

Use of Fiscal Policy Reaction Functions in Analyzing the Macroeconomic Effects of Tax Policy

Abstract - We model an empirically estimated fiscal policy reaction function (FPRF) in a macroeconomic growth model. In general, an FPRF uses information about the path of past and expected future macroeconomic events and fiscal policy to forecast future fiscal policy reactions. We show that an empirically estimated FPRF, consistent with past legislative activity, can return unsustainable fiscal forecasts to sustainability. However, we also demonstrate that modeling other variants of an FPRF, equally consistent with the literature, do not return fiscal forecasts to sustainability. We conclude that additional empirical work is necessary before implementation of an FPRF in macroeconomic models could decisively improve modeling results or their presentation.

INTRODUCTION

A number of recent papers have looked empirically at the extent to which present and future fiscal policy reacts to past and anticipated future fiscal policy and economic developments. An estimated equation taken from one of these papers can be viewed as a fiscal policy reaction function (FPRF), which tells a macroeconomic modeler the extent to which changes in macroeconomic or fiscal policy variables will result in legislated changes to current or future fiscal policy. The variables to which the FPRF responds can be past, current, or anticipated future macroeconomic or fiscal policy variables.¹

For instance, if current law is anticipated to result in a path of future deficits, then an FPRF might imply that legislation will occur now and in the future that will offset those deficits. Indeed, the baseline fiscal policy forecast underlying our macroeconomic growth model is characterized by deficits that are not sustainable—that is, debt is forecast to grow faster than GDP, so that the ratio of debt to GDP increases without limit. Further, if legislation is passed in the current year which results in a new path of surpluses or deficits, with new macroeconomic consequences, then an FPRF

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National Tax Journal
Vol. LVIII, No. 3
September 2005

¹ The literature on fiscal policy reaction functions is, in part, inspired by the well-developed literature on monetary policy reaction functions, such as the Taylor Rule; see, e.g., John B. Taylor (1999).

might imply that legislation will occur in the future that will offset those deficits or surpluses, and may in turn modify the new macroeconomic path.

This paper shows that a specification of an FPRF that is consistent with the empirical literature, applied in a macroeconomic model, can move an unsustainable baseline forecast to one that is sustainable. Furthermore, the same FPRF can still move the forecast to one that is sustainable, even in the face of an alternative fiscal policy that would otherwise exacerbate the current, unsustainable path. This could be interpreted as evidence that if policymaker's behavior in the future is consistent with their behavior in the past, then fiscal policy would return to a sustainable path. But another specification of the FPRF, equally consistent with the literature, has a dichotomous result: It does not return the forecast path to sustainability, either with respect to the current baseline, or with respect to the alternative fiscal policy. This dichotomy of results means that further empirical evidence is required before macroeconomic modelers could be confident that they are implementing an FPRF that is truly consistent with past behavior. This has implications for two of the sources of interest in implementing FPRFs in macroeconomic models.

One source of interest in implementing an FPRF in a macroeconomic model is that a model that does not implement an FPRF might be considered to be inherently inconsistent with likely policy responses. But this inherent inconsistency is not yet resolved by implementing an empirically consistent FPRF, because of the dichotomous results that can be obtained.

A further source of interest in implementing an FPRF in a macroeconomic model is the possibility that modelers could reduce the number of simulations and simplify the presentation of results. Typically, when making a forecast that requires the Federal government finances to

be on a sustainable path, macroeconomic modelers are forced to provide a number of simulations covering the variety of ways that the fiscal gap can be closed. But the dichotomous results obtainable from implementing an empirically consistent FPRF mean that its implementation would not currently allow for a reduction in the number of simulations, nor a simplification in the presentation of results. Further empirical work is required.

The paper proceeds as follows: first, we will discuss the baseline forecast with particular attention paid to the period outside of the budget window; second, we will describe the ten percent individual income tax rate cut that is our policy change; third, we will discuss some of the literature on fiscal policy reaction functions with particular attention to implementation in a macro model of the U.S. economy; fourth, we present our results from implementing the FPRF in both the baseline and for our policy change; and finally, we conclude with some implications and directions for further research.

MODELING ENVIRONMENT

When economists evaluate the effects of tax policy on the economy, they must begin by specifying the expected effects of current fiscal policy. That is, it is necessary to determine what the baseline—present law economy looks like. Once a baseline is determined it is possible to begin looking at how a change in fiscal policy would affect the economy. In practice, the Joint Committee on Taxation (JCT) staff has used a baseline provided by the Congressional Budget Office (CBO) for the first several years (ten years) and then allowed its macro-economic models to determine the level of activity in years after the budget window.

JCT staff analysis of the macro economic effects of changes in tax policy usually incorporates a myopic neoclassical growth model (MEG), a myopic econometric

model, and a perfect-foresight forward-looking overlapping-generations model (OLG).² Because the OLG model is forward looking, agents in the model are capable of determining whether the current fiscal path is sustainable. If the policy is not sustainable the agents are unable to determine what the outcome would be and the model cannot solve. This makes it necessary to close any unsustainable fiscal gap. The standard procedure is to close the gap either with a lump-sum tax cut or a proportionate tax cut, beginning in the first year after the budget window. Therefore, one motivation for looking at FPRF is to incorporate an econometrically estimated FPRF into our analysis.³ This is a potentially more formal method of closing the fiscal gap than has been used up to now.

BASELINE FORECAST

Inside the budget window we calibrate the MEG model to closely match CBO estimates for government expenditures and receipts, and the overall activity in the economy. Our task is to advise Congress as to the likely effects of their proposals on the economy, and therefore we assume that the only changes Congress will make are those we are analyzing. Consequently, we do not explicitly implement an FPRF inside the budget window.

In the long run, we calibrated the model to make it broadly consistent with the CBO long-run forecast for taxes and expenditures.⁴ On the receipt side we forecast tax rates for the sources of income including wages, interest, dividends, proprietor income, rental income, and capital gains.⁵ These are forecast using the JCT individual tax simulation model, which is based on a stratified sample of tax returns for tax year 2001. The sample of tax returns includes almost 192,000 returns. The model has a detailed tax calculator for the base year and each subsequent year. Each return has an associated weight that allows the sample to weight up to the total number of returns filed for tax year 2001. In the budget window period (2004–2014), the individual simulation model is extrapolated by adjusting the dollar amounts and the weights to meet the target values for the population and CBO forecasts for the economy.⁶ Using the individual tax simulation model we are able to determine the average and marginal rates for a variety of different income sources, and by socio-economic status. After 2014, we move the tax rates by the average change in the tax rate over the period from 2012 to 2014. The average change over the period from 2012 to 2014 picks up the effects of bracket creep with real income growth and the increasing effect of the Alternative Minimum Tax

² Detailed discussion of these models is beyond the scope of the current paper and is provided in U.S. Joint Committee on Taxation (2003). Also, see Diamond and Moomau (2003) for a description of many of the issues in analyzing the macroeconomic effects of tax policy and details about the parameters of MEG, and OLG models.

