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DEFICITS: THEIR IMPACT ON INFLATION AND GROWTH

A STAFF STUDY

PREPARED FOR THE USE OF THE

SUBCOMMITTEE ON MONETARY AND FISCAL POLICY

OF THE

JOINT ECONOMIC COMMITTEE

CONGRESS OF THE UNITED STATES

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LETTER OF TRANSMITTAL

JULY 27, 1981.

Hon. HENRY S. REUSS,
Chairman, Joint Economic Committee, Congress of the United States, Washington, D.C.

DEAR MR. CHAIRMAN: I am pleased to transmit herewith a staff study, prepared for the Joint Economic Committee by staff senior economist Robert E. Weintraub, with the assistance of Roy Jutabha, entitled "Deficits: Their Impact on Inflation and Real Growth."

Dr. Weintraub explores six related issues:

Do deficits increase aggregate demand?

Do they increase aggregate supply?

Does it matter whether they are caused by spending increases or by tax cuts?

Do they increase real growth?

Are they inflationary?

Does it matter whether they are financed by printing money or by Treasury sales of new debt securities?

The issues are first examined analytically and then put to the test of evidence. Econometric evidence is used to obtain definitive answers. The answers that spring from this evidence will not be welcomed either by those who refuse to admit that marginal tax rates have important supply-side effects or by those who deny that increases in the Federal deficit have any demand-side effects if money growth is not allowed to accelerate when the deficit rises.

The study concludes that increases in the deficit increase both aggregate supply and aggregate demand. The latter increases even if money growth does not change.

The study also shows that changes in the Federal Government's revenue have larger and more significant effects on real GNP growth than changes in its spending level. A major reason behind this result is that tax rate changes, whether legislated or from bracket creep, have larger and more significant supply-side effects than changes in spending. Supply-side effects of tax cuts include increased labor supply, saving, risk taking, and entrepreneurial activity.

The study has important implications for the current debate on the President's proposal to cut marginal tax rates this year and the next 2 years. It shows that the deficit definitely will increase if we do cut taxes. There will be tax reflows, but they will not be large enough to prevent the deficit from increasing. Interest rate increases will be much less than feared, even if the impact of reducing marginal tax rates on the propensity to save, which another staff study ("Marginal Tax Rates, Saving, and Federal Government Deficits") shows will be substantial, are ignored.

Because the deficit and interest rates will increase, the tax cut will lead to an increase in the velocity at which money circulates. This is the channel through which increases in the deficit increase aggregate demand (spending) when money growth remains the same or falls from period to period. Specifically, the study shows that today a $35 billion increase in the deficit would increase the rate of rise of M1B's velocity by about 2 percentage points.

The increase in velocity's rate of rise will be matched by a proportional increase in real GNP growth. There will be no change in inflation, none whatever. The study shows that inflation is a monetary phenomenon. It can be controlled by reducing M1B growth from an average of more than 7 percent in recent years to about 2 percent per year and by keeping it there.

Finally, the study recognizes that decelerating money growth will put temporary downward pressure on real GNP growth. But the evidence presented in this study shows that the 3-year Reagan tax cut will keep real GNP growth at or near our economy's growth capacity even while the growth of the money supply is slowed to a noninflationary rate and inflation is stopped at long last.

The study concludes that "President Reagan is right to have embraced both supply-side economics and monetarism." I agree. I commend the study to members of the committee, other Members of Congress, and the public at large.

Sincerely,

ROGER W. JEPSEN,
Chairman, Subcommittee on Monetary and Fiscal Policy.

CONTENTS

DEFICITS: THEIR IMPACT ON INFLATION AND GROWTH

By Robert E. Weintraub*

INTRODUCTION

From the end of World War II through the Truman and Eisenhower presidencies, the receipts of the Federal Government exceeded its expenditures in the national income and products accounts more often than not. In those 15 years (1946–1960), the budget was in surplus nine years and in deficit for six years. Cumulatively, receipts exceeded expenditures by $10 billion. During the next six years (1961–1966), the budget was in deficit four years and in surplus for two years. Expenditures exceeded receipts by a total of $12.4 billion. Then, to borrow from "Alice in Wonderland,"

Thick and fast they came at last, and more and more and more.

From 1967 through 1980, the budget was in deficit 13 years and in surplus only one year. Cumulatively, expenditures exceeded receipts by over $350 billion. The yearly record is tabulated below.

TABLE 1.—FEDERAL SURPLUSES (DEFICITS), 1946 TO 1980[1]

	Billions		Billions
Period:		Year—Contiuned	
1946–60	$10.0	1973	($5.6)
1961–66	(12.4)	1974	(11.5)
Year:		1975	(69.3)
1967	(13.2)	1976	(53.1)
1968	(6.0)	1977	(46.4)
1969	8.4	1978	(29.2)
1970	(12.4)	1979	(14.8)
1971	(22.0)	1980	(61.3)
1972	(16.8)		

[1] Calendar years in the national income and product accounts.

Many observers attribute large parts of both the inflation, which has beset and plagued us since the middle-1960's, and the declines in capital formation and economic growth that occurred in the 1970's, to this repetitious record of deficits piled on deficits year after year since 1967, excepting only 1969. However, others deny that inflation is a necessary result of deficit spending. They argue that it matters whether the deficit is rising or falling, whether it is increased by faltering economic performance or by policy changes, whether the economy is operating under its capacity or at or near full employment, and, in the latter case, whether the source of the deficit increase is increased spending or tax cuts. Some assert that judicious tax cuts will

*With the assistance of Roy Jutabha.

produce supply-side effects. Labor force growth and capital formation will be increased and, thereby, economic growth will rise. Thus, judicious tax cuts will not be inflationary even though they might increase the deficit.

Economists also disagree on whether the method of financing the deficit matters. More and more see this as the critical question. They argue that deficits financed by bond sales are not inflationary but deficits financed by printing money can be.

This study examines the roles played in the determination of inflation and real economic growth by the Federal Government's expenditures, revenue, and deficits, taking into account considerations raised above.

Definitions

Inflation is defined as the change from one period to another in the general level of prices expressed as a percent per annum. We use the Gross National Product (GNP) deflator as the index of the general level of prices.

Real economic growth is defined as the change from one period to another in the economy's output of goods and services expressed as a percent per annum. We use the value of GNP in constant dollars to measure the national output.

The Federal Government's spending, revenue, and the deficit are the dollar amounts reported in the national income and product accounts for the periods under study. However, inflation and real GNP growth cannot be related to these statistics as they stand. They must be transformed as discussed below.

Changes versus Levels

It is changes in Federal expenditures, revenue, and the deficit that matter, not their levels or dollar amounts. In the conventional static macro analysis of the determination of the level of national income and the level of prices, it is levels of Federal spending, revenue, and the resulting difference between the two that matter. But when, as in this study, the focus of the analysis is on changes in the price level (the rate of inflation) and changes in output (real GNP growth), dollar amounts of Federal expenditures, revenue, and the deficit must be transformed into changes in spending, revenue, and the deficit to capture their effects.

Correcting for Changes in the Size of the Economy

Second, changes in expenditures, revenue, and the deficit must be scaled to take into account that the economy has grown over time. Ten billion dollar changes in expenditures, revenue, and the deficit this year will have less impact on inflation and real GNP growth than $10 billion changes had in past years. We did not use percentage changes in expenditures, revenue, and the deficit to resolve the scaling problem because it is not the size of the deficit and the magnitude of expenditures and revenue relative to themselves that matters. What matters is the size of the deficit and the magnitudes of expenditures and revenue relative to the economy. Therefore, we used as our scaler an index of potential real GNP.

Correcting for Endogeneity

Finally, it must be recognized that this year's changes in expenditures, revenue, and the deficit will reflect both present policy decisions and ongoing (and possibly also past) changes in the economy. Thus, if we want to study how changes in Federal spending, revenue, and the deficit influence inflation and real GNP growth, we must relate current inflation and real GNP growth to past changes (appropriately scaled) in Federal spending, revenue, and the deficit.[1]

Issues

The issues explored in this study are as follows:

Do increases in the deficit increase aggregate demand?

Do they increase aggregate supply?

What impact do they have on real growth?

Are they inflationary?

Does it matter whether changes in the deficit reflect primarily expenditure changes or changes in revenue?

Does it matter whether deficit spending is financed by printing money or by selling Treasury bonds, notes, and bills?

The study is in five parts. Chapter I discusses the analytical issues. Chapter II discusses some empirical evidence on the relevance of changes in Federal spending, revenue, and the deficit for aggregate demand and aggregate supply. Chapter III presents and fits a small scale econometric model which relates inflation and real growth to changes in the deficit and, alternatively, spending and revenue, together with other factors including money supply, and thereby casts indirect light on the six issues laid out above. Chapter IV discusses the policy implications of our statistical results. Some pertinent foreign experience is discussed briefly in Chapter V.

[1] If a reliable measure of the full employment deficit were available, it probably would be better to use changes in the scaled value of it at zero lag instead of changes in the scaled value of the actual deficit lagged one year. However, the full employment deficit has been revised substantially so often, even for years long past, that it is difficult to view it as a reliable measure of exogenous fiscal stimulus. We cannot be confident that the historical series available today will closely approximate what is "official" in the future.

I. ANALYTICAL ISSUES

The Simple Keynesian Case

In the simple world of the standard Keynesian introductory model, in which financial variables and events are ignored, increases in deficit spending increase aggregate demand regardless of their source or how they are financed. Increases in government spending do so directly. This is because aggregate demand is defined as the sum of spending on newly produced goods and services (GNP) by households, business, and government. Tax reductions increase disposable personal income and the cash flow of the business sector. These changes allow households to increase their consumption expenditures and business firms to increase their investment expenditures. Aggregate demand thus rises indirectly; as a result of the increases in disposable incomes and cash flows which are the direct effects of tax cuts.

Whether initiated by a rise in spending or a reduction in taxes, aggregate demand will have risen by a multiple of the shock when the economy has adjusted fully to a rise in the deficit. However, as discussed later, in this model, the spending multiplier is larger than the tax multiplier.

In this framework, the ultimate effects of increases in aggregate demand depend on the responsiveness of aggregate supply. If there are few or no production bottlenecks and substantial slack in labor and other input markets, increases in aggregate demand act primarily to raise real GNP. There is relatively little change in the price level. However, if the economy is operating at or close to full employment, with labor and other input markets generally tight, real GNP rises very little and there is a relatively large increase in the price level.

Put in terms of percent per annum changes in GNP spending, if input markets are slack, real GNP growth is increased by increases in aggregate demand but there is little change in the rate of inflation. However, if input markets are tight, real GNP growth rises very little and there is a relatively large increase in the rate of inflation.

Using aggregate price-quantity demand and supply schedules transformed into per annum percentage changes, the former case is illustrated in the left-hand panel of Figure 1; the latter in the right-hand panel. (From here on, the terms aggregate demand and aggregate supply refer to these yearly inflation rate real growth relationships.)

In Figure 1, the demand relationships are 45 degree lines, reflecting that total spending is fixed along each aggregate demand schedule. This means that, given aggregate demand, changes in the rate of inflation are balanced by equal percentagewise but opposite changes in real GNP growth. For example, if the inflation rate rises by 2 percentage points, the real growth rate must fall by 2 percentage points. The supply schedules are upward sloping to show that producers respond to price incentives but are not otherwise constrained.

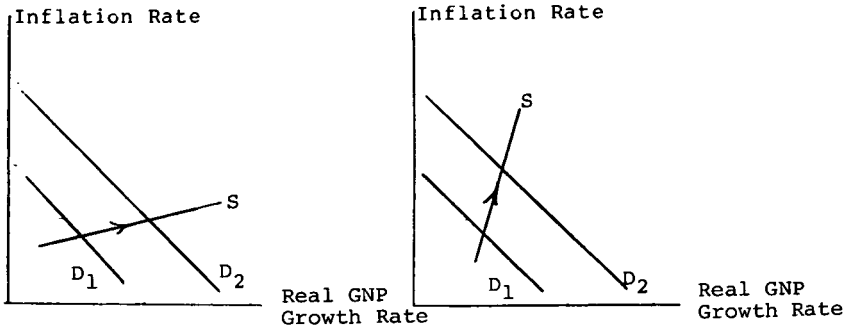

FIGURE 1.—Changes in Aggregate Demand

To summarize, by deduction from the simple or introductory textbook Keynesian case, increases in the deficit—

Increase aggregate demand. The aggregate demand schedule is shifted upward, as in both panels of Figure 1.

Do not affect aggregate supply. The position of the aggregate supply schedule is unchanged.

Increase real growth if labor and other input markets are slack. Percent per annum real GNP growth is relatively elastic or responsive to the rate of inflation, as in the left-hand panel of Figure 1. Demand, to borrow from Say's Law, creates its own supply.

Are inflationary if labor and other input markets are tight. Percent per annum real GNP growth is relatively invariant with respect to the rate of inflation, as in the right-hand panel of Figure 1.

In addition, in the simple Keynesian model, aggregate demand is increased more by spending increases than by tax cuts. This is because spending increases impact on aggregate demand directly. They raise aggregate demand dollar for dollar in their initial impact. Tax cuts increase aggregate demand less than dollar for dollar in their first impact because part of the directly resulting increase in disposable income is saved.

Finally, it should be noted that the simple Keynesian model throws no light whatever on whether it matters if deficit spending is financed by printing money or through sales of new debt securities. Neither money nor debt enters the introductory model.

THE EXTENDED MODEL

The introductory Keynesian framework is incomplete. It ignores how an increase in government spending or a reduction in taxes is financed and how the choice affects the inflation rate and the rate of real GNP growth. Further, it ignores the possibility of shifts in the aggregate supply schedule. However, the model can be extended to make up for these deficiencies.

The Financing Question

We define money as the Nation's means of payment. We measure the means of payment by aggregating the public's holdings of coin,

currency, and checking deposits in depository institutions. This is the Federal Reserve's M1B measure of money.

The rate of money growth can be increased to finance increases in the deficit both in the real world and in the abstract world of economic models. If the Federal Reserve passively or deliberately manages the rate at which it supplies bank reserves and currency (base money), so that the growth of M1B rises to accommodate increases in the deficit, aggregate demand will increase in tandem with increases in deficit spending. This is because increases in the means of payment (or at least base money) are perceived by money holders as adding to their nominal wealth without there being a corresponding fall in the net worth of taxpayers or other parties and entities. Money (or at least base money) is an asset to those who hold it. It is not debt in any meaningful sense to those who issue it and are nominally obligated to redeem it. As a result, increases in the rate of money growth increase aggregate demand. The larger the increase in the money stock, the larger is the increase in aggregate demand. There should be no dispute about this.

