COWLES FOUNDATION FOR RESEARCH IN ECONOMICS
AT YALE UNIVERSITY

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COWLES FOUNDATION DISCUSSION PAPER NO. 1071

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IS MONETARY POLICY BECOMING LESS EFFECTIVE?

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April 1994

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Abstract

This paper estimates the amount by which the effectiveness of monetary policy in changing real output has declined due to the increased size of the federal government debt.

1 Introduction

It is well known that the U.S. federal government debt as a percent of GDP has risen substantially since 1980. For example, the debt as a percent of GDP rose from 16.9 in 1980:1 to 39.0 in 1990:4. Much of this increase was financed by U.S. households. One consequence of the increasing size of the government debt is that the size of the income effect of interest rate changes on demand is increasing relative to the size of the substitution effect. The larger is the debt, the larger is the change in interest payments of the government (and thus the interest receipts of those holding the debt) for a given change in interest rates. This means, for example, that household income, which includes interest receipts, is falling more over time for a given fall in interest rates because of the increasing holdings of government debt by households. A fall in income from a fall in interest rates has a negative effect on demand, which offsets at least some of the positive substitution effect. The ability of the Federal Reserve

to, say, stimulate the economy by lowering interest rates may thus be decreasing over time due to the increasing size of the income effect relative to the substitution effect. The purpose of this paper is to try to estimate how large this decrease in the effectiveness of monetary policy has been since 1980.

The macroeconometric model of the U.S. economy in Fair (1984) is used to examine this question. The model is first used to estimate what the economy would have been like between 1980 and 1990 had the federal government debt not risen so much. Call this economy the "alternative" economy. The model is then used to run the same monetary-policy experiment for both the actual and alternative economies. The difference in results for the two economies is an estimate of how much the effectiveness has been changed as a result of the rise in the government debt. The model is briefly discussed in Section 2; the creation of the alternative economy is discussed in Section 3; and the monetary-policy experiment is examined in Section 4. Section 5 discusses two other alternative economies, and Section 5 contains a brief conclusion.

An alternative procedure to that followed here would simply be to run the monetary-policy experiment for an earlier period when the government debt was not as large and compare these results to those for a later period. The problem with this procedure, however, is that other things would be different as well between the two periods, and it would not be clear how much of the difference in results to attribute to government debt differences as opposed to other differences. The procedure used in this paper controls better for other differences.

2 The Model

The version of the model used here consists of 30 stochastic equations and 101 identities and is estimated over the 1954:1–1993:2 period. The model is quarterly. This section contains a brief discussion of the properties of the model that are relevant for present purposes.[1] Keep in mind in the following discussion that the model is dynamic and effects generally take time to work themselves out. The initial effects are usually much smaller than the effects after, say, four to six quarters.

There are six sectors in model: household, firm, financial, foreign, state and local government, and federal government. All the flows of funds among these sectors and all balance-sheet constraints are accounted for in the model. This is done by linking the national income and product accounts (NIPA) and the flow of funds accounts (FFA). There is, for example, an identity that relates the change in the net financial assets of the federal government (the negative of the federal government debt) to its level of saving (the negative of its deficit). The data on net financial assets are FFA data, and the data on saving are NIPA data. There are similar identities for the other sectors. The sum of the savings across the six sectors is zero: some sector's expense is some other sector's revenue. Also, some sector's financial asset is some other sector's financial liability. Because the model accounts for all flows of funds and balance-sheet constraints, it is well suited to examine the consequences of an increasing government debt. The model keeps track of the rise in the financial assets of other sectors that must take place when there is a rise in government liabilities.

The basic version of the model includes an estimated interest rate reaction function of the Federal Reserve (Fed). The three month Treasury bill rate is on the left

[1] A complete description of the model is available from the author upon request.

hand side of this equation and variables that are assumed to affect Fed behavior are on the right hand side. In this version of the model monetary policy is endogenous; the Fed is assumed through open market operations to achieve the bill rate implied by this equation each quarter. For purposes of this paper the interest rate reaction function is dropped and monetary policy is taken to be exogenous, where the bill rate is taken as the policy variable to change.

