The Automatic Fiscal Stabilizers: Quietly Doing Their Thing[1]

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Abstract

This paper presents theoretical and empirical analysis of automatic fiscal stabilizers, such as the income tax and unemployment insurance benefits. Using the modern theory of consumption behavior, we identify several channels--insurance effects, wealth effects and liquidity constraints--through which the optimal reaction of household consumption plans to aggregate income shocks is tempered by the automatic fiscal stabilizers. In addition we identify a cash flow channel for investment.

The empirical importance of automatic stabilizers is addressed in several ways. We estimate elasticities of the various federal taxes with respect to their tax bases and responses of certain components of federal spending to changes in the unemployment rate. Such estimates are useful for analysts who forecast federal revenues and spending; the estimates also allow high-employment or cyclically-adjusted federal tax receipts and expenditures to be estimated. Using frequency domain techniques, we confirm that the relationships found in the time domain are strong at the business cycle frequencies. Using the FRB/US macro-econometric model of the United States economy, the automatic fiscal stabilizers are found to play a modest role at damping the short-run effect of aggregate demand shocks on real GDP, reducing the "multiplier" by about 10 percent. Very little stabilization is provided in the case of an aggregate supply shock.

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I. Introduction

The cyclical nature of the U.S. economy has undergone profound changes over the past century. As carefully documented by Francis Diebold and Glenn Rudebusch (1992) and by Christina Romer (1999), since World War II, recessions have become less frequent and business expansions have become substantially longer. In addition, Romer (1999) argues that recessions are now less severe: output loss during recessions is about 6 percent smaller on average in the post-World War II period than in the 30-year period prior to World War I and substantially smaller than in the 1920 to 1940 interwar period. Further, the variance of output growth has declined as well. Romer attributes these changes largely to the rise of macroeconomic policy after World War II; in particular, the automatic fiscal stabilizers--including the income-based tax system and unemployment insurance benefits--are argued to have played a prominent role in converting some periods of likely recession into periods of normal growth as well as in boosting growth in the first year following recession troughs. Given the Keynesian style models used by Romer to support her claims, one would expect that personal consumption also would have been stabilized since World War II. Indeed, Susanto Basu and Alan Taylor (1999) present evidence that the volatility of aggregate U.S. consumption has declined in the post-war period.

This paper presents theoretical and empirical analysis of automatic fiscal stabilizers. Using the modern theory of consumption behavior, we identify several channels through which optimal reaction of household consumption plans to aggregate income shocks is tempered by the automatic fiscal stabilizers. Such automatic stabilization occurs even when households have full understanding of the constraints on their behavior implied by the government's intertemporal budget constraint and have full awareness of the difference between aggregate and idiosyncratic shocks to their labor income. This does not necessarily imply that the current fiscal stabilizers in the United States are set at optimal levels; the analysis of optimal tax rates, for example, is the subject of a large literature that involves comparing the benefits and costs of different settings and would take us well beyond the scope of this paper.

Moreover, our theoretical findings raise the issue of whether the insurance, wealth, and liquidity effects of the income tax system that we identify are realistic channels through which the effects of income shocks are stabilized; further, there is the issue of whether these channels are more or less empirically important than the wealth channel identified in earlier work, a channel whose effect requires that households have incomplete information about the nature of income shocks. We believe that these remain important open issues, although we would not be surprised if elements from each channel eventually were found to be empirically meaningful.

However, in an attempt to bring at least some evidence to bear on these issues, we present results from several empirical exercises using post-war U.S. data. Using standard time domain techniques, we estimate elasticities of the various federal taxes with respect to their tax bases and responses of certain components of federal spending to changes in the unemployment rate. Using frequency domain techniques, we confirm that the relationships found in the time domain are strong at the business cycle frequencies. Together these results showing strong ties between cyclical variation in income and federal government spending and taxes suggest the potential for the automatic fiscal stabilizers to play a quantitatively important role in the economic stabilization process.

Using the Federal Reserve Board's FRB/US quarterly econometric model, however, it is found that the automatic fiscal stabilizers play a rather limited role at damping the short-run effect of aggregate demand shocks on real GDP, reducing the "multiplier" by about 10 percent, although they have a somewhat larger damping impact (in percentage terms) on personal consumption expenditures. Very little stabilization is provided in the case of an aggregate supply shock.

Before turning to the details of our analysis, it is worth mentioning the startling result developed by Robert Lucas (1987). In the context of a standard model of an optimizing representative consumer, Lucas argues that perfect stabilization, i.e., complete elimination of the variance of consumption in the United States, would yield virtually no utility gain to households both in absolute terms and relative to the huge utility gain associated with only a modest increase in the growth rate of consumption. Moreover, much of the subsequent literature has supported the robustness of this result. As such, this finding calls into question devoting resources to the study (as well as the practice) of stabilization policy.

While a complete response is well beyond the scope of this paper, we would make the following brief points. First, national election outcomes and, indeed, the very cohesiveness of societies appear to depend on the state of the business cycle; such factors are not generally captured in the standard utility maximizing framework. Second, cyclical downturns have a negative and, quite possibly, sizable impact on a minority of the workforce; thus stabilization policy may generate a large welfare gain even if the gain averaged across the entire population is small.[2] Third, business cycle variation and long-term growth (or the mean level of consumption) may not be completely independent as assumed by Lucas; for example, the loss of human capital associated with job loss during a cyclical downturn might have long-lasting impacts. Fourth, the Lucas result depends partly on the actual variance of U.S. consumption over the post-World War

[2] For an opposing view, see Andrew Atkeson and Christopher Phelan (1994).

II period, a variance that has declined relative to the pre-war period to a fairly low level. If this outcome has resulted largely from macroeconomic stabilization policy, as argued by Romer (1999), then elimination of stabilization policy might cause a large enough increase in aggregate consumption variance to alter the Lucas result.

The rest of the paper is structured as follows. The next section offers three theoretical arguments for the effectiveness of automatic stabilizers; each is formally developed as a variation on the same underlying consumer optimization problem. While these modeling exercises, as well as a brief analysis of firms' investment demand, are carried out in a partial equilibrium context, there will be some discussion of general equilibrium issues as well. Section III reports simulations of the Federal Reserve Board's FRB/US quarterly econometric model. Section IV analyzes the business cycle relationship between income and certain federal government taxes and spending using frequency domain techniques. Section V presents a complete re-estimation of the high-employment budget model that has been used by staffs at the Federal Reserve Board and at the Congressional Budget Office for the past twenty years. Section VI contains our conclusions.

II. The Analytics of Automatic Fiscal Stabilizers

A. Review of Literature

This section examines theoretically the role of automatic fiscal stabilizers--in particular, the income tax--in modifying the response of consumption to income shocks. Perhaps surprisingly there has been very little written on this subject in the academic literature since the mid-1980s, despite numerous legislative changes in individual income tax rates beginning with the Tax Reform Act of 1986.[3] We will briefly discuss earlier work on the role of automatic stabilizers, drawing on the excellent summary in Alan Blinder and Robert Solow (1974) in the context of the basic Keynesian model and on the seminal work in Lawrence Christiano (1984) showing the possibility that the automatic stabilizers could work using an explicit framework of an optimizing consumer facing uncertain income prospects.[4] We then present new models of the effects of the income tax on optimizing consumers that we feel are a move toward more realism. In contrast to the earlier Keynesian tradition, our models are not full general equilibrium exercises. However, we would argue that the consumer's decision problem must be central to any sensible analysis of the role of automatic stabilizers and, at the end of the section, we conjecture that general equilibrium feedbacks are unlikely to change qualitatively the results of the partial equilibrium analysis. At the end of the section, we also briefly discuss the relationship between investment demand and the automatic stabilizers.

The basic idea of the textbook Keynesian model is that the impact on aggregate current consumption and output of an exogenous shock to aggregate demand, for example, is mitigated by the automatic stabilizers which damp any effect of the shock on current personal disposable income. By evaluating the "multiplier" (the impact of an exogenous change in aggregate demand on output) for positive and zero values of the income tax rate, one can show that automatic stabilizers reduce the multiplier by $\alpha\tau/(1-\alpha+\beta)(1-\alpha+\alpha\tau+\beta)$, where α denotes the marginal

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[3] One notable exception is Alan Auerbach and Daniel Feenberg (1999).

[4] The Blinder and Solow paper does not evaluate automatic fiscal stabilizers under the assumption of rational expectations. In a rational expectations macroeconomic model, B. McCallum and J. Whitaker (1979) establish that automatic stabilizers can be effective at stabilizing output; however, like Blinder and Solow, their results are not based on an explicit set of optimizing models for consumers and firms.

propensity to consume out of after-tax income, τ denotes the marginal income tax rate, and β is a term that captures the crowding out effect of higher interest rates and prices on aggregate demand.[5] A key assumption underlying such results is that current--rather than permanent or lifetime--personal income and taxes are the only determinants of consumption demand.[6]

These Keynesian results are seemingly at odds with the predictions of the basic life cycle-permanent income models of consumer behavior with no government (Angus Deaton (1992)). Under several simplifying assumptions, including quadratic utility, equality of the interest rate

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[5] The basic Keynesian model result that the automatic stabilizers, in fact, stabilize obviously does not hold in versions of the model in which the aggregate demand multiplier is zero and stabilization is unnecessary. For example, the automatic stabilizers are irrelevant when there is a completely inelastic aggregate supply of goods (the full-employment version of model) or flexible exchange rates; in these cases, flexible wages, prices, or exchange rates do the stabilizing. An example of stabilizing flexible exchange rates is the famous Mundell-Fleming model. This model of a small, open economy provides interesting insights into open-economy intereactions but is limited in its applicability to large, open economies such as the United States.

In addition to the possibility of being irrelevant, the automatic stabilizers may be a de-stabilizing force. A standard example is the case of supply side shocks and of increasing marginal income tax rates that are not indexed to prices. The idea is that a negative supply shock (for example, an exogenous increase in oil prices) that reduces the supply of output possibly could raise nominal incomes and hence real tax payments as people moved into higher non-indexed tax brackets, thereby generating a reinforcing negative impulse to real aggregate demand. This example of destabilization has become less relevant since enactment of legislation in the United States that indexed the tax brackets to prices starting in the mid-1980s. Another example involves forward-looking expectations (and thus deviates from the basic Keynesian framework). If an income tax rate is varied countercyclically (but not completely automatically, if Congress must first recognize that a recession is underway) employed households may optimally reduce labor supply at the start of a recession (in response to an anticipated increase in after-tax wages), further reducing output. Similarly, if an investment tax credit were varied countercyclically, firms might postpone investments at the start of a recession and accelerate them during booms, thereby exacerbating cyclical fluctuations.