³ Because we want to analyze the effects of incorporating a FPRF, our starting point is the myopic MEG model, where the model can solve even when it is on an unsustainable path. This paper focuses on FPRF starting from non-stable fiscal policies and therefore is limited to just the MEG model. A future area of research would be to compare the results from the FPRF with those of closing the gap with a lump-sum tax or proportionate tax increase in the OLG model.

⁴ See Congressional Budget Office (2003). In particular, with respect to expenditures, our forecast is consistent with the intermediate spending associated with Scenarios two and five.

⁵ For a discussion of the importance of differentiating and carefully modeling tax rates by source of income, see Altshuler, Bull, Diamond, Dowd and Moomau (2005).

⁶ For a detailed description of the individual tax model, see Cilke (1994). For a more general discussion of the models and techniques used for revenue estimating by the JCT staff, see U.S. Joint Committee on Taxation (2005).

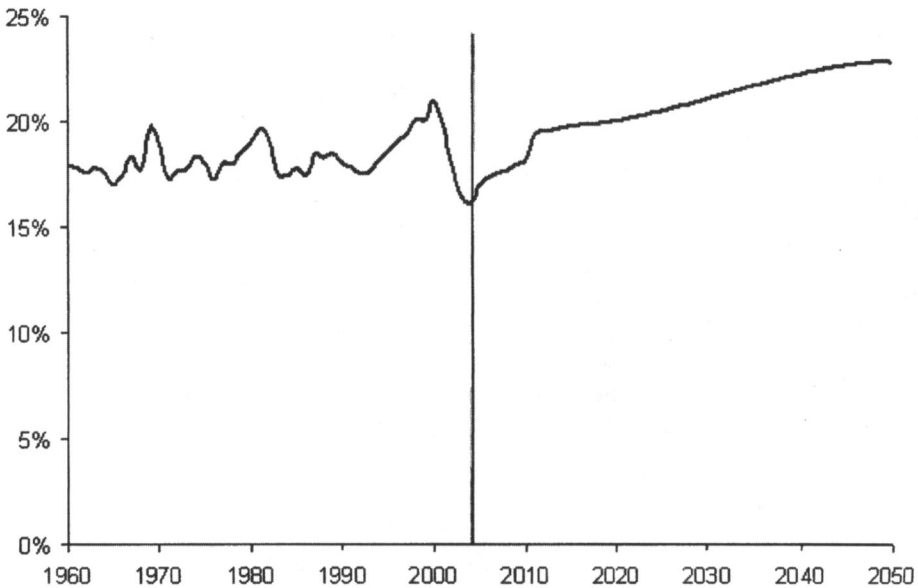
("AMT") on taxpayer liability. As can be seen in Figure 1, taxes as a share of GDP rise from roughly 16 percent in 2004 to approximately 23 percent in 2050.⁷

On the expenditure side, outside the budget horizon, we hold all expenditures, except transfer payments, constant as a share of GDP at their 2014 levels. Thus, given the 2014 share, the endogenously determined level of GDP in, e.g., 2032 determines non-transfer expenditures in that year.

On the other hand, transfers follow a very different path in the long run. As

can be seen in Figure 2, the elderly population as a share of the population 16 and over will increase dramatically from around 15 percent today to 25 percent around 2030 and stay steady at that level through 2050.⁸ This represents a dramatic change in the distribution of the population toward the elderly. The aging of the baby boomers (those born between 1946 and 1964) has resulted in an increase in labor supply, and in changes in the composition of consumer spending.⁹ There are numerous effects of a changing age composition on the economy,

Figure 1. Federal Taxes as a Share of GDP, Historical and Forecast (2004 and thereafter)

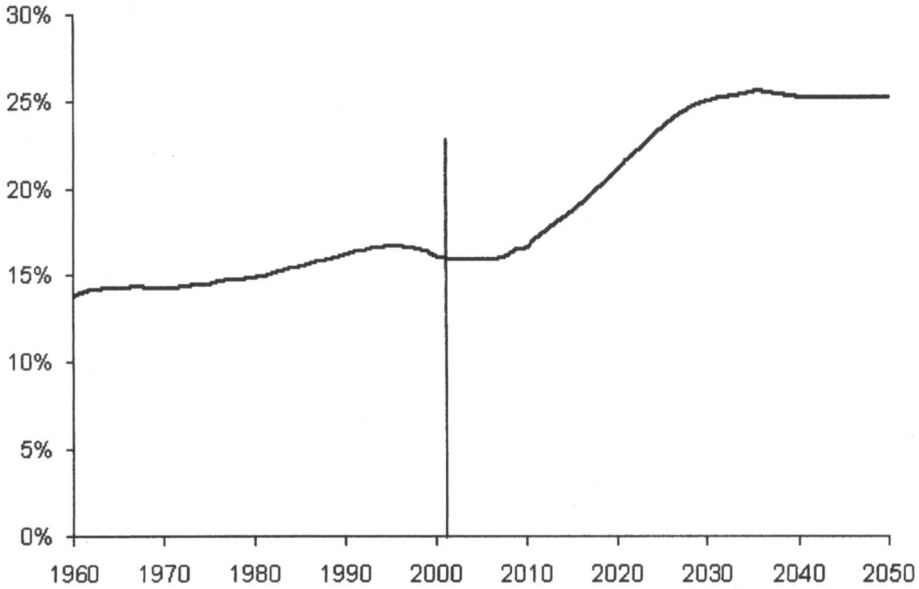


⁷ During the historical period, taxes as a share of GDP have typically ranged between about 16 percent and 20 percent. Typically, when the tax share has approached the top of this range, subsequent legislation has cut taxes and brought it back within the range—a form of fiscal policy reaction. But whether such a reaction would take place to the long-run forecast of an unusually high tax share is not clear, since as we will see, contemporaneous demographic changes are forecasted to cause growing deficits, despite the high tax share.

⁸ Population forecasts are taken from the middle-series projections from the Census bureau (January, 2000 release).

⁹ There have been numerous studies looking at the effect of the baby boom on the economy, including Easterlin (1991), Fair and Dominguez (1991) and Yoo (1994). Card and Lemieux (2000) find that larger cohorts are associated with lower levels of educational attainment. Abel (2002) finds that baby booms can result in asset price inflation initially, with a decline once the boom generation reaches retirement age.