There are two term structure equations in the model that link the bill rate to two long term interest rates, a bond rate and a mortgage rate, where the long rates are a function of the current and lagged bill rates. The bill rate thus affects long term rates through these term structure equations.

There are four household expenditure equations in the model, explaining 1) consumption of services, 2) consumption of nondurables, 3) consumption of durables, and 4) residential investment. There is also an import equation. Interest rates appear as explanatory variables in these equations—the bill rate in the services equation and the mortgage rate in the others. (The bill rate is taken as a proxy for short term rates in general, and the mortgage rate is taken as a proxy for long term rates in general.) The coefficient estimates of the interest rate variables are all negative (and significant except in the import equation). There is also a nonresidential fixed investment equation in the model, and the bond rate appears in this equation with a negative and significant coefficient estimate. Therefore, through this part of the specification a decrease in interest rates increases household expenditures and nonresidential fixed investment and increases imports. The increase in imports is not large enough to offset the other increases, and so there is a net increase in the demand for domestic goods in the model when interest rates fall through this part of the specification.

The bond rate also appears in a stock price equation, where a decrease in the bond rate has a positive effect on stock prices. The value of stocks is part of household wealth, and household wealth (lagged once) appears as an explanatory variable in two of the four household expenditure equations with positive coefficient estimates. A decrease in interest rates thus has a positive effect on household expenditures through stock prices.

Disposable income appears in the household expenditure equations and in the import equation. The net effect of an increase in income is positive on the demand for domestic goods—the positive effect from the expenditure equations outweighs the negative effect from the import equation. Since interest receipts of households are part of income, a decrease in interest rates (and thus interest receipts) has a negative effect on income and thus on demand through this part of the specification. This negative effect is not large enough to completely offset the positive effects discussed above, and the total effect on output from a fall in interest rates is positive in the model. This effect is, however, changing as the size of the government debt is increasing, which is the main point of this paper.

Another important equation in the model for present purposes is the one that explains the level of interest payments of the federal government. In practice the level of interest payments in any given quarter depends on the amounts of existing government securities issued at each date in the past and on the relevant interest rates prevailing at each date. The interest payments equation is an approximation to this relationship. As interest rates rise, the level of interest payments rises, and as the size of the government debt rises, the level of interest payments rises. An attempt is made in this equation to account for the maturity structure of the debt. In practice

a change in interest rates does not affect interest payments on existing securities, only on new securities, and the interest payments equation tries to account for this. According to the equation, when interest rates change, interest payments gradually change as new securities are issued to finance the current deficit and to replace the securities that are expiring.

Some of any increase in government interest payments goes to the foreign sector, and there is an equation in the model that accounts for this. Most of any increase, however, goes to the household sector, which holds most of the government debt.

It should be noted that although the household wealth variable includes household bond holdings, the bonds are only valued at the time of issue. Capital gains and losses on bonds due to interest rate changes are not captured in the wealth variable. (Data do not exist to allow this to be done.) In practice one would expect, say, a rise in bond prices from a fall in interest rates to have, other things being equal, a positive effect on current expenditures. Since this effect is not captured through the wealth variable, it is probably at least in part captured through the interest rate variables. The coefficient estimates of the interest rate variables in the household expenditure equations are thus probably somewhat larger in absolute value than they would be if capital gains and losses on bonds were included in the wealth variable.

The following is a summary of how a decrease in the bill rate affects the economy in the model.

1. Long term rates fall over time through the term structure equations.
2. Stock prices rise, which is a rise in household wealth.
3. Interest payments of the federal government fall, which leads to a fall in interest receipts of the household sector and thus, other things being equal, household income.

4. The fall in interest rates and rise in wealth have a positive effect on expenditures on domestic goods, and the fall in income from the fall in interest receipts has a negative effect. The total effect is positive, but, as will be seen below, it is decreasing in size as the size of the government debt is increasing.

