure 3. Crowding Out of Consumption and Investment in the February 2009 Stimulus Legislation (Government purchases are as in Figure 2)

Note that as the government purchases come back down in 2013, the multiplier turns negative. The declines in consumption plus investment are greater than the increases in government spending. Though not shown in Figure 2, the simulations show that the impact on GDP is negative for many years beyond 2013.

Because of the negative effects on consumption and investment, it is possible to get negative GDP multipliers in the first year with government purchases paths slightly different from those in Figures 2 and 3. For example, a sharper increase in government spending in the second year compared to the first leads to more crowding out of consumption and investment in the first year and the multiplier can turn negative. In fact, our simulations of the first stimulus bill passed by the House of Representatives in 2009 had this property, but changes by the conference committee and revised estimates of the path of government purchases by the Congressional Budget Office removed the negative multiplier.

There is a large literature on whether an increase in government spending reduces consumption and investment in real business cycle models, and the literature carries over to some degree to new Keynesian models with sticky prices and wages like the Smets-Wouters model. See Coenen and Straub (2005) for a discussion and references to many other contributions. In the standard real business cycle model government spending has a negative wealth effect. Households consume less. Investment also declines.

A possible criticism of new Keynesian models like the Smets-Wouters model is that they are not Keynesian enough, because they assume that all households are forward-looking and optimize their spending decisions. Some have suggested that one should allow for the possibility that some households follow "rules of thumb" like the original Keynesian consumption function with a high and constant marginal propensity to consume. Others have suggested that one should assume that many households are constrained to consume all their current income. See for example, Gali, Lopez-Salido, Valles (2007). However, Coenen and Straub (2005), show that it is empirically unlikely that an increase in government spending crowds in consumption even with such assumptions. There are two reasons: the estimated share of constrained households is relatively low and the negative wealth effects induced by government spending shocks are large.

Although some might worry that new Keynesian models are faulty because they miss old Keynesian rule-of-thumb or constrained consumers, we note that the Smets-Wouters model is estimated and it fits the data well. People might also worry that the small and negative multipliers depend on assumptions about monetary policy responses and the particular time profiles of fiscal spending packages. It is for this reason that we have used actual data on fiscal policy and realistic assumptions about monetary policy.

It is also possible to criticize new Keynesian models such as Smets-Wouters because they are too Keynesian. In contrast with real business cycle models, the estimated new Keynesian models assume "sticky prices" by introducing staggered price and wage setting. But as Chari, Kehoe, and McGrattan (2009) have emphasized the models go further in the Keynesian direction by assuming "the backward indexation of prices" in "a mechanical way" which amplifies Keynesian aggregate demand effects of policy.

VII. Impacts of an Entire U.S. Stimulus Package

Although the formal model simulations in this paper have focussed on government spending multipliers in the case of changes in government *purchases* of goods and services, it is possible to say something about the impact of a the broader U.S. fiscal stimulus package, which also includes tax rebates and one-time transfer payments to individuals. For this purpose we focus on the impact in the fourth quarter of 2010 where the size of the increased government purchases (including 60 percent of transfers to states and localities for this purpose) is .73 percent of GDP and the impact on GDP is .46 percent, implying a multiplier in that quarter of .63 (=.46/.73). We choose this quarter for two reasons. First, as shown in Figure 2, it is close to the quarter of maximum GDP impact, so by choosing this quarter we will in no way be understating the results. In fact, the impact declines sharply after this quarter. Second, this is the quarter for which Romer and Bernstein (2009) report their widely-

cited calculation that the fiscal stimulus package of February 2009 will increase GDP by 3.6 percent and employment by 3-1/2 million. Hence, the last quarter of 2010 is useful for comparison purposes.

As Table 3 shows, the deficit (excluding interest payments) increases by more than the increase in government purchases in fiscal year 2009 through 2011. The lion's share of the difference between the deficit and purchases, 80 percent, consists of temporary tax rebates and entitlement benefits for unemployment insurance, Medicaid benefits, health insurance subsidies, and cash welfare payments. The fourth quarter of 2010 (calendar year) is the first quarter of fiscal year 2011. In fiscal year 2011, the deficit minus purchases is $41 billion (=134-93=41). However, this is a large decrease from fiscal year 2010 where the difference is $246 billion (400-154=246). So for the purpose of estimating the impact of the broader package in 2010Q4 (calendar) we take the average of fiscal year 2010 and 2011, or the average of 41 and 246, which is $144 billion or about 1 percent of GDP.