[6] Indeed, it is not clear how best to incorporate (expected) future taxes into the basic Keynesian framework; perhaps the present discounted value of the tax stream could be included as a component of private non-human wealth, itself a determinant of consumption demand. Alternatively, one could modify the simple textbook model to allow for dynamic and forward-looking elements along the lines of Olivier Blanchard (1981).

and rate of time preference, and lack of borrowing constraints, those models suggest the feasibility and optimality of constant consumption throughout the life cycle. If a household's labor income is anticipated to rise over time, for example, then the household simply would borrow to support consumption in excess of labor income early in the life cycle. Further, unanticipated changes in a household's income, for example owing to temporary changes associated with the business cycle, would alter the level of the desired consumption path but not its slope. Moreover, the impact on the level of consumption would not be mitigated in the presence of an income tax provided that the change in income taxes (induced by the business cycle shock to income) were offset by a change in future taxes necessary to keep the government's intertemporal budget constraint in balance, because the present value of household lifetime tax liabilities would be unchanged. How then can policies--in particular, government taxes and spending--help to stabilize household consumption when households optimally should be doing the stabilizing themselves?

Christiano (1984) appears to be the first to find a role for the automatic tax stabilizers in the context of an optimizing consumer choice problem. In his two-period model, consumers maximize expected utility; specifically, a constant absolute risk aversion utility function of consumption in each period (but not leisure) is used. Labor income is uncertain in the first period owing to the possibility of both common (aggregate) and idiosyncratic shocks that are normally distributed, while labor income in the second period is certain. There is an income tax on wages in the first period and lump sum taxes in the second period; this rules out the possibility that the income tax can play an insurance role (even if second-period wage income were uncertain). Also, any change in aggregate income taxes in the first period is offset by an equal present value increase in taxes in the second period. Borrowing is allowed by individuals and the government, and the interest rate is tied down by a storage technology.

Christiano first considers the full information case in which households are able to distinguish between the aggregate and idiosyncratic income shocks. In this case, the automatic income tax stabilizer has no effect on the positive correlation between aggregate income shocks and consumption, because there is no insurance effect provided by the tax structure and because there is no wealth effect as the present value of tax payments is unchanged by assumption. However, the positive correlation between individual consumption and idiosyncratic income shocks is reduced by the presence of an income tax. This arises because the income shock has an imperceptible effect on aggregate taxes in both periods but does alter an individual's tax bill, thereby providing an offsetting wealth effect. In the case of incomplete information, households respond to a common shock as though it were partly idiosyncratic; based on the results in the full information case, the more the shock is perceived as idiosyncratic, the more the income tax will serve as an automatic stabilizer.

The new analysis of automatic tax stabilizers developed below builds on the work of Christiano, as well as that of Louis Chan (1983), and of Robert Barsky, Gregory Mankiw, and Stephen Zeldes (1986), although the latter two do not consider automatic stabilizers. The basic framework of these three papers is remarkably similar. All develop two-period models of optimizing representative agents facing labor income uncertainty and a government intertemporal budget constraint that requires second-period taxes to adjust to maintain balance. Labor supply is fixed, and each allows for precautionary saving (a positive third derivative of the utility function). However, there are some interesting differences. For example, Christiano assumes that in period one there is labor income uncertainty and an income tax, but in period two there is no uncertainty and a lump sum tax. By contrast, Barsky et al. assume that in period one there is a lump sum tax and no income uncertainty, while in period two there is an income tax and idiosyncratic income uncertainty.

Chan makes the same assumptions as Barsky et al. about labor income uncertainty; however, in his benchmark model, second-period lump sum taxes are randomly assigned to individuals (even though aggregate taxes in period two are known with certainty). He further assumes that a tax cut in period one is accompanied not only by higher taxes in period two (to maintain the government's intertemporal budget constraint) but by an increase in the cross-sectional randomness of tax shares as well. This additional randomness is understood by households who accordingly increase their precautionary saving or reduce first-period consumption; that is, the tax cut reduces consumption. We do not incorporate the uncertainty about future tax shares below because it is not clear that a current tax cut should necessarily raise future income uncertainty. There is always uncertainty about who will pay (and how much) in future taxes even without a current tax cut. For example, even if the budget is always balanced, there can be future revenue neutral tax reforms that change the distribution of tax burdens.

B. New Results--Approach 1: Insurance Effects

Our first approach adopts the core two-period optimizing framework of the above models. In particular, we assume that there is future idiosyncratic labor income uncertainty and the absence of private insurance and financial instruments that can provide complete insurance. Moral hazard and anti-slavery laws often are cited as underlying reasons for the inability of individuals to privately diversify away labor income risk. We differ from the above models by assuming--perhaps more realistically--that there is an income tax in both periods; this allows an income shock in the first period automatically to affect taxes in the first period and hence the income tax rate in the second period. It is through this channel that the automatic stabilizers work. The idea is that the income tax provides insurance against otherwise uninsurable future uncertain variation in labor income, because a higher income tax rate reduces the variance of future after-tax income (for a given variance of before-tax income); as a result, the higher tax rate lowers precautionary saving or increases current consumption.

In the model, each individual j (= 1,...,N) maximizes expected utility:

$$EU(C_1 , C_2 , G_1 , G_2) \qquad (1)$$

where C_i denotes private consumption in period i = 1,2; G_i denotes government consumption in period i; E is the expectations operator conditional on information available in the first period. We assume that $U_{11} < 0$, $U_{22} < 0$, and $U_{12} \geq 0$. Derivatives with respect to G will be discussed below. In our first model, government consumption expenditures are fixed in both periods.

Each person (assumed identical) has labor income, Y , in period i:

$$Y = \mu_i + \varepsilon_i \qquad (2)$$

where μ_i denotes certain endowment labor income in period i, assumed the same for each individual; ε_i denotes the idiosyncratic shock in period i and has zero mean and is uncorrelated across individuals. For simplicity, we abstract from the type of aggregate or common labor income shocks considered by Christiano; instead, we analyze the effects of unanticipated changes to each individual's endowment income and, in this sense, our approach is similar to that in Barsky, et al.

There is a proportional tax on labor income in each period, where τ_i denotes the tax rate in period i. Individuals save by holding government bonds, which pay a gross return of R (= 1+r, where r is the risk-free interest rate).[7] Note that there is no tax on interest income, an

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[7] Chan (1983) and Christiano (1984) both allow for households to invest in a private risky asset. At this stage of the analysis, we abstract from such investment opportunities. Also,

issue to which we return below. Also note that labor is supplied inelastically. At the end of the first period, wealth of each individual, W, is given by:

$$W = (\mu_1 + \varepsilon_1)(1 - \tau_1) - C_1 . \qquad (3)$$

Consumption of each individual in the second period is:

$$C_2 = RW + (\mu_2 + \varepsilon_2)(1 - \tau_2). \qquad (4)$$

Aggregate tax revenue in period i is denoted by T_i . Thus the government's intertemporal budget constraint (assuming zero initial government debt) is:

$$T_1 + R^{-1}T_2 = G_1 + R^{-1}G_2 . \qquad (5)$$

But aggregate taxes in period i simplify to:

$$T_i = \tau_i [\Sigma\mu_{ij} + N\Sigma\varepsilon_{ij} /N] = \tau_i \mu_{iA} , \qquad (6)$$

since $\Sigma \varepsilon_{ij} / N = 0$, and the summations are taken over j. Also μ_{iA} denotes aggregate endowment labor income in period i; because all N individuals are assumed identical, $d\mu_{iA} = Nd\mu_i$. Thus the income tax rate in period i faced by individuals is $\tau_i = T_i / \mu_{iA}$. Because equation 5 implies that aggregate taxes in period 2 depend on taxes in period 1, the tax rate in period 2 depends on T_1 and, hence, on the tax rate in period 1:

$$\tau_2 = (RG_1 + G_2) /\mu_{2A} - (R\tau_1\mu_{1A})/ \mu_{2A} \qquad (7)$$

In analyzing this model, we adopt an approach similar to that in Chan (1983) and in Barsky, Mankiw, and Zeldes (1986). Consumers maximize expected utility (1) subject to equations (2) - (7). Now suppose that a recession, for example, causes a temporary (i.e., period one) shock to endowment income, μ_1 , of all individuals. Differentiation of the first order conditions with respect to μ_1 establishes that:

implicitly households are allowed to borrow and lend at the risk-free interest rate, r.

$$dC_1 / d\mu_1 = (1/H)\{-RE[RU_{22} - U_{12}] + E(RU_{22} - U_{12})(-R(\varepsilon_2/\mu_{2A}))\tau_1 N\} \quad (8)$$

$$= (1/H)(-RE[RU_{22} - U_{12}]) - (R\tau_1 N/\mu_{2A} H)\mathrm{Cov}[RU_{22} - U_{12}, \varepsilon_2]$$

where $H = -E[U_{11} - 2RU_{12} + R^2 U_{22}] > 0$.

The first term on the right hand side of expression (8) is the positive "wealth effect" associated with an unanticipated increase in before-tax labor income; note that because higher first-period income taxes are exactly offset in present value terms by lower second-period income taxes, there is no impact of taxes on the wealth effect. The second term represents the offsetting negative effect on consumption owing to higher precautionary saving: higher aggregate first-period income tax receipts imply a lower second-period income tax rate and thus less insurance against idiosyncratic income shocks. As shown in Barsky et al., the precautionary saving effect requires that $RU_{222} - U_{122}$ is positive (so that the covariance term in equation 8 is positive). We assume the wealth effect dominates the precautionary saving effect and, hence, that a positive (negative) increment to labor income boosts (reduces) first-period consumption. Differentiation of (8) with respect to τ_1 establishes that a stronger automatic stabilizer (i.e., a larger τ_1) reduces the positive impact of a temporary income shock on first-period consumption, i.e., it establishes that $\partial[\partial C_1/\partial\mu_1]/\partial\tau_1 < 0$; it does so by strengthening the precautionary saving effect.

Before moving on to our next models, we briefly discuss the assumption made here and in the prior literature that interest income is not taxable. The introduction of interest-income taxation into our model would tend to strengthen the above results regarding automatic stabilizers for two reasons. First, higher before-tax income in period one would lead to a reduction in the income tax rate in period two for the same reason as before and because the second-period tax base is larger (higher labor income boosts first-period saving and hence interest income subject to tax in the second period) and total second-period tax receipts are determined completely by first-period taxes and government spending. The resulting lower income tax rate in period two further strengthens precautionary saving. Second, a lower second-period tax rate boosts the after-tax interest rate, for a given before-tax rate, which further increases the incentive to save (if the substitution effect exceeds the income effect).