Finally, one should keep in mind that aggregate equations like the ones discussed here are at best only rough approximations to actual behavior. For example, the different ways in which interest rate changes affect current household expenditure decisions are approximated by adding as explanatory variables to the household expenditure equations 1) interest rates, 2) a wealth variable that includes the value of stocks, and 3) household income that includes interest receipts. This paper is based on the implicit assumption that this specification is an adequate approximation for the question at hand, but this is obviously only an assumption. This specification is also based on the assumption that households treat their holdings of the government debt as wealth.

3 The Alternative Economy

The model was used to create the alternative economy in the following way. The aim was to raise the average personal income tax rate in the model, denoted $D1G$, to generate more tax revenue (and thus lower the deficit from its historical path) while at the same time lowering the bill rate to keep real GDP roughly unchanged from its historical path. An increase in $D1G$ has a net negative effect on demand because it lowers disposable income, which affects consumption and nonresidential fixed investment, while the decrease in the bill rate has a net positive effect. As noted above, for this work the interest rate reaction function was dropped from the model so that the bill rate could be taken to be exogenous (and thus changed as a policy

variable). The beginning quarter for the changes was 1980:1, and the changes were sustained through 1990:4.

The residuals from the estimation of the stochastic equations were first added to the equations and taken as exogenous.[2] This results in a perfect tracking solution when the actual values of the exogenous variables are used. Then various paths of $D1G$ and the bill rate were tried. It turned out that a sustained increase in $D1G$ of 1 percentage point and a sustained decrease in the bill rate of 2 percentage points over the 1980:1–1990:4 period led to little change in real GDP from the base path and a substantial decrease in the deficit (and thus the debt). The actual value of the bill rate ranged between 5.3 and 15.1 percent during this period, and so the lowest value of the bill rate was 3.3 percent for this simulation.[3]

The actual and predicted values of six variables from this simulation are presented in Table 1. The six variables are the federal government deficit, the federal government debt, net financial assets of the household sector, interest payments of the federal government, household saving, and real GDP. The deficit, interest payments, and household saving variables are at quarterly rates in billions of current dollars, and real GDP is at a quarterly rate in billions of 1987 dollars. The government debt

[2]Adding the estimated residuals to the equations before solving the model assumes that the shocks that occurred in the actual economy also occur in the alternative economy. The two economies have the same shocks, but different values of $D1G$ and the bill rate.

[3]Although at the time of this study data were available through 1993:2, the simulation period used here was taken to end in 1990:4. By the end of 1992 the actual value of the bill rate was down to 3.0 percent, and a 2 percentage point drop in the bill rate would have lowered it to 1.0 percent, which is extremely low by historical standards. I am reluctant to push the model into values that are too far outside the range used in the estimation, and this is the reason for stopping in 1990:4.