Figure 2. Population Aged 65 and Over as a Share of Population Aged 16 and Over, Historical and Forecast (2001 and thereafter)



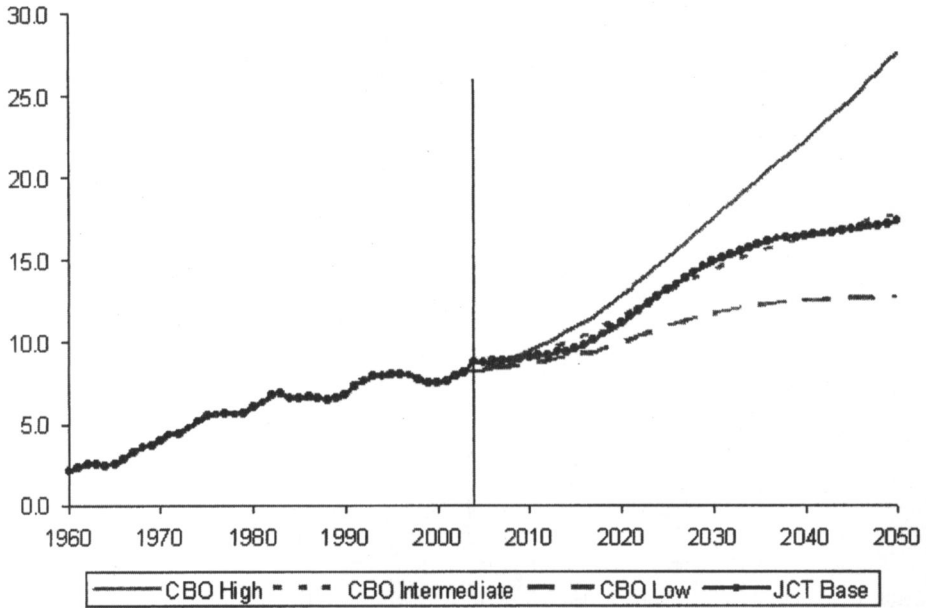
including what will happen to the Federal budget.¹⁰

With the aging of the baby boomers, the forecast for total expenditures by the Federal government is dominated by increasing expenditures on Social Security and Medicare. Figure 3 shows transfer payments as a share of GDP, both for our baseline forecast as well as for the range shown in CBO (2003). As can be seen in the figure, transfers as a share of GDP have grown from 2.1 percent of GDP in 1960 to 7.5 percent of GDP in 2000. Our baseline forecast has transfers growing to 9.4 percent of GDP in 2014 and 17.2 percent in 2050. The bulk of this growth is associated with excess cost growth in the health sector combined with an increasingly older population. Transfer payments for Social Security, and Medicare

and Medicaid are roughly evenly split in 2000, with Social Security transfers equaling 4.1 percent of GDP and Medicare and Medicaid equaling 3.4 percent of GDP. However in the forecast period, even with modest assumptions about excess cost growth, Medicare and Medicaid represent a steadily increasing portion of the budget and GDP. Our baseline forecast assumes that excess cost growth for Medicare and Medicaid is 1 percentage point faster than economy wide inflation. CBO (2003) shows that between 1960 and 2001, the average annual difference between growth in national health expenditures and GDP was 2.5 percent. However, this amount has been declining in each of the successive decades since 1960. Even if excess cost growth in the health sector declined to 1 percent from its historical

¹⁰ See Dowd, Monaco, and Janoska (1998) for a discussion of the effect of an aging population on the sectoral composition of the economy and the Federal budget. Elmendorf and Sheiner (2000) provide an analysis of the effect of an aging population on savings and the Federal budget.

Figure 3. Transfers as a Share of GDP, Historical and Forecast (2004 and thereafter)



average of 2.5 percent, CBO forecasts that that Medicare and Medicaid will represent about 11.6 percent of GDP and Social Security transfer payments will be equal to 6.2 percent of GDP in 2050. Thus, in their middle series, CBO forecasts that total transfer payments in 2050 will represent 17.7 percent of GDP. In order to be consistent with CBO's middle series our baseline forecast also assumes that excess health-care cost growth is 1 percentage point faster than economy wide inflation, as determined endogenously within the MEG model.

Social Security growth is driven by both wage growth and consumer price index (CPI) growth, which are determined endogenously within the MEG model. These result in Social Security transfer payments that are broadly consistent with the CBO middle series for Social Security expenditures. The net effect of government expenditures and receipts is shown in Figure 4.

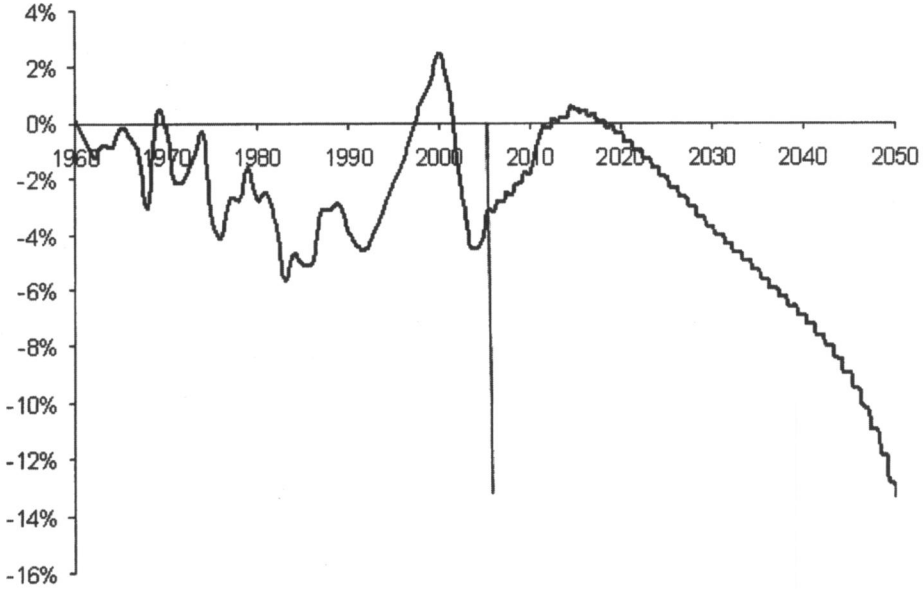
It should be noted that some of our assumptions about expenditures and receipts

in our baseline forecast are a form of a FPRF, albeit one that does not explicitly respond to increasing deficits. For instance, keeping expenditures other than transfers constant as a share of GDP outside the budget window may implicitly assume the passage of legislation that would have that effect. Also, on the revenue side, there is a considerable automatic stabilizer effect of the tax code: Auerbach and Feenberg (2000) estimate that the tax code could offset as much as 8 percent of GDP shocks.