C. New Results--Approach 2: Wealth Effect

We now modify the model to allow a change in income taxes induced by a temporary income shock to be matched by a change in government consumption spending; both are assumed to occur in the first period. It is thus useful to rewrite equation 7 as follows:

$$G_1 = \tau_1\mu_{1A} + \tau_2\mu_{2A}R^{-1} - G_2R^{-1} \qquad (9)$$

In addition, it is assumed that private and government consumption expenditures are directly substitutable (although not necessarily perfect substitutes) within periods; that is, G_1 is a substitute for C_1 but not for C_2, and similarly for G_2. Thus, for the utility function in equation 1--i.e., for $U(C_1, C_2, G_1, G_2)$--we assume that $U_{13} < 0$ and $U_{24} < 0$ and $U_{23} = U_{14} = 0$; in our example, however, G_2 is fixed and, hence, only the conditions $U_{13} < 0$ and $U_{23} = 0$ are relevant.[8] To evaluate the effect of a shock to the first-period endowment labor income of each person, we again differentiate the first order conditions, giving:

$$dC_1 / d\mu_1 = (1/H)(-RE[RU_{22} - U_{12}])(1 - \tau_1) + (N\tau_1/H)(EU_{13}) \qquad (10)$$

where H is defined above.

The first term on the right hand side of equation 10, which is positive, represents the

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[8] A way to motivate this setup is found in David Aschauer (1985); in his model, utility is a function of effective consumption in period i, C^*_i, defined as $C_i + \theta_i G_i$, where θ_i is positive if C and G are substitutes. That is, for a given level of effective consumption, an additional unit of government spending will induce the individual to reduce private consumption by θ units. Defining $U_1 \equiv \partial U/\partial C^*_1$, $\partial U_1/\partial G_1 = U_{11}\,\partial C^*_1/\partial G_1 = U_{11}\theta_1 < 0$ since $U_{11} < 0$. $\partial U_1/\partial G_1 < 0$ corresponds to our assumption $U_{13} < 0$.

"wealth effect" of higher *after-tax* labor income; before-tax labor income is higher, but this is partially offset by higher income taxes in the first period. This offset, owing to the automatic stabilizers (i.e., the income tax), is reinforced by the second term on the right hand side of equation 10. The latter term, which is negative, represents the direct substitution effect of higher government consumption spending (owing to higher income taxes) on private consumption. We assume that the wealth effect dominates the direct substitution effect and, hence, $dC_1 / d\mu_1 > 0$. Differentiation of equation 10 with respect to τ_1 establishes that a stronger automatic stabilizer (i.e., a higher τ_1) weakens the positive impact of a temporary shock to before-tax labor income, i.e., it establishes that $\partial[\partial C_1/\partial\mu_1]/\partial\tau_1 < 0$.

D. New Results--Approach 3: Borrowing or Liquidity Constraints

In the final variant of our model, we introduce explicit constraints on borrowing by households following the approach in Chan (1983). We assume that borrowing cannot exceed a fixed fraction of current after-tax labor income and, for simplicity, that $\varepsilon_1 = 0$. If L denotes household lending (L > 0) or borrowing (L < 0), the constraint can be written as:

$$b(1 - \tau_1)\mu_1 + L \geq 0 \qquad (11)$$

where b is some fixed, positive number. For example, if b = 1 and if the constraint is binding in the sense that household borrowing equals after-tax income and, hence, first period consumption is double after-tax income (i.e., the sum of disposable income and the borrowed amount, also equal to disposable income). Such a constraint is consistent with home mortgage payment rules-of-thumb in which monthly interest payments cannot exceed a fixed fraction of income. The possibility of borrowing or liquidity constraints is appealing, especially in light of recent empirical work, such as that of Jonathan Parker (1999) and Nicholas Souleles (1999), which finds that individual consumption rises when fully anticipated increases in after-tax income are realized.

The rest of the model is the same as in section IIB above, in which future income taxes are assumed to adjust to maintain the government's intertemporal budget constraint (and in which W is replaced by L in equation 3 and 4). We consider households for whom the borrowing constraint (11) is binding. For such individuals, the model solution for first-period consumption follows immediately, as in the example above, because the borrowing constraint (along with current after-tax labor income) completely determines first-period consumption. It follows that a higher income tax rate--i.e., stronger automatic stabilizers--reduces first-period consumption and, hence, reduces the effect of a labor income shock on first-period consumption. With an adverse shock to labor income, for example, private borrowing is reduced but, because income taxes decline, government borrowing is increased; as noted by Chan (1983) in a related problem, the government--not subject to a borrowing constraint--is effectively borrowing on households' behalf, thereby circumventing the household limit.

E. Investment and General Equilibrium Considerations

We now address some loose ends in the prior analysis. We begin with a discussion of the relationship between investment demand and the automatic stabilizers in a partial equilibrium, optimizing framework. We then discuss general equilibrium issues, offering several conjectures but not the development of a full model.

Conventional models of business fixed investment--under the key assumptions of convex adjustment costs, complete information, and perfect capital markets--imply that a firm's investment demand depends on marginal "q," that is, on the present discounted expected value of profits from new investment. To the extent that business cycles are viewed as symmetric variations of economic activity (and hence profits) about trend, a recession will be followed by above-trend activity, implying that the recession likely would have little effect on the present value of a representative firm's expected profit stream and hence on investment demand. In this case, a corporate profits tax would not be expected to damp the effect of cyclical swings in economic activity on investment demand.

Other models, based on asymmetric information and the resulting incentive problems in capital markets, imply that information costs and the internal resources of firms influence the cost of external funds. Consequently, investment demand depends on the "financing constraint" of a firm's net worth, proxied for by current after-tax cash flow, in addition to marginal q. Glenn Hubbard (1998) provides an excellent discussion of such models, whose empirical importance is the subject of some controversy. These models imply that the impact of a cyclical downturn on before-tax cash flow and, hence, on investment demand would be attenuated by the presence of an income tax; thus, the tax would serve as an automatic stabilizer for investment demand.

We now briefly discuss general equilibrium issues. The most basic question is whether the economy is better modeled using the equilibrium real business cycle approach, as in Marianne Baxter and Robert King (1993), or using an approach that allows for nominal demand shocks to have real effects in the short run, as in New Keynesian models. Although the appropriate framework has been the source of ongoing tension among macroeconomists, in qualitative terms, the effectiveness of automatic stabilizers appears invariant to the choice of framework. For the remainder of this section, we assume that both frameworks embed the basic consumer optimization model analyzed above.

In the equilibrium business cycle approach, a shock that reduces aggregate equilibrium output--such as a temporary negative labor-income endowment shock--generally originates on the supply or production side of the economy, and the components of aggregate demand must adjust to maintain goods market equilibrium. Thus, if personal consumption falls (as the above analysis suggests) and if government purchases of goods and services are reduced to offset the budget impact of lower income tax receipts, then investment likely will decline to maintain goods market equilibrium.[9] The decline in real income net of tax as well as the decline in government purchases have no immediate effect on output unless labor supply adjusts in response to wealth and interest rate effects. However, over time, as the capital stock falls relative to baseline, output also declines which, in turn, reduces consumption possibilities. The magnitude of the consumption decline will vary inversely with the strength of the automatic stabilizers.

By contrast, in a model with sticky wages and prices, negative shocks to any component of nominal aggregate demand (for example, export demand) can lead to short-run reductions in output as labor demand and hours worked decline. The resulting fall in after-tax income reduces private consumption demand (and government purchases fall if they are adjusted to maintain budget balance); the decline in consumption is mitigated by the automatic stabilizers for the same reasons as discussed earlier. Of course, investment demand likely is boosted by lower interest rates, which implies subsequent increases in the capital stock and output; again the magnitude of such increases will vary inversely with the strength of the automatic stabilizers. Simulation results from a general equilibrium econometric model with new Keynesian style features are presented in the next section.

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[9] For example, if income falls temporarily by $100, personal consumption should fall by about $5 (given econometric estimates of the marginal propensity to consume out of wealth); with a 20 percent income tax rate, taxes and, hence, government purchases would fall $20. Thus, investment would fall $75. The decline in investment likely will be larger if future income taxes are raised, rather than government purchases reduced, to maintain budget balance.

III. Results from the FRB/US Model

In sections III, IV, and V we present our empirical results. This section presents estimates of the impact of automatic stabilizers--particularly, income taxes--based on simulations of the Federal Reserve Board's FRB/US quarterly econometric model of the U.S. economy, developed as a replacement for the MPS model. Detailed discussions of the new model are in Flint Brayton and Peter Tinsley (1996) and in David Reifschneider, Robert Tetlow, and John Williams (1999). Households and firms are optimizers whose current decisions are based on expectations of future conditions. For estimation purposes, sectoral expectations are derived from forecasts of small VARs. Each VAR has a common set of variables including consumer price inflation, the output gap, and the federal funds rate. Inclusion of the funds rate means that this form of expectations incorporates an average sample view of how monetary policy was conducted historically. Simulation exercises in this paper also use the same VAR systems.

In terms of dynamic adjustments in the model, financial market variables such as interest rates and stock prices adjust immediately to changes in expectations because financial decisions are assumed unaffected by frictions, given the small cost of transacting in these markets. However, the response of nonfinancial variables such as consumption, investment, and employment to changes in fundamentals is not immediate because of (non-explicitly-modeled) frictions in the dynamic adjustment process such as contracts and capital adjustment costs. Indeed, prices and quantities do not adjust quickly enough to ensure full resource utilization at all times. In the long run, all adjustments are complete and all markets clear.

Of particular relevance for the simulation results reported below, as well as for a comparison to the prior theoretical discussion of section II and subsequent empirical analysis of tax elasticities in section V, is the modeling of aggregate income taxes and consumption in

FRB/US. Starting with taxes in FRB/US, the average federal personal income tax rate is procyclical, implying an elasticity of personal taxes with respect to the taxable income base somewhat greater than the corresponding elasticity of 1.4 estimated in section V.[10] Social insurance contributions are specified as proportional to its tax base, implying a unitary elasticity; in section V, we estimate that the elasticity is about 0.9. The average corporate income tax rate is mildly procyclical in FRB/US; this contrasts with the mildly countercyclical tax rate found in section V.

Turning to the modeling of aggregate consumption in FRB/US, a small fraction of consumption decisions is made by liquidity-constrained households; the share of after-tax income associated with this group of households is estimated at about 10 percent. This group's behavior would be consistent with the model in section II D above.

However, for most households, consumption depends on current property wealth plus the present value of expected after-tax labor (and transfer) income in FRB/US. Expected future income flows are discounted at a high, 25 percent, annual rate in computing present values, because it is argued that households are quite averse to the uncertainty of future uninsurable income. As a result of the heavy discounting, current consumption is little affected by changes in income taxes in the distant future that might be necessary to satisfy the government's intertemporal budget constraint; put another way, the rate used by individuals to discount future taxes exceeds the government's borrowing rate.