Table 1
Comparison of the Actual and Alternative Economies

	Fed. Gov. Deficit			Fed. Gov. Debt			HH Net Fin. Assets		
Quar.	Alt.	Act.	Dif.	Alt.	Act.	Dif.	Alt.	Act.	Dif.
1980:1	3.9	9.3	-5.4	440.2	446.7	-6.5	2346.9	2312.7	34.2
1980:2	10.0	15.4	-5.5	451.9	464.7	-12.8	2530.5	2496.2	34.3
1980:3	12.5	18.4	-5.9	471.0	489.9	-18.9	2673.1	2634.8	38.3
1980:4	10.3	16.9	-6.6	475.5	501.4	-26.0	2782.9	2743.0	39.9
1981:1	3.1	10.5	-7.5	490.7	524.4	-33.7	2802.7	2763.6	39.1
1981:2	4.4	12.5	-8.1	491.3	533.5	-42.2	2826.5	2789.7	36.8
1981:3	5.1	14.0	-8.9	497.7	549.3	-51.5	2697.5	2664.7	32.8
1981:4	12.1	21.6	-9.5	514.0	575.2	-61.2	2826.6	2799.1	27.5
1982:1	14.7	24.8	-10.0	539.6	611.3	-71.6	2745.6	2724.6	20.9
1982:2	17.5	28.1	-10.6	552.8	635.4	-82.6	2764.3	2750.5	13.9
1982:3	25.7	36.8	-11.1	589.0	682.9	-93.9	2883.0	2877.2	5.7
1982:4	34.6	45.9	-11.3	620.2	725.8	-105.7	3049.5	3052.6	-3.1
1983:1	33.1	44.8	-11.7	670.0	787.4	-117.5	3204.6	3217.1	-12.5
1983:2	30.0	42.2	-12.2	707.3	837.1	-129.8	3388.9	3411.3	-22.4
1983:3	34.0	46.9	-12.9	730.2	873.3	-143.1	3411.8	3444.6	-32.8
1983:4	32.6	46.1	-13.6	743.1	900.1	-157.0	3343.5	3386.9	-43.3
1984:1	26.6	40.9	-14.3	783.8	955.4	-171.6	3315.4	3370.9	-55.5
1984:2	23.5	38.4	-14.9	811.3	997.9	-186.6	3319.7	3386.6	-67.0
1984:3	25.3	40.9	-15.6	850.3	1052.8	-202.5	3440.0	3519.2	-79.2
1984:4	30.5	46.6	-16.2	869.9	1088.9	-218.9	3442.1	3534.4	-92.4
1985:1	21.0	37.5	-16.5	898.4	1134.5	-236.1	3613.7	3719.4	-105.7
1985:2	34.5	51.6	-17.1	933.5	1187.2	-253.8	3726.3	3845.5	-119.2
1985:3	28.1	45.5	-17.4	963.0	1234.2	-271.2	3656.0	3789.8	-133.8
1985:4	28.9	46.8	-17.9	1010.6	1299.9	-289.2	3913.0	4060.8	-147.7
1986:1	27.4	45.8	-18.5	1044.8	1353.1	-308.3	4152.5	4315.1	-162.6
1986:2	37.0	56.0	-18.9	1087.8	1415.3	-327.6	4250.5	4428.7	-178.2
1986:3	35.7	54.9	-19.2	1124.6	1471.8	-347.2	4119.0	4312.4	-193.3
1986:4	24.8	44.4	-19.6	1144.5	1512.0	-367.5	4244.1	4454.2	-210.1
1987:1	27.4	47.4	-20.0	1167.0	1554.5	-387.5	4678.4	4903.2	-224.7
1987:2	12.1	32.5	-20.4	1179.4	1587.3	-407.9	4710.4	4950.6	-240.2
1987:3	12.4	33.6	-21.2	1196.3	1625.7	-429.5	4245.0	4501.0	-256.0
1987:4	16.1	38.2	-22.1	1205.5	1657.1	-451.6	4231.3	4503.6	-272.2
1988:1	17.0	39.4	-22.4	1237.1	1711.3	-474.2	4336.8	4625.6	-288.8
1988:2	10.5	33.6	-23.1	1255.3	1752.9	-497.5	4425.4	4731.4	-306.0
1988:3	6.1	29.9	-23.8	1278.2	1799.7	-521.5	4407.9	4731.0	-323.2
1988:4	9.3	33.8	-24.5	1293.6	1839.7	-546.1	4475.2	4816.0	-340.8
1989:1	2.1	27.5	-25.4	1305.6	1877.2	-571.6	4581.5	4940.6	-359.1
1989:2	1.4	27.4	-26.0	1328.5	1926.5	-598.0	4874.9	5251.7	-376.8
1989:3	5.9	32.0	-26.1	1357.3	1981.2	-624.0	5020.1	5414.9	-394.8
1989:4	8.5	35.4	-26.8	1376.0	2027.1	-651.1	5044.8	5458.3	-413.6
1990:1	14.2	41.6	-27.5	1395.4	2074.4	-679.0	5045.5	5477.8	-432.3
1990:2	9.8	38.0	-28.2	1401.8	2109.5	-707.8	5149.4	5601.7	-452.2
1990:3	7.1	36.2	-29.1	1405.0	2141.9	-737.0	4822.3	5294.8	-472.5
1990:4	18.9	47.8	-28.8	1414.3	2180.5	-766.2	5125.8	5617.4	-491.5