However, the Federal Reserve is not required either by law or logic to increase its supply of base money or otherwise allow or cause the money supply to rise to accommodate increases in the Federal Government's deficit. As Arthur Burns [U.S. Congress, 1977, p. 93], the former Chairman of both the Federal Reserve Board (1970–1978) and the Council of Economic Advisers (1953–1956), stated in responding during a congressional appearance to a question about President Carter's 1977 proposal to rebate $50 to low- and middle-income taxpayers, "The Treasury does not have this money. The Treasury has to go out and borrow it."

The question is: What happens if the Federal Reserve does not accommodate the Treasury's borrowing needs; if the quantity of money and its growth rate are totally unaffected by Treasury borrowing? As indicated above, few dispute that increases in the rate of money supply growth, for whatever reason, increase aggregate demand. However, there is considerable debate about whether new Treasury borrowing increases aggregate demand, holding the growth of the money supply constant.

When the Treasury borrows to finance new deficit spending, two things happen. First, it takes purchasing power out of the private sector. Second, it puts upward pressure on interest rates. The theoretical effects of these changes on aggregate demand are considered below.

Private Sector Purchasing Power

By definition, Treasury borrowing absorbs as many dollars from the "rest of the world" (hereafter, the private sector) as it finances in Federal Government expenditures in excess of tax receipts, whether the excess is caused by spending increases or tax cuts. However, some assert that those who buy bonds have, on average, an unusually or relatively high propensity to hold money (i.e., a low propensity to spend). Assuming their funds would otherwise be idle, an increase in government spending or a cut in tax rates which is financed by Treasury borrowing can be said to be expansionary and to increase aggregate demand. However, there is no obvious reason to accept this assumption.

An objective argument that has been made to show that increases in government spending and tax reductions will increase aggregate demand is that the Government's debt is money. This view has been put forcefully by Preston J. Miller, Assistant Vice President of the Federal Reserve Bank of Minneapolis with the assistance of Alan Struthers, Jr. [1979, p. 2]. Miller and Struthers wrote:

> Currently, it seems safe to assume that the United States Government will not pay off its debt. Since the 1960's, it has not done so and it appears to have no intention of doing so. Congress and the Administration have sought to balance the budget only when there is full employment, only at the peaks of the business cycle. They are clearly saying that the budget on average will be in deficit. The longer they follow this policy, the greater the total Federal debt will be.
>
> When the Federal Government runs a deficit, it simply prints and sells more bonds. Federal bonds are nothing more than an alternative form of currency—they are promises to deliver currency in the future. Like currency, these bonds are pieces of paper backed by nothing tangible; they are flat paper. Like currency, they are a debt that the government never promises to retire. They are, in all essentials, a part of our ever-expanding money supply. When the government has no intention of retiring its debt, there is little difference between currency and bonds; both are money.
>
> In this circumstance, any increase in the deficit is an inflation tax. As is well understood, government can cause inflation by printing more money. When more paper is purchasing the same amount of goods, it takes more paper to buy each good. The value of the paper declines; the price of goods goes up. Obviously, this is inflation.

What Miller states about money and inflation cannot be denied, as discussed in detail in Chapter II and demonstrated in Chapter III. However, whether debt and money are the same thing is debatable. To us, it depends on how money is defined.

It does not matter whether the Government's debt will be retired. Debt could be issued, as in the case of British consols, without maturity. Consols are not money in the sense of money defined as the means of payment; so-called M1B money, which consists of currency and checkable accounts in depository institutions. Nor are Treasury securities with fixed maturities means of payment. Treasury bonds, notes, and bills must first be converted into M1B money before they can be exchanged for goods and services or used to discharge debts. The conversion is not costless.

However, it can be argued with some legitimacy that Treasury debt is money in an expanded M2 "temporary abode of purchasing power" sense of the word. This would be the perception if the public assumed that the Government was going to cover interest payments on its outstanding debt by issuing new debt ad infinitum. In this case, those who buy Treasury's new bonds, notes, and bills (or consols) will capitalize their promised future interest income streams at higher present values than taxpayers assign to their obligation to make these interest payments. In the extreme, taxpayers will "understand" that they are not going to be taxed to make "good" the promised interest payments. They will "know" that all future interest payments on the debt will be financed by issuing still more debt. Treasury debt will be viewed as a store of value and purchasing power by those who own it, while at the same time being viewed by taxpayers as perpetual non-burdensome debt, just as currency is.

Given these perceptions, increases in government spending and/or tax reductions which are financed by issuing new Treasury debt will operate to increase aggregate demand—the demand for goods and

services. The increase in aggregate demand is registered as an increase in the rate of rise of M1B's velocity above its trend.[1] In turn, this reflects a fall in the demand for M1B money as the new Treasury debt is substituted for M1B in the public's asset portfolio.

However, the perceptions are unrealistic. The assumption that the Government can issue new debt ad infinitum to cover interest payments on its outstanding debt is particularly suspect. In this regard, Professor Robert Barro [1978, p. 194] of the University of Rochester has pointed out that:

> . . . public debt issue implies a stream of future interest payments and possible repayments of principal. These future payments must be financed either by future taxes (including future money creation, which is a form of taxation that works through its effect on the price level) or by additional deficits, which would further increase future interest and principal payments. The option of financing interest payments solely through new debt issue raises the possibility that taxes could be escaped through perpetual deficit finance. But this possibility depends on a chain-letter mechanism in which individuals would be willing to hold ever-expanding amounts of public debt without regard to the government's limited capacity to raise revenue for debt repayment. Generally, it seems safe to ignore this "free lunch" possibility, and to assume that debt issue implies a corresponding increase in the total of taxes that must be collected.

Barro's point is that the public "knows" that it is going to have to pay future taxes to service a substantial part and perhaps all of the Treasury's outstanding debt. He is surely right. To borrow from Barnum, "You can't fool all of the taxpayers all of the time." However, as Barro also noted, unless the public believes that additional taxes will be imposed in the future to exactly match in timing and magnitude Treasury's future interest payments as obligated by the additional debt, there will be some, albeit perhaps insignificant, perceived increase in net wealth and purchasng power. As a result, the issuance of new government debt to finance increases in government spending and tax reductions will decrease M1B demand, and as a corollary, increase the rate of rise of its velocity. Thereby, aggregate demand rises.

Interest Rate Changes and Their Effects

Another way of looking at this phenomenon is to start with the likely interest rate change from an observed increase in deficit spending by the Federal Government which is financed by issuing new debt. Some increase in interest rates is likely because, to equilibrate the capital market following a rise in deficit spending, either private saving must rise, or private investment (including by State and local governments) must fall. Barring a surge in saving in response to a cut in marginal tax rates sufficient to cover the deficit increase, an increase in interest rates is required to induce the necessary rise in saving, fall in investment, or combination of the two.

If as a result of the increase in interest rates the trend rate of rise of the velocity at which money turns over into these goods and services increases, then, aggregate demand will rise. However, what happens to velocity's rate of rise depends on the propensity of the public to hold money with respect to interest rates. If money holding is totally unresponsive to changes in interest rates, the rate of rise of velocity will be

[1] Velocity is, of course, equal to the number of times a unit of money turns over into GNP goods and services each year.

unaffected and aggregate demand will not increase. But, this result is not consistent with the most basic tenet of economics; to wit, people respond to changes in relative prices.

For example, it would appear contradictory to argue that the propensity to save rises in response to higher interest rates while asserting that the propensity to hold money is invariant with respect to the level of interest rates. We, therefore, accept as plausible the Keynesian chain of causation that runs from an increase in deficit spending, which is financed by selling new debt securities, through higher interest rates to an increase in the rate of rise of M1B's velocity, and thereby to increase aggregate demand.[2]

Accepting this Keynesian chain of causation does not tell us how much the rate of rise of velocity will increase in response to a given increase in interest rates, or by how much interest rates will increase as a result of a given increase in the deficit. These are empirical questions. We return to them in Chapter II.

Aggregate Supply Shifts

In standard Keynesian models, advanced as well as introductory, supplies of goods and services increase only in response to increases in aggregate demand. Changes in aggregate supply, in this framework, are the result of events that impact directly on aggregate demand. The process by which an increase in the rate of growth of demand (graphically, a shift upward in the aggregate demand schedule) creates higher growth in quantity supplied (a move up the aggregate supply schedule) was illustrated in the left-hand panel of Figure 1. For convenience, the process is depicted again in the left-hand panel of Figure 2.

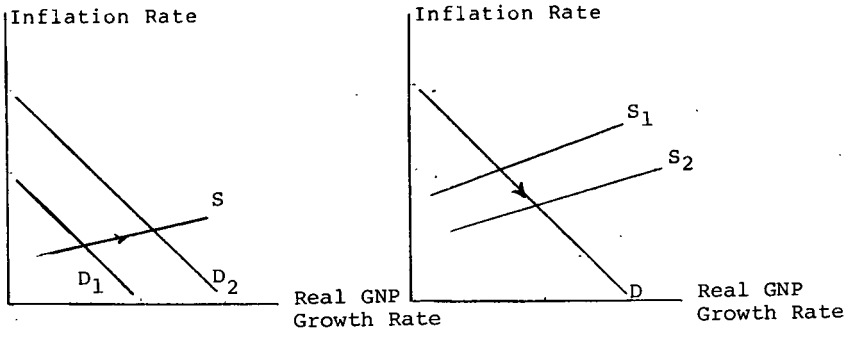

FIGURE 2.—Contrasting Changes in Aggregate Demand and Supply

This restrictive assumption, that the economy's supply of goods and services increases only in response to increases in aggregate demand, is neither realistic nor necessary. Suppliers, supplies, and hence aggregate supply, respond directly to a wide variety of events, including

[2] The crucial change is the increase in the rate of rise of M1B's velocity. In turn, this change reflects a fall in the demand for money. It does not matter whether it is argued that the fall in the demand for M1B is impelled by a rise in interest rates, as here, or by an increase in wealth and purchasing power as was earlier argued. Both result from increased sales of government debt. Their effects are not additive. They are different aspects of the same event.

fiscal events. These events are easily modeled. Say's Law, that "supply creates its own demand," expressed in terms of percent per annum changes, is depicted in the right-hand panel of Figure 2. It is as logical and realistic as the Keynesian notion depicted in Figure 2's left-hand column that new demand growth creates its own incremental supply growth.

The main channels through which fiscal events work to change aggregate supply are the economy's labor and capital markets. The direction of the effect is not always the same. However, it is legitimately hypothesized that, by and large, policies and events that increase the Federal Government's deficit act to increase both labor supply growth (quickly) and the growth of private capital(in due time), while policies and events that decrease the deficit tend to decrease labor supply growth and private capital formation. As discussed below, the case is stronger for deficit increases that derive from reductions in taxes than for those that derive from increases in expenditures.

Spending Changes

Large parts of incremental Federal spending each year have no obvious direct effect either on labor supply growth or private capital formation. Incremental interest payments to service the Federal debt, incremental spending on defense, and increases in grants to State and local governments for such purposes as park land acquisition are examples that fit this description, although none of them may fit perfectly.

Other spending programs, weighed at the margin, can be expected to decrease labor supply growth and thereby to decrease aggregate supply. Extended unemployment benefits and Trade Adjustment Assistance (TAA) payments are direct, pointblank disincentives to seeking work. Public housing, by limiting mobility, also acts as a disincentive to seeking work. Still other government spending programs tend to decrease aggregate supply by restricting competition and production. An example is the acreage diversion payments program.

However, there also are Federal spending programs which have operated at the margin in the past, and may still do so, to increase labor supply growth and capital formation. Spending which facilitates job hunting such as spending to disseminate information about labor market conditions and on daycare centers; spending which increases the versatility of the labor force such as spending on veterans' educations and job training for disadvantaged youth; spending which increases the endurance of the labor force such as spending on public health services; spending which facilitates transport and communication and thereby increases the division of labor such as spending on Coast Guard activities, postal services, waterways, airports and highways; and spending which creates new investment opportunities such as spending on soil conservation and flood control are examples. Historically, some spending on these programs surely increased labor supply growth and capital formation. Increases above current spending levels might be similarly productive in this or future years.

On the whole, the case for stating that increased government spending increases labor supply growth and capital formation is far from formidable. But it is not implausible.

Revenue Changes

Revenue changes result primarily from changes in effective marginal tax rates on business, investment, and labor income. These changes in tax rates are not always legislated. Regardless, in principle, they can profoundly affect personal effort, entrepreneurial activity, investment, and saving. The connections are not airtight, of course. Business firms might use incremental profits which are attributable to reductions in business taxes to increase dividends and respond to decreases in profits by cutting dividends; and stockholders might not react to changes in dividends. Householders might not save more of their incomes, work harder, or take more risks in response to personal tax rate reductions. However, business firms might invest incremental profits and stockholders might invest incremental dividends, and householders might save more, work harder, and take more risks. These latter responses seem more likely to us.

Reductions in tax rates recast rewards in favor of investment more, saving more, working harder, and taking more risks. This much is definite. Legislated decreases in personal and business marginal tax rates definitely increase take home pay and rewards for saving, taking risks, and investing. Conversely, increases in effective marginal tax rates definitely diminish rewards to work, save, take risks, and invest. This is so whether marginal rate increases are newly legislated, as in 1968, or result from the interfacing of rising personal income with progressive tax rates and rising corporate income with historical cost accounting.

Because of the change in rewards, it is legitimately argued that economic activity becomes less self-indulgent, less protective, and more productive if tax rates are reduced; that householders will work harder, take risks more willingly, and save more; that business firms will save and invest more and increase entrepreneurial activities; and that the aggregate supply schedule will shift out to the right. Conversely, it is legitimately argued that economic activity becomes more self-indulgent and protective and less productive as tax rates rise; and that the supply schedule shifts to the left. However, the income effects of changing tax rates may outweigh their effects on rewards. Incomes rise (fall) with tax rate reductions (increases), which, despite rewards being increased (decreased), may lead people to reduce (increase) personal effort, saving, risk taking, and investment activity. These questions cannot be settled by argument, a priori. They are empirical. Relevant data are discussed in Chapters II and III.