Moreover, the simulations below are based on VAR expectations which do not incorporate expectations of future tax rate changes; thus a change in income taxes (owing to an

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[10] The elasticity estimated in FRB/US probably captures discretionary changes in the tax code as well as endogenous changes in receipts.

aggregate demand shock, say) has a wealth effect on consumption.[11] While this is similar to the wealth effect in the model of section II C above, there is a difference in that current government purchases are not adjusted in FRB/US (and so there is no substitution of private for government consumption).

Finally, FRB/US may be consistent with a precautionary saving motive. This is because prudent households act as if they apply a high discount rate to future uncertain income, which is the case in the model. Further, consumption depends positively in FRB/US on the expected output gap, which is viewed as capturing countercyclical variation in the perceived riskiness of future before-tax income. Even granting these interpretations, the model does not capture the insurance effect of income tax rates developed in section II B above; that is, an anticipated change in the income tax rate has no effect in FRB/US on the variance of after-tax income. Summing up, FRB/US captures liquidity and wealth effects associated with the income tax system, but does not capture the insurance effect.[12] However, there is a sense in which the impact of changes in taxes (and transfers) on consumption demand is assumed: for example, there is no formal testing of the hypothesis that the effects of changes in before-tax income and in taxes are of equal and opposite sign (and separately statistically significant); rather, after-tax income is the variable included in the FRB/US model consumption equations.

Results of the simulation exercises are reported in the tables below. The model has four

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[11] When fully rational (rather than VAR) expectations are incorporated into the simulations, the model assumes that the government's intertemporal budget constraint is satisfied by altering future income tax rates to stabilize the government debt-GDP ratio.

[12] In addition, after-corporate-tax cash flow has a positive impact on investment in producers' durable equipment and on personal consumption expenditures (via stock market wealth) in FRB/US. However, these channels of influence play only a minor role in the subsequent simulation results.

federal tax rates (for personal income taxes, corporate income taxes, indirect business taxes, and social insurance contributions). The effects of automatic stabilizers are measured by comparing simulations in which each federal tax rate is at its actual value with simulations in which each tax rate is set to zero and an add factor (essentially a lump sum tax) is introduced that sets tax receipts equal to their baseline values (given the baseline values of the tax bases). A demand shock and a supply shock are considered. The demand shock (to state and local government purchases) is scaled to equal one percent of the level of real GDP in the baseline. The supply shock is a $5 per barrel increase in the price of oil. Each simulation is run under two monetary policy settings. One setting holds the real federal funds rate constant and the other uses the Taylor rule--which relates the nominal federal funds rate to the output gap and to a four-quarter moving average of the inflation rate.[13]

As shown in table 1 (panel A), with a fixed real federal funds rate, the model's real GDP "multiplier" is only modestly increased by the substitution of lump sum for income (and social insurance and indirect business) taxes from 1.23 to 1.35 at the end of four quarters (and increased by a similarly modest amount at the end of eight quarters) in the case of the demand shock. The impact of the demand shock on personal consumption expenditures also is increased only modestly at the end of four quarters (although by a much larger percentage amount).[14] This outcome largely owes to the model's property that consumption is not very sensitive to movements in after-tax income that are essentially transitory; moreover, households expect

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[13] Note that there can be a slight tension between the expected federal funds rate generated by the VAR system and the "actual" federal funds rate resulting under either of the two monetary policy assumptions; that is, policy misperceptions are possible, at least in the short run.

[14] Note that the table shows increases in the *percentage* deviation from baseline in real PCE; this translates into an increase in the PCE "multiplier" from about 0.2 to 0.3.

(through the VAR system) a countercyclical policy response to the demand shock. When monetary policy is characterized by the Taylor rule (panel B), the multipliers on output and consumption are smaller than in the prior case, but the increase owing to elimination of the income tax is about the same.

Table 1: Simulated Macroeconomic Effects of Shock to Autonomous Aggregate Demand
(Percent change from baseline)

Response in quarter	Historical Tax Rates			Tax Rates = 0		
	Real GDP	Consumer Prices	Real PCE	Real GDP	Consumer Prices	Real PCE
Panel A: Constant Real Federal Funds Rate						
4	1.23	.10	.30	1.35	.10	.43
8	1.05	.56	.01	1.23	.58	.30
Panel B: Taylor Rule						
4	.89	.01	.02	.97	.01	.12
8	.22	.13	-.57	.30	.14	-.46

Notes: The demand shock is to state and local government purchases and is scaled to equal one percent of the level of real GDP in the baseline. Also, "real GDP" is gross domestic product in chain-weighted 1992 dollars; "consumer prices" is the personal consumption expenditure chain-weighted price index; "real PCE" is personal consumption expenditure in chain weighted 1992 dollars.

As shown in table 2, the income tax has very little effect on the model multipliers in the case of the adverse supply (oil price) shock. Because the shock pushes real output and prices in opposite directions, nominal taxable incomes are not affected much; as a result, the level of tax receipts is not very sensitive to the presence of income taxes. Of course, taxes in real terms are

Table 2: Simulated Macroeconomic Effects of $5 Increase in Oil Prices
(Percent change from baseline)

Response in quarter	Historical Tax Rates			Tax Rates = 0		
	Real GDP	Consumer Prices	Real PCE	Real GDP	Consumer Prices	Real PCE
Panel A: Constant Real Federal Funds Rate						
4	-.04	.36	-.15	-.05	.36	-.16
8	-.16	.78	-.51	-.16	.77	-.50
Panel B: Taylor Rule						
4	-.22	.32	-.30	-.24	.32	-.32
8	-.47	.59	-.71	-.50	.59	-.75

Notes: "real GDP" is gross domestic product in chain-weighted 1992 dollars; "consumer prices" is the personal consumption expenditure chain-weighted price index; "real PCE" is personal consumption expenditure in chain weighted 1992 dollars.

lower; similarly, in the lump-sum tax simulation, real taxes are lower following the shock (owing to a higher price level and an unchanged level of nominal taxes). Indeed, real taxes in the two simulations are similar enough following the shock that the tax structure (income versus lump sum) makes little difference to multiplier values.[15] The fact that the presence of an income tax has virtually no effect on supply shock multipliers is interesting, because arguably it is optimal to

[15] Although we have not explicitly considered non-oil-price supply shocks, results reported in Reifschneider et al. (1999) suggest that the role of the automatic stabilizers in the face of other supply shocks would differ somewhat from those described above. For example, in FRB/US a productivity shock affects supply and demand (the latter by altering permanent income), and, thus, the impact of the automatic stabilizers on model multipliers would be intermediate to the separate demand and supply shock cases considered above.

have no automatic stabilization in the face of a supply shock.[16]

Finally--noting that FRB/US is approximately linear, so that positive and negative shocks of equal size have roughly the same absolute effect on the major endogenous variables--our simulation results shed light on the issue of whether the presence of automatic fiscal stabilizers reduces the variance of U.S. real GDP. To the extent that variation in real GDP is driven primarily by supply-side shocks, our results suggest an extremely limited stabilizing role of the income tax system. By contrast, if demand-side shocks are the primary driving force, income taxes provide a modest degree of stabilization. Unfortunately, because our results are based on a model estimated over the post-war sample period, they are of limited value in answering the question of whether the automatic stabilizers have contributed to the reduction in the volatility of the U.S. macroeconomy that evidently has occurred over the past century.

IV. Empirical Results from the Frequency Domain

In this section, we examine the frequency-domain or spectral properties of certain federal taxes and tax bases as well as the properties of unemployment insurance benefits. To the best of our knowledge, this approach has not been taken before. We initially present the estimated spectral density functions for several types of taxes and then show the squared coherencies of these taxes with their respective tax bases. We use National Income and Product Account (NIPA) quarterly current-dollar tax and income data as well as unified budget tax data, both for most of the post-war period. The analysis of unemployment insurance benefits also utilizes post-

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[16] The idea is that the sensitivity of the output gap (actual minus potential) with respect to an aggregate supply shock is greater the stronger are the automatic stabilizers in a simple textbook model of aggregate demand and supply. For example, with a negative aggregate supply shock that reduces desired output, actual output also will decline as prices rise; however, the price rise will be smaller--and hence the narrowing of the output gap more limited--the stronger are the automatic stabilizers.

war NIPA data as well as the civilian unemployment rate.

In evaluating our results, it is useful to recall that the area under the spectrum is simply the variance of a series; also the spectrum is symmetric about the zero frequency, so we only plot the estimated spectra for frequencies, ω, between 0 and π.[17] Because the techniques of spectral analysis apply to stationary time series, we examine the growth rates of the various taxes (which are stationary series) rather than the dollar levels; also, to achieve stationarity, we examine unemployment insurance outlays as a percent of nominal GDP. We focus attention on whether a sizable portion of the variance of a series is explained by variation at the business-cycle and seasonal frequencies, that is, we look for sizable peaks in the estimated spectra at these frequencies. In our figures, business cycle frequencies occur between 0.2 and 1.0, which correspond to periods (= 2π/ω) of roughly 32 quarters and 6 quarters, respectively (the range of values used in the recent literature). Seasonal frequencies are at (or near) π/2 and π, corresponding to periods of 4 quarters and 2 quarters, respectively.

We also present squared coherencies between taxes and tax bases.[18] The coherency measures the square of the linear correlation between the two variables at every frequency and is analogous to squared correlation coefficients; the coherency can vary between 0 and 1. For example, if the squared coherency is near one at frequency ω, it means that the ω-frequency components of the two series are highly related, but a value near zero means the corresponding

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[17] For a review--aimed at the practitioner--of the key results of spectral analysis used in this paper as well as references to the literature, see the appendix in Cohen (1999).

[18] We utilize PROC SPECTRA from SAS to generate the basic spectral densities and squared coherencies. We use kernel estimation of the spectrum with a bandwidth parameter of 4. The respective 95 percent confidence bands were programmed by us. On rare occasions, the squared coherencies will lie outside the lower 95 percent confidence band; this is possible because of the squaring operation.

frequency components are not closely related. One must be careful in interpreting the squared coherencies in the business cycle frequency range, because the coherency is simply a bivariate measure. While it undoubtedly reveals information about the "automatic" response of taxes to income (and unemployment insurance outlays to the unemployment rate), it also contains information about the relationship between business cycle fluctuations in income and legislated changes in tax rates (and between fluctuations in the unemployment rate and legislated changes in the unemployment insurance program).