Table 1 (continued)

	Fed. Gov. Int. Pay.			Household Saving			Real GDP		
Quar.	Alt.	Act.	Dif.	Alt.	Act.	Dif.	Alt.	Act.	Dif.
1980:1	11.5	12.5	-1.0	18.6	23.7	-5.1	940.2	942.4	-2.2
1980:2	12.1	13.3	-1.3	29.2	34.5	-5.3	917.5	920.6	-3.0
1980:3	11.6	13.1	-1.5	26.7	32.8	-6.1	919.0	921.4	-2.4
1980:4	12.0	13.8	-1.8	27.0	34.0	-7.0	938.2	939.3	-1.1
1981:1	14.4	16.7	-2.3	23.1	31.0	-7.9	956.7	956.4	.3
1981:2	14.6	17.2	-2.6	25.2	33.8	-8.6	953.5	952.0	1.5
1981:3	15.2	18.3	-3.1	32.2	41.5	-9.3	962.5	960.0	2.5
1981:4	15.9	19.5	-3.6	38.1	48.0	-9.9	950.6	947.5	3.2
1982:1	16.1	20.1	-4.0	38.1	48.4	-10.3	937.4	933.8	3.5
1982:2	16.3	20.9	-4.5	43.3	54.1	-10.8	941.0	937.5	3.6
1982:3	16.8	21.8	-5.0	41.3	52.4	-11.1	933.0	929.6	3.4
1982:4	16.4	21.7	-5.3	37.7	49.1	-11.3	931.9	928.8	3.1
1983:1	16.1	21.8	-5.7	37.2	48.6	-11.4	941.4	938.6	2.8
1983:2	16.2	22.4	-6.2	26.5	38.3	-11.8	964.5	962.0	2.5
1983:3	17.0	23.8	-6.8	24.5	36.6	-12.2	979.2	977.0	2.2
1983:4	17.4	24.8	-7.4	23.3	35.9	-12.6	996.1	994.2	1.9
1984:1	18.3	26.3	-8.0	27.9	40.7	-12.9	1020.2	1018.6	1.6
1984:2	18.4	26.9	-8.5	28.1	41.4	-13.2	1036.3	1034.9	1.4
1984:3	20.0	29.4	-9.4	31.7	45.5	-13.8	1044.2	1043.2	.9
1984:4	20.6	30.6	-10.0	26.8	40.9	-14.1	1048.4	1048.0	.4
1985:1	20.6	31.1	-10.5	16.4	30.3	-14.0	1056.9	1056.9	.0
1985:2	20.9	31.9	-11.0	35.2	49.6	-14.4	1062.9	1063.2	-.2
1985:3	20.4	31.7	-11.3	13.4	27.8	-14.4	1075.9	1076.3	-.4
1985:4	20.5	32.3	-11.8	19.6	34.3	-14.6	1082.3	1082.8	-.4
1986:1	20.4	32.7	-12.3	21.6	36.3	-14.7	1096.2	1096.7	-.5
1986:2	20.3	33.0	-12.7	26.4	41.5	-15.0	1094.8	1095.2	-.4
1986:3	19.6	32.5	-12.9	11.3	26.3	-15.0	1103.1	1103.4	-.3
1986:4	19.4	32.8	-13.3	12.0	27.2	-15.2	1106.1	1106.3	-.2
1987:1	19.3	33.0	-13.7	15.0	30.2	-15.2	1115.4	1115.5	.0
1987:2	19.2	33.4	-14.2	-5.6	9.7	-15.3	1129.7	1129.4	.3
1987:3	19.5	34.4	-14.8	-2.2	13.6	-15.8	1139.3	1138.8	.5
1987:4	20.2	35.8	-15.6	10.1	26.3	-16.3	1156.3	1155.7	.6
1988:1	19.2	34.9	-15.7	9.8	26.0	-16.3	1164.5	1163.8	.6
1988:2	19.8	36.3	-16.4	9.0	25.8	-16.7	1176.8	1176.2	.6
1988:3	20.0	37.0	-17.0	9.8	27.0	-17.2	1184.1	1183.6	.5
1988:4	20.2	37.8	-17.6	10.8	28.3	-17.5	1195.3	1194.9	.4
1989:1	21.3	40.0	-18.6	11.1	29.3	-18.1	1204.4	1204.4	.0
1989:2	22.0	41.5	-19.4	4.2	22.5	-18.3	1209.4	1209.8	-.3
1989:3	21.4	41.1	-19.7	7.9	26.3	-18.4	1209.1	1209.8	-.6
1989:4	21.8	42.2	-20.4	14.0	32.7	-18.7	1213.3	1214.2	-.9
1990:1	21.9	42.9	-21.0	13.6	32.6	-19.0	1223.5	1224.6	-1.1
1990:2	22.4	44.2	-21.8	17.9	37.5	-19.5	1228.0	1229.3	-1.2
1990:3	23.0	45.8	-22.7	17.4	37.2	-19.8	1225.2	1226.6	-1.5
1990:4	21.2	43.6	-22.4	28.4	47.8	-19.4	1215.3	1216.8	-1.5