Finally, we note that changes in the personal exemption from income taxes and the standard deduction have only minimal supply-side effects compared to changes in marginal tax rates. Increases in the exemption and standard deduction will increase personal effort, risk taking, and saving only to the extent that they bring people into lower tax brackets. Clearly, across-the-board cuts in marginal tax rates create greater incentives to work harder, save, and take risks.

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Summary

Do increases in the deficit by and in themselves increase aggregate demand? It is reasonably urged that they do. However, it can be argued that aggregate demand is invariant with respect to changes in the deficit. This would be the case if we assumed (1) that the public believes that additional taxes will be imposed in the future to exactly match in timing and size the future interest payments which Treasury is obligated to make on the outstanding public debt and (2) that money demand and hence the velocity at which money turns over into GNP goods and services are totally unresponsive to changes in interest rates. But unless we accept these "special case" assumptions, we must accept the Keynesian argument that increases in the deficit increase aggregate demand even without any accompanying increases in the supply of base money or money (measured as the means of payment, M1B). The quantitative significance of the Keynesian or demand-side argument is an empirical question. It is taken up in Chapters II and III.

Do increases in the deficit by and in themselves increase aggregate supply? Again, it is reasonably urged that they do, although here too, the case is not airtight. Empirical evidence bearing on the question is taken up in Chapters II and III.

Are increases in the deficit, with no accompanying change in money growth, inflationary? The question cannot be answered by deduction from economic analysis. Analytically, deficit increases tend to increase both aggregate demand and aggregate supply, as shown in Figure 3. The former tends to increase inflation, the latter to decrease it. Whether deficit increases are inflationary, therefore, depends on (1) the relative magnitudes of shifts in demand and supply that occur as a result of deficits, and (2) how changes in the amount supplied that occur in response to shifts in the aggregate demand schedule compare to changes in quantity demanded in response to shifts in aggregate supply.[3] Therefore, in the final analysis, whether deficit increases—by and large and on average—are inflationary is an empirical matter. The question is taken up in Chapter III.

What impact do deficit increases have on real GNP growth? Here, theoretical analysis yields a definitive answer. If incremental deficit spending increases either aggregate demand or aggregate supply, and assuming in the former case that supply is not totally inelastic, the answer, unambiguously, is that deficit increases increase real GNP growth. As shown in Figure 3, the effect of an increase in aggregate demand always is to increase real GNP growth and so is the effect of an increase in aggregate supply.

Does it matter whether deficit spending is financed by printing money or by selling Treasury bonds, notes, and bills? The short answer is "yes." On the demand side, the extent to which an increase in the deficit increases aggregate demand, without which there can be no increase in the rate of inflation, depends critically on how deficits are financed. If they are financed fully by sales of new Treasury bonds,

[3] Supply is presumed to be relatively elastic (responsive) when there is slack in the economy and inelastic when it is not. The elasticity of aggregate demand is constrained to equal −1. This latter follows from the consideration that total dollar spending is constant unless either money growth or the rate of rise of money's velocity changes.

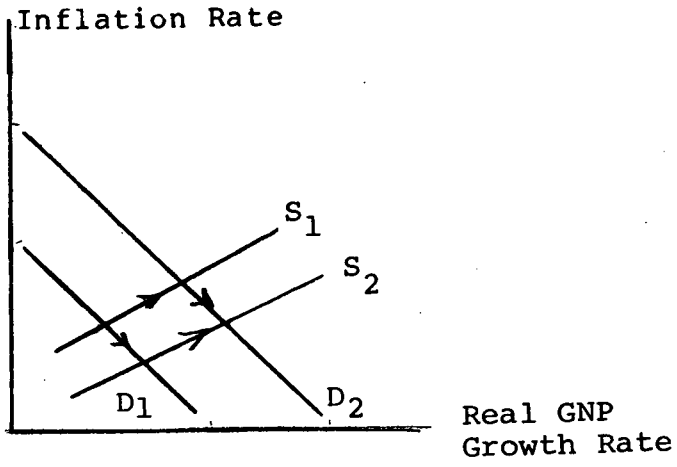

FIGURE 3.—Combining Changes in Aggregate Demand and Supply

notes, and bills, the immediate result is a rise in interest rates. Except in the limit, when money demand and thus the GNP velocity of money are totally unresponsive to interest rate changes, even increases in the deficit that are fully financed by new Treasury borrowing will increase aggregate demand somewhat. However, those that are financed in part or full by new money growth will increase it even more. Thus, the impact of increases in deficit spending on aggregate demand, and thereby on inflation and real growth, depend strategically on how accommodative monetary policy is. As put by Alice M. Rivlin [U.S. Congress, 1979, p. 134], Director of the Congressional Budget Office, in testimony before a Senate Banking Committee Subcommittee:

> A government deficit increases total spending in the economy . . . if the increased spending is to aggravate inflation, the Federal Reserve must accommodate it—at least to some extent—by permitting faster money growth. If there is not accommodation, then the financing of the deficit will drive up the cost of borrowing and choke off some private-sector spending—eventually relieving the upward pressure on prices caused by the deficit.

The ultimate supply-side effects of increases in the deficit on the economy also depend on whether deficit increases are monetized or financed by sales of new debt. If they are not monetized and aggregate demand is unchanged, the rightward shift in aggregate supply will result in deflation. Monetization would avoid deflation in this case. However, to the extent that the rise in the deficit increases velocity, inflation could result from increased money growth.

Does it matter whether changes in the deficit reflect primarily expenditure changes or changes in revenue? The tentative answer is "yes." In Keynesian analysis, aggregate demand responds more to changes in spending than to changes in taxes. This is because spending changes impact on aggregate demand directly while changes in taxes do so by changing disposable incomes and cash flows, parts of which are saved. From this standpoint then, spending changes are more important than tax changes. However, the Keynesian analysis ignores supply-side effects. When these are considered, tax changes may turn

out to be more important. At least it may be reasonably argued that, on average, changes in taxes have a larger effect on aggregate supply than changes in spending. As was discussed earlier, revenue changes nearly always reflect changes in effective marginal tax rates—whether through legislation or bracket creep. Changes in marginal tax rates affect the choices people must make between work and leisure, risk taking and safety, and saving and consumption. In turn, these choices affect the supply of labor and capital formation. In contrast, a large part of incremental spending each year has no obvious influence on labor supply or capital formation and some spending programs appear to provide disincentives for seeking work and thereby decrease the supply of labor.

In the final analysis, it is an empirical question whether changes in taxes, which appear to have more powerful supply effects but less powerful demand-side effects than do changes in spending, have greater effects on inflation and real growth than changes in spending. That question is taken up in Chapter III.

II. EVIDENCE

In this Chapter, we begin our empirical investigation by examining direct evidence on whether increases in the deficit act to increase (i) aggregate demand and (ii) aggregate supply. In the next Chapter, a small scale econometric model is introduced and its reduced forms are estimated, using standard statistical procedures, to quantify to a first approximation how changes in the deficit and, separately, changes in Federal expenditures and revenue have affected inflation and real GNP growth in the United States during the post-Korean War period. These tests also measure the roles played by changes in other factors, including M1B growth, in determining inflation and real growth.

Aggregate Demand

Percentage increases in aggregate demand during a particular period can be expressed as the sum of percentage increases in spending by consumers, business, and government on GNP goods and services, plus the foreign trade balance or, alternatively, as the sum of percentage increases in M1B and its velocity. To a close approximation, for any given period of time such as a year, we have that,

$$\%\text{CHG}-\text{Current \$GNP}=\%\text{CHG}-\text{M1B}$$
$$+\%\text{CHG}-\text{V}$$

where %CHG–Current $GNP denotes the percentage change in dollar spending on the Gross National Product or aggregate demand, %CHG–M1B denotes the percentage change in the M1B measure of money, and %CHG–V denotes the percentage change in M1B's velocity. In 1980, measured as a whole from all of 1979, current $GNP increased by 8.78 percent, M1B grew 6.44 percent and its velocity rose 2.2 percent.[1]

The arithmetic makes clear that for increases in the deficit to increase the rate of rise of aggregate demand above its rate of rise in the previous period, either %CHG–M1B or %CHG–V must increase, and if either one decreases the other must rise by more than it falls. We explore next the effects of changes in the deficit first on %CHG–M1B and then on %CHG–V.

Money

The years since 1967 have been marked by both deficit spending and fast money growth. From 1956 to 1966, the deficit, as measured in the national income and products accounts, averaged $1.1 billion yearly and M1B growth averaged 2.3 percent per year. From 1967 to 1980, the deficit averaged $25 billion a year ($20 billion scaled) and M1B

[1] %CHG–M1B and %CHG–V do not quite add to 8.78 because mathematically, it is (1+%CHG–M1B) times (1+%CHG–V) minus 1 that equals %CHG–Current $GNP/100.

growth averaged 6.2 percent per year. For each dollar of deficit spending by the Federal Government since 1967, the Federal Reserve allowed or caused the Nation's money stock to grow by sixty-seven cents. Even deducting the increase in the money supply that would have occurred from 1967 to 1980, if money had grown during this period at the 1956 to 1966 rate of 2.3 percent per year, we find that the Federal Reserve has allowed or caused the money stock to increase by nearly fifty cents for each dollar of deficit spending since 1967, and sixty-four cents if the deficit is scaled.

These statistics perhaps overstate the case. William A. Niskanen [1978, p. 601], now a member of the Council of Economic Advisers, writing in a paper that was published when he was employed by the Ford Motor Company, concluded that, "Over the whole period (1948 to 1976), about 15 to 20 percent of the Federal deficit appears to have been monetized." Niskanen qualified this conclusion, by noting that:

> This effect, however, nearly disappears when one allows for the substantial shift in monetary policy in the last decade. In any given year, the Federal deficit does not appear to have any significant effect on the rate of change of the money supply.

The relationship, then, is a relatively recent phenomenon which holds over a period of years but not every year. In this same vein, Michael J. Hamburger of New York University and Burton Zwick of the Prudential Insurance Company [1981, p. 141] found that "deficits have had a significant impact on the growth of the U.S. money supply throughout most of the period since 1961." They (p. 148) note, however, that "such a relationship need not always hold." Significantly, it did not in 1975 and 1976. The authors write that Milton Friedman, among others, views the 1975 to 1976 experience as sufficient to refute the hypothesis that budget deficits lead inevitably to fast money growth. Nonetheless, Hamburger and Zwick (p. 148) conclude that, "The general tendency in U.S. economic policy over the last two decades has been for budget deficits to stimulate money growth and thus promote inflation."

The question is why? Why has the Federal Reserve accommodated deficit spending in recent years by allowing or causing inflationary growth of the Nation's money supply? We place the genesis of this policy around 1967, which is near where Niskanen [1978, p. 601] marks "a substantial shift in monetary policy." Inflation began to accelerate in 1965. That year, for the first time in the 1960's, the GNP deflator, measured year on year, rose by more than 2 percent. In 1966, it increased 3.3 percent. In 1967, it increased 2.9 percent versus 1966 as a whole and at a 4 percent annual rate in the second half of the year. In 1967, President Johnson asked Congress to impose 10 percent surcharges on the income taxes of individuals and corporations. Congress did so in June 1968. The direct effect of this legislation was to decrease the deficit. It was hoped that this would stop the burgeoning inflation. But it did not.

The reason it did not is that President Johnson balked at also reducing money growth to fight inflation. As he [1969, p. 10] put it in his 1969 "Economic Report":

> High interest rates and tight money can restrain the economy—and will do so if fiscal policy fails to do it. But the cost of monetary restraint is high and unfair, imposed on a single industry—homebuilding.

In short, he was unwilling to use monetary policy to restrain aggregate demand. The Johnson CEA [1968, p. 84] argued that:

> In present circumstances the accompanying further rapid expansion of credit demand would impose severe strains on financial markets—even under an expansionary Federal Reserve policy. . . . To the extent that policy was aimed at moderating inflationary pressures, the more interest rates would rise and the more homebuilding would be depressed.

Thus, the Federal Reserve was assigned the job of dampening interest rates increases, whatever their source, through monetary expansion, and doing so even though the deficit was falling (or a surplus was developing). The assignment was kept in force until just recently. It was modified in October 1979, and there are signs now (Spring 1981) that it is being scrapped. As explained below, while in force, the policy backfired.

Excepting in 1975 and 1976, when the combination of decelerating inflation and a large amount of slack in the economy kept interest rates down and, in addition, the President (Ford) wanted the lid kept on money growth, the new assignment guaranteed that money growth would be rapid when the deficit was large in the post-1967 period. For when the Treasury sold new debt to finance the deficit, the Federal Reserve was obliged to buy securities on the open market to keep interest rates from rising when the new debt was marketed. These purchases added to bank reserves and thereby provided the base for faster money growth. Ironically, the result of this, in turn, was to preserve and accelerate inflation and thereby assure that interest rates would rise over the long run. It would have been better to have allowed interest rates to rise sharply in the short run, when the new debt was marketed, and, thereby, to have avoided the calamitous sequence of faster money growth, accelerating inflation, and still higher interest rates.

In summary, there is no doubt whatever that if increased deficits lead to faster money growth, then, aggregate demand, inflation, and interest rates all will increase. By and large, and on average, this is what has happened in the years since 1967. However, as Professor David Laidler (personal conversation) of the University of Western Ontario has put it, we must distinguish between "what has been" and "what could have been." Despite the huge deficits accumulated since 1967, money growth could have been stabilized at 2 or 3 percent per annum if there had been a will to do so.

Scott E. Hein [1981, p. 4] of the St. Louis Federal Reserve Bank put it this way:

> Although the Federal Reserve affects the money supply by buying or selling government securities (Federal debt), there is no direct link between Federal Government deficits (that is, the issuance of Federal debt) and Federal Reserve open-market operations. Since a 1951 "accord" between the Federal Reserve and the Treasury, the Federal Reserve has no longer been directly responsible for stabilizing government security prices or for purchasing any given portion of the public debt. Consequently, Federal deficits do not require that the Federal Reserve purchase more government securities; therefore, Federal deficits, per se, need not lead to increases in bank reserves or the money supply.