Beginning with the NIPA tax data, personal income, corporate income, and indirect business tax receipts (all in growth rate form) display pronounced spectral peaks at business cycle frequencies (figures at end of paper). Perhaps surprisingly, social insurance contributions show little spectral power at business cycle frequencies although substantial power at the seasonal frequencies. The latter occurs, even though the data are seasonally adjusted, because of the NIPA convention of "level adjusting" this series once every four quarters to reflect the impact of a change in the taxable maximum wage base.

Squared coherencies at the business cycle frequencies are quite high between the personal income tax and its tax base (personal income less other labor income less government transfer payments plus personal contributions to social insurance) and between corporate income taxes and taxable corporate profits. Again, one must be careful in interpreting these results because the squared coherencies conceptually are picking up both automatic and discretionary changes in taxes.

To shed a bit further light on this matter, one can compute the gain at the business cycle frequencies; the gain is interpretable as the regression coefficient of taxes on income. Because both variables are in growth rate form, the gains provide estimates of tax elasticities at every frequency. The gain in the case of corporate income taxes varies within the narrow range of 1.0 to 1.1 across the business cycle frequencies, only slightly larger than more standard time series estimates (as in section V below) of the "automatic" effect of changes in profits on taxes. Thus, the squared coherency likely is showing that the automatic piece of the relationship is strong at the business cycle frequencies. A somewhat different situation is revealed by the gain between the personal income tax and its base, which varies from about 1.0 to 2.9 across the business cycle frequencies; certainly, one could reasonably expect, as discussed in section V below, an elasticity owing to business-cycle induced changes in incomes greater than or equal to 1, but it is likely that the high values of the gain might well be picking up a tendency for legislated personal tax cuts to occur during recessions as well as the automatic decline in receipts.

Finally, on the NIPA tax side, squared coherencies between social insurance contributions and wages and salaries and between indirect business taxes and nominal GDP are only of moderate size (up to about 0.5).

We now discuss results using unified individual income tax data (on a quarterly basis). Because these data are not seasonally adjusted (nsa), we also need a nsa personal income tax base. The latter is not available; instead we use nsa nominal GDP, which is publicly available. The use of nsa data gives a pure reading of real-time fluctuations in taxes and income faced by households but at the cost of introducing a lot of noise, especially into the analysis of individual non-withheld taxes (declarations, paid four times per year, plus final payments, paid once each year). The squared coherency between nsa withheld income taxes and nominal GDP (again, both in quarterly growth rate form) is sizable both at the business cycle frequencies and at the primary seasonal frequency ($\omega=\pi/2$); the former is strongly suggestive of the working of automatic stabilizers during business cycle swings, while the latter reflects seasonal patterns in labor incomes and withheld taxes (such as increases in each that often occur at the beginning of calendar years). The gain varies between 1 and 3 at the business cycle frequencies, again suggestive of discretionary tax changes in addition to the automatic stabilizer component. Very similar results at the business cycle frequencies arise when the raw data are filtered using four-quarter growth rates (although the strong seasonal relationship is eliminated, as would be expected).

By contrast, the squared coherency between nsa individual nonwithheld taxes and nominal GDP is not large at business cycle frequencies; indeed, the relatively small coherencies apply to both declarations and final payments. Such results suggest the relative ineffectiveness of automatic stabilizers via this tax channel.

Finally, on the spending side of the budget, the squared coherency between unemployment insurance outlays as a percent of GDP and the unemployment rate is very high at the business cycle frequencies. Thus, even though there may be a short waiting period to collect benefits, the unemployment insurance program appears to operate as an effective, virtually automatic, income stabilizer for unemployed individuals.[19]

To sum up, the frequency domain analysis establishes a very strong relationship between income taxes and tax bases at the business cycle frequencies; in all cases this reflects the automatic nature of tax variation--particularly individual withheld taxes--when incomes change, and in some cases it likely reflects discretionary tax changes as well. Further, unemployment insurance also appears effective as an automatic stabilizer of income.

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[19] Further, as shown in Cohen (1999), other federal transfer programs--such as social security, medicare, medicaid, and food stamps--have low squared coherencies with the unemployment rate at business cycle frequencies, implying that these programs are weak automatic stabilizers at best.

V. The High-Employment Budget Surplus

In this section, using standard time-domain techniques, we present updated empirical estimates of the responsiveness of federal taxes and certain spending programs to cyclical swings in the economy. While such estimates are useful for many purposes, they are used here as a basis for computing the cyclically-adjusted or high-employment budget surplus (HEB) of the federal government. Although the HEB is not without its faults, as discussed in Blinder and Solow (1974), it nonetheless has been used as a summary measure of the stance of fiscal policy by many U.S. government agencies (and many countries) since the 1960s. Twenty years ago, an intergovernmental task force developed the “gross-up” methodology that currently is used by staffs at the Congressional Budget Office and the Federal Reserve Board (see deLeeuw, et al., 1980).

Using taxes to illustrate the method, high-employment tax receipts equal a cyclical adjustment, or a gross-up, plus actual (or projected actual) tax receipts. The gross-up is the difference between an estimate of taxes at a benchmark (i.e., high employment) level of economic acitivity--computed by setting the GDP gap equal to zero in key econometric equations--and at the actual level of economic activity--computed by using the actual GDP gap. As a result, the gross-up method has the property that actual and high-employment taxes are equal when the economy is operating at potential. More fundamentally, the method has the property that unexplained shocks to taxable income shares and tax receipts are allowed to pass through to high-employment estimates. The remainder of this section presents detailed estimates.

A. High-employment receipts

The calculation of high-employment receipts involves three steps. First, income share equations are estimated to determine the level of the tax bases if actual GDP were equal to potential GDP. Second, the tax elasticities with respect to cyclical changes in income must be estimated. Finally, these two estimates are combined to obtain cyclical components of tax revenues which are added to actual revenues to obtain high-employment revenues. The basic equations for receipts are:

$$SHAREK_{j,t} = SHARE_{j,t} - \sum \beta_i * GDPGAP_{t-i} \quad (12)$$

$$BASEK_{j,t} = GDPK_t * SHAREK_{j,t} \quad (13)$$

$$TAXK_{j,t} = TAX_{j,t} * (BASEK_{j,t} / BASE_{j,t})^{\varepsilon(j,t)} \quad (14)$$

$$RECEIPTSK_{j,t} = \sum TAXK_{j,t} \quad (15)$$

where SHARE is the ratio of the tax base to GDP, $BASE_j$ is the tax base applicable to the jth tax, TAX_j is tax revenues from tax j, and RECEIPTS is the sum of all taxes from all sources. The suffix K denotes a high-employment estimate, β is the sensitivity of the share of the tax base in GDP to changes in the GDP gap (GDPGAP), and ε is the elasticity of the tax with respect to cyclical changes in the tax base.

On the income-side, GDP is composed of labor compensation (wages and salaries, and supplements to wages and salaries such as employer provided health insurance), capital income (corporate profits, proprietors' income, rental income and net interest) and GDP less national income (the statistical discrepancy between income and product side measures of GDP as well as indirect taxes and net subsidies to businesses). We estimate the cyclical properties of each of these income sources using the Congressional Budget Office's estimates of potential GDP, NAIRU, and potential labor force. From these estimates we construct estimates of the GDP gap, (GDPK-GDP)/GDPK, and the employment gap (table 3).[20] Our regression equations for income shares are in first-difference forms of equation 13 because the shares are not stationary over the sample period.[21] The cyclically adjusted share is equal to the actual share less the sum of the products of the estimated gap terms and the coefficients. The cyclically adjusted shares are smoother; for example, the adjusted profits share does not dip during recessions as much as actual profits.

NIPA personal taxes are roughly 45 percent of federal NIPA-based receipts. They are composed of personal income taxes, estate and gift taxes and non-taxes (essentially fees and fines). As income taxes are about 97 percent of personal taxes we use the personal income tax elasticity for all personal taxes. This elasticity, Epersonal, can be decomposed into two elasticities: the change in income taxes with respect to AGI, and the change in adjusted gross income (AGI) with respect to NIPA adjusted personal income, E_{agi}.[22] Furthermore, the elasticity of income taxes with respect to a change in AGI is a weighted sum of the elasticity of taxes to number of returns, En, and the elasticity of taxes with respect to average income per return, Ey, where the weights equal the relative contributions of changes in returns and average income to

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[20] The CBO data are based on BEA's estimates of GDP before the comprehensive revision which was published in October 1999. Our estimates use the same data.

[21] Indeed, this was a problem for deLeeuw et al. (1980), which they addressed by using time trends. Our difference approach creates stationary series and does not rely on deterministic time trends. That said, levels specifications, using cubic-spliced time trends, yield similar results for the coefficients on the GDPGAP terms.

[22] Using the annual SOI data on tax liabilities implies that we are estimating a liability elasticity. Both the NIPA budget estimates and the unified budget record taxes on a payments basis. Our estimates may not capture the precise timing of the changes in payments being estimated. For example, during a downturn in the economy, tax payments may be accelerated relative to liabilities.

cyclical changes in income. Thus, Epersonal may be written as:[23]

$$\text{Epersonal} = \{En*ngap + Ey*ygap*(1+ngap)\}/[ngap + ygap*(1+ngap)]\}*E_{agi} \quad (16)$$

where:

ngap is the percent gap in number of income tax returns,
ygap is the percent gap in AGI per tax return,
En is elasticity of personal income taxes to change in number of returns,
Ey is elasticity of personal income taxes to change in AGI per return, and
E_{agi} is the elasticity of AGI to NIPA adjusted personal income.

En is defined as equal to one by assuming that changes in the number of tax filers occur in proportion to the existing distribution. By assuming En is one, Ey should account for the elasticity of the tax code, given the distribution of income, and the change in the distribution of income over the cycle. Our estimate of Ey, though, is based solely on the tax structure and the existing distribution of income; thus it abstracts from any potential cyclical sensitivity of the income distribution. Equation 16 was modified to account for two types of filers as the number of returns and the incomes of single filers appear to exhibit different cyclical properties than those of non-single filers.

We calculate Ey for single and nonsingle filers (overwhelmingly married filing jointly, but also heads of households, married filing separately, and surviving spouses) using Statistics of Income (SOI) cross-section data for each year. Ey for a given type of filer is the weighted sum of the elasticities of the AGI groups shown in the SOIs where the weights equal the tax shares of the groups. The elasticity is estimated by dividing the *effective* marginal tax rate by the average tax

[23] Simplifying to the case where AGI equals adjusted personal income ($E_{agi} =1$), equation 16 is obtained by taking the total differential of the tax function, T= F(n,y)--which implicitly allows tax revenues to respond differently to changes in number of returns and changes in income per return--and dividing the resulting expression by the total differential of the aggregate income function, AGI = n*y, all multiplied by AGI/T.

rate for the group.[24] The effective marginal tax rates are lower than the statutory rates because the effective rates incorporate the rise in deductions that occur as income rises and include the tax preference for capital gains realizations.[25]

The first two columns of table 5 display the resulting elasticity estimates. Over the 1951-1996 period the AGI income per return elasticity for non-single returns averaged 1.6, and was 1.5 for single returns. The difference largely reflects differences in the 1950s and 1960s owing to lower average tax rates faced by nonsingles in the lower income brackets because of the relatively more generous personal exemptions in place at the time. Focusing on non-single filers, their elasticity fell by 0.1 as a result of the Reagan tax cuts in the early 1980s and another 0.1 with the 1986 Tax Reform Act. During the 1990s the overall elasticity of the tax schedule has been little changed, as the elasticity boosting effects of the expansion of the Earned Income Credit and increased marginal income tax rates for high-income filers has been offset by the decrease in the tax rate on capital gains realizations and the shift in income distribution towards high income filers who have lower elasticities.