Units are billions of 1987 dollars for real GDP and billions of current dollars for the others. The flow variables are at quarterly rates.

and household asset variables are stock variables in billions of current dollars.[4]

Table 1 shows that by the end of the simulation period the federal debt was $766.2 billion less than the actual (historical) value. The federal deficit was $28.8 billion less at a quarterly rate, which at an annual rate is $115.2 billion. The level of federal interest payments was $22.4 billion less. Household saving was $19.4 billion less, which was caused in part by the lower interest rates. The level of net financial assets of the household sector was $491.5 billion less by the end of the simulation period, which was due to the lower past levels of household saving. Therefore, as expected, raising the personal tax rate and lowering the bill rate led to less government dissaving and less household saving. Note that the real GDP path is similar to the actual path, which was the aim of the simulation.

Although not shown in Table 1, nonresidential fixed investment is higher in the

[4]It is not the case in Table 1 that household saving (say SH) equals the change in household net financial assets (say ΔAH). There are three reasons why this is not the case. First, and most important, AH includes the value of stocks held by households, and so capital gains and losses on stocks (CG) can change AH without any change in SH. Second, AH does not include the demand deposit and currency holdings of the household sector (MH), and so nonzero values of SH can result in changes in MH as well as AH. Third, data on AH and MH are FFA data, whereas the data on SH are NIPA data, and there is a discrepancy ($DISH$) between the two sets of data. The identity for these variables is

$$\Delta AH = SH + CG - \Delta MH - DISH.$$

Similarly, it is not the case in Table 1 that the federal government deficit (say DG) equals the change in the federal government debt (say ΔLG). The identity that includes DG and ΔLG is

$$\Delta LG = DG + \Delta MG - \Delta CUR - \Delta(BR - BO) + \Delta Q - MRS - SUR + INS + DISG$$

where MG is the level of demand deposits of the federal government, CUR is the amount of currency held outside banks, $(BR - BO)$ is the level of nonborrowed reserves, Q is the amount of gold and foreign exchange holdings of the federal government, MRS is the amount of mineral rights sales, SUR is the current surplus of federally sponsored credit agencies and mortgage pools and of the monetary authority, INS is the amount of insurance credits to households from the federal government, and $DISG$ is the discrepancy term. The data on DG are NIPA data, and the data on the other variables are FFA data. The figures cited at the beginning of this paper on the debt as a percentage of GDP are figures for LG divided by nominal GDP at an annual rate.

alternative economy than the actual economy. Nonresidential fixed investment depends positively on output and negatively on interest rates in the model. Output is roughly the same in both economies, but interest rates are lower in the alternative economy, and so investment is higher in the alternative economy. In 1990:4 nonresidential fixed investment was 1.8 percent higher in the alternative economy than the actual economy. More investment means a larger capital stock, and by 1990:4 the capital stock was 3.0 percent higher in the alternative economy. Thus, as expected, lower interest rates with output held constant led to more private investment.