Velocity

In order for increases in the deficit to increase aggregate demand without a speed-up in money growth, they must increase the rate of rise of the turnover of M1B into GNP goods and services, i.e., M1B's velocity. However, on average, the rate of rise of velocity has been lower in the period since 1967 during which deficit spending totalled more than $350 billion than it was in the 1956 to 1966 period when the cumulative deficit was only $12 billion. Velocity rose 3.4 percent per year in the earlier period and only 3.1 percent per year from 1967 to 1980. Thus, the simple, direct evidence indicates that in the long run, increases in the deficit do not affect the rate of rise of velocity or, as a corollary, aggregate demand. However, it may be that the long run is too long a period in which to observe a simple, direct relationship between increases in the deficit and the rate of rise of velocity.

But evidence for shorter periods also fails to uncover or demonstrate the required linkage between changes in the deficit and the rate of rise of M1B's velocity. An Almon lag regression, which is reported in the Appendix, of the quarter-to-quarter rate of rise of M1B's velocity was run on current and lagged (up to 16 quarters) values of the quarter-to-quarter change in the Federal deficit scale by an index of potential GNP. The regression covered the period from the fourth quarter of 1962 to the first quarter of 1981. We did not find a single lag at which the current value of the quarter-to-quarter rate of rise of velocity is significantly effected by the lagged value of the scaled quarter-to-quarter change in the deficit. Using year-on-year changes also failed to uncover a significant positive relationship between changes in the rate of rise of velocity and changes in the scaled deficit at any lag.

However, for two reasons, these tests also are unlikely to show a positive correlation between increases in the deficit and the rate of rise of velocity. One reason is that the pressures which increased deficits put on aggregate demand through their interest rate effects may have been fully relieved by accelerating M1B growth after 1966. That is, if money growth had not been accelerated, the rate of rise of velocity might have risen. The second reason why simple correlations are unlikely to show a positive relationship between the rate of rise of velocity and increases in the scaled deficit is that velocity moves procyclically and the deficit (and the scaled deficit) countercyclically. Therefore, the simple, direct evidence is likely to show that the rate of rise of velocity falls as the deficit increases; not because the deficit increases but as it does. Moreover, correcting for recessions will not necessarily turn this result around.

Table 2 sets forth year-on-year changes in the scaled deficit and the rate of rise of M1B's velocity for the 1956 to 1980 period. Inspection of these data shows that in the recession years of 1958 and 1961, the rate of rise of velocity was unusually low while the scaled deficit increased by relatively large amounts compared to surrounding years. To a lesser extent, this pattern was repeated in the mini-recession of 1967 and the recession of 1970. But as the Almon-lag regression of quarterly data discussed above shows, the rate of rise of M1B's velocity is not directly or positively related to changes in the scaled deficit even if the early years (1956 to 1961) of the post-Korean War period are ignored.

TABLE 2.—CHANGES IN THE DEFICIT[1] AND VELOCITY, 1956 TO 1980

[Dollar amounts in billions]

	Changes in scaled deficit	Percentage rate of rise in M1B's velocity		Changes in scaled deficit	Percentage rate of rise in M1B's velocity
Year:			Year:		
1956	[2] 2.29	4.13	1969	−13.62	2.12
1957	5.73	4.70	1970	18.99	1.38
1958	17.51	.11	1971	7.95	1.73
1959	−12.76	6.56	1972	−5.02	2.84
1960	−5.34	3.79	1973	−9.55	4.22
1961	8.73	1.29	1974	4.46	2.99
1962	.20	5.10	1975	43.44	3.27
1963	−5.41	2.00	1976	−13.57	5.03
1964	4.04	2.92	1977	−6.01	3.84
1965	−4.23	3.78	1978	−12.86	3.95
1966	2.41	4.60	1979	−10.17	3.92
1967	11.33	1.79	1980	30.37	2.20
1968	−7.41	2.05			

[1] Scaled by an index of potential real GNP. The index uses 1967 as the base year. Potential GNP in 1967 is set equal to 1.

[2] A minus sign indicates a fall in the scaled deficit.

Conceivably, by entering other possible influences on velocity into the analysis, we could use regression analysis to find and estimate the impact of changes in the deficit (and as a corollary, the scaled deficit) on the rate of rise of velocity. However, this approach would take us too far afield because it requires building and estimating a velocity model. Instead, we again assert the validity of the Keynesian chain of causation that links changes in the deficit to changes in velocity via changes in interest rates and money demand. Below, we employ a three-step intuitive approach to estimate the impact.

The first step involves estimating the direct effect of a given dollar change in the deficit on the rate of interest. As detailed below, we estimate that a $35 billion increase in the deficit (in 1980 dollars) could increase rates of interest perhaps as much as 20 percent in the short run but only by 10 percent or so in the long run.

The second step involves estimating how velocity responds to interest rate changes. Again as detailed below, we estimate that, given a 100 percent increase or doubling of interest rates, velocity would increase 2 percent in the short run but by 20 percent in the long run.

The third step produces estimates of the impact of a $35 billion increase in the deficit on velocity. This is done by multiplying the short-, intermediate-, and long-run interest rate changes estimated in step one by the responses of velocity to interest rate changes which are estimated in step two. For example, multiplying the estimated long-run 10 percent or .1 rise in interest rates by the estimated long-run rise in velocity of .2 or 20 percent for a doubling of interest rates, we obtain a long-run 2 percent increase ($.2 \times .1 = .02$) in velocity for the assumed $35 billion increase in the deficit.

Step 1. The Direct Effect of a Change in the Deficit on Interest Rates

To estimate the impact of changes in the deficit on interest rates, we assume initially a $35 billion static tax cut in 1980 dollars and ask by how much interest rates must rise to fully crowd out the same amount

of private and State and local government borrowing. In the second half of 1980, total private and State and local government borrowing was at an annual rate of $350 billion. Hence, we are asking how much interest rates must rise to decrease private and State and local government borrowing by 10 percent.

The answer depends on the interest rate elasticity of private and State and local credit demand. If a value of −1 is assigned, a $35 billion increase in the deficit, scaled to 1980's U.S. economy, would require that the rate of interest rise by 10 percent (e.g., from 10 to 11 percent) in order to *fully* crowd out $35 billion of private and State and local government borrowing.

If a value of −.5 is assigned, a $35 billion increase in the deficit requires the rate of interest to rise by 20 percent in order to decrease private and State and local government borrowing by $35 billion. If a value of −.25 is assumed, the rate of interest must rise by 40 percent. Finally, if a value of −.1 is assumed, the rate of interest must rise by 100 percent.

It is reasonably urged that a value of −1.0 is appropriately assigned in the long run and that elasticity here is not significantly lower (in absolute value) in the short and intermediate runs than in the long run. This is because private and State and local government borrowing usually can be rescheduled. We use −.50 for the short run and −.60 and −.80 for intermediate runs.

Step 2. The Response of Velocity to Interest Rate Changes

The percentage change in velocity in any given period closely approximates the percentage change in current dollar GNP minus the percentage change in the quantity of money. If money demand is totally insensitive to interest rates, neither velocity, nor, as a corollary, current dollar GNP, will change when interest rates change. However, if, for example, the quantity of money demanded falls 2 percent in response to a 100 percent increase in interest rates, and interest rates double, both velocity and GNP will increase 2 percent. If the quantity of money demanded falls only 1 percent, then, velocity and GNP will increase only 1 percent, etc. In all cases, the fall in the quantity of money demanded because of higher interest rates is exactly matched by a rise induced by the GNP increase so that, in the final analysis, there is no change in the quantity of money. We estimate the responses of velocity to changes in interest rates by using widely accepted research results for the interest rate elasticity of the demand for money (defined as the means of payment and measured by M1B). Specifically, we use a value of .02 for the short run, indicating a fall in money demand and corollary increase in velocity of 2 percent for a 100 percent increase or doubling of interest rates, and values of .2 for the long run and .05 and .1 for intermediate runs.

Step 3. The Percentage Change in Velocity

Step three can now be performed. Multiplying our estimates of the impact of a $35 billion increase in the deficit on rates of interest by the estimated responses of velocity to these interest rate increases, we obtain the following range of estimates for %CHG–V in response to a $35 billion increase in the deficit scaled to the 1980 U.S. economy:

Length of run	Using— Interest elasticity of private and State and local government credit demand (1)	Associated interest rate percentage change with full crowding out and a $35 billion deficit (2)	Absolute value of interest elasticity of money demand (3)	Obtain: Percentage rise in velocity for a $35 billion deficit increase (2) × (3) (4)
Short	−0.50	20.0	0.02	0.40
Intermediate	−.60	16.7	.05	.835
Do	−.80	12.5	.10	1.25
Long	−1.00	10.0	.20	2.00

Modifications

It is important to stress that the above estimates for changes in both interest rates and velocity assume full crowding out of private and State and local government borrowing. In fact, after all adjustments to an initial, static $35 billion increase in the deficit have taken place, private and State and local government borrowing would fall by $35 billion, only if (1) the interest rate elasticity of money demand, and hence the response of velocity to changes in rates of interest, is zero, and (2) there is no labor supply or saving response to the deficit change. In the first case, there would be no change in aggregate demand; in the second case, no change in aggregate supply. Hence, there would be no feedback increasing Federal or other government revenue flows or private saving and, therefore, private and State and local government investment would have to fall by $35 billion.

Assuming some elasticity of money demand with respect to rates of interest (and so an aggregate demand effect) and/or some labor market response to changes in marginal tax rates (an aggregate supply effect), a $35 billion tax cut would not result in a $35 billion increase in the deficit. Moreover, private and State and local government borrowing will not have to fall by the same amount as the final increase in the Federal deficit. Here is why.

A $35 billion marginal tax rate cut will increase GNP—whether by increasing aggregate supply or aggregate demand, or both. Conservatively, GNP can be expected to increase by $50 to $60 billion. Twenty percent of this increment, or $10 to $12 billion, will reflow back to the Federal Government because tax receipts will rise commensurately. Thus, the deficit will rise by only $23 to $25 billion as a result of a $35 billion tax cut. Moreover, private and State and local government borrowing will not have to fall by this amount to equilibrate the tax cut. State and local government tax receipts will rise by $5 to $7 billion. Personal saving will rise by $2 billion as a result of the increase in GNP and could rise an additional $10 to $12 billion because the tax cut will increase both the return to saving and the cost of borrowing. Gross business saving will rise $6 to $7 billion as a result of the increase in GNP and would rise additional billions of dollars to the extent the tax cut is tailored to reduce corporate taxes. Net business saving will rise $2 billion.

Summing across these several changes, we have that at maximum only $12 to $16 billion of private and State and local government bor-

rowing must be crowded out to equilibrate a $35 billion tax cut. And it is at least conceivable that incremental domestic saving and inflows of foreign capital which are induced by the higher after-tax returns on saving and capital in the United States would exceed $12 or even $16 billion.

Using $14 billion, or 4 percent of the $350 billion annual borrowing rate of private and State and local government entities in the second half of 1980, as the amount of private and State and local government borrowing that must be crowded out (given a $35 billion marginal tax rate cut),[2] we obtain the following interest rate changes:

Length of run	Using— Interest elasticity of private and State and local government credit demand (1)	Associated percent change in interest rates with full ($35 billion) crowding out (2)	Percent change in interest rates to crowd out $14 billion private credit demand (3)	Obtain: Associated percentage rise in rates using a base rate of 14 percent (3)×0.14
Short	−0.50	20.0	8.0	1.12
Intermediate	−.60	16.7	6.68	.935
Do	−.80	12.5	5.0	.70
Long	−1.00	10.0	4.0	.56

Again using the $14 billion figure, the estimated long-run percentage change in velocity associated with a $35 billion tax cut is only .8 percent, or 40 percent of the 2 percent estimate (see Step 3) for full crowding out, since $14 billion is 40 percent of $35 billion. Thus, spending on GNP goods and services (aggregate demand) would rise as a result of a $35 billion tax cut by only .8 percent. In the short and intermediate runs, the rise is less. This is because the absolute value of the interest elasticity of money demand decreases as the length of run decreases.

Other credit and money demand elasticities can be used to estimate the interest rate and velocity effects of increases in the deficit and tax cuts. Ultimately, the question is empirical. As noted, the money demand elasticities we have used to estimate the responses of velocity to given interest rate changes are based on widely accepted research results. And our credit demand elasticities seem plausible. Finally, in this regard, statistical results reported later are consistent with the hypothesis that a $35 billion increase in the observed deficit in 1980 dollars will increase velocity about 2 percentage points.

Changes in the Deficit and Aggregate Supply

It is standard in economics to treat production as a function of the employment of labor and capital. We do so here. In turn, the employment of labor and capital are related to aggregate demand and the terms on which labor and capital are supplied. In the event that aggregate demand rises, producers try to hire more input in order to increase

[2] The $14 billion figure is the mid-point between $12 billion and $16 billion, which in turn equal $35 billion minus the sum of $10 to $12 billion for the Federal tax reflow, $5 to $7 billion for the tax reflows to State and local governments, $2 billion for the increase in personal saving and $2 billion for the increase in net business saving. These deductions are conservative final adjustments or long-run estimates of the tax reflows and increases in savings from the GNP increase which a $35 billion tax cut can be expected to generate in the long run. In the short run, the tax reflows would be smaller but the savings increases would be larger. Their sum would be about the same.

their output. If there is slack in input markets, output will expand. Otherwise, the hire prices of labor and capital rise converting the initiating rise in aggregate demand into a rise in the inflation rate. However, if the initiating factor is an event that causes labor and capital to be supplied on more favorable (less costly) terms than a period ago, then producers definitely are able to hire more labor and capital and increase production, and they have incentive to do so. The rate of inflation falls in this case.

We examine next certain direct evidence which, while not conclusive, supports the contention of supply siders that increases in the deficit, especially those that derive from tax rate reductions, increase both the supply of labor and the propensity to save. The former is sufficient to assure an increase in production (rise in aggregate supply) because the hire price or wage of labor falls as a result. The increase in the saving rate, however, will produce a rise in capital accumulation and production only if the resulting rise in saving exceeds the rise in the deficit after all tax reflows are taken into account.

The Supply of Labor

As discussed earlier, only a few Federal spending programs affect incentives to work. Of those that do, some would appear to provide production and work incentives and other disincentives. Research results reported by Kenneth W. Clarkson and Roger E. Meiners [1977, pp. 27–51] of the University of Miami Law and Economics Center show that the food stamp program, unemployment compensation (particularly legislation passed in the 1970's extending the period during which it is paid), and Trade Adjustment Assistance have provided work disincentives by decreasing the cost of being unemployed. Given the findings by Clarkson and Meiners, a strong case can not be made in support of the contention that increases in Federal spending, by and large and on average, increase the supply of labor.