ALTERNATIVE FISCAL POLICY: TEN PERCENT TAX RATE CUT

Since the purpose of this paper is primarily to analyze implementation of a FPRF, both relative to current law, and relative to a proposed change to that law, we consider a tax policy experiment that is straightforward and simple. The policy experiment that we analyze is a 10 percent across the board rate cut in individual regular, dividend, capital gains, and Alter-

Figure 4. Surplus as a Share of Potential GDP, Historical and Forecast (2004 and thereafter, no Fiscal Policy Reaction Function)



native Minimum Tax rates. The rate cuts we model are taken relative to present law as of the beginning of 2004, including all of the sunsets of the 2001 and 2003 tax cuts, but excluding the effects of the legislation at the end of 2004.¹¹ We have assumed that the tax cut would be implemented beginning on January 1, 2005 and that there were no announcement effects allowing for shifting of income from 2004 into 2005. Because the individual income tax is complicated and there are many non-linearities in the tax code, a 10 percent rate cut does not result precisely in a 10 percent cut in marginal and average wages, but such differences do not significantly affect the results of implementing an FPRF.¹² Figure 5 shows the surplus as a share of potential GDP in the baseline and under the alternative fiscal policy.

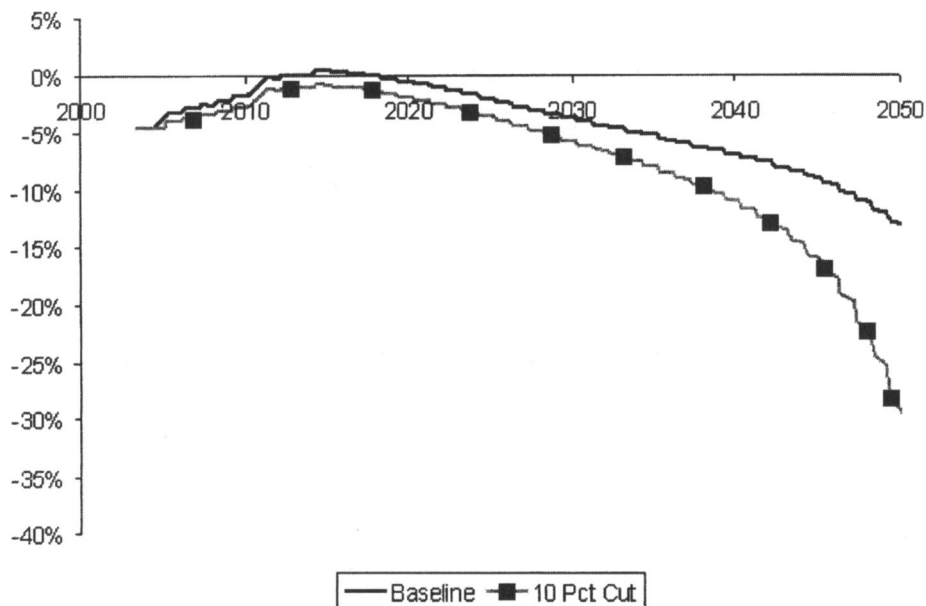
FPRF ECONOMETRIC STUDIES

There are a number of studies that have empirically estimated FPRFs. Auerbach (2003, forthcoming) looks at the change in the full-employment budget surplus, as constructed by CBO, as a function of lagged measures of the budget surplus and the GDP gap. He finds that lagged values of the GDP gap and the budget surplus are negatively related to the current period budget surplus. Thus, it appears that fiscal policy acts counter-cyclically, and that fiscal policy responds to the government budget situation. He also estimates separate equations for revenues and outlays and finds estimates that are consistent with the budget surplus results. Using similar data, Cohen and

¹¹ That is, the analysis excludes the effects of the American Jobs Creation Act of 2004 and of the Working Family Tax Relief Act of 2004. Tables showing the present-law tax rates underlying the current analysis are shown in U.S. Joint Committee on Taxation (2005a).

¹² Further discussion of the effect on taxpayer's average and marginal rates of an across-the-board rate reduction is provided in Diamond and Moomau (2003).

Figure 5. Surplus as a Share of Potential GDP, Baseline and 10 Percent Rate Cut, No Fiscal Policy Reaction Function.



Follette (2003) extend Auerbach’s work and show that defense expenditures can be treated as exogenous. Bohn (1998) analyzes U.S. data from 1916–1995. Unlike the Auerbach approach he uses the debt to GDP ratio instead of the lagged value of the surplus and finds evidence that the primary surplus—the surplus excluding interest payments on the debt—responds positively to the debt to GDP ratio. This suggests that the debt to GDP ratio exhibits mean-reversion.

Because we implement the Auerbach (forthcoming) estimates in our macro model, what follows is a more detailed description of his estimate. Auerbach estimates a regression equation with the dependent variable being either the discounted legislated changes to the surplus, receipts, or expenditures for the current period and the subsequent four fiscal years. The discount method applies geometrically declining weights to the current

period and the subsequent four years. For example, if the dependent variable is the discounted value of the expected surplus, then its value is calculated as:

$$S_t = \alpha \cdot ds_t + \alpha \cdot (0.5) \cdot ds_{t+1} + \alpha \cdot (0.5)^2 \cdot ds_{t+2} + \alpha \cdot (0.5)^3 \cdot ds_{t+3} + \alpha \cdot (0.5)^4 \cdot ds_{t+4}$$

where ds_t is the change in the surplus at time t and α is a normalization factor so that the weights add up to 1. A value of α equal to 0.516 will result in a sum of the weights equal to 1. The regression that is estimated for the surplus is:

$$S_t = B_0 + B_1 \cdot GDPGap_{(t-1)} + B_2 \cdot BudgetSurplus_{(t-1)} + \epsilon_{(t)}$$

Similar definitions of the dependent variable and of the regression equations would apply when the fiscal policy reaction of revenues and outlays is being estimated, except that R_t , for revenues, or

O_t , for outlays, would replace S_t . Table 1, below, presents the estimated results.

Because it is a little tricky to see the implications of these regression results, it is worth going through them in detail. Consider the surplus regression. The constant term says that even in the absence of any policy change, with the economy running at potential, there would be an addition of -0.3 percent of potential GDP to the present value of current and future surpluses; thus, there is an autonomous movement in the direction of increased deficits.

The lagged budget surplus term shows a negative correlation with this year's surplus: For example, suppose that last year's surplus was -4 percent of potential GDP (i.e., we were running a deficit); then the -0.137 coefficient on the lagged surplus would add 0.548 percent ($= -4 * -0.137$) of potential GDP to the present value of current and future surpluses.

Finally, the lagged GDP gap term is also negatively correlated with the current year's deficit: If we were 0.5 percent below potential last year (i.e., in a recession), then the -0.124 coefficient on the GDP gap would result in a counter cyclical decrease in the present value of current and future surpluses of -0.062 percent ($= 0.5 * -0.124$) of potential GDP.