To conclude, the results in Table 1 are interesting in their own right in that they show that a 1 percentage point increase in the average personal income tax rate and a 2 percentage point decrease in the bill rate beginning in 1980:1 would have remarkably changed the debt structure of the U.S. economy by the end of the 1980s while having only trivial effects on real GDP.

4 The Monetary-Policy Experiment

Given the alternative economy, the next step is to run a monetary-policy experiment for the two economies and compare the results. The monetary-policy experiment is a sustained decrease in the bill rate of 1 percentage point beginning in 1987.1. The experiment runs through 1990:4, for a total of 16 quarters.[5] For these experiments the residuals were added to the stochastic equations and taken to be exogenous. This means that when the model is solved using the actual values of the exogenous variables, a perfect tracking solution results. The actual values are thus the "base" values. For the alternative economy the "actual" values of the bill rate and $D1G$

[5]The smallest value of the bill rate for these experiments was 2.5 percent in 1987:1 for the alternative economy.

are the values relevant for this economy, and the perfect tracking solution is the solution that reproduces the data for this economy. The residuals are the same for both economies. For each experiment the bill rate was lowered by 1 percentage point in each of the 16 quarters and the model solved. The difference between the solution value from this simulation and the actual value for each endogenous variable and each quarter is an estimate of the effect of the bill rate change on the variable. A comparison of the results for the two economies is presented in Table 2 for selected variables. The sum of the changes across the 16 quarters is presented for some of the variables, which is a useful summary statistic.

The results in Table 2 show that government interest payments fell more in the actual than in the alternative economy—$51.9 billion versus $34.9 billion over the 16 quarters. This resulted in a larger fall in disposable income in the actual economy—$19.4 billion versus $3.6 billion. The (negative) effect from the fall in income is thus larger in the actual economy, which resulted in less household demand and thus smaller real GDP increases. The increase in real GDP over the 16 quarters is $60.1 billion in the actual economy versus $68.1 billion in the alternative economy, a difference of 13.3 percent. It is also the case, however, that the difference between the real GDP increases in Table 2 grows larger as the number of quarters ahead increases. By the 16th quarter the change in real GDP from the base value is .35 percent in the alternative economy compared to .27 percent in the actual economy, a difference of 29.6 percent. Note finally from Table 2 that the government deficit decreases more in the actual economy than in the alternative economy. This is primarily due to the larger drop in government interest payments in the actual economy.

Table 2
Estimated Multipliers in the Actual and Alternative Economies for a Decrease in the Bill Rate of One Percentage Point

		Number of Quarters Ahead							
		1	2	3	4	8	12	16	Sum
					Real GDP				
$RS\downarrow$	Act.	-.01	.05	.15	.25	.47	.38	.27	60.1
	Alt.	-.00	.06	.17	.27	.51	.44	.35	68.1
					Nonfarm Price Deflator				
$RS\downarrow$	Act.	.00	.00	.00	.02	.16	.30	.33	–
	Alt.	.00	.00	.01	.02	.18	.35	.38	–
					Federal Government Interest Payments				
$RS\downarrow$	Act.	-1.4	-1.6	-1.7	-1.9	-2.9	-4.2	-5.6	-51.9
	Alt.	-1.1	-1.1	-1.2	-1.3	-2.0	-2.8	-3.6	-34.9
					Disposable Personal Income				
$RS\downarrow$	Act.	-2.0	-1.9	-1.8	-1.4	-.3	-.9	-2.3	-19.4
	Alt.	-1.7	-1.6	-1.4	-1.0	.5	.5	-.4	-3.6
					Federal Government Deficit				
$RS\downarrow$	Act.	-1.4	-1.6	-2.1	-2.6	-4.4	-5.6	-6.5	-68.9
	Alt.	-1.1	-1.3	-1.8	-2.2	-3.8	-4.7	-5.1	-57.4

Act. = Actual economy.
Alt. = Alternative economy.
Sum = Sum of the effects across the 16 quarters.