However, we are not aware of similar evidence that any tax cuts decrease labor supply, while there is direct evidence which, though not conclusive, suggests that cuts in marginal tax rates increase the supply of labor.

In the three years before the Kennedy tax cuts of 1964, the labor force participation rates of males declined 1.9 percentage points and the participation rate of females rose by 0.6 percentage point. In the three following years, the male rate declined only 0.6 percentage point and the female rate rose 2.4 percentage points. Among males, the greatest positive shift occurred in the 16- and 17-year-old group. Those 55 to 64 years old and those 65 years and over also appear to have responded positively to the 1964 tax cut. Males 18 and 19, 20 to 24, and 45 to 54 years old appear to have responded negatively. The first two of these age groups may have been responding to the exemption from the draft that was given to college students at the time, together with the heating-up of the Vietnam War. Among females, the response appears to be strongly positive for all age groups through 44 years old.

After the Kennedy tax cuts, the average duration of unemployment fell from 14 weeks in 1963 to 13.3 weeks in 1964, to 11.8 weeks in 1965 and to 10.4 weeks in 1966.

After the Kennedy tax cuts, average weekly hours worked in manufacturing rose from 40.5 in 1963 to 40.7 in 1964, to 41.2 in 1965, and to 41.4 in 1966. In construction, average weekly hours rose from 37.3 in 1963 to 37.6 in 1966. In wholesale and retail trade, average weekly hours fell. This reflects the employment of relatively large numbers of part-time workers in this latter sector.

Research results confirm that cuts in marginal tax rates increase the supply of labor. Economists have long agreed that the labor supply of females is sensitive to changes in the return to work relative to the return to leisure. That is, few dispute that females will increase their supply of labor in response to a tax cut which raises the return to labor. Recent empirical work by Professor Jerry Hausman [1981, pp. 27–83] of MIT confirms this conclusion, and also shows that hours worked by prime age males are quite sensitive to the combination of Federal and State income taxes and the payroll tax. He found that tax increases reduce hours worked significantly.

In addition, tax rates also affect decisions such as how much training or education to acquire and what occupation to pursue. Commentators on Hausman's paper, as reported by Brookings' scholars Henry J. Aaron and Joseph A. Pechman [1981, p. 4], believe "they may be quite important."

Finally, as reported by Aris Protopapadakis [1981, p. 15] of the Philadelphia Federal Reserve Bank, "evidence from a study (by Terrance Wales in the International Economic Review, February 1973) done on self-employed individuals shows that both their hours worked and their intensity of work are highly sensitive to after-tax income and, therefore, to tax rate cuts."

Saving

There is considerable evidence that personal marginal tax rate cuts increase householders' propensity to save and thereby the accumulation of capital. Following the Kennedy tax cuts, personal saving rose from 5.4 percent of disposable income to 1963 to 6.7 percent in 1964, to 7.1 percent in 1965, to 7.0 percent in 1966, and to 8.1 percent in 1967. In 1968, together with the imposition in June of a 10 percent surcharge on personal income taxes, the saving rate fell to 7.1 percent. It fell still further to 6.4 percent in 1969, the only year when the surtax was in effect throughout the year. At the beginning of 1970, the surtax was reduced to 5 percent and it was eliminated entirely at midyear. The saving rate rose to 8.0 percent in 1970 and to 8.1 percent in 1971. Further, in this regard, a new study by economists Mark Policinski and Timothy Roth [U.S. Congress, 1981, pp. 1–19] of the Committee's Republican staff concludes that a 10 percent cut in personal marginal tax rates results in a 9.89 percent increase in personal saving.

In the same vein, Stanford Professor Paul Evans [1981, p. 3], in a research paper which was recently published by the San Francisco Federal Reserve Bank, concluded that, "despite all the changes in the economy since 1964, the best available evidence supports the (Reagan) Administration's position that Kemp-Roth would raise saving. The critics who assert that there is not a shred of evidence to support this claim just have not looked for it."

In addition, tax rates also affect the allocation of savings between financial assets and physical assets such as houses and collectibles. Cuts in marginal personal tax rates favor financial assets where returns are largely in the form of taxable income. Increases in tax rates favor collectibles where returns sometimes are non-pecuniary or in the form of capital gains. In this connection, we note that after the Kennedy tax cut, investment in housing dropped as a percent of gross private domestic investment from 35.4 percent in 1963 to 33.5 percent in 1964, to 29.8 percent in 1965, to 25.5 percent in 1966, and to 25.4 percent in 1967, and that collectibles such as the precious metals and antiques have been increasingly favored as investments in recent years as bracket creep raised marginal personal income tax rates.

Summary

In summary, the evidence reviewed in this chapter strongly supports the supply-side hypothesis that increases in the deficit, at least those which derive from personal marginal tax rate reductions, increase both the supply of labor and the propensity to save. In contrast, tax rate increases, whether legislated or derived from bracket creep, decrease the supply of labor and saving.

III. CHANGES IN THE DEFICIT, REAL GNP GROWTH AND INFLATION: SOME ECONOMETRIC EVIDENCE

We turn now to estimating in the context of a small scale econometric model how changes in the deficit and, alternatively, in spending and revenue, affect real GNP growth and the rate of inflation, taking into consideration the influences of other factors including most importantly the rate of growth of the M1B money supply.

The Model

Our model is a modified version of the small econometric model of the U.S. economy which we originally specified and estimated in a report issued by the House Subcommittee on Domestic Monetary Policy in December 1980 [U.S. Congress, 1980].

The model assumes a single economy-wide competitive product market where a single homogenous output is bought and sold at a single uniform price. The single output is constant dollar or real GNP. It is measured yearly. The single price is the GNP price deflator. It, too, is measured yearly. The year-on-year rate of inflation is denoted %CHG–GNPDEF. Year-on-year real GNP precentage growth is denoted %CHG–CON$GNP.

Demand

The behavior of buyers in all parts and sectors of the economy is compressed in a single equation which relates the percentage growth in the amount of real GNP demanded in the current year to (1) the percentage change in relevant past years in the money supply, measured by recorded M1B, (2) the dollar change a year ago in the thrust of fiscal policy scaled by an index of potential real GNP, and (3) concurrent percentage changes in the GNP deflator. We model aggregate demand as the following linear equation:

$$\%\text{CHG–CON\$GNP}^{d} = +a(\%\text{CHG–M1B}_{-1} \ldots) + b(\text{FHG}_{-1}) - c(\%\text{CHG–GNPDEF})$$

where $\%\text{CHG–M1B}_{-1}$ . . . denotes the percentage rate of money growth in the relevant past period, FCHG_{-1} is last year's dollar change in the thrust of Federal fiscal policy measured, as detailed later, by scaled changes in the deficit or, alternatively, scaled changes in revenue and expenditures, and %CHG–GNPDEF is the current year change in the GNP price deflator.

By hypothesis, the demand for incremental output rises with prior increases in money growth and prior incremental fiscal stimulus and is decreased by increases in the current rate of inflation.

Supply

The supply of constant dollar GNP is asserted to fall as the cost of production rises and to rise as the price at which it can be sold rises. Mathematically,

$$\%CHG\text{–}CON\$GNP^s = -a(\%CHG\text{–}COST) + b(CHG\text{–}GNPDEF)$$

Production cost schedules—total, average, and marginal—are derived from the hire prices of labor and capital together with a production function which relates output for all producers to their input of labor and capital.

Cost schedules change as a result of production function changes as well as changes in the hire prices of labor and capital. The production function changes as a result of technological advances and innovations.

The hire price of labor is determined by the supply and demand for labor. The supply of labor is related to the change in fiscal stimulus a year ago—especially from changes in personal marginal tax rates, to year ago values of unemployment and inflation, and to this year's wage rate—the current hire price. The demand for labor is related to the current wage rate and the existing stock of capital (which determines the properties of the production function).

Setting labor supply and demand equal to one another, we can solve for the hire price of labor. The solution shows that this year's wage rate depends on *year ago* values of fiscal stimulus, inflation, and unemployment, which will be denoted UNY, and on the existing stock of capital.

The existing stock of capital depends on the stock at the end of the previous year and on exogenous shocks that take place during the current year. Specifically, increases in the price of imported oil are asserted to render part of the existing capital stock obsolete. Thus, given the price of imported oil, which is viewed as determined exogenously (by OPEC), we can find the existing stock of capital and use it together with year ago values of fiscal stimulus, inflation, and unemployment to find both the current hire price of labor and the quantity of labor employed.

The hire price of capital, too, depends on its supply and demand. Its supply is related to past values of fiscal stimulus, exogenous shocks (changes in the price of imported oil), and the current hire price of capital. The demand for capital is related to its current hire price and the quantity of labor employed. As discussed above, this latter is found in the labor market. Like the wage rate, the quantity of labor employed depends on *year ago* values of fiscal stimulus, inflation, and unemployment and on the existing capital stock. Thus, setting the demand for capital equal to its supply, we have that the hire price of capital depends on *past* values of fiscal stimulus, changes in the price of imported oil, and the quantity of labor employed.

As noted above, in the theory of production, the wage rate and hire price of capital are used together with the production function (which describes the relevant technical conditions of production) to obtain the cost schedules needed to derive aggregate supply schedules. Our model follows this tradition in building its aggregate supply function.

The Supply or Cost Hypotheses

Before proceeding, it would appear useful to back-track in order to go over in some detail our supply-side hypotheses. By hypothesis, the current cost of producing constant dollar GNP is asserted (i) to decrease over time as a result of labor force growth, capital formation, and technological advances and innovations; (ii) to decrease in response to *past* increases in the Federal Government deficit and, as a corollary, to past increases in spending and decreases in taxes; (iii) to decrease as a result of *past* increases in unemployment; (iv) to increase as a result of *past* increases in the rate of inflation, and (v) to increase as a result of *current* increases in the price of imported oil.

These hypotheses are commonsense deductions which follow from the foundations of production theory. The first recognizes our economy's secular achievement of increasing production. The second recognizes that changes in the thrust of the Federal Government's fiscal policy can change incentives to work, save, invest, and take risks. In principle, it does not matter whether people are motivated to change their work, saving, and productive activities as a result of changes in the Federal Government's spending levels and programs or by changes in effective tax rates. However, changes in the deficit that result from tax changes appear to be the more powerful influence. Legislated decreases in personal and business taxes increase rewards and, by hypothesis that any income effects are overwhelmed, incentives to work, save, invest, engage in entrepreneurial activities, and produce. Labor supply and capital formation rise and, as a result, the cost of producing constant dollar GNP falls and aggregate supply increases. Conversely, increases in effective tax rates, whether newly legislated or resulting from the interfacing of rising personal income with progressive tax rates, and rising corporate income with historical cost accounting, diminish incentives to work and produce. Labor supply and capital formation fall. The cost of production rises. Aggregate supply decreases.

Because changes in the deficit, whether originating in spending or tax changes, impact on production cost indirectly (by changing suppliers' incentives and the economy's inventory of public productive facilities), the impact occurs with a lag. It takes time for incentives to change following changes in tax rates or spending on programs that influence incentives to work and produce. It also takes time to complete the building of productive facilities. As a result, there is a lag before observed deficit changes, or changes in spending and revenue, are reflected in the cost of producing constant dollar GNP.

The third hypothesis reflects both the forward orientation and time consuming nature of most production and the fact that wages and other input prices, including interest rates, tend to rise as unemployment falls and fall as unemployment rises. Increases in input prices that occur when unemployment drops reflect increased tightness in labor and other input markets. Decreases reflect increased slack. In turn, because firms often hire, buy and borrow in the current period at wage rates, prices and interest rates contracted or otherwise fixed in the past, the current cost of producing GNP is importantly affected by past unemployment. Low unemployment in period t-1 causes concommitant forward increases in input prices and thus shows up as increases in the current period's production cost. Conversely, high un-

employment in t-1 shows up in the current period as a decrease (or a decrease in the rate of increase) of production cost.

Our fourth supply hypothesis also follows from consideration of the fact that most production is planned ahead and is time consuming. As a result, in many cases, the hire prices of labor and capital which apply to current period production are likely to have been contracted for in the past. Thus, a past acceleration of inflation operates to increase current production cost.

Our fifth supply hypothesis recognizes that the current cost of producing constant dollar GNP is increased by increases in the price of imported oil landed in the United States in the current year. This is because these increases render part of the capital stock obsolete. No lag is involved.

Aggregate Supply

Substituting these commonsense hypotheses for the cost term in the supply function for the growth of real GNP, we model aggregate supply as the following linear equation:

$$\begin{aligned}\%\text{CHG-CON\$GNP}^s = &+t\\ &+d(\text{FCHG}_{-1})\\ &+e(\text{UNY}_{-1})\\ &-f(\%\text{CHG}-\text{GNPDEF}_{-1})\\ &-g(\%\text{CHG}-\text{IMOIL}-\text{P})\\ &+h(\%\text{CHG}-\text{GNPDEF})\end{aligned}$$

where the positive sign on the coefficient h reflects the usual supply hypothesis that output rises with own-price, where t captures (but as explained later, does not measure) the impact on production of secular labor force growth, capital formation, and technological advances and innovation, and where %CHG−IMOIL−P denotes the current year percentage change in the price of imported oil.

By hypothesis, this year's incremental real GNP, measured in percentage terms, rises with year ago incremental fiscal stimulus, with the value of unemployment a year ago, and with the current rate of inflation (percentage rise in own-price). Supply falls with increases in inflation recorded a year ago and with current year increases in the price of imported oil.

Equilibrium

The model assumes equilibrium between aggregate supply and aggregate demand at all times.

Solving the Model

The right side elements of the supply and demand equations were substituted in the equilibrium equation which was then solved to obtain the reduced form equation for %CHG-GNPDEF.

The reduced form equation for inflation is:

$$\begin{aligned}\%\text{CHG-GNPDEF} = &+a\\ &+b(\%\text{CHG-GNPDEF}_{-1})\\ &-c(\text{UNY}_{-1})\\ &+\text{or} -d(\text{FCHG}_{-1})\\ &+e(\%\text{CHG-IMOIL-P})\\ &+g(\%\text{CHG-M1B}_{-1}\ \ldots)\end{aligned}$$

The double sign on $FCHG_{-1}$ reflects that the inflation effect of a change in fiscal stimulus is ambiguous. The supply-side effect is to reduce inflation. The demand-side effect is to increase it. The question cannot be settled a priori. It is an empirical matter. The tests that we report later are intended to shed light on the question.

