CONTEMPORARY ECONOMIC POLICY

WHAT IT TAKES TO SOLVE THE U.S. GOVERNMENT DEFICIT PROBLEM

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This paper uses a structural multi-country macroeconometric model to estimate the size of the decrease in transfer payments (or tax expenditures) needed to stabilize the U.S. government debt/gross domestic product (GDP) ratio. It takes into account endogenous effects of changes in fiscal policy on the economy and in turn the effect of changes in the economy on the deficit. A base run is first obtained for the 2013:1–2022:4 period in which there are no major changes in U.S. fiscal policy. This results in an ever increasing debt/GDP ratio. Then transfer payments are decreased by an amount sufficient to stabilize the long-run debt/GDP ratio. The results show that transfer payments need to be decreased by 2% of GDP from the base run, which over the 10 years is $3.2 trillion in 2005 dollars and $4.8 trillion in current dollars. The real output loss is 1.1% of baseline GDP. Monetary policy helps keep the loss down, but it is not powerful enough in the model to eliminate all of the loss. The estimates are robust to a base run with less inflation and to one with less expansion. (*JEL* E17)

I. INTRODUCTION

This paper estimates, using a structural multi-country macroeconometric model, denoted the "MC model," what it takes to stabilize the long-run U.S. federal government debt/gross domestic product (GDP) ratio. The fiscal policy tool is federal transfer payments. This question is complicated in part because of endogeneity issues. A fiscal-policy change designed to decrease the deficit has effects on the macroeconomy, which in turn affect the deficit. Any analysis of fiscal-policy proposals must take these effects into account: one needs a model of the economy.

The period considered is 2013–2022. The experiments are performed off of a base run. The base run is one in which there are no major changes in U.S. fiscal policy from 2013 on. Aggregate tax rates are taken to be unchanged from their values in 2012:4 except for the payroll tax rate, which is taken to go back to its 2010:4 value. (The payroll tax cut is not extended beyond 2012:4.) This treatment of tax rates means that the Bush tax cuts are assumed *not* to expire at the end of 2012. Federal government purchases of goods and services and federal transfer payments to households and to state and local governments are assumed to grow at recent historical rates net of the effects of the various stimulus measures. This means that the currently legislated cuts in future defense spending are assumed *not* to go into effect.

As will be seen, the base run has an ever increasing debt/GDP ratio. This is, of course, consistent with almost all recent analyses. Without major fiscal-policy changes, the U.S. government debt/GDP ratio is expected to rise without limit. See, for example, Penner (2011) and CBO (2011). The experiments consist of decreasing transfer payments from the base run beginning in 2013:1. The size of the decrease is chosen to stabilize the debt/GDP ratio by 2022.

The results show that decreasing transfer payments by 2% of GDP from the base run stabilizes the debt/GDP ratio. The decrease in transfer payments over the 10 years is $4.8 trillion in current dollars and $3.2 trillion in 2005 dollars. The sum of the real output loss (2005 dollars) over the 10 years is $1.8 trillion, which is 1.1% of sum of real output over the 10 years from the base run. The average number

*The results in this paper can be duplicated on the author's website (fairmodel.econ.yale.edu), and alternative base runs and experiments can be done. The MCH version is used, dated April 27, 2012. I am indebted to William Brainard for helpful comments.

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ABBREVIATIONS

DSGE: Dynamic Stochastic General Equilibrium
GDP: Gross Domestic Product
NIPA: National Income and Product Accounts

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of jobs per quarter is 1.55 million lower, and the average number of people unemployed per quarter is 680,000 higher.

Monetary policy is endogenous in the model; it is determined by an estimated interest rate rule. Monetary policy mitigates the fall in output from the fiscal contraction, but it is not powerful enough to eliminate all of the output loss.[1]

Section II discusses the MC model; Section III presents the base run; Section IV presents the alternative run; and Section V discusses some robustness checks.

II. THE MC MODEL[2]

The MC model uses the methodology of structural macroeconometric modeling, sometimes called the "Cowles Commission approach," which goes back at least to Tinbergen (1939). I contrast this methodology with that of dynamic stochastic general equilibrium (DSGE) models in Fair (2012). The main arguments against the DSGE methodology are that the models tend to be heavily calibrated, leave out many features of the economy, use theory in a highly restrictive way, and are based on the assumption of rational expectations, which may not be realistic. The MC model is much more empirically based than are the DSGE models, but the model is not just a series of ad hoc regressions. In the theory behind the model, households maximize expected utility and firms maximize expected profits. The theory is used to choose left-hand-side and right-hand-side variables in the equations to be estimated. The estimated equations are taken to be approximations to the decision equations of agents. The theory leads to many exclusion restrictions in the estimated equations, and lack of identification is not an issue. Expectations are assumed to be adaptive.