Values are percentage changes (in percentage points) from the base values for real GDP and the nonfarm price deflator and absolute changes (in billions of current dollars at a quarterly rate) from the base values for the others.

5 Two Other Alternative Economies

To examine the robustness of the results to the use of different fiscal-policy tools to generate the alternative economy, two other alternative economies were generated. For the first the level of transfer payments from the federal government to households was cut, and for the second the level of government purchases of goods was cut. These cuts replaced the income tax increase. The bill rate change in both cases was as above, namely a decrease of 2 percentage points in the bill rate from its base value

each quarter.

For the first of the two other alternative economies, the level of transfer payments was decreased each quarter from its base value by 1 percent of the historical value of taxable income. This decrease is comparable in size to the 1 percentage point increase in the average personal income tax rate above. The quarterly decreases ranged from $4.8 to $11.6 billion at quarterly rates. Changing the level of transfer payments in the model has very similar effects to changing the personal income tax rate, and the results using transfer-payment decreases were quite similar to those using tax-rate increases. Real GDP in the alternative economy was little changed from that in the actual economy; the government debt was much less; and the level of net financial assets of the household sector was much less. The results for the monetary-policy experiment were very similar to those in Table 2 for the alternative economy. The sum of the real GDP increases across the 16 quarters was $68.5 billion, which compares to $68.1 billion in Table 2, and the change in the 16th quarter was .35, which is the same as in Table 2. The same conclusions clearly hold when transfer-payment decreases replace tax-rate increases.

For the second of the two other alternative economies, the level of government purchases of goods was decreased each quarter by exactly the amount needed to keep real GDP unchanged from its base value. Changing government purchases of goods has more of an impact on GDP in the model than does changing transfer payments or changing personal tax rates. Therefore, the decrease in expenditures on goods needed to keep real GDP unchanged in light of the bill rate decrease was less than the decrease in transfer payments needed or the increase in personal taxes needed. The federal government deficit thus decreased less in this case, and so the

government debt decreased less. In 1990:4 the government debt was $593.3 billion lower than in the actual economy, which compares to $766.2 billion in Table 1. The level of household net financial assets was $426.6 billion lower than in the actual economy in 1990:4, which compares to $491.5 billion in Table 1.

The results for the monetary-policy experiment in this second case were similar to those in Table 2 for the alternative economy. The sum of the real GDP increases across the 16 quarters was $67.2 billion. This is 11.8 percent more than in the actual economy, which compares to 13.3 percent more in Table 2. The change in the 16th quarter was .33. This is 22.2 percent more than in the actual economy, which compares to 29.6 percent more in Table 2. These slightly smaller percentages are as expected, since the alternative economy in the current case has a larger government debt (and a smaller level of household net financial assets) than does the alternative economy used for the results in Table 2. The differences are, however, fairly modest, and the same basic conclusion holds here as holds in the other two cases.

6 Conclusion

The results in Table 1 show that the financial asset and liability structure of the U.S. economy would have been considerably different by 1990 had the average personal income tax rate been 1 percentage point higher and the bill rate 2 percentage points lower beginning in 1980. The government would have dissaved less and the household sector would have saved less, resulting in a substantially lower government debt by 1990 and a substantially smaller level of net financial assets of the household sector.

The results in Table 2 show that the effectiveness of monetary policy in changing

real GDP is between about 13 and 30 percent less, depending on the measure used, in the actual economy than it would be if the economy were instead the alternative economy in Table 1. A similar conclusion is reached in Section 5 for two other alternative economies, one generated by cutting transfer payments instead of increasing taxes and one generated by cutting government purchases of goods instead of increasing taxes.

References

[1] Fair, Ray C., 1984, *Specification, Estimation, and Analysis of Macroeconometric Models*, Cambridge, MA: Harvard University Press.