The reduced form equation for %CHG–CON$GNP was obtained as follows. First, the supply and demand equations were transposed so that each could be solved for %CHG–GNPDEF. Second, the right-side elements of the transposed supply and demand equations were substituted in the equilibrium equation. Finally, the new equilibrium expression was solved for %CHG–CON$GNP. The reduced form equation for real GNP percentage growth is:

$$\begin{aligned}\%\text{CHG–CON\$GNP} = {} & +a \\ & -b(\%\text{CHG–GNPDEF}_{-1}) \\ & +c(\text{UNY}_{-1}) \\ & +d(\text{FCHG}_{-1}) \\ & -e(\%\text{CHG–IMOIL–P}) \\ & +g(\%\text{CHG–M1B}_{-1})\end{aligned}$$

The net impact of secular labor force growth, capital formation, and technological advances and innovation on the growth of constant dollar GNP equals the sum of a and c times UNY_{-1}, where for this special purpose only UNY is the post-Korean War mean value of non-recession unemployment.

Apart from the percentage change in the current price of imported oil, which once again is viewed as autonomously determined by OPEC, all of the right side or independent variables of the reduced forms are predetermined. All are lagged one year, except that a more complicated lag is used to capture the response of inflation to changes in money growth than in the case of production. As explained next, the response of the rate of rise of the GNP price deflator to changes in M1B growth is both relatively delayed and prolonged.

The Role Played by Money

The role that money supply plays in the model is particularly important. It is worth discussing in some detail. In the model, and we believe in the real world as well, changes in money growth engender changes in real GNP growth and inflation that are spread out through time. In the case of real growth, the changes are positive early on, negative later on, and sum to zero in the long run. In the case of inflation, although commodity prices and prices of shelf goods move up and down with changes in M1B growth almost immediately, the change in the overall measure of inflation may be negative at first. This is because the initial output change following a change in money growth will tend to have an opposite effect on the rate of inflation. If money growth and real GNP growth rise, inflation is reduced. However, in time, the rate of inflation is positively impacted by money growth changes. In the long run, it tends to change in proportion to the change in money growth and real GNP growth returns to its initial rate.

Our approach follows the broad outline of this well-known sequence. However, we delay one year before allowing any impact of money growth on either real GNP growth or inflation. We do so in order to avoid relating changes in real GNP growth and inflation to concurrent changes in M1B growth, since this can result in what is called simultaniety bias.

Heuristically, we assert that money growth changes are absorbed fully by changes in financial markets and inventories during the year that money growth is changed. This is not totally unrealistic. Part of the impact of changes in money growth is initially absorbed in ephemeral changes in interest rates and inventories. Briefly, what happens is this: Increases in money growth engender prompt increases in new orders and decreases in money growth cause new orders to fall promptly. Suppliers of goods react to the change in orders in part by depleting or accumulating physical inventories. However, because of short-run supply inelasticities, the rate of spending on GNP goods and services *in total* tends to lag changes in money growth. As a corollary, changes in money growth impact partly on financial markets at first. In essence, part of incremental flows of new money balances is parked in financial assets until suppliers are able to rebuild inventories and respond fully to increases in new orders with new production. When they do the initial effects in financial markets are erased. Vice versa, decreases in money growth engender liquidation of financial assets until suppliers can wind down production of goods and services to correspond to cuts in new orders.

In time, the rate of spending on GNP goods and services changes to match the changes in money growth, but there are further delays before the rate of rise of prices in general fully adjusts. Again for discovery purposes, we assert that in the first year after the year in which money growth changes, changes in constant dollar GNP growth fully absorb the spending changes that result from the changes in M1B growth. Subsequently, in periods we delineate as the second, third, and fourth years after money growth is changed, the inflation rate adjusts. Finally, as a result of the change in the rate of inflation, the cost of production changes and constant dollar GNP growth returns to its initial rate. This last adjustment begins in the third year after money growth is changed.

The adjustment of the rate of rise of prices in general is delayed and prolonged for institutional reasons. For example, prices established by contract, advertisement, and even word of mouth cannot be changed quickly. Also, regulated prices are not allowed to change "on demand." But, whatever the reasons, in theory, and as will be demonstrated in fact, over the long haul as well, accelerated money growth tends to be fully dissipated in faster inflation.

Summary of the Model's Hypotheses

The hypotheses of our model concerning real GNP growth are as follows. Real GNP growth this year depends on its secular trend and—

(1) Last year's inflation, measured by the percentage change in the price of real GNP (the GNP deflator) from the year before last;

(2) Last year's rate of unemployment;

(3) Last year's change, scaled by potential real GNP, in the Federal Government's deficit (or expenditures and revenue);

(4) This year's percentage change in the price of imported oil landed in the United States; and

(5) Last year's percentage change in M1B.

Briefly, the reasoning underlying the selection of these factors is as follows:

On the supply side:

Current year production cost is higher and hence current real GNP growth is lower, the higher inflation was a year ago when many current wage rates and other input prices were contracted or otherwise fixed.

The more unemployment and slack there was in labor and other input markets a year ago, the lower production cost is this year because of contractual and other lags, and therefore the higher current output is.

Current year production and work incentives are stronger, and, therefore, current year real GNP growth is higher, the more the deficit increased (or expenditures increased and revenue decreased) last year.

Increases in the price of imported oil landed in the United States increase production cost directly by rendering part of the capital stock obsolete, and this reduces real GNP growth concurrently.

On the demand side:

Year ago increases in both money growth and fiscal stimulus directly increase this year's aggregate demand, and thereby this year's real GNP growth is increased.

Our hypotheses concerning inflation are that it depends on—

(1) Past changes in money supply operating on the demand side;

(2) Past changes in the deficit operating on both the demand side and the supply side; and

(3) The model's other cost factors which operate on the supply side.

Briefly, the arguments here are as follows:

On the demand side:

In the short run, money supply changes impact on inflation through their effects on constant dollar GNP growth. If money growth is increased, real GNP growth rises (temporarily) and the pressure of increased supplies of goods and services dampens inflation. In the long run, as regulatory, contractual, and other rigidities give way, changes in M1B growth result in proportional or nearly proportional increases in the rate of inflation. The growth of real GNP returns to its initial rate.

On both the supply side and the demand side:

Increases in the deficit increase both aggregate demand and aggregate supply. Increased aggregate demand pulls up prices and the rate of inflation and impels increased production. Increased aggregate supply directly increases production. In turn, the pressure of increased supply tends to restrain inflation. Thus, while increases in the deficit unambiguously operate to increase real GNP growth, their impact on the rate of inflation cannot

be settled a priori. The question is empirical. The tests which we report and discuss in the next section of this Chapter are intended to shed light on the matter.

On the supply side:

The model's other cost factors (other than the change in fiscal stimulus) also impact on inflation through their effects on real or constant dollar GNP growth. Year ago decreases in unemployment and increases in inflation, and current increases in the price of imported oil, all operate to increase current production cost, and thereby to decrease real GNP growth. In turn, this reduces supply-side pressures to lower prices or keep them in check. Inflation tends to rise.

Estimating and Testing the Model

To measure the model's explanatory power and test the validity of the hypotheses which have been deduced from it, the reduced form equations for %CHG–CON$GNP and %CHG–GNPDEF were fitted by U.S. data for the 1956 to 1975 period using standard linear regression techniques. The estimated reduced form equations were then used to predict real GNP growth and inflation in the 1976 to 1981 period.

The estimating period was confined to 1956 to 1975 for two reasons. One was to avoid the extremely powerful special influences that operated in the U.S. economy during the Korean War and its immediate aftermath. The second was to provide room at this end of history to allow us to test how well the model's reduced form equations forecast real GNP growth and inflation outside the period that was used to estimate these equations.

The data that were used in the regressions of this report are the latest available revised data. Regression results that were reported in the study issued by the Domestic Monetary Policy Subcommittee of the House Banking Committee in December 1980 used the latest data available in the summer of 1980. The revisions since then have not been trivial. For example, in 1974, measured year on year, real GNP growth was revised up by .8 percentage point and the increase in the GNP deflator was decreased 1 percentage point. Important revisions also have been made in the potential GNP series, which is the index used to scale changes in the deficit, spending, and revenue, and in the series on the price of imported oil. Thus, the results reported in this report differ somewhat from those we reported in 1980.

The Regressions of Constant Dollar GNP Growth

The regression statistics that were obtained by fitting the reduced form equation for %CHG–CON$GNP are tabulated in Table 3. These results are discussed immediately after reviewing how the variables that were used in the regressions are defined and measured.

Dependent Variable.—The dependent variable of the regressions whose results are reported in Table 3 is the percentage change in constant dollar GNP measured from one whole year to the next. For example, in 1975, constant dollar GNP, as now measured by the Department of Commerce (for the whole year), dropped 1.1 percent below its 1974 level. Hence, minus 1.1 percent is the actual value of

the dependent variable for 1975. As previously noted, constant dollar GNP growth is denoted %CHG–CON$GNP.

Independent Variables.—The independent or explanatory variables listed in the order in which they are presented in Table 3, are as follows:

%CHG–M1B$_{-1}$ which denotes the percentage change in M1B a year ago. The change is measured from one whole year to the next. Specifically, yearly percentage changes in M1B were computed by dividing last year's average quantity of money into this year's average quantity of money. They were entered in the regressions lagged one year.

%CHG–GNPDEF$_{-1}$ which denotes the percentage change in the rate of inflation a year ago. This variable is measured by the percentage change in the GNP price deflator from one whole year to the next. Specifically, yearly percentage changes in the deflator were computed by dividing last year's average price level into this year's average price level, and entered in the regressions lagged one year.

UNY$_{-1}$ which denotes the average rate of unemployment a year ago.

%CHG–IMOIL–P which denotes the percentage change in the price of a barrel of imported oil landed in the United States this year. The change here is also measured from one whole year to the next by dividing last year's average price into this year's. However, this variable is not lagged. It enters the regressions concurrently with the dependent variable, %CHG–CONGNP.

DCHG$_{-1}$ which denotes last year's change in the Federal Government's budget deficit scaled by an index of potential GNP. This variable was computed in two steps as follows. First, the deficit recorded for each calendar year was divided by the index of potential GNP. The index uses potential GNP in 1967 as the base year and sets its value equal to 1. Second, the result for last year was subtracted from the result for two years ago. To illustrate, in 1958, the scaled deficit was $14.24 billion. In 1957, there was a $3.27 billion surplus (scaled). Subtracting minus $14.24 billion from plus $3.27 billion, we find that the deficit rose by $17.51 billion in 1958. Again, in 1979, the scaled deficit was $9.84 billion. In 1978, it was $20.01 billion. Subtracting minus $9.84 billion from minus $20.01 billion, we find that the deficit fell by $10.17 billion. This variable was used in the regressions whose results are reported in Columns 1 and 3.

RCHG$_{-1}$ which denotes last year's change in the Federal Government's revenue scaled by the index of potential GNP. This variable was computed by first dividing each calendar year's revenue by the index of potential GNP and then subtracting the result for two years ago from the result for last year. It was used in the regression whose results are reported in Column 2.

ECHG$_{-1}$ which denotes last year's change in the Federal Government's expenditures scaled by potential GNP. This variable was computed by first dividing each calendar year's expenditures by the index of potential GNP and then subtracting the scaled statistic for two years ago from the scaled result for last year.

This variable was used in the regression whose results are reported in Column 2.

The results reported in Table 3 indicate that during the 1956 to 1975 period, the growth of U.S. output, measured by year-on-year percentage changes in constant dollar GNP, was powerfully affected by the reduced form equation's independent variables or predictors, together with secular labor force growth and technological advances and innovations. Collectively, these factors explain over 85 percent of year-on-year percentage changes in constant dollar GNP during the 1956 to 1975 period. Second, the predicted value of constant dollar or real GNP growth can be expected to be within 1.8 percent of the actual value 95 percent of the time. These conclusions hold for all of the regressions whose results are reported in Table 3.

TABLE 3.—REGRESSIONS OF THE REDUCED FORM OF %CHG-CON$GNP, 1956 TO 1975

	Ordinary least squares	Ordinary least squares	Hildreth-Lu
Constant	0.185 (1.40)	0.215 (1.39)	0.202 (1.17)
%CHG—M1B$_{-1}$	.856 (.122)	.900 (.128)	.885 (.098)
%CHG—GNPDEF$_{-1}$	−1.15 (.139)	−1.08 (.153)	−1.17 (.123)
UNY$_{-1}$	.781 (.240)	.760 (.238)	.775 (.195)
Percent change—IMOIL-P	−.015 (.005)	−.015 (.005)	−.015 (.005)
DCHG$_{-1}$	.090 (.024)		.079 (.022)
RCHG$_{-1}$		−.111 (.031)	
ECHG$_{-1}$		.058 (.038)	
Adj R	.87	.87	.90
D-W	2.71	2.85	2.03
SE	.89	.88	.83

Note: Numbers in parentheses next to the coefficients are their standard errors.

The Column 1 and 2 regressions exhibit negative autocorrelation. However, as shown by comparing the statistics in Columns 3 and 1, when the Column 1 equation is regressed using the Hildreth-Lu procedure to correct for autocorrelation, the values of the coefficients on the independent variables are substantially unchanged in value and significance and the Durbin-Watson statistic drops to 2.03.

Table 3 also lists estimates of the direct or partial effects of the independent variables or predictors on the value of constant dollar GNP growth, and provides statistics which permit us to estimate the effect of labor force growth and technological advances and innovations. Specifically, the coefficients of the regressions reported in Table 3 indicate that:

> Secular labor force growth and technological advances and innovations combined during the 1956 to 1975 period to increase constant dollar GNP, on average, by between 4.02 and 4.09 percent per year. These measures of the impact of labor force growth and technological change on real GNP growth take into consideration both direct supply-side effects and indirect effects operating via demand. They were computed by assuming zero M1B growth and inflation, no change in the measures of fiscal policy, and no change in the price of imported oil, and then calculating %CHG-CON$GNP using the values of the constant terms and the unemployment coefficients, together with the estimated value of non-recession unemployment in the post-Korean War period. For example, using the constant term and the unemployment co-

efficient reported in Column 1 of Table 3 and estimating non-recession unemployment as 5.0 percent,[1] we have that secular growth in constant dollar GNP equalled:

$$-.185+.781(5)=4.09\%$$

Second, on average, during the 1956 to 1975 period, a 1 percent increase in M1B increased constant dollar GNP between .86 and .90 percent the following year, and a 1 percent decrease in M1B decreased real GNP between .86 and .90 percent a year later. However, a caveat is in order here. This effect measures only the direct or short-run impact of M1B growth on our economy's output of GNP goods and services in the test period. There also were and are indirect effects.