The MC model is presented in Fair (2004), and it has been updated for purposes of this paper (version dated April 27, 2012). The updated version is on the author's website. The U.S. part of the MC model will be denoted the "U.S. model," and the rest of the model will be denoted the "ROW model." Sometimes the U.S. model is analyzed by itself, but in this paper the entire MC model is used. The MC model is completely estimated (by 2SLS); there is no calibration. The estimation periods begin in 1954 for the U.S. model and 1962 for the ROW model and go through the latest data at the time of this study. The following is a brief outline of the models.

A. U.S. Model

In the U.S. model there are three estimated consumption equations, three investment equations, an import equation, four labor supply equations, two labor demand equations, a price equation, a nominal wage equation, two term structure of interest rate equations, and an estimated interest rate rule of the Federal Reserve, among others. In the interest rate rule the Fed responds to inflation and unemployment. The use of this rule means that monetary policy is endogenous. The zero lower bound constraint on the short-term interest rate began at the end of 2008, and so the estimation period for the rule was taken to end in 2008:3. After this period, the observed interest rate (essentially zero) may not be what the Fed would choose, given the state of the economy, if there were no zero lower bound constraint. In the simulations using the model if the estimated rule called for a negative interest rate, a zero value was used.

There are a total of 28 estimated equations and about 100 identities in the U.S. model. The unemployment rate is determined by an identity; it equals unemployment divided by the labor force. In the identities all flows of funds among the sectors (household, firm, financial, state and local government, federal government, and foreign) are accounted for. The federal government deficit is determined by an identity, as is the federal government debt. There is an estimated equation determining the interest payments of the federal government as a function of interest rates and the government debt. This is an important equation for the present analysis as the interest payments are a large component of government spending. The data on interest payments are national income and product accounts (NIPA) data, and the data on the debt are flow of funds accounts data. The link between interest payments and the debt is complicated because it depends on the date a security was issued, its maturity, and the interest rate at that date. The estimated interest payments equation is only a rough approximation. The interest rate used is a weighted average of the 3-month rate and the

1. The ability of monetary policy to stabilize the economy in the MC model is analyzed in Fair (2005), where it is shown that the ability is limited.

2. Some of the discussion in this section is similar to that in Section II in Fair (2010).

current and seven lagged values of the bond rate. The interest payments equation is consistent with the historical data in the sense that it is estimated (no calibration), but it is still only a rough approximation. Regarding the term structure of interest rate equations in the U.S. model, there is no adjustment for risk in the equations. Long-term rates depend on current and past short-term rates. Any effects of the large federal deficits possibly increasing the interest rates that the federal government has to pay because of added risk are not captured in the model.

There are important real wealth effects in the U.S. model. An increase in household wealth, say from an increase in stock prices or housing prices, leads to an increase in consumption. The wealth variable in the model includes both household equity wealth and housing wealth. This variable thus captures the huge fluctuations that have taken place since 1995 in stock prices and housing prices. Spending out of real wealth in the model is about 4% per year of the wealth change. Real disposable income is an explanatory variable in the three consumption equations and in the housing investment equation. Decreasing transfer payments lowers disposable income, which leads to lower consumption and housing investment, other things being equal. This is discussed further below.

There are also important physical stock effects in the model. There are four physical stock variables: durables, housing, capital, and inventories. Lagged one period, the stock of durables has a negative effect on durable expenditures, the stock of housing has a negative effect on housing investment, the stock of capital has a negative effect on plant and equipment investment, and the stock of inventories has a negative effect on inventory investment. These stock effects mitigate recessions and tame booms. As physical stocks get low in a recession, there is, other things being equal, an increased demand to replenish them, which helps counteract the recession. The opposite happens in a boom. All these stock effects are estimated—again no calibration.

The production function in the model is assumed to be one of fixed proportions in the short run. Actual labor productivity is output divided by labor hours, and potential labor productivity is taken to equal actual labor productivity at the peaks of the actual series. Potential labor productivity is then linearly interpolated between the peaks. A similar procedure is followed for capital productivity. This allows measures of excess labor and excess capital to be computed, where at the peaks the measures are zero. The peak-to-peak interpolations are taken to be exogenous, and so potential output is exogenous. The amount of excess labor on hand has a negative effect on labor demand, and the amount of excess capital on hand has a negative effect on investment.