The weights applied to En and Ey are estimated by calculating relative magnitudes of the effects of the GDP gap on filing a return and the cyclical change in income per return. The change in returns is modeled as a function of changes in employment, tax filing rules and a

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[24] The elasticity of each group equals the slope of the line traced out by the natural logarithms of average taxes and average income. The slope for an AGI group is estimated by calculating the derivative of the parabola defined by three points consisting of the group and the groups above and below.

[25] Some deductions, mortgage interest for example, may be more closely related to permanent income than cyclical income while other deductions, such as state and local income taxes, are closely related to cyclical income. Thus our calculations may understate the true cyclical marginal tax rate. The lower tax rate for capital gains may also unduly reduce the effective cyclical marginal tax rate to the extent that realizations do not reflect cyclical factors.

dummy variable to capture the apparent change in the coefficients after 1977. Regression results in table 6 indicate that until 1977 a 1 percent change in employment led to a 2 percent change in single returns, while after 1977 there a one-to-one relation. The reduction probably reflects a variety of demographic factors such as the falloff of marriage rates in the earlier period and the entry of married women into the labor force over the later period. By contrast, changes in employment have negligible impact on non-single filers, probably owing to lower levels of unemployment and higher levels of income generating assets of married households. Similar results hold for our estimates of the cyclical response of AGI per return (table 7): average income is more cyclically sensitive for single filers than for non-singles. A 1 percent increase in aggregate per-employee income results in a 1.41 percent increase in incomes on returns of singles (there is no break in the 1970s), while the estimate of the coefficient in the case of non-singles is 0.81, but has not been stable over time.

With these regression results we can construct the weights on En and Ey for single returns (the weight on En for non-singles is zero owing to the lack of response of the number of returns to economic activity). The return gap, ngap, equals the product of the coefficient on employment in the returns equation and the employment gap. The income per return gap, ygap, is the product of the coefficient estimate for the average income per return and the per capita income gap. The resulting annual weights on En and Ey vary wildly over time and are quite sensitive to the GDP and employment gap measures. In response, we opted to make the weights constant over time by taking their average value: the weights on En and Ey are both 0.5.[26] The regressions, the bottom

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[26] The chief problem is that the weights become unstable when the gaps are very small. By contrast, our 0.5 estimate is consistent with the swings in the gaps--and the weights--from business cycle peaks to troughs throughout the sample period. For example, we estimate that the gap in number of returns swung from -1.0 in 1989 to 1.6 in 1991 while the gap in average income

panel of table 7, provide us with estimates of the elasticity of aggregate AGI to NIPA adjusted personal income, the final elasticity needed to evaluate equation 15, the elasticity of personal income taxes to adjusted personal income. Our estimate is shown in the final column of table 5 and it has varied between 1.3 and 1.5.

Social insurance taxes currently exceed 35 percent of NIPA-based federal revenues. The major components of these taxes are social security taxes (for OASDI, Medicare, and railroad retirement benefits), federal and state unemployment taxes, federal civilian and military retirement contributions, and supplemental medical insurance premiums.[27] An estimate of the overall elasticity of social insurance taxes is calculated by estimating separate elasticities for employed social security taxes (FICA), self-employed social security taxes (SECA), and unemployment insurance taxes. It is assumed that railroad retirement taxes have the same elasticity as FICA taxes and that other taxes and contributions have a zero elasticity with respect to cyclical changes in the economy.[28]

The cyclical income elasticity of FICA contributions, EFICA, is estimated as a weighted average of the elasticities taxes to changes in employment and changes in wages per employee.

$$EFICA = \{En*ngap + Ey*ygap*(1+ngap)\}/[ngap + ygap*(1+ngap)] \quad (17)$$

where:

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per return swung from -.5 to 2.0 over the same period and thus the changes in the gaps were approximately equal. Similar results obtained across earlier business cycles.

[27] In addition, there is a small amount collected for veteran's life insurance, workmen's compensation, CHAMPUS (the military health program for dependents), and private employer pension benefits (PBGC premiums).

[28] The elasticity of federal employee retirement contributions is assumed to be zero because there have been no endogenous changes in federal employment or pay owing to the business cycle. The income elasticity of SMI is approximately zero because Medicare status is based largely on age.

ngap is the percent gap in wage earners,
ygap is the percent gap in average wage,
En is elasticity of FICA contributions to change in employment, and
Ey is elasticity of FICA contributions to change in average wages.

As with personal income taxes we assume that En equals 1 and Ey should account for the elasticity of the tax code, given the distribution of income.[29] Ey is less than 1 because wages and salaries above a maximum amount of taxable earnings are not subject to OASDHI taxes. The share of workers above the wage cap has fallen from one-quarter of workers in the 1960s to about 6 percent now (and the Medicare portion of the OASDHI tax covers full wages). Equation 18, below, states that aggregate FICA taxes is the product of the FICA tax rate and the wages subject to tax broken into two parts--earnings by those below the wage cap and the taxable portion of earnings of those with earnings above the cap. A little algebra yields the elasticity of taxes with respect to and increase in income, equation 19.

$$T(t,w,y,x,n) = t*[y*x*n + w*(1-x)*n] \qquad (18)$$

where:
t = statutory tax rate,
y = average wage of those below the wage cap,
x = fraction of wage earners below the wage cap,
w = maximum wages subject to taxation, and
n = number of wage earners.

$$Ey = (y*x)/(y*x + w*(1-x)) \qquad (19)$$

Calculations using data on the distribution of earners and earnings above the wage cap from the annual Social Security Bulletin yield the tax-schedule elasticities, Ey, shown in table 8, columns

[29] Our analysis indicates that the distribution of income between those above the taxable wage cap and those below is not sensitive to the business cycle. We developed two parameters that are sufficient to describe the distribution of wages to make OASDI tax calculations--the share of wage earners below the cap and the ratio of wages of those above the cap to those below the cap. The former is not correlated with the business cycle the latter has only a weak correlation. Thus, we will ignore cyclical sensitivity of the income distribution.

1 and 3. The elasticity of FICA taxes with respect to wages and salaries rises after the early 1970s because the share of workers below the wage cap rises as a result of the 1972 and 1977 amendments to the Social Security Act. Similar calculations were made for the elasticity of SECA taxes; the elasticity of the SECA tax schedule, is on average 25 percent lower than the elasticity of the FICA schedule because a smaller share of the income earned by the self-employed is earned by those below the caps.[30]

The second step is to estimate the relative shares of the cyclical changes to aggregate wage and salary income that result from greater employment and greater income per worker. The percent gap in wage earners and percent gap in average wages are estimated by the following regressions:

FICA:

$$\Delta \ln(covemp) = \underset{(.23)}{.001} + \underset{(10.0)}{1.00}{*}\Delta \ln(emp) + \underset{(3.74)}{.013}{*}\Delta law, \quad \text{adj. } R^2 = .72$$

$$\Delta \ln(avecovwage) = \underset{(.20)}{.000} + \underset{(12.5)}{1.031}{*}\Delta \ln(avewage), \quad \text{adj. } R^2 = .79$$

SECA:

$$\Delta \ln(covemp) = \underset{(-.61)}{-.013} + \underset{(2.43)}{1.71}{*}\Delta \ln(emp) + \underset{(2.50)}{.066}{*}\Delta law, \quad \text{adj. } R^2 = .21$$

$$\Delta \ln(avecovwage) = \underset{(3.30)}{.027} + \underset{(3.39)}{.24}{*}\Delta \ln(avepro), \quad \text{adj. } R^2 = .25$$

where:

covemp = covered employment, from SSA,
emp = civilian employment,
law = dummy for changes in coverage, 1 for 1955, 1957, 1966, 1983, 1984, 1988, 1991,
avecovwage = average wage for covered employment, SSA,
avewage = average wage, total wages and salaries divided by civilian employment,
avepro = proprietor's income divided by covered workers.

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[30] For example, in 1997, 6 percent of the self-employed had income exceeding the caps, and they earned 21 percent of total self-employed income. Among wage earners, only 5 percent were above the caps and they earned 14 percent of total income.

As with the personal income tax elasticity estimates, the weights on En and Ey implied by the regressions move dramatically over time, especially when the sum of ngap and ygap is close to zero, and thus are very sensitive to estimates of potential GDP. As before, we decided to use the average weight over time which placed 62 percent of the weight on the employment term for FICA. The resulting point estimate for the weight on the employment elasticity for SECA was 1.1. This value seemed unreasonable and probably reflected the poor fit of the SECA equations; so we opted to use the weights from the FICA.

The elasticity of unemployment taxes to cyclical income was approached in a distinct manner. The UI tax system has two key features. In most states the wage cap is quite low: indeed in 12 states the wage cap is $7,000 and the weighted average across states was only $9,000 in 1997.[31] The second key feature of the system is that tax rates for firms are experience rated. Thus, tax rates tend to rise for several years after a recession and fall during an expansion. To capture this endogenous behavior we modeled the UI tax rate (Uirate) as a function of lagged unemployment rates and changes in federal tax laws concerning the FUTA wage cap and tax rate.[32] Lagged changes in unemployment rates for four years and the change in the wage cap were significant, but changes in the tax rate--which have been small and infrequent--had no explanatory power.

$$\underset{}{\Delta UIrate} = \underset{(-2.85)}{-.026} + \underset{(4.25)}{.042\Delta UR_{t-1}} + \underset{(7.77)}{.074\Delta UR_{t-2}} + \underset{(-.32)}{.004\Delta UR_{t-3}} + \underset{(2.65)}{.025\Delta UR_{t-4}} + \underset{(5.51)}{.60\Delta WAGECAP}, \quad adj.R^2 = .84$$

Corporate profits taxes, excluding Federal Reserve earnings, are about 10 percent of

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[31] Program specifics are legislated at the state level subject to general federal criteria as well as strong incentives to tax at least $7000.