The indirect effects reflect the impact of M1B growth on the equation's other predictors, most importantly inflation, and their impact on real GNP growth. In the final analysis, when both the direct and indirect effects of changes in M1B are taken into account, and sufficient time passes for the economy to fully adjust to these changes, the growth of real GNP is unchanged. Thus, although recessions can and have been triggered and exacerbated and recoveries propelled by changing money growth, in the final analysis, measured real GNP growth is invariant with respect to money growth. However, this does not mean that money growth which is high enough to generate inflation is costless. There are substantial costs from inflation, including dead-weight production losses because of higher search and shopping costs; increased trading in financial hedges, precious metals, etc.; the shortening of investment horizons; and increased regulation and litigation. Inflation also has incidental distributive effects that are not necessarily welcome.

Third, on average, a 1 percent change in the GNP price deflator changed real GNP between 1.08 and 1.17 percent a year later. Increases in the rate of inflation acted to decrease real GNP growth and decreases operated to increase it, cancelling the effects of money growth increases and decreases, with which they must be viewed in conjunction, as discussed above.

Fourth, the economy was resilient in the 1956 to 1975 period. On average, a 1 percentage point rise in the unemployment rate one year, consistent with the model's hypothesis that increases in unemployment reduce production costs with a lag, was followed by a .76 to .78 percent increase in constant dollar GNP the following year. Conversely, a 1 percentage point fall in unemployment one year was followed by a .76 to .78 percent decrease in real GNP the next year.

Fifth, on average, changes in the scaled deficit generated positive changes in real GNP after a lag of one year. On average, a $10 billion rise in the scaled deficit, which requires about a $16 billion increase in 1981 dollars, increased constant dollar GNP .8 to .9 percent, again with a one-year lag. Revenue changes were a more powerful influence than expenditures changes. As shown

[1] Unemployment in the post-Korean War period averaged 5.2 percent. However, excluding peak unemployment years following or coinciding with recession years (1958, 1961, 1970, and 1975), it was 4.8 percent. It is reasonably urged, therefore, that "non-recession" unemployment averaged 5 percent during the 1956 to 1975 period.

by the results reported in Column 2, the $RCHG_{-1}$ coefficient is substantially larger than the $ECHG_{-1}$ coefficient. These results indicate that a $10 billion rise in scaled revenues operated to decrease constant dollar GNP by 1.11 percent the following year, and a $10 billion fall in scaled revenues operated to increase real GNP by 1.11 percent a year later. In the case of scaled expenditures, a $10 billion increase increased real GNP the following year by only .58 percent, and a $10 billion decrease decreased it by the same amount. Moreover, in the case of changes in expenditures, we are much less certain about the result than in the case of changes in revenue. This is because the coefficient on $ECHG_{-1}$ is only 1.5 times as large as its standard error, whereas the coefficient on $RCHG_{-1}$ is 3.6 times its standard error. However, it should be noted that our research into the separate impacts of expenditures and revenue is far from definitive. This is because different expenditure and revenue streams have different impacts. We did not try to distinguish among expenditure and revenue streams.

Finally, the results indicate that, on average, doubling the price of the oil which we import from abroad acted to decrease our production of GNP goods and services by 1.5 percent in the same year that the oil was landed here. In the 1956 to 1975 test period, the price of a barrel of imported oil landed in the United States increased by 219.83 percent in 1974 but otherwise changed relatively little—28 percent in 1973 and no more than 12 percent in any other year. Using the Column 1 coefficient value for %CHG–IMOIL–P, the rise of the price of the oil which we imported in 1974 explains 3.3 percentage points of the 6.4 percentage point drop in real GNP growth that year (from 5.8 to −0.6 percent), where 3.2 percent=.015 (219.83 percent). Other than in 1974, through 1975, the value of %CHG–IMOIL–P multiplied by its coefficient did not exceed one-half percentage point.

For the post-1975 period, the largest increase in the price of imported oil landed in the United States was in 1980. (Keep in mind that %CHG–IMOIL–P is measured from one whole year to the next.) The 65 percent rise in the price of imported oil in 1980 converts to a 1.0 percent decrease in 1980's constant dollar GNP below what it otherwise would have been.

The Acid Test

The acid test of a model is how well its estimated reduced form equations forecast values of the dependent variables outside the estimation period. The regression whose results are reported in Column 1 of Table 3 was used to make the acid test with respect to real GNP growth. In summary, its forecast values fit the data on constant dollar GNP growth reasonably well in the years 1976 to 1980 which follow immediately after the estimating period, especially considering the volatility of real GNP growth during these years. The forecast for 1981 also appears to be reasonably close to the mark at this time. In making the 1981 forecast, it was assumed that the price of imported oil would average the same in 1981 as in the final quarter of 1980. Actual values of year-on-year constant dollar GNP growth in the 1976 to 1981 period are assembled below together with the values forecast by the regression results.

TABLE 4.—ACTUAL AND FORECAST %CHG-CON$GNP VALUES

Year	Actual	Forecast	Difference
1			
1976	5.40	3.81	1.59
1977	5.50	3.64	1.86
1978	4.80	4.90	−.10
979	3.20	1.76	1.44
1980	−.20	−.28	.08
1981		3.64	

The Inflation Regressions

We continue the discussion of our regression results with the statistics that were obtained by fitting the reduced form equation for inflation. These statistics are assembled in Table 5.

The regressions whose results are reported in Table 5 used the same predictors as the Table 3 regressions, except that %CHG–MW_{-2} was used instead of %CHG–$M1B_{-1}$. The new measure was designed to capture our hypothesis that the response of the GNP price deflator to changes in M1B is delayed and prolonged compared to the response of real GNP. The new variable, %CHG–MW_{-2}, abbreviates an arbitrarily weighted average of %CHG–M1B values, lagged two years. Specifically, the weighted average itself, %CHG–MW, equals four times the current year percentage change in M1B, plus twice last year's change, plus the change that occurred two years ago, divided by the sum of the weights, 7. As indicated by the subscript −2, %CHG–MW_{-2} is lagged two years in the inflation regressions.

The lag structure embodied in %CHG–MW_{-2} is, of course, experimental. We do not claim that it captures the "actual" distribution of the lags which is encountered before changes in M1B produce changes in inflation. Indeed, we do not believe that there is a unique invariant distribution. However, for discovery purposes, we have invented one by arbitrarily dividing the economy's adjustment to changes in money growth into three stages. In the first period (or year), changes in M1B growth impact on financial markets. If M1B growth rises, financial assets are purchased and interest rates are bid down. Incremental money flows are parked temporarily in financial assets until new orders for goods and services can be filled.

In the second period (or year) following a rise in M1B growth, real GNP growth increases. During this period, financial assets are liquidated to pay for the incremental output and hence interest rates now begin to rise. However, the pressure of increased supplies on prices in general keeps the GNP deflator from rising even though commodity and shelf goods prices increase.

In the third period (or year), inflation increases. In turn, there are corollary increases in production costs which engender production cutbacks that wipe out the second period's gains in real GNP growth. Add also that increased inflation makes people more anxious to issue financial assets (borrow) and more reluctant to buy or hold them (lend), which drives interest rates above their initial level commensurate with the added inflation.

In fact, there are no clear-cut lines between our discovery periods. Some new orders can be filled promptly by new production. Some prices adjust quickly. However, early on, changes in real GNP growth

dominate. Interest rate changes that result directly from changes in M1B growth are trivial and short lived. As time passes, they follow consequent to the induced changes in real GNP growth and inflation and rise commensurately with the initial change in money growth.

Almon lag regressions whose results are reported in our 1980 Study for the Domestic Monetary Policy Subcommittee provide supportive evidence for the three-period sequence and also indicate that there are no clear cut lines between the three periods. In particular, there is some change in real GNP growth in the same period that M1B growth is changed. Nevertheless, we deliberately delayed the response one year in order to avoid problems of simultaneity bias in estimating our model. In the same vein, to keep changes in the rate of inflation behind changes in real GNP growth, we delayed the adjustment of inflation two to four years. However, as was shown in our 1980 study, using %CHG–MW at t–1 instead of t–2 does not require changing any of our conclusions in a substantive way.

In using $\%CHG–MW_{-2}$, we are postulating that it takes two to four years for changes in money growth to change the rate of inflation. More than half of the impact is hypothesized to occur in the second year after the change in money growth, another two-sevenths the third year and the final seventh in the fourth year.

TABLE 5.—REGRESSIONS OF THE REDUCED FORM OF %CHG-GNPDEF, 1956 TO 1975

	Ordinary least squares	Ordinary least squares	Orbinary least squares [1]
Constant	−0.863 (1.30)	−0.938 (1.27)	0.086 (0.353)
$\%CHG–MW_{-2}$	.546 (.211)	.519 (.206)	.489 (.189)
$\%CHG–GNPDEF_{-1}$	.511 (.202)	.435 (.205)	.534 (.191)
UNY_{-1}	.169 (.223)	.188 (.217)	
%CHG–IMOIL–P	.010 (.004)	.009 (.004)	.011 (.004)
$DCHG_{-1}$	.010 (.021)		
$RCHG_{-1}$		.030 (.025)	
$ECHG_{-1}$		.024 (.033)	
Adj R	.89	.89	.90
D–W	2.09	2.42	2.28
SE	.78	.76	.75

[1] This regression omits those independent variables that were revealed to be statistically insignificant in the column 1 and column 2 regressions.

Note: numbers in parentheses next to the coefficients are their standard errors.

The results presented in Table 5 indicate that during the 1956 to 1957 period, the rate of inflation in the United States was, in the proximate or immediate sense, dominated by past money growth and past inflation. Specifically:

On average, accelerating the growth of M1B by 1 percentage point directly increased the rate of inflation about ½ (.49 to .55) percentage point. By experimental design, the process was delayed two years and took four years to complete.

In turn, increases in the rate of inflation one year later engendered still further acceleration of inflation the next year. On average, a 1 percentage point rise in the GNP price deflator one year was followed by a .44 to .53 percentage point increase the following year.

The price of oil imported from abroad acted to increase the GNP price deflator about 2 percentage points in 1974, but otherwise played only a minor role in our inflation experience. In no

other year did the price of imported oil rise enough during the 1956 to 1975 test period to increase the GNP rate of inflation more than three-tenths of a percentage point.

The level of unemployment did not play a statistically significant role in our inflation experience in the 1956 to 1975 period.

Finally, and for this report, most important, neither changes in the deficit, nor changes in its roots—expenditures and revenue—had a statistically significant effect on the rate of inflation.

The regressions whose results are reported in Table 5 explain nearly 90 percent of year-to-year changes in the GNP inflation rate in the 1956 to 1975 period. The predicted value of %CHG-GNPDEF can be expected to be within 1.6 percentage points of the actual value 95 percent of the time.

Post-1975 Forecasts

Predictions made from the regression whose results are reported in Column 1 of Table 5 fit the data on inflation reasonably well in the 1976 to 1980 period, and based on data now available, it also appears that the regression equation's forecast will be close to the mark this year. Actual values of yearly inflation are assembled in Table 6 together with values that were projected by multiplying the regression coefficients in Column 1 of Table 5 by the actual 1976 to 1981 values of the independent variables or predictors, and summing together with the value of the constant term.

TABLE 6.—ACTUAL AND FORECAST %CHG-GNPDEF VALUES

Year	Actual	Forecast	Difference
1976	5.20	8.16	−2.96
1977	5.80	6.08	−.28
1978	7.30	6.18	1.12
1979	8.50	7.97	.53
1980	9.00	9.34	−.34
1981		8.90	

IV. POLICY IMPLICATIONS

Our economy's performance in recent years has been unsatisfactory. We have experienced persistent and increasingly virulent inflation for over a decade. Interest rates have risen with and because of inflation. Real growth dropped sharply in 1979 and precipitously in 1980, and although it rose at an annual rate of 8.5 percent in the first quarter of 1981, it is unlikely to average more than 4 percent in 1981 as a whole versus 1980 as a whole. Finally, unemployment rose sharply in the early part of the 1980's, remained around 7.5 percent during the latter part of 1980, and appears to be drifting still higher this year.

The Roles Played by Monetary and Fiscal Policies

Poor monetary and fiscal policies have contributed to the Nation's economic ills as discussed next.

Monetary Policy

By allowing or causing (and it does not matter which) the Nation's means of payment, M1B, to grow at annual rates averaging nearly 6.5 percent in the period since 1968 and nearly 7.5 percent since 1976, the Federal Reserve financed the persistent and increasingly virulent inflation that we have suffered since the late 1960's. Make no mistake about it, although inflation can be triggered or worsened by supply-side shocks such as the 219 percent increase in the price of imported oil in 1974, or demand shocks such as occurred at the start of the Korean War which increased the rate of rise of M1B's velocity, in a random world inflationary shocks do not occur endlessly. Persistent inflation, to paraphrase Edna St. Vincent Millay, is not due to one darn thing after another, but to the same thing over and over again. The recurring inflationary event is fast money growth.

Our results show convincingly that in the final analysis accelerated money growth is fully dissipated in faster inflation. For the steady state situation, in which both the price of imported oil and the size of the deficit relative to the economy are fixed, where unemployment equals its average nonrecession rate of 5 percent, and both M1B growth (and hence %CHG-MW) and the rate of inflation are the same year after year, we have, using the Column 1 regression of Table 5, that yearly inflation is nonexistent when M1B growth is zero, and rises by 1.12 percentage points for every percentage point of yearly M1B growth. Using the regression whose results are reported in Column 3 of Table 6, there is no inflation when M1B growth is zero but yearly inflation increases by 1.05 percent for every 1 percentage point of yearly M1B growth.

Our results confirm the classical postulate that increases in the stock of money are fully dissipated in proportional increases in the level of prices.

Do increases in the deficit, decreases in revenue, and increases in spending increase aggregate demand? The answer is "yes."

Do they increase aggregate supply? Again, the answer is "yes."

Do changes in the deficit, expenditures, and revenue affect real GNP? The answer is "yes." Because increases in the deficit and expenditures and decreases in revenue increase both aggregate demand and aggregate supply, this result is certain as a matter of logical deduction.