B. *ROW Model*

The ROW model consists of estimated equations for 37 countries. There are up to 13 estimated equations per country and 16 identities. There are a total of 279 estimated equations in the ROW model. The estimated equations explain total imports, consumption, fixed investment, inventory investment, the domestic price level, the demand for money, a short-term interest rate, a long-term interest rate, the spot exchange rate, the forward exchange rate, the export price level, employment, and the labor force. The specifications are similar across countries. The short-term interest rate for each country is explained by an estimated interest rate rule for that country. In some cases, the U.S. interest rate is an explanatory variable in the estimated rule, where the Fed is estimated to have an effect on the decisions of other monetary authorities. The exchange rates are relative to the dollar or the euro. The two key explanatory variables in the exchange rate equations are a relative interest rate variable and a relative price level variable. The two key explanatory variables in the domestic price equation are a demand pressure variable and a cost-shock variable—the price of imports. In the price of exports equation, the price of exports in local currency is a weighted average of the domestic price level and a variable measuring the world export price level (translated into local currency using the exchange rate). The weights are estimated.

There are 59 countries in the MC model (counting an "all other" category), and the trade share matrix is 59×59. Data permitting, a trade share equation is estimated for each country pair. In a trade share equation, the fraction of country i's exports imported by country j is a function of the price of country i's exports in dollars relative to a weighted average of all other countries' export prices in dollars (excluding oil-exporting countries). The weights are trade shares lagged one quarter. A total of 1,333 trade share equations are estimated. Trade shares for which there are no estimated equations are still used in the solution of the MC model; they are simply taken as exogenous. The trade share data are from the IFS Direction of Trade data. Quarterly data are available back to 1960. While the trade share equations are all quarterly, the structural equations for some countries are estimated using annual data. Interpolation is used when necessary to convert annual variables to quarterly variables.

There are many links among countries. The use of the trade shares means that the differential effects of one country's total demand for imports on other countries' exports are accounted for. There are interest rate links through the U.S. interest rate affecting some other countries' rates in the estimated interest rate rules. In a few cases the euro (earlier German) interest rate affects other countries' interest rates. Exports are endogenous for each country, since they depend on the imports of other countries, which are endogenous. The price of exports in local currency of each country is endogenous, since it depends, as noted above, on the domestic price level and the world price level. The price of exports in dollars is endogenous because the price of exports in local currency is endogenous and the exchange rate is (for most countries) endogenous. The price of imports in each country is endogenous because it depends on the price of exports of the other countries weighted by the trade shares. Since, as noted above, the price of imports affects the domestic price level in each country's estimated domestic price equation, there are price links among countries. An increase in the price of exports in dollars in one country leads to increases in other countries' import prices, which affects their domestic and thus export prices, which feeds back to the original country, etc.

C. Verifying the Results

Because of the many links among variables in the MC model and because there are many simultaneous effects, there is a danger that the model seems like a black box. It is not feasible to explain everything in one paper, and I have tried to deal with this problem by putting all the documentation on my website. The complete specification of the MC model is presented on the site, and all coefficient estimates are presented along with the results of tests of each estimated equation. Also, the complete model can be used on the site, including duplicating the results in this paper. It can also be downloaded for use on one's own computer, which allows all of the equations to be estimated by the user if desired. Although the complete MC model is solved for the experiments, only results for the United States are discussed below. The reader is referred to the website for further details, including the effects on other countries.

D. Transfer Payments Versus Taxes

As noted above, real disposable income (denoted YD in the model) is an explanatory variable in the three consumption equations and in the housing investment equation for the United States. Transfer payments are added to YD and taxes are subtracted. Transfer payments are from both the federal and the state and local governments, and taxes are paid to both. In this paper, the level of transfer payments from the federal government is used as the policy variable, but the analysis is actually broader than this. Many tax changes are changes in what are sometimes called "tax expenditures"—changing loopholes, deductions, etc.—rather than changes in tax rates. Changes like these are essentially changes in transfer payments, and they have the same effects in the model as do changes in regular transfer payments since both taxes and transfer payments affect demand through changing YD. Also, federal grants-in-aid to state and local governments can be considered transfer payments to the extent that state and local governments in turn transfer the money to households, thus changing YD.

It may be the case, however, that changing a tax expenditure like the deductibility of mortgage interest changes behavior enough to have macro implications in addition to implications for the distribution of spending across sectors. Any macro implications would not be captured in the MC model since all tax-expenditure changes are channeled through changes in YD. They are probably small for most tax-expenditure changes, but this is hard to test.