To sum up, in this example, the net effect of the constant term, plus a 4 percent

of GDP deficit, plus GDP of $\frac{1}{2}$ percent below potential would be to change the expected value of current and future surplus by 0.186 percent of potential GDP. With potential GDP of about $\$11.5$ trillion, this implies an increase in the expected value of current and future surpluses of about $\$21$ billion.

IMPLEMENTATION OF FPRF ECONOMETRIC STUDIES IN A MACROECONOMIC MODEL

Now the next step is to implement these regression results in a macroeconomic model of the economy. To be concrete, what policy change is consistent with increasing the surplus by $\$21$ billion in present value? While there is a continuum of possible policy changes, the regression results suggest considering differentiating policies along at least two dimensions. The first dimension is the length of time over which they are implemented, for example, a temporary or permanent policy. The second dimension is the extent of fiscal policy detail, for example whether the policy is a simple, direct change to the surplus, or a more detailed modeling of changes to outlays and receipts.

With respect to the length of time over which the policy changes are implemented, we consider two prototypical examples. Specifically, suppose that the

TABLE 1
EMPIRICAL FISCAL POLICY REACTION FUNCTION ESTIMATION RESULTS

Independent Variable	Sample Period and Dependent Variable: 1984:2—2004:1		
	Revenues	Expenditures	Surplus
Constant	-0.001 (.0003)	0.002 (.0005)	-0.003 (0.001)
Budget Surplus (-1)	-.060 (.015)	.077 (.018)	-0.137 (0.027)
GDP Gap (-1)	-.050 (.021)	.074 (.026)	-0.124 (0.040)
Rbar ²	.281	.294	0.374
Observations	40	40	40

Source: Auerbach (forthcoming).

method of increasing the surplus is to reduce transfer payments. Then the following two policies have a present value of \$21 billion, when the discount factor, α , equals .516, and when only the first five years of the policy are included in the present value calculation:

- 1) A one-year, temporary decrease in transfer payments of \$41 billion next year; and
- 2) A permanent decrease in transfer payments of \$21 billion per year.

In the case of the one-year temporary decrease in transfer payments, its weighted present value is just $\alpha \cdot 41 = .516 \cdot 41 = 21$. In the case of the permanent decrease of \$21 billion per year, its weighted present value is $\alpha(1 + 0.5 + 0.5^2 + 0.5^3 + 0.5^4) \cdot 21 = 21$, by construction, since we chose $\alpha = .516$ to make it so that the weights would add up to 1.0 (and note that all years after the fifth are ignored in calculating the dependent variable in the empirical present-value formula).¹³ While both these policies have the same weighted value, they clearly may differ significantly in macroeconomic effects, both in the short and the long run. In the short run, the effect of the temporary policy is always quantitatively larger, but it has no persistent long run effects. By contrast, the permanent policy has persistent long run effects, by construction; a one-year recession last year results in a permanent “counter-cyclical” decrease in each future year’s surplus. Current law contains many examples of policies that are either tempo-

rary or “permanent”—their actual duration is an empirical question, discussed later in the conclusion.

The second dimension across which the modeling can vary is the sophistication with which fiscal policy is modeled. Specifically, the modeler can implement a variation of the “surplus regression,” for example by assuming that the resulting changes to the surplus are all done through lump-sum changes to transfer payments. Or the modeler can implement a combination of the first two columns of regression results, calculating the change in expenditures and revenues consistent with the empirical results.

For the expenditure regressions, we calculate the change in expenditures and then allocate the change either to transfer payments or purchases. Cohen and Folllette (2003) find that there appears to be no effect of a fiscal reaction function on defense purchases. But in practice, we found that restricting all of the fiscal policy reaction implied by Auerbach’s regressions to non-defense purchases implied in some cases that these purchases should be negative. We therefore allocated the change to government purchases equiproportionately across both types of purchases.

For the revenue regressions, recall that these only tell the modeler how much the level of revenues will respond, and not how tax policy will change to generate that change in revenues. One alternative would be a lump-sum change, but this would be fairly similar in many respects to our treatment of the “surplus regression.” We therefore modeled the revenue

¹³ One other alternative that might be of some interest—because of its similarities to the expiring features of EGTRRA and JGTRRA—would be a five-year, temporary decrease in transfer payments of \$21 billion per year, which would also have a present value of \$21 billion. But while this would be much more difficult to model, since we would have to keep careful track of the vintage of the policy change, it would not be likely to yield a great deal more information. The temporary nature of the policy change would mean that its long-run effects are similar to those of the one-time, temporary policy change. And since the MEG model is not forward-looking, the fact that the first five years of the policy change match with those of the permanent policy change mean that these two policies would have similar short-run effects.

regression as an across-the-board rate cut to individual and corporate rates sufficient to change revenues by the specified amounts. We do this with a proportional allocation across bases, and then determine the average rate change required, and then the implicit change in marginal rates required to be consistent with the average rate change.

More explicitly, the first step is to calculate the average rate change for each base needed to generate the revenue change allocated to that base. Then we compute the marginal rate change for each individual tax base computed using an estimated elasticity of marginal rate for each base with respect to the average rate. We estimate these marginal rate elasticities from the individual micro-simulation model, using an across-the-board rate cut. Table 2, below, shows the elasticity of marginal tax rates with respect to the average tax rate. The first column shows the elasticity of the marginal tax rate on wages with respect to the average tax rate on wages. Over the period 2005–2010, a 1 percent decline in the average tax rate is associated with a 0.9 percent decline in the marginal tax rate on wages, a 1.05 percent decline in the marginal tax rate on interest income, a 0.65 percent decline in the marginal tax rate on dividends, and a 0.44 percent decline in the marginal tax rate on capital gains. The table shows how the present law sunset of tax cuts

enacted in 2001 in the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA) and in 2003 in the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA) will increase the marginal tax rate elasticities for all of the income bases except capital gains.

In sum, we investigate the effects of implementing the FPRF in a macro model of the economy. We do this by assuming the estimated equations for changes in the Federal budget surplus result in changes in transfer payments to individuals. We implement both a temporary change and a permanent change to the transfer payments to individuals. In order to implement the expenditure and revenue estimate equations, we assume that transfers and purchases, including defense, are changed. On the revenue side, we distribute the implied change in revenues between corporate and individual receipts proportionate to their contribution to overall receipts. We also assume that the changes in tax rates are across the board changes in statutory rates. Finally, we simulate both a temporary version of the FPRF and a permanent version. The temporary version is a one year change in the surplus or in revenues and expenditures that has a weighted value consistent with the empirical FPRF results, as discussed above. The permanent version is a permanent change in the surplus or in revenues and expenditures that has a