[32] This may also capture legislated changes by state governments in response to UI trust fund reserves.

federal revenues. Corporate profits tax liability (CPT) is defined as the product of the average tax rate on income subject to tax (τ) and income subject to tax before credits (IST), less tax credits (C); $CPT = \tau * IST - C$. The average tax rate is derived from the data, given BEA's estimates for the other three terms. Income subject to tax equals modified NIPA economic profits (corporate profits less Federal Reserve earnings and rest-of-world profits), CP, less adjustments, ADJ. The adjustments are losses and capital gains which are added to CP, and tax-exempt interest, state and local corporate taxes, and deductions for loss carry-overs which are subtracted. These data are found in *SOI Corporate Income Tax Returns* and in BEA's reconciliation tables between IRS measures of profits and taxes and the NIPA economic profits and profits taxes. Tax credits are primarily for foreign taxes and the investment tax credit. The elasticity of corporate profits taxes to changes in modified corporate profits (CP) is determined as follows:

$$E_{cpt,cp} = (\tau * IST(E_{\tau,cp} + E_{ist,cp}) - C * E_{c,cp})/(\tau * IST - C) \qquad (20)$$

where: $E_{\tau,cp} = E_{\tau,ist} * E_{ist,cp}$, and

$$E_{ist,cp} = (CP - \Sigma ADJ_i * E_{adj,cp}) / (CP - \Sigma ADJ_i).$$

The elasticity of income subject to tax with respect to modified corporate profits in (20) is found by estimating the cyclical sensitivity of the major adjustments to corporate profits (table 9). The elasticities are calculated in two steps. In the first step, the adjustments and modified profits were regressed against the GDP gap and potential GDP.[33] The elasticity with respect to GDP is estimated by evaluating the marginal change at mean GDP. Second, the elasticities of the

[33] This is identical to the deLeeuw et al. (1980) procedure which has potential econometric problems as the adjustments and potential GDP are nominal values in level terms. "Share style" equations showed no explanatory power.

adjustments with respect to GDP were divided by the elasticity of modified profits with respect to GDP to produce the estimates of the elasticity with respect to modified profits. When these results are plugged back into equation (20) an average elasticity of income subject to tax with respect to modified profits of 0.8 is obtained; the annual figures vary from 0.4 in 1982 to 0.98 in 1966 (table 10).[34] These estimates are similar to the deLeeuw et al. (1980) estimates. The low elasticity reflects the importance of corporate losses which is the only adjustment that causes the elasticity to fall below one.

$E_{\tau,ist}$ is the elasticity of the corporate profits tax rate. This is only slightly higher than zero because the corporate income tax in not very progressive and few corporate profits are generated by firms in the lower tax bracket.[35] We have assumed that the elasticity of credits with respect to modified profits varies with the share of credits that are for foreign taxes (which appears to have a zero elasticity) and the share of credits owing to investment tax credits (with an assumed 1.0 elasticity). Combining the elasticities in equation 20 produces an overall elasticity of corporate profits taxes to NIPA economic profits of 0.9, on average (table 10).

Indirect business taxes, which constitute only 5 percent of federal receipts, are composed of excise taxes, customs duties and business non-taxes. As before, the elasticity is the weighted sum of the elasticities of each tax, where the weights are the share of the receipts in total taxes and the elasticity of excise taxes and customs duties are the demand elasticities with respect to cyclical GDP.

The share estimates are constructed using BEA's annual estimates of these taxes. The

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[34] The elasticity tends to fall during recessions owing to the rise in losses.

[35] deLeeuw et al. (1980) estimated the elasticity of the tax code declined from 0.08 in 1955 to 0.02 in 1979. We have assumed that it is has remained at that level.

elasticities for excise taxes and non-taxes are built up from the elasticities of their components. The elasticities of the various components are assumed to be constant over time, thus the variation over time in the excise tax and non-tax elasticities reflects changes in the composition of these taxes. The elasticity of customs duties is set at 2.0, the cyclical elasticity found in the FRB/US model. Our estimates of the elasticities of indirect business taxes and its components with respect to cyclical income are shown in table 12.

The elasticity of excise taxes with respect to cyclical income is obtained by taking the sum of the products of the share of each tax receipt in total excise taxes and the demand elasticity of the taxed good (the latter drawn from various prior studies). Table 12 shows the change in the composition of excise taxes over the years and the elasticities used for each tax. The rise and decline of importance of auto excise taxes and windfall profits taxes are the major contributors to changes in the elasticity of excise taxes over time.

The elasticity of business non-taxes has risen over time owing to the rising share of deposit insurance premiums in non-taxes. We assume that the cyclical income elasticity of deposit premiums is equal to 1.0, reflecting the income elasticity of deposits. Note, the cyclical elasticity will be different than 1 to the extent that opportunity costs of deposits are cyclical. The other major element of non-taxes are rents and royalties from resource extraction on the outer continental shelf; we assume that it has a zero elasticity. Finally, other non-taxes largely consist of proprietary receipts paid to the Department of Agriculture (e.g. inspection fees), Department of the Interior (timber, mineral and water), and fines. Some of the fees are a condition of doing business and presumably are inelastic with respect to the level of output, while others depend upon the level of business activity and thus are more elastic; as a guess we assume that these other non-taxes had an elasticity of 0.5. Table 11 reports our estimates of the elasticity of indirect business taxes with respect to cyclical GDP.

After calculating the high-employment income shares and elasticities, HEB taxes are calculated using the gross-up method by adjusting actual taxes by the tax elasticity times the percent difference between actual and high-employment tax base. The results are summarized in tables 13 and 14. The far column of table 13 shows the cyclical change in tax revenues as a percent of potential GDP per one percentage point of GDP growth. Thus, in 1998, a pick-up of GDP growth of 1 percentage point would boost revenues by 0.31 percent of GDP. This corresponds to an elasticity of receipts to cyclical changes in GDP of 1.5, a figure in excess of the individual tax elasticities because of the relatively elastic changes of the tax bases. Over time, this 0.3 response of taxes with respect to cyclical changes in GDP has been relatively constant, ignoring the values obtained when the GDP gap is small, despite the large changes in marginal tax rates, because the individual tax elasticities have not changed as much as implied by the changes in statutory rates and because the down drift in the personal income tax elasticity has been offset by the rise in the elasticity of social insurance taxes.

Table 14 highlights the sources of cyclical variation in receipts. Typically, 40 percent to 50 percent of the change comes from personal taxes while another one-third to one-half comes from corporate taxes. Corporate income taxes generate more of the cyclical response than social insurance contributions, despite their smaller share of overall receipts and similar tax elasticity because its tax base, profits, is much more cyclical than wages.

B. High-employment expenditures

Among expenditures, only those transfers and grants that are oriented toward income support respond endogenously to changes in economic activity. Among these, unemployment benefits rise rapidly during a downturn in activity, but also the number of beneficiaries of low-income and disability programs such as food stamps, earned income credit, welfare (AFDC and TANF), and disability insurance, expand as well, but only to a small extent. The large retirement transfers are essentially unaffected by fluctuations in the economy.[36]

Unemployment benefits are available for involuntarily unemployed workers who were recently employed and meet certain criteria. In general, benefits can last up to 26 weeks, or up to 39 weeks under the extended benefits program for workers in areas with high unemployment. This permanent extended benefits program was instituted in 1970. The HEB excludes expenditures by the permanent program. However, both before and after that time temporary extended benefits programs have been enacted near the end of each recession. HEB estimates typically include these expenditures because they are not automatic; they result from discretionary policies. However, for some uses of the HEB it may be appropriate to exclude these payments as well. Table 15 provides a summary of the temporary programs.

Unemployment benefits have become less sensitive to business cycle fluctuations over the past two decades as the criteria for obtaining benefits has been tightened and the taxation of benefits effectively reduced their value. In 1975, 76 percent of the unemployed qualified for benefits, but this had fallen to only 52 percent by 1992. Excluding the temporary extended benefits programs (but not benefits paid under the 1970 Act), a 1 percentage point increase in the

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[36] Medicare enrolments are insensitive to business cycle fluctuations because enrollment is largely based on age. OASI enrolments and outlays are boosted during recessions because some workers take early retirement when faced with poor employment prospects. This factor would raise benefit payments by about 0.3 percent for each percentage point change in the unemployment rate. However, OASI payments are held down by the effects of previous recessions because the additional claimants from those recessions receive lower benefits than if they had retired at the normal age. Given that the present value of the benefit stream is approximately the same for those who take early retirement and those who retire at 65, we have assumed that the net cyclical effect for the government is zero.

unemployment rate would boost unemployment benefits about $5 billion in 1998 and would boost the permanent extended benefits program by varying amounts depending on the level of unemployment.[37]

The Aid to Families with Dependent Children program, AFDC, was never very cyclically sensitive. Its successor program Temporary Assistance for needy families, TANF, is essentially a block grant to states and thus it is no longer sensitive to the business cycle from the federal government's perspective. Our estimates for the cyclical response of AFDC are based on Blank (1997). She finds that a 1 percentage point increase in the unemployment rate raises traditional AFDC caseloads (single parent households) by 3-1/2 percent over an eighteen month and period, which then decline to about a 2 percent increase after three years. About 10 percent of AFDC expenses are on AFDC-Unemployed Parent, AFDC-UP, a program for couples, which appears to be much more cyclically responsive. AFDC-UP caseloads rise by about 20 percent during the first 1-1/2 years before easing to a 15 percent rise after 3 years.[38] The following equation approximates the dynamic response of total caseloads to an increase in unemployment as estimated by Blank:

$$\Delta AFDC = AFDC^{*}(.006\Delta UR_{t-1} + .006\Delta UR_{t-2} + .006\Delta UR_{t-3} + .006\Delta UR_{t-4} + .006\Delta UR_{t-5} + .006\Delta U_{t-6} - .003\Delta UR_{t-7} - .003\Delta UR_{t-8} - .003\Delta UR_{t-9} - .003\Delta UR_{t-10} - .003\Delta UR_{t-11} - .003\Delta UR_{t-12})$$

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[37] Until the extended benefits program is triggered by high levels of unemployment an increase in the unemployment rate will have little effect on these expenditures. For example, in 1982 $2.5 billion was spent on extended benefits, but only $0.3 billion was spent in 1991 largely because the latter recession was milder.

[38] This result appears to be dependent on the states included in the sample. The reported result is obtained when the sample is limited to the 19 states that provided the AFDC-UP program continuously over the 1975-95 period. When the sample is enlarged to include states that were forced to initiate the program in the 1990s the unemployment rate becomes insignificant.