What about tax-rate increases instead of transfer payment decreases or tax expenditure decreases? In the model personal income tax rates affect labor supply, and so increasing tax rates does lead to different results than decreasing transfer payments by an equivalent amount. Both affect YD, but there are also labor supply responses. The differences are not, however,

TABLE 1
Transfer Payment Multipliers Using the MC Model (Deviations From Baseline in Percentage Points)

qtr	Y	UR	P	R	D
2013.1	0.22	−0.05	−0.03	0.04	0.14
2013.2	0.50	−0.13	−0.01	0.13	0.20
2013.3	0.74	−0.24	0.03	0.23	0.25
2013.4	0.90	−0.33	0.08	0.33	0.34
2014.1	0.98	−0.41	0.14	0.40	0.45
2014.2	1.01	−0.45	0.21	0.45	0.61
2014.3	1.00	−0.47	0.27	0.48	0.79
2014.4	0.96	−0.46	0.34	0.49	1.00
2015.1	0.91	−0.44	0.40	0.49	1.23
2015.2	0.85	−0.41	0.45	0.48	1.48
2015.3	0.79	−0.38	0.49	0.46	1.73
2015.4	0.74	−0.34	0.53	0.44	2.00
2016.1	0.70	−0.30	0.56	0.42	2.27
2016.2	0.66	−0.28	0.59	0.40	2.54
2016.3	0.62	−0.25	0.61	0.38	2.82
2016.4	0.60	−0.23	0.63	0.36	3.10
2017.4	0.54	−0.18	0.68	0.31	4.18
2018.4	0.54	−0.18	0.72	0.30	5.24
2019.4	0.54	−0.19	0.76	0.29	6.26
2020.4	0.55	−0.20	0.81	0.30	7.27
2021.4	0.54	−0.21	0.85	0.29	8.27
2022.4	0.54	−0.21	0.88	0.29	9.27

Notes: Y = real GDP; UR = unemployment rate; P = GDP deflator; R = 3-month Treasury bill rate; D = nominal federal debt/nominal GDP. Percent deviations for Y and P, absolute deviations for UR, R, and D. Experiment is a sustained increase in real transfer payments of 1.0% of real GDP.

large because the labor supply responses are modest. Similar conclusions to those reached in this paper would be obtained using tax rates.

E. Transfer Payment Multipliers

To get an idea of the properties of the MC model regarding changing transfer payments, Table 1 presents transfer payment multipliers for the period 2013:1–2022:4. For the results in the table, the level of real transfer payments was permanently increased by 1.0% of real GDP from its baseline values. This is an experiment in which nothing is paid for: no changes to any exogenous variable were made except for transfer payments. The table shows that the peak multiplier for output is 1.01 after 6 quarters. The multiplier settles down to about 0.6 after about 16 quarters. Physical stock effects and interest rate effects are the main reasons for the decline in the multipliers after the peak. By 2022:4 the debt/GDP ratio has risen by 9.27 percentage points.

III. THE BASE RUN

The results in this paper are based on actual U.S. data through 2012:1 (data available as of April 27, 2012). The base run consists of predicted values for the period 2012:2–2022:4 that I made on April 27, 2012, using the MC model. These values are on my website.[3]

There are two features of the base run's forecast of the macro economy that differ from what is consensus at the time of this writing: the economy is more expansive and inflation is higher. Fortunately, results like those in this paper are generally not sensitive to changes in a base run. The results of interest are those comparing the predicted values from an alternative run to the predicted values from a base run, and it is generally the case that the differences in these predicted values are not sensitive to the levels in the base run. To the extent that the base run is "off" in levels, so will be the alternative run. To

3. For countries other than the United States data were not available as late as 2012:1, and the overall forecast began earlier than 2012:1, with actual values used for the United States until 2012:2.

check for this, two other base runs are analyzed in Section V, one less expansive and one with lower inflation. It will be seen that the estimates of the decreases in transfer payments needed to stabilize the debt/GDP ratio are not sensitive to these changes. The value at which the debt/GDP ratio is stabilized, however, does differ slightly in the two cases.

The following assumptions were made for the base-run forecast. First, the exogenous federal spending variables that affect federal purchases of goods and services, which are federal purchases of goods, civilian jobs, and military jobs, were chosen to grow at recent past rates abstracting from the effects of the stimulus measures. Second, exogenous federal tax rates were taken to remain unchanged from their 2012:1 values except for the employee social security tax rate, which beginning in 2013:1 was taken to be its value in 2010:4. Third, federal transfer payments to households and to state and local governments were chosen to grow at recent past rates abstracting from the effects of the stimulus measures. Finally, the exogenous state and local government tax and spending variables were chosen to result in a roughly balanced state and local government budget.

The remaining exogenous variables for the United States are either fairly easy to forecast, like population, or are small and not important. Values of each of these variables were chosen to be consistent with recent behavior. The main exogenous variable for each of the other countries is government spending. Remember that exports, export prices, and import prices are all endogenous in the MC model. No assumptions are needed for these. Also, no assumptions are needed about monetary policies because the estimated interest rate rules of the various monetary authorities are used.