TABLE 2
ELASTICITY OF MARGINAL TAX RATE WITH RESPECT TO AVERAGE TAX RATE

Income	Wages	Interest	Dividends	Cap Gains
Post-JGTRRA				
05–10 average	0.88	1.05	0.65	0.44
St dev	0.02	0.03	0.03	0.08
Pre-EGTRRA				
11–14 Average	0.95	1.08	1.06	0.43
St dev	0.03	0.02	0.05	0.05
All Years				
05–14 Average	0.91	1.06	0.89	0.43
St dev	0.05	0.03	0.22	0.06

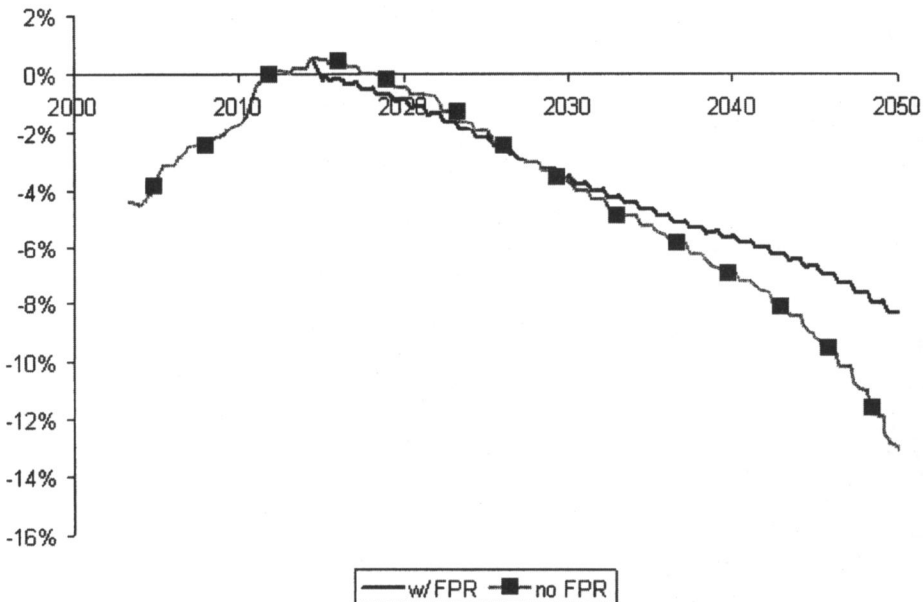
five-year weighted value consistent with the empirical FPRF results. For expenditure changes, we consider both a change to untaxed transfers, and to government purchases.

IMPLEMENTATION OF TEMPORARY VERSION OF FPRF

Results of implementing a temporary version of an FPRF are shown in Figures 6 and 7, and in Table 3. We present the graphs first, because they give a more immediate sense of the results; the table shows more detail. Figure 6 shows the federal surplus as a share of potential GDP, for baseline policy, both with and without the temporary version of an FPRF. The figure shows only the results of the surplus FPRF. The other two FPRF alternatives—transfers and taxes, or purchases and taxes—differ only slightly from those for the surplus FPRF, as can be seen in Table 3.

As can be seen in Figure 6, the baseline without the FPRF briefly shows a positive value surplus just prior to the retirement of the baby boomers. However, after 2018 the small surplus turns sharply into ever-increasing deficits. This reflects the increasing demands on the Federal government of both Social Security and Medicare, which are only partially offset by the slight increases in taxes as a share of GDP seen in Figure 1. Figure 6 also shows the effect on the baseline of including a FPRF for the surplus. The negative coefficient on the lagged value of the budget surplus has the effect of pushing the surplus negative in 2015, the first year of implementation of the FPRF. There is a 0.6 percentage point difference between the surplus without a FPRF and with a FPRF. In 2027 and thereafter, the deficit with the FPRF is smaller than the deficit without the FPRF. In 2035, the deficit without a FPRF is 5.6 percent of GDP, and the deficit with a FPRF is 0.7 percentage points smaller. By 2050, the

Figure 6. Surplus as a Share of Potential GDP, Baseline Policy, with and without Fiscal Policy Reaction Function, Temporary Version, Surplus Policy Reaction.



Analyzing the Macroeconomic Effects of Tax Policy

Figure 7. Surplus as a Share of Potential GDP, 10 Percent Rate Cut, with and without Fiscal Policy Reaction Function, Temporary Version, Surplus Policy Reaction.

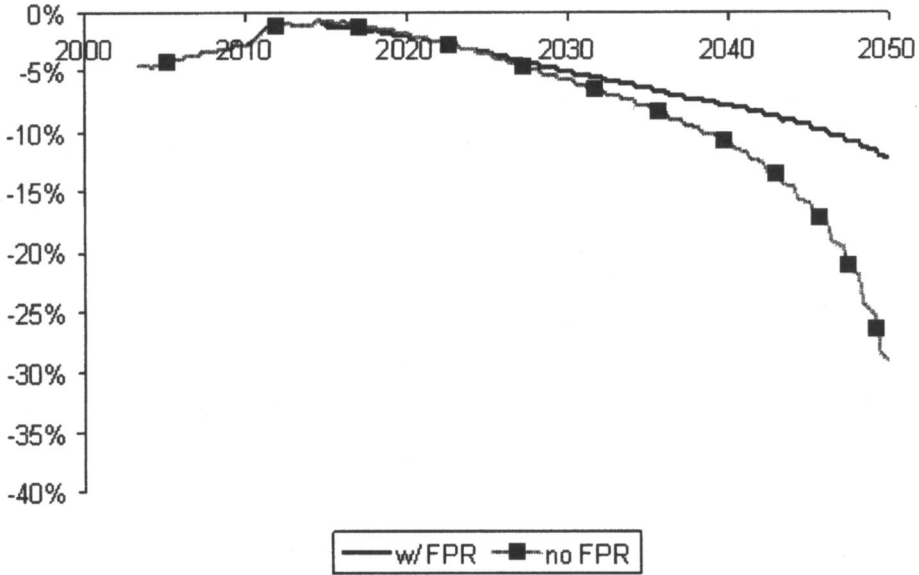


TABLE 3
RESULTS OF TEMPORARY VERSION OF FISCAL POLICY REACTION FUNCTION

	Type of FPR: Temporary, one year			
	No FPR	Surplus	Transfers Taxes	Purchases Taxes
Outside the budget horizon: (2050)				
Percentage point change relative to baseline:				
nominal GDP	2.48	-0.51	-0.70	-0.60
real GDP	-4.13	-1.97	-2.50	-2.34
real producer's capital stock	-13.11	-4.50	-6.10	-5.94
real residential capital stock	-17.50	-8.94	-8.60	-7.91
private sector employment	1.72	0.58	0.46	0.45
Ratios to potential GDP (percent):				
Deficit share: <i>baseline</i>	-13.40	-8.27	-8.77	-8.69
Deficit share: alternative	-31.38	-12.10	-13.36	-13.12
Transfers share: <i>baseline</i>	16.91	15.16	15.94	16.86
Transfers share: alternative	17.06	14.21	15.36	16.95
Purchases share: <i>baseline</i>	1.90	1.90	1.90	0.96
Purchases share: alternative	1.91	1.90	1.90	0.29
Tax share: <i>baseline</i>	22.63	22.79	23.54	23.59
Tax share: alternative	19.72	21.88	23.00	23.09

deficit without a FPRF is over 13 percent of GDP, and the difference in the deficit between the simulations with a FPRF and without is 5.2 percentage points.