Are increases in the deficit and expenditures and decreases in revenue inflationary? Because increases in the deficit and expenditures and decreases in revenue increase both aggregate demand and aggregate supply, the question cannot be settled by a prior argument. However, our regression results indicate that the answer is "no."

Our regression results show that the rate of GNP inflation is closely related to past money growth. On occasion (1974 and 1980) it also has been linked to contemporaneous changes in the price of imported oil. However, in our regressions inflation is not significantly affected by changes in the deficit, expenditures, or revenue.

In contrast, our results show that real GNP growth is significantly affected by changes in fiscal stimulus in the preceding year. Specifically, in today's terms, an increase in the deficit of $35 billion increases real GNP the following year by 1.8 to 2.1 percent. (Its growth rate rises that year by 1.8 to 2.1 percentage points. The computation is as follows: $35 billion scaled equals $23 billion. Multiplying $23 billion by .079, the Hildreth-Lu coefficient, and .090, the Column 1, Table 3 coefficient, we obtain 1.8 to 2.1 percent.) Converting back to dollars, we have that real GNP increases by 47 to 55 billion 1980 dollars. The multiplier is thus 1.34 to 1.57. A somewhat more powerful result is indicated for changes in revenues. A decrease in revenues of $35 billion increases real GNP the following year by 2.55 percent. The dollar rise is $67 billion in 1981 dollars. The multiplier is 1.91. Changes in expenditures have a smaller impact. A $35 billion increase in expenditures increases real GNP only 1.34 percent. The dollar rise is $35 billion. The multiplier is exactly 1. Furthermore, as already noted, the coefficient on expenditures is not statistically significant.

Viewed together, the inflation and real GNP growth fiscal policy regression coefficients provide strong indirect evidence that new fiscal stimulus, especially from tax cuts, increases both aggregate demand and aggregate supply. The positive coefficients in the real GNP growth regressions would not have been found unless new fiscal stimulus acted to increase either aggregate demand, aggregate supply, or both. The insignificant coefficients in the inflation regressions mean that both aggregate demand and aggregate supply are increased if either one is. For, except in the special case where the aggregate supply schedule is infinitely elastic, new fiscal stimulus must increase inflation if aggregate demand is increased and there is no supply-side effect. Conversely, new fiscal stimulus must decrease inflation if only aggregate supply is increased.

Because the results show that inflation is not affected by new fiscal stimulus, and that real GNP growth is, we can be reasonably certain

that new fiscal stimulus increases both aggregate demand and aggregate supply.

Finally, in this regard, recall that our theoretical analysis indicated that an observed $35 billion increase in the deficit would increase the rate of rise of M1B's velocity by 2 percentage points in the long run. Holding M1B's rate of growth constant, the growth rate of nominal GNP necessarily also would rise by 2 percentage points. Our statistical results tend to confirm this analysis. As just noted, in 1980 dollars, an observed $35 billion increase in the deficit is estimated to increase real and nominal GNP by 1.8 to 2.1 percent.

However, we stress again that, in the final analysis, a $35 billion static tax cut, after feedback tax flows are taken into account, would be observed as a $23 billion increase in the deficit. Thus, we can expect to observe only a 1.1 to 1.5 percent rise in nominal and real GNP from a $35 billion tax cut. That, however, is far from trivial.

Does it matter whether changes in the deficit derive from expenditure changes or revenue changes? The answer is "yes." As discussed above, the real GNP multiplier is larger for revenue changes than it is for expenditure changes. These results are consistent with our earlier a priori arguments that most spending changes do not affect incentives to work and save, and some spending increases actually operate as work disincentives, while tax changes have important positive supply-side effects. Those who think that, to borrow from Gertrude Stein, "a change in the deficit is a change in the deficit, is a change in the deficit" are wrong. Deficit changes that stem from decreases in revenue have supply-side effects. These effects magnify the impact of deficit increases on real GNP growth, as compared to increases that stem from spending increases, and keep them from being inflationary.

Finally, does it matter how deficit increases are financed? Here, too, the answer is "yes." Inflation results if deficit increases are financed by accelerating money growth. Our regression results show convincingly that in the final analysis accelerated money growth is fully dissipated in faster inflation, but that holding money growth constant, inflation is not significantly effected by changes in the deficit, expenditures, or revenue.

Recommendations

Two unequivocal recommendations follow from our analyses and statistical results. First, M1B growth must be reduced to no more than 2 to 3 percent per year if we are to stop inflation and reduce interest rates, and it must be kept there if we are to keep both the price level and interest rates relatively stable. Second, marginal tax rates must be reduced. Tax cuts can help substantially to maintain real GNP growth and unemployment at normal levels in the short run, and to increase saving, capital formation, and real GNP growth in the long run, even while monetary growth is reduced to a sustainable noninflationary rate and kept there.

Policies consistent with these recommendations broke the back of the virulent inflation which we suffered after World War II without causing prolonged recession.

In that period, inflation—measured by the year-on-year percentage rise in the GNP deflator—dropped from 15.7 percent in 1946 to 12.9 percent in 1947, to 6.9 percent in 1948, and to minus 0.9 percent in

1949. Real GNP growth, which had recovered from the enormous fall in defense spending in 1946, to rise at a 4.1 percent rate in 1948, fell to 0.5 percent in 1949. The 1949 decline reflected a recession that began in November 1948 and ended a year later, more than six months before the Korean War.

The economy's performance in the late 1940's was profoundly influenced by a sharp, prolonged deceleration in money growth. Measured year on year, the stock of money grew 16 percent in 1945, 7.3 percent in 1946, 5 percent in 1947, and one-half percent in 1948, and fell 1 percent in 1949. Given this order of deceleration in money growth, it is not surprising that inflation, virulent as it was in 1946 and 1947, was broken, or that real growth dropped below zero in 1949.

The wonder is that real GNP growth did not decline much more. That it did not was due to a tax cut which Congress passed over President Truman's veto in the Spring of 1948. Personal marginal tax rates were cut between 10 and 20 percent. As reported by Bruce R. Bartlett [1981, p. 110], Deputy Director of the Joint Economic Committee staff, "Although Keynesian economists of the time had opposed the tax cuts on the grounds it would be inflationary, this proved not to be the case. In fact, as it turned out, the country was on the brink of a recession. Thus, the current judgment of the 1948 tax cut is that it was enacted just in time, making the subsequent recession much milder than it would otherwise have been."

The combination of decelerating money growth and tax cuts also stopped inflation in West Germany after OPEC increased the price of its crude oil in 1974 with only a short interruption in economic growth. As reported by Richard Medley [U.S. Congress, 1981b, pp. 132–133], in a study prepared by the Democratic staff of the Joint Economic Committee, West Germany responded to the oil price shock of 1973–74 on the fiscal front by "reintroduction of depreciation tax credits, and the abolition of investment taxes." At the same time, "the Bundesbank announced that it would continue to pursue its restrictive monetary policies in full force."

This combination of supply-side economics and monetarism worked. The oil cost push was not translated into increased prices in general. Inflation was held to 7 percent in 1973–74 and reduced to 2.5 percent in 1978. Wage increases, which had accelerated to an average of 13 percent in 1974, dropped to an average of 7 percent in 1975. There was a recession, but it was mild and short lived. In 1976, Germany's GNP rose 5.3 percent, and the recovery continued "to pick up steam through 1978 and 1979."

Taken together, our results and the experiences of the U.S. economy in the late 1940's and of West Germany in the 1970's suggest that President Reagan is right to have embraced both supply-side economics and monetarism. Those who now disagree will later welcome the results of implementing these policies.

V. FOREIGN EXPERIENCE

Based on our results, increases in the deficit do not have inflationary consequences. That finding contradicts the widely held view that deficits are inflationary. However, as Leon Taub [1980, A–23] has pointed out, "it is not just in the United States that the size of budget deficits and the rate of inflation seem unrelated."

Taub [A–25] presents graphic evidence for Germany, Japan, France, the United Kingdom, Canada, and Italy. He plots inflation against budget deficits measured as a proportion of GNP the previous year. Data for the 1954 to 1979 period are charted and observations for 1974 to 1979 are so indicated. His figures are reproduced here. Before proceeding, it is important to note that Taub graphs the deficit as a negative number. We entered increases in the deficit as positive numbers in our regressions. Thus, following conventional wisdom, we should have found a direct relationship between inflation and deficit increases. The way Taub graphs the data, the expected relationship is inverse.

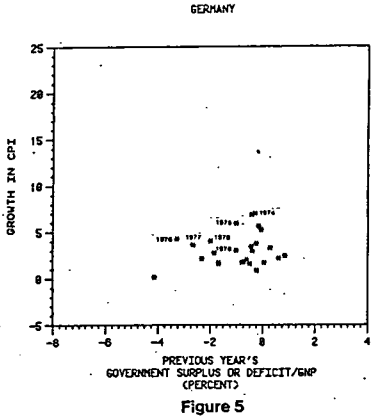

Figure 5

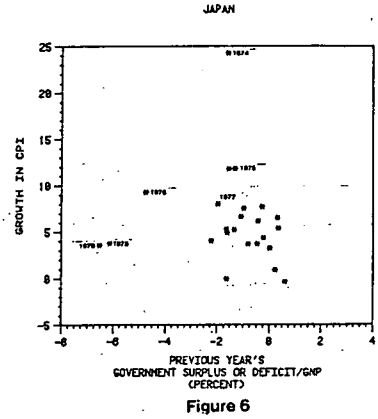

Figure 6

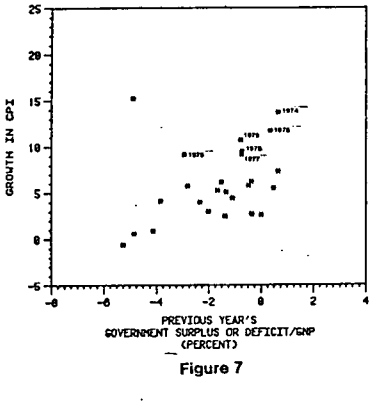

Figure 7

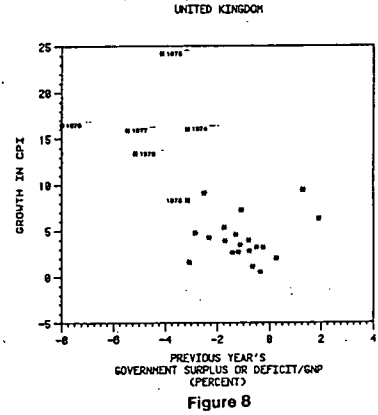

Figure 8

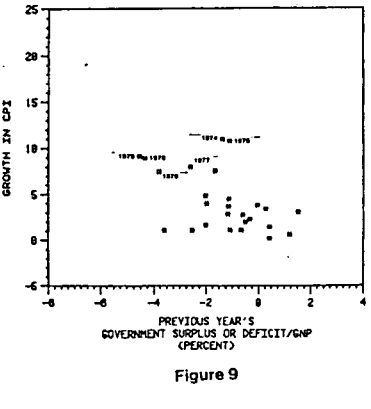

Figure 9

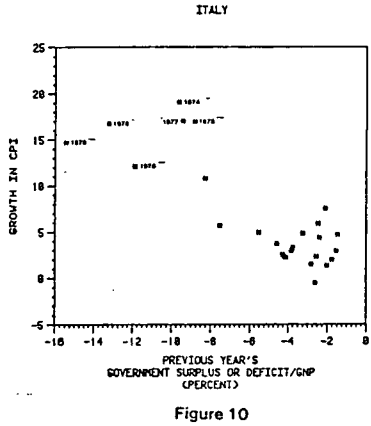

Figure 10

Taub [A–26] draws the following conclusions from his graphs:

1. For most nations there appears to be no clear relationship between budget deficits and inflation. The data for Germany, Japan and Canada show no relationship at all between the size of the deficit and the rate of inflation. The data for France show a direct (rather than the expected inverse) relationship. Only the data for Italy (which it should be noted is on a different "X" axis) and the United Kingdom show any evidence of the expected inverse relationship. Furthermore, even for these countries, no relationship between deficits and inflation is apparent when the post-1973 years are segregated from the earlier years.

2. For all nations inflation has been higher in the post-embargo environment than it was before the oil embargo. Japan and Germany had considerable success in controlling inflation during the years 1978–1979. Nevertheless, for every country the post-1973 rate of inflation was significantly greater than the pre-1974 rate.

3. It is even uncertain as to whether or not huge continuing deficits add to a nation's rate of inflation. During the middle to late 1970's, Italy and the United Kingdom consistently ran deficits equal to 4 percent or more of GNP. The rate of inflation for these countries in recent years appears to have been significantly worse than average. Further evidence of a nonlinearity in the relationship (i.e., that large budget deficits add to inflation even if small budget deficits do not) do not exist since these two countries are the only ones in which larger deficits appear to be associated with higher inflation.

However, as noted above the data for Italy and the United Kingdom, when split into pre-OPEC and post-OPEC periods, are ambiguous. Furthermore, aside from Italy and the United Kingdom, relatively high deficit countries do not appear to have significantly greater inflation than low deficit countries. Despite its budgetary virtue, France appears to have had a worse experience with inflation than either Japan, Germany, or Canada. Japan, in particular, ran quite large deficits in the late 1970's without paying any apparent inflation penalty. Therefore, the high deficits and high inflation in Italy and Great Britain hardly provide conclusive pieces of information. It may simply be that other serious economic ills have led to both high inflation and large budget deficits.

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APPENDIX

CHANGES IN VELOCITY AND THE SCALED DEFICIT[1]

Term	Coefficient	Standard error
Constant	3.06	0.175
DCHG at:		
Zero lag	.018	.014
t–1	.013	.012
t–2	.009	.011
t–3	.005	.010
t–4	.001	.010
t–5	–.003	.011
t–6	–.006	.011
t–7	–.008	.011
t–8	–.011	.011
t–9	–.012	.011
t–10	–.014	.011
t–11	–.015	.011
t–12	–.016	.011
t–13	–.016	.012
t–14	–.016	.013
t–15	–.016	.016
Sum of lags	–.087	
Adj. R	.04	
S.E.	.71	

[1] Almon lag regression, quarterly data, 1962:4–1981:1. Dependent variable is M1B's velocity measured as the percent per year change from one quarter to the next. Independent variable is the dollar change in the scaled deficit between adjacent quarters.

O