Regarding asset prices, one set of asset-price variables consists of the export prices of the oil-exporting countries (roughly the price of oil). These prices have been taken to be exogenous and to grow at historically average rates. An asset-price variable in the U.S. model is the price of housing relative to the GDP deflator. This ratio is taken to be exogenous and to grow at an annual rate of 1.0% throughout the forecast period. Exchange rates and the change in U.S. stock prices, which are asset-price variables, are endogenous in the model—there are 23 estimated exchange rate equations and an equation explaining capital gains or losses on the financial assets of the household sector (Flow of Funds data), variable CG. However, very little of the variances of CG and the change in exchange rates are explained by these equations (as would be expected), and the effects on these variables in the model are modest. The base run is thus based on the assumption of no bad asset market reactions even though in this run the debt/GDP ratio continually increases. Since asset-price changes are essentially unpredictable, it would be arbitrary to add large asset-price shocks to the base run. The base run is thus not necessarily realistic in this sense. It is a baseline from which the effects of decreases in transfer payments can be estimated.

Note also that the base run is not completely in line with existing laws. For example, the Bush tax cuts have been assumed to remain after 2012, contrary to current legislation. And future spending cuts that were legislated in 2011 are not used.

Results for the base run are presented in Table 2. This forecast has the unemployment rate falling to 5.7% by 2022. Inflation rises to 3.9% by 2014 and then falls to about 3.3% by 2020. The Fed is predicted to increase the short-term interest rate (3-month Treasury bill rate) to 3.8% by 2022.[4] The economy is thus predicted to come gradually out of the recession. It is perhaps not surprising that the model is predicting this given that fiscal policy is expansive and there are no bad asset-price shocks. Interest payments as a percent of GDP rise from 1.70% in 2012:1 to 4.39% by 2022:4. The deficit as a percent of GDP falls from 6.76% in 2012:1 to 5.5% in 2013 and then rises to about 6% after that. The debt/GDP ratio, which was 37.3% in 2007:4 and 56.4% in 2012:1, rises to 78.9% by 2022:4. Herein lies the problem.[5]

IV. THE ALTERNATIVE RUN: DECREASING TRANSFER PAYMENTS

It turned out that decreasing transfer payments by 2% of GDP was enough to stabilize

4. Note that by 2013:1, the short-term interest rate is up to 0.91%, so there is no longer a zero lower bound. The base run is thus not one in which there is a binding zero lower bound.

5. The federal government debt is measured in practice in a variety of ways. The measure used here is the one used in the MC model, which is based on data from the U.S. Flow of Funds Accounts (variable $-AG$ in the model). It is the debt in the hands of the public. To get a sense of how large 78.9% is, this number should be compared to earlier values, like 37.3% in 2007:4.

TABLE 2
Base Run: Forecast 2012:2–2022:4 (Values Are in Percentage Points)

qtr	*g*	*u*	π	*r*	int	def	debt
Actual values							
2007.4	1.70	4.81	1.91	3.39	1.98	1.94	37.3
2008.4	−8.89	6.90	0.51	0.30	1.56	4.70	41.1
2009.4	3.80	9.97	1.04	0.06	1.66	9.01	46.1
2010.4	2.35	9.59	1.77	0.14	1.76	8.73	52.6
2011.1	0.35	8.99	2.73	0.13	1.80	8.08	51.8
2011.2	1.33	9.07	2.59	0.05	2.08	8.49	50.5
2011.3	1.82	9.06	2.46	0.02	1.82	7.65	53.1
2011.4	2.95	8.71	0.95	0.01	1.77	7.15	55.1
2012.1	2.20	8.24	1.53	0.07	1.70	6.76	56.4
Forecast values							
2012.2	3.89	8.13	2.30	0.25	1.73	6.70	58.3
2012.3	5.02	7.97	2.72	0.43	1.76	6.57	59.6
2012.4	5.55	7.74	2.93	0.65	1.80	6.41	60.7
2013.1	5.00	7.48	3.28	0.91	1.84	5.58	61.6
2013.2	4.58	7.25	3.40	1.18	1.89	5.51	62.4
2013.3	4.37	7.04	3.53	1.43	1.94	5.46	63.3
2013.4	4.25	6.85	3.65	1.66	2.01	5.43	64.1
2014.4	3.78	6.32	3.93	2.44	2.38	5.46	67.1
2015.4	3.37	6.08	3.92	2.96	2.81	5.66	70.0
2016.4	3.14	6.02	3.78	3.25	3.15	5.82	71.2
2017.4	3.06	6.03	3.60	3.38	3.44	5.96	72.6
2018.4	3.07	6.04	3.47	3.46	3.68	6.04	74.1
2019.4	3.13	6.02	3.37	3.51	3.89	6.06	75.6
2020.4	3.21	5.95	3.33	3.59	4.07	6.03	76.9
2021.4	3.28	5.85	3.32	3.69	4.23	5.97	78.0
2022.4	3.35	5.72	3.33	3.83	4.39	5.89	78.9

Notes: g = real GDP, percentage change, annual rate; u = unemployment rate; π = GDP deflator, percentage change, annual rate; r = 3-month Treasury bill rate; int = federal government interest payments as a percent of GDP; def = federal government deficit (NIPA) as a percent of GDP; debt = federal government debt as a percent of GDP.

the debt/GDP ratio.[6] The decreases were linearly phased in over 3 years beginning in 2013:1. No other changes were made for the alternative run.