Figure 7 shows the same graph as in Figure 6 except that now we have imple-

mented an across the board 10 percent rate cut. The effect of the FPRF is more dramatic with the introduction of the 10 percent rate cut. The rate cut pushes all of the deficit numbers larger including those with a FPRF. However, the difference be-

tween the two simulations is even larger than in the baseline simulations. In 2015, the FPRF has the effect of increasing the deficit by about 0.3 percentage points. By 2035, the FPRF reduces the deficit by 1.8 percentage points from a deficit to GDP ratio of 8.2 percent. Finally, in 2050, the 10 percent across the board tax cut increases the deficit to GDP to 32 percent of GDP, while the FPRF simulation moderates the tax cut resulting in a deficit to GDP ratio of 12 percent.

Table 3 shows more detail on the effect of the temporary version of the FPRF on a number of macroeconomic variables in the year 2050. In the top panel of the table, the first column shows the effects of the 10 percent across the board tax cut when there is no FPRF. The second, third, and fourth columns show the effects of the tax cut with differing types of FPRF. The bottom panel of the table makes it easy to see how the FPRF affects the deficit, and how it is implemented (i.e., by changing transfers, purchases, or taxes). As can be seen from the table, a fiscal policy that simply reduces Federal expenditures and does not increase taxes, second column, results in higher levels of GDP, more capital stock, and a smaller deficit to GDP than either of the alternative FPRFs. The other two FPRFs, in columns three and four, implement the FPRF by breaking the reaction into expenditures and taxes. Relative to column two where there is only the reduction in transfer payments, the negative coefficient on the lagged value of the budget surplus has the tendency to increase taxes in the face of an increasing deficit. While the increase in taxes reduces the overall size of the deficit, it also has incentive effects that are not included in the transfers-only simulations.

IMPLEMENTATION OF PERMANENT VERSION OF FPRF

Results of implementing a permanent version of an FPRF are shown in Figures

8 and 9, and in Table 4. The results are sharply different than those for the temporary versions of an FPRF. Here, the graphs show the results for the permanent version of an FPRF that operates through changes to tax rates and to government purchases. Again, the results are similar to those of the two other variations of permanent FPRFs.

The baseline without the FPRF follows the same path as in Figure 6. Implementing a permanent FPRF pushes the surplus negative in 2015, owing to the negative coefficient on the lagged value of the budget surplus. Soon thereafter, the FPRF is working to reduce deficits, but because the FPRF is backward-looking, its response is never quite strong enough to offset the growth in baseline deficits. In 2015, there is a 0.8 percentage point difference between the surplus without a FPRF and with a FPRF. In 2027 and thereafter, the deficit with the FPRF is smaller than the deficit without the FPRF. In 2035, the deficit without a FPRF is 5.4 percent of GDP, and the deficit with a FPRF is 2.6 percentage points smaller. By 2050, the deficit without a FPRF is over 13 percent of GDP, and the difference in the deficit between the simulations with a FPRF and without is 10.6 percentage points.

Figure 9 shows the same graph as in Figure 8 except that now we have implemented an across the board 10 percent rate cut. Similar to the temporary version of the FPRF, the effect of the FPRF is more dramatic with the introduction of the 10 percent rate cut, which pushes all of the deficit numbers larger, including those with a FPRF. In 2015, the FPRF has the effect of increasing the deficit by about 0.4 percentage points. By 2035, the FPRF reduces the deficit by 5.1 percentage points from a deficit to GDP ratio of 8.2 percent. Finally, in 2050, the 10 percent across the board tax cut increases the deficit to GDP to 31 percent of GDP, while the FPRF simulation moderates the tax cut resulting in a deficit to GDP ratio of 2.9 percent.

Analyzing the Macroeconomic Effects of Tax Policy

Figure 8. Surplus as a Share of Potential GDP, Baseline Policy, with and without Fiscal Policy Reaction Function, Permanent Version, Purchases and Tax Rate Policy

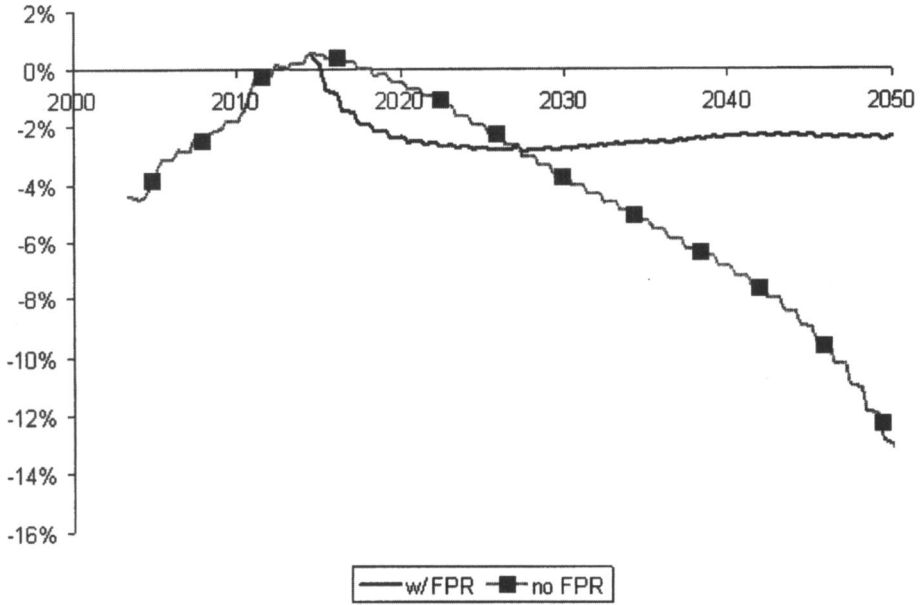


Figure 9. Surplus as a Share of Potential GDP, 10 Percent Rate Cut, with and without Fiscal Policy Reaction Function, Permanent Version, Purchases and Tax Rate Policy