How much of this "non-government-purchases" increase in the deficit should we add to government purchases to compute the impact on GDP? To the extent that the tax rebates and transfers to individuals are temporary, permanent income theory, even in the presence of liquidity effects, says that the impact on consumption and thereby aggregate demand will be small. Although there is a great deal of uncertainty, a review of the literature over the years suggests that the marginal propensity to consume for such tax and transfer payments is at most 0.3, though it will depend on timing, expectations, and other factors. Recent aggregate evidence suggests that it may be much smaller. For example, an examination of the Economic Stimulus Act of 2008 indicates that the impact of the tax rebates on consumption was insignificantly different from zero.[10] Transfers to individuals, such as entitlement payments for unemployment compensation, and health and welfare benefits, could be expected to have an effect on consumption similar to temporary tax rebates. Although such

[10] The estimated regression coefficients reported in Taylor (2009) are not statistically different from zero.

payments may temporarily boost household income, they also create employer incentives for layoffs and for household members to delay their return to work. In sum, in our view, a coefficient of .3 for the impact of these tax and transfers payments on consumption is likely an upper bound and certainly a generous assumption about the size of the impact.

In any case, by assuming that the impact on consumption of the extra 1 percent discretionary increase in the deficit is .3 percent of GDP and using the above mentioned multiplier of .63 the impact will be to increase GDP by an additional .19 percent. If we add this to the .46 percent GDP increase from purchases, the total impact will be to increase GDP by.65 percent in the fourth quarter of 2010 compared to what it would otherwise be.

Romer and Bernstein (2009) calculated that the impact of the 2009 stimulus package would be to raise GDP by 3.6 percent by the fourth quarter of 2010, which is 6 times greater than our calculation based on the new Keynesian model simulations of the impact of purchases and a generous assessment of the impact of tax rebates and temporary transfers.

Romer and Bernstein (2009) also give an estimate of the increase in employment from the fiscal package. They assume an additional 1 million jobs for each 1 percent increase in real GDP. Thus they estimate an increase of 3-1/2 million jobs as a result of the fiscal policy package enacted in February 2009. Using the same method our estimate is closer to ½ million additional jobs. Romer and Bernstein also report job estimates in a number of private sector industries which would have to be radically scaled down if the numbers we have calculated are correct. In addition, our finding of crowding out of private consumption and investment due to the increase in government purchases raises doubts about the estimate that 90 percent of the jobs will be created in the private sector. Indeed, with the impact of government purchases on GDP (.46) nearly three times greater than the impact of tax rebates and transfers on GDP (.19), a net decline in private sector jobs is likely.

VIII. Conclusion

In this paper we used a modern empirical approach to estimate government spending multipliers, and we contrasted these multipliers with those that have recently been used in practice to analyze fiscal policy in the United States. We focused on an empirically estimated macroeconomic model—the Smets-Wouters model. As explained by Michael Woodford in his recent survey in the *American Economic Journal: Macroeconomics*, this model well represents new Keynesian macroeconomic thinking. We assumed that interest rates were held constant for one or two years and then are adjusted according to a policy rule built into the model.

We find that the government spending multipliers from permanent increases in federal government purchases are much less in new Keynesian models than in old Keynesian models. The differences are even larger when one estimates the impacts of the actual path of government purchases in fiscal packages, such as the one enacted in February 2009 in the United States or similar ones discussed in other countries. The multipliers are less than one as consumption and investment are crowded out. The impact in the first year is very small. And as the government purchases decline in the later years of the simulation, the multipliers turn negative.

The estimates reported here of the impact of such packages are much different from those reported in the paper by Christina Romer and Jared Bernstein. They report impacts on GDP for a broad fiscal package that are six times larger than those implied by government spending multipliers in a typical new Keynesian model and our calculations based on generous assumptions of the impacts of tax rebates and transfers on GDP. They also report job estimates that are six times larger than these alternative models. At the least, our findings raise serious doubts about the robustness of the models and the approach currently used for practical fiscal policy evaluation.

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