Before discussing the results, one feature of the model should be stressed. It was mentioned in Section II that expectations are assumed to be adaptive. If in the present context the government announces that it is going to stabilize the debt/GDP ratio, this has no immediate effect on behavior. There is, for example, no increase in consumer and investor confidence that could increase spending. Spending behavior changes after the decreases in transfer payments take place. Likewise, there are no changes in stock prices and interest rates until the economy begins to respond to the fiscal-policy change. If some of these omitted responses are large, it may be that the debt/GDP ratio could be stabilized with a smaller decrease in transfer payments than 2% of GDP. The 2% figure is thus an upper bound.

The results from this run are presented in Table 3. This table has two variables not in Table 2: the change in transfer payments from the base run in real terms (2005 dollars) and in nominal terms (current dollars). Comparing Table 3 to Table 2, the decrease in transfer payments is contractionary, as expected. The notes to Table 3 give the sums or averages of the deviations from the base run to the alternative run over the 10 years. The sum of the real output loss is $1.86 trillion, which is 1.1% of the sum of real GDP from the base run. The number of unemployed is on average 680,000 larger per quarter. The number of jobs is on average 1.55 million smaller per quarter, which is 1.1% of the average number of jobs per quarter.

The good news is that the debt/GDP ratio is roughly stable. It is 61.5% in 2013:1 and 63.2% in 2022:4. The deficit as a percent of GDP is

6. For this run the level of real transfer payments was decreased by 2% of an estimate of real potential GDP in the model, which is exogenous.

TABLE 3
Alternative Run: Transfer Payments Decreased by 2% of GDP

qtr	*g*	*u*	π	*r*	int	def	debt	ΔTP[a]	ΔTP[b]
2013.1	4.84	7.49	3.29	0.91	1.84	5.41	61.5	−26.0	−30.6
2013.2	4.24	7.28	3.41	1.15	1.88	5.17	62.4	−52.4	−62.1
2013.3	3.85	7.11	3.51	1.36	1.93	4.97	63.2	−79.2	−94.8
2013.4	3.63	6.97	3.59	1.53	1.99	4.79	63.9	−106.4	−128.7
2014.4	3.12	6.74	3.70	2.02	2.24	4.19	66.5	−218.8	−277.7
2015.4	2.87	6.76	3.56	2.23	2.48	3.63	68.4	−337.7	−449.2
2016.4	3.35	6.75	3.41	2.38	2.59	3.61	67.8	−347.4	−487.6
2017.4	3.37	6.60	3.38	2.60	2.71	3.51	67.2	−357.5	−526.3
2018.4	3.23	6.46	3.35	2.79	2.82	3.42	66.5	−367.9	−564.5
2019.4	3.18	6.38	3.29	2.91	2.92	3.34	65.8	−378.7	−603.6
2020.4	3.22	6.31	3.25	3.01	3.00	3.23	65.1	−389.9	−644.7
2021.4	3.28	6.23	3.23	3.12	3.05	3.09	64.2	−401.4	−688.7
2022.4	3.36	6.11	3.25	3.26	3.10	2.93	63.2	−413.3	−735.7

Notes: See notes to Table 2. ΔTP[a] = change in transfer payments from the base run, 2005 dollars, annual rate; ΔTP[b] = change in transfer payments from the base run, current dollars, annual rate; Sum of real output loss is $1.86 trillion, 1.1% of the sum of output from the base run; Average number of jobs per quarter is 1.55 million lower, 1.1% of the average number of jobs per quarter from the base run; Average number of people unemployed is 680,000 more; Sum of transfer payment decrease is $3.2 trillion in 2005 dollars and $4.8 trillion in current dollars.

down to 3% percent by 2022. Interest payments as a percent of GDP stabilize at about 3%.

The interest rate is lower in the alternative run than in the base run, which is the Fed responding to the higher unemployment and the lower inflation. Although the lower interest rates mitigate the contraction from the transfer payment decrease, they by no means eliminate the contraction. As noted in the Introduction, the effects of interest rate changes in the model are not large enough to eliminate the negative effects on output of a transfer payment decrease of the size considered here.[7]

What is the size of the transfer payment decrease? Table 3 shows that the decrease in transfer payments in 2005 dollars rises to about $400 billion by 2022 (at an annual rate). In nominal terms the number is about $700 billion. The sum of the decrease over the 10 years is $3.2 trillion in 2005 dollars and $4.8 trillion in current dollars.