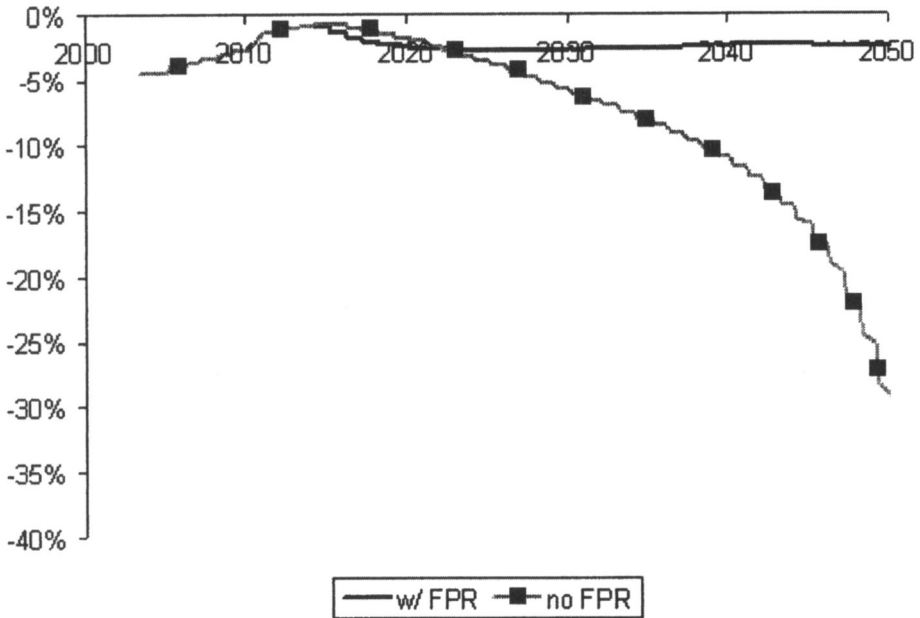


TABLE 4
RESULTS OF PERMANENT VERSION OF FISCAL POLICY REACTION FUNCTION

	Type of FPR: Permanent			
	No FPR	Surplus	Transfers Taxes	Purchases Taxes
Outside the budget horizon: (2050)				
Percentage point change relative to baseline:				
nominal GDP	2.48	0.68	0.27	0.45
real GDP	-4.13	0.99	0.77	0.78
real producer's capital stock	-13.11	2.57	2.00	1.57
real residential capital stock	-17.50	-0.91	-1.97	-0.93
private sector employment	1.72	0.70	0.82	0.73
Ratios to potential GDP:				
Deficit share: <i>baseline</i>	-13.40	-2.37	-2.83	-2.82
Deficit share: alternative	-31.38	-2.37	-2.79	-2.92
Transfers share: <i>baseline</i>	16.91	13.24	16.08	16.98
Transfers share: alternative	17.06	12.49	15.52	16.89
Purchases share: <i>baseline</i>	1.90	1.90	1.90	1.02
Purchases share: alternative	1.91	1.90	1.90	0.53
Tax share: <i>baseline</i>	22.63	22.68	26.19	26.24
Tax share: alternative	19.72	21.83	25.59	25.63

Table 4 shows more detail on the effect of the permanent version of the FPRF on a number of macroeconomic variables in the year 2050. The table is similar in structure to Table 3. The most notable difference in results is that with the permanent version of the FPRF, when the 10 percent rate cut is put in place, and the FPRF is allowed to react, real GDP is higher than baseline GDP for all three variants of the permanent version of the FPRF. This contrasts with the decrease from baseline in GDP that is present for the "No FPR" experiment, and for the three versions of the temporary variant of the FPRF seen in Table 3. The ratio of the deficit to potential GDP is nearly the same in all variants of the permanent FPRF, whether against baseline law or against the 10 percent rate cut. This contrasts sharply with the variants of the temporary FPRF, which close only a portion of the deficit relative to the "No FPR" case, and which have significantly different deficit shares between the baseline case and the 10 percent rate cut. Comparing the remainder of the second panel between the two tables makes clear how the policy reaction has achieved these effects. For instance, in the "Surplus" case,

the permanent reaction function has taken transfers as a share of GDP to 13.2 percent in the baseline run, much lower than the 15.2 percent share in baseline run for the temporary reaction (the small changes in the tax share of GDP primarily reflect changes to GDP in the two runs). In the "Transfers/Taxes" run, the tax share of GDP jumps more sharply to 26.2 percent in the baseline run of the permanent version than in the temporary version, where the baseline share jumps only to 23.5 percent; the story is similar for the "Purchases/Taxes" run.

CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

Implementing an FPRF is complicated and requires numerous assumptions in order to operationalize the empirical estimates in a model of the economy. We made simplifying assumptions regarding the timing of fiscal reactions and how those fiscal responses are translated into changes in expenditures and receipts. We chose two extreme timing alternatives: one-year temporary, and permanent versions. We found that the temporary version of an FPRF does not

generate a stable debt to GDP ratio, while the permanent version does. Both of these versions of an FPRF are equally consistent with the empirical results, so which is “more” consistent with actual historical behavior is as-yet indeterminate. Pending a consensus on which assumptions are most reasonable, the number of policy results presented is not necessarily reduced.

Further econometric work would be useful to identify the way in which fiscal policy reactions have been distributed across transfers versus purchases, as well as to identify the types of tax law changes that have been implemented, for example rate changes versus quasi-lump-sum tax changes, such as the child credit. In addition, further econometric work may be useful in identifying econometrically the duration of fiscal policies, since this variable has critical effects on sustainability. The time span over which policies are actually implemented is ultimately an empirical question. On the one hand, the letter of the law may say that a policy is permanent—such as the phase-out of the personal exemption (PEP)—or that it is temporary, such as the Research and Experimentation (R&E) credit. On the other hand, the actual lifespan of the policies may differ than the letter of the law. For example, PEP was eliminated in recent legislation (though PEP comes back when that legislation expires); and the R&E credit has been extended so many times that some may view it as being permanent. Thus, as an empirical question, the duration of policies should be determined ex-post. Does an FPRF whose duration is consistent with such an empirically determined duration result in a move from an unsustainable baseline to a sustainable fiscal policy?

It is worth noting that the estimation period does not include demographic events that are comparable to the forecast period, so even if past behavior were consistent with sustainability, this does not mean that

future behavior would be consistent—and even if past behavior were inconsistent, it does not mean that future behavior could not become consistent with sustainability. Finally, we note that implementing an FPRF in an overlapping generations model that contained demographic detail consistent with current forecasts might generate very different results. In such a model, a forward-looking version of an FPRF could be implemented. Of course, such an FPRF would have to be stable, in the sense of returning to a sustainable path of the debt to GDP ratio.

Acknowledgments

We wish to thank Alan Auerbach, Darrel Cohen, Glenn Follette and our colleagues John Diamond and Pam Moomau for clarifying discussions and helpful comments. In addition, we thank participants at the NBER conference on Behavioral Effects of Tax Policy, and our discussant at the NTA Spring Symposium, Eric Engen. All errors and omissions are our own. The views represented here should in no way be construed as those of the Joint Committee on Taxation or any member of the Committee.

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