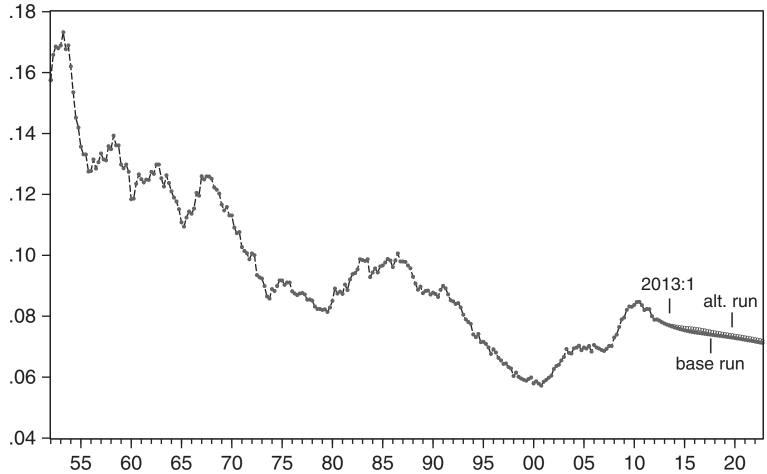
Figures 1 and 2 give some perspective on the present results. Figure 1 plots the ratio of federal purchases of goods and services to GDP for the 1952:1−2022:4 period. Values beyond 2012:1 are predicted values. Values for 2013:1 on are presented for both the base run and the alternative run.[8] The values for the prediction period are low by historical standards. As discussed in Section III, no major changes in government purchases of goods and services were made for the prediction, and so the ratio is roughly flat.

Figure 2 is the more interesting figure. It plots the ratio of net taxes to GDP, where net taxes is defined to be federal personal income taxes plus federal social security taxes minus federal transfer payments to persons minus federal transfer payments to state and local governments. The value of net taxes was negative in the 2009−2012 period. Revenue of the federal government is also obtained from corporate taxes, indirect business taxes, and a few other items, but this revenue is relatively small. It was roughly the case in the 2009−2012 period that all federal government spending on goods and services was financed by borrowing in that the value of net taxes was negative. The base run has the ratio of net taxes to GDP rising, but to a level that is still low historically. The alternative run, of course, has it rising much more. At the end, the ratio is still low by historical standards, but so is the ratio of purchases of goods

7. To get a sense of the size of the effect of U.S. monetary policy in the model, the estimated U.S. interest rate rule can be dropped and the short-term interest rate taken to be exogenous. If this is done and the short-term interest rate is decreased by one percentage point in each quarter (from a baseline), real GDP is larger by about 0.4% after four quarters and 0.7% after eight quarters (assuming no zero lower bound). The effects are thus non trivial, but modest.

8. The values from the two runs differ slightly because of the endogeneity of GDP.

FIGURE 1
Federal Purchases of Goods and Services as a Percent of GDP: 1952:1–2022:4



and services in Figure 1. Compared to historical averages, less needs to be raised in net taxes if spending on goods and services is low.

Figure 2 is important for getting a sense of how much net taxes has to be raised to stabilize the debt/GDP ratio. The ratio in Figure 2 is conditional on the historically low ratio in Figure 1. Although this is harder to measure, it is probably also conditional, given the aging of the U.S. population, on the future elderly receiving fewer benefits than the past elderly did. The base run assumes that federal transfer payments grow at a constant rate based on recent past growth rates abstracting from the stimulus measures. Implicit in this treatment is the assumption that the future elderly are receiving less than the past elderly because there are more of them. If one wanted to give the future elderly the same, then to keep the same net tax ratio in Figure 2 either other transfer payments would have to be cut or taxes would have to be increased. To repeat, given the spending assumptions in Figure 1, the net tax ratio in Figure 2 must be maintained in some way.

V. ROBUSTNESS CHECKS

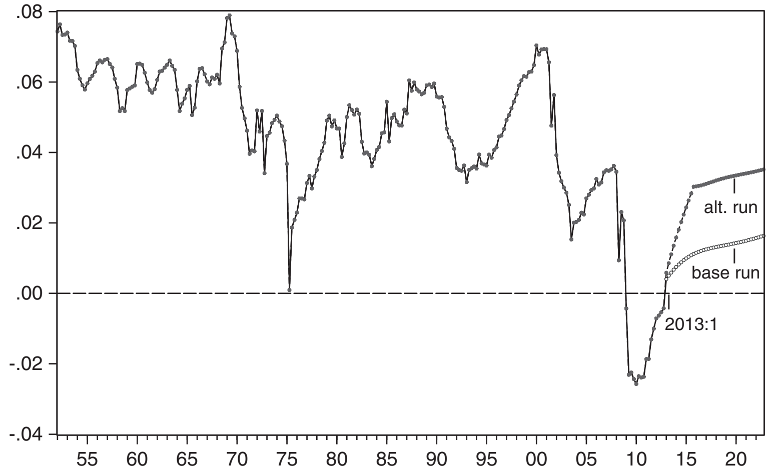
Since inflation in the base run is higher than consensus, a base run was made in which the U.S. price equation was shocked to result in lower inflation. In this base run the inflation rate was never higher than 2.82% (versus a maximum of 3.93% in Table 2), and at the end of 2022 the GDP deflator was 13.9% lower than it is in the regular base run. In this case the debt/GDP ratio is 81.8% in 2022:4 versus 78.9% in the regular base run.

This effect on the debt/GDP ratio is as expected. An increase in inflation, other things being equal, lowers the debt/GDP ratio. The effect is not huge, however, and it is not the case that the debt can be inflated away according to the MC model. For one thing, the Fed raises the nominal interest rate as inflation increases, which increases interest payments. It is also the case that much of government spending is tied in one way or another to the price level, and as inflation increases spending increases. So a decrease in inflation, as in this robustness check, does increase the debt/GDP ratio, but only modestly.

In this case, a decrease in transfer payments of 2% of GDP also stabilized the debt/GDP ratio. The ratio was stabilized at 65.9% versus 63.2% in the regular case.

For the second robustness check, a base run was made in which two of the consumption equations were shocked to result in lower consumption spending. In this base run real GDP is on average 1.5% lower than in the regular base run and the unemployment rate is on average 0.47 percentage points higher. The debt/GDP ratio is 81.3% in 2022:4 versus 79.9% in the regular base run. In the slower economy less tax revenue is generated, which is one of the

FIGURE 2
Federal Net Taxes as a Percent of GDP: 1952:1–2022:4



reasons for the higher debt/GDP ratio. Working in the opposite direction is the fact that the interest rate is lower (the estimated Fed rule at work), which lowers interest payments.

A decrease in transfer payments of 2% of GDP also stabilized the debt/GDP ratio in this case. The ratio was stabilized at 64.5% versus 63.2% in the regular case.

The two experiments in this section thus do not modify the main conclusion of this paper, namely that it takes a net tax increase of about 2% of GDP to stabilize the long-run debt/GDP ratio. The main effect of the experiments is to change slightly the value at which the debt/GDP ratio stabilizes.

VI. CONCLUSION

This paper provides estimates of the size of the decrease in transfer payments (or tax expenditures) needed to stabilize the U.S. government debt/GDP ratio. It takes into account endogenous effects of changes in fiscal policy on the economy and in turn the effect of changes in the economy on the deficit. The size needed is discussed at the end of Section IV, particularly around the discussion of Figure 2. Transfer payments need to be decreased by 2% of GDP from the base run. The output loss is about 1.1% of baseline GDP. Monetary policy helps keep the loss down, but it is not powerful enough in the model to eliminate all of the loss. The estimates are robust to a base run with less inflation and to one with less expansion. The value at which the debt/GDP ratio is stabilized is slightly higher in these two cases than in the regular case.

Possible caveats are the following. First, monetary policy might be more powerful than is estimated in the model, which would lessen the output loss. Second, if the process of putting policies in place to stabilize the debt/GDP ratio permanently increases asset prices or animal spirits (like consumer and investor confidence), this would, other things being equal, have a positive effect on output, and this effect is not in the model.

Third, the MC model may be so seriously misspecified as to make any results from it untrustworthy. One might, for example, trust DSGE models more. As mentioned in Section II, the MC model is more empirically based than are DSGE models, which tend to be heavily calibrated. It also takes into account many more features of the economy, some of which are important for purposes of this paper. Other types of models, like VAR models, also do not take into account enough features of the economy to be able to analyze debt issues. The MC model is theoretically grounded and empirically based, which lends some support to its use.

What happens if, say, the government delays doing anything about the debt? An experiment was run in which the decrease in transfer payments began a year later, in 2014:1. In this case decreasing transfer payments by 2% of GDP again stabilized the debt/GDP ratio, but at a higher value. The value in 2022:4 was 65.1% versus 63.2% when the policy began in 2013:1. The main effect of delaying is to stabilize at a higher ratio with the same percent decrease in transfer payments.

What happens if the government never tackles the debt problem and the debt/GDP ratio never stabilizes? This is where the MC model has little to say. There is nothing in the model that breaks down with rising debt/GDP ratios. What is likely to happen, of course, is that at some point there will be asset-market reactions to the rising ratio, which a model could never predict. The probability of a bad asset-market reaction likely rises as the debt/GDP ratio rises, but the timing cannot be predicted.

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