A rise in the unemployment rate of 1 percentage point would boost AFDC payments by 5 percent after 1-1/2 years and by only 2-1/2 percent after three years. In its peak year, in 1994 the federal government spent $13 billion for program benefits (and another $1-1/2 billion for administrative expenses): thus a one percentage point increase in the unemployment rate would have raised federal outlays by only $1/2 billion, or $1 billion for the combined federal and state governments. The equation is set to zero beginning in 1997.[39]

The food stamp program has similar responsiveness to unemployment rates as found in AFDC. Thus, we used the same estimates. By contrast, this program may have become more cyclically sensitive for the federal government because the eligibility rules enacted in 1996 limit the amount of time non-working individuals are eligible for benefits. Here, a 5 percent increase in expenditures after 1-1/2 years implies that expenditures would rise by $1 billion.

Medicaid expenditures will also be raised by an increase in unemployment as more individuals qualify for AFDC/TANF and become eligible for benefits. Only one-third of Medicaid payments go to the non-aged poor and thus a 5 percent increase in AFDC enrollments would boost overall Medicaid expenditures by 1-1/2 percent or about $1-1/2 billion in 1998.

The Earned Income Credit was greatly expanded in the 1990s from a minor program to the federal government's largest low-income support program. The portion of the credit that exceeds the income tax due is recorded in the budget as an outlay.[40] There is no cyclical experience with this greatly expanded credit. To fill the gap, we estimated the elasticity using the personal income tax methodology, assuming that all changes occur owing to income per family

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[39] The zeroing out of welfare abstracts from the small contingency program ($2 billion over 5 years) for states with high and rising unemployment.

[40] The rest appears as lower taxes and is captured by our tax elasticity estimates.

rather than number of families.[41]

For a family with one child the EIC in 1996 rose by 34 percent per dollar of earned income until annual earned income reached $6330 dollars. It was constant for income earned income up to $11,610 and then was phased-out at the rate of 16 cents per dollar until $25,078. Thus, the sign of the elasticity to an increase in earned income depends upon the relative magnitudes of the amount of earnings in the three regions. Most EIC payments go to those in the phase-out range and a 1 percent increase in incomes would, on net, reduce the EIC by .9 percent.[42] Using our earlier result that a 1 percent increase in NIPA adjusted personal income raises AGI for non-singles by 0.8 percent, we obtain the following equation for the cyclical component of the EIC:

$$\Delta EIC = EIC(t)*(100+YADJGAP(t-1)*0.8*(-0.9))/100$$

where YADJGAP is the gap of adjusted personal income (in percentage points) and is lagged one year because EIC outlays are largely paid out when tax returns are filed. With refundable credits totaling $24 billion, a 1 percentage point increase in NIPA adjusted personal income would reduce outlays by $0.2 billion.

The federal government provides cash benefits for persons with severe disabilities through two programs, the Disability Insurance program of OASDI and the Supplemental Security Income program. Eligibility for the DI program is based on work experience while the

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[41] The regressions for the personal income tax indicated that the number of non-single filers is not sensitive to the business cycle and these represent the lion's share of EIC beneficiaries.

[42] The actual elasticity for the expenditure portion may be smaller as the refundable portion (about $24 billion of the $28 billion in 1996) would be less heavily weighted in the phase-out region.

SSI program does not require work experience and is means tested. Econometric evidence indicates that one of the factors that affects applications and awards for these program is the unemployment rate. While the unemployment rate appears to have a stronger impact on DI applications than it does on SSI applications, the impacts on awards are equivalent. In each case, a rise in the unemployment rate of 1 percentage point raises awards by 2 percent.[43] In the case of the DI program, new awards are about 10 percent of the total caseload. For SSI, only half of the caseload is disabled working-age adults (the rest are disabled children and elderly disabled or poor) and new awards are about 10 percent of this subset of the overall caseload. In 1998, expenditures on these two programs were $50 billion for DI and $30 billion for SSI. Thus, a 1 percentage point increase in the unemployment rate would boost outlays by $0.1 billion in the DI program and $0.03 billion for SSI.[44]

C. High-employment surplus

As shown on table 16, in 1998 the actual unemployment rate was 1.1 percentage points below the CBO estimate of NAIRU which depressed expenditures by $7 billion, about 0.4 percent of total expenditures (a 4 percent increase in the affected programs).[45] Most of the increase would occur as increased unemployment benefits (table 17). To put this in context with receipts, a 1 percent fall in GDP is comparable to about a ½ percent increase in unemployment, thus a one percent fall in GDP would boost expenditures by $3 billion, compared to a $30 billion

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[43] See "Determinants of the Growth of SSA's Disability Programs-An Overview", Kalman Rupp and David Stapleton, Social Security Bulletin, Winter 1995.

[44] These calculations ignore any hysteresis that is probably especially evident in the DI program where few leave the roles. But if the roles do tend to rachet up over time, it is not clear that the increases owing to recessions should be included in cyclical measures.

[45] The ultimate effect would be somewhat larger owing to the lagged response of these programs.

reduction in receipts in the first year.

Table 18 shows the effects of the business cycle on the budget surplus. Over the past decade, the cyclical component of the surplus has swung by 1-1/2 percentage points of GDP, from adding 0.8 percentage point to the *deficit* in 1992 to boosting the *surplus* by 0.7 percentage point in 1998.

VI. Conclusion

This paper presents theoretical and empirical analysis of automatic fiscal stabilizers, such as the income tax and unemployment insurance benefits. Using the modern theory of consumption behavior, we identify several channels through which the optimal reaction of household consumption plans to aggregate income shocks is tempered by the automatic fiscal stabilizers.

The insurance channel--in which higher anticipated income tax rates reduce the variance of uncertain future after-tax income--is effective provided that the precautionary motive for saving is important and that individuals understand the implications of the government's intertemporal budget constraint. The wealth channel--in which current income taxes are lower as a result of a recession, say--is effective if individuals expect government purchases (rather than income tax rates) to adjust to maintain the government's intertemporal budget constraint. This channel also can be effective if the rate used by individuals to discount future income tax hikes exceeds the government's borrowing rate (as in the FRB/US model). The liquidity channel--in which lower current income taxes relax borrowing or liquidity constraints--is effective to the extent that such constraints are in fact binding for a non-trivial fraction of the population.

To bring some evidence to bear on these issues, we present results from several empirical exercises using post-war U.S. data. Using standard time domain techniques, we estimate elasticities of the various federal taxes with respect to their tax bases and responses of certain components of federal spending to changes in the unemployment rate. Such estimates are useful for analysts who forecast federal revenues and spending; the estimates also allow high-employment or cyclically-adjusted federal tax receipts and expenditures to be estimated. Using frequency domain techniques, we confirm that the relationships found in the time domain are strong at the business cycle frequencies. Such results suggest the potential for the automatic fiscal stabilizers to play a quantitatively important role in the economic stabilization process.

In one large-scale, macroeconometric model of the United States economy--FRB/US--however, the automatic fiscal stabilizers are found to play a modest role at damping the short-run effect of aggregate demand shocks on real GDP, reducing the “multiplier” by about 10 percent, although they have a somewhat larger damping impact (in percentage terms) on personal consumption expenditures. Very little stabilization is provided in the case of an aggregate supply shock. In light of the findings from the FRB/US simulations, perhaps the title and conclusion of our paper should be--The Automatic Fiscal Stabilizers: Quietly *and Modestly* Doing Their Thing.

Table 3
Potential GDP, NAIRU, and Labor Force Participation

Year	Potential GDP billions $	NAIRU	Potential Labor force millions	GDP gap	Employment gap
1951	327.5	5.3	61.9	-3.7	-2.3
1952	348.6	5.4	62.2	-2.9	-2.4
1953	367.2	5.4	62.7	-3.4	-3.1
1954	383.9	5.4	63.8	0.7	0.5
1955	402.2	5.4	65.0	-3.2	-1.1
1956	429.2	5.4	66.1	-2.0	-2.1
1957	458.6	5.4	67.1	-0.5	-0.9
1958	485.7	5.4	67.7	3.8	1.5
1959	508.6	5.4	68.2	0.3	-0.2
1960	534.9	5.5	68.9	1.6	-1.0
1961	562.0	5.5	70.1	3.1	0.7
1962	591.7	5.5	71.2	1.1	0.9
1963	622.6	5.5	72.4	0.8	0.8
1964	657.5	5.6	73.6	-0.8	0.2
1965	698.6	5.7	74.8	-2.9	-0.8
1966	749.9	5.8	76.0	-5.1	-1.8
1967	807.8	5.8	77.3	-3.2	-2.2
1968	879.4	5.8	78.5	-3.6	-2.7
1969	957.8	5.8	79.8	-2.5	-3.6
1970	1046.1	5.9	82.0	1.0	-1.9
1971	1138.2	5.9	84.4	1.1	-0.0
1972	1225.9	6.0	86.8	-0.9	-0.7
1973	1339.7	6.1	89.3	-3.2	-1.4
1974	1510.5	6.2	91.8	0.9	-0.8
1975	1705.9	6.2	94.2	4.4	2.9
1976	1862.7	6.2	96.8	2.3	2.2
1977	2045.9	6.2	99.4	0.9	1.2
1978	2269.3	6.3	102.0	-1.0	-0.4
1979	2544.5	6.3	104.8	-0.5	-0.6
1980	2860.6	6.2	107.0	2.7	1.0
1981	3208.4	6.2	108.8	2.9	1.6
1982	3488.4	6.1	110.6	7.1	4.1
1983	3721.1	6.1	112.3	5.6	4.4
1984	3958.5	6.0	114.1	1.4	2.1
1985	4206.8	6.0	115.9	0.6	1.6
1986	4442.1	6.0	117.8	0.4	1.0
1987	4709.1	6.0	119.7	0.4	0.1
1988	5015.9	5.9	121.6	-0.7	-0.5
1989	5366.1	5.9	123.6	-1.4	-0.9
1990	5736.0	5.9	125.4	-0.1	-0.6
1991	6092.7	5.9	126.9	2.9	1.4
1992	6382.8	5.8	128.3	2.2	1.9
1993	6679.4	5.8	129.7	1.8	1.6
1994	6981.9	5.8	131.2	0.5	0.4
1995	7312.3	5.7	132.6	0.6	0.1
1996	7644.9	5.7	134.1	-0.2	-0.2
1997	8005.5	5.7	135.9	-1.3	-1.1
1998	8328.8	5.6	137.4	-2.2	-1.4

Source: Congressional Budget Office

Table 4
Share Equations

Dependent variable	Wages	Supple-ments	Profits	Proprietors income	Rental income	Net interest	Other personal interest	Dividends
constant	-0.018 (-1.15)	0.038 (5.27)	-0.005 (-0.21)	-0.027 (-1.69)	-0.010 (-1.56)	0.022 (1.98)	0.010 (2.09)	0.004 (0.85)
gap	0.221 (12.6)	0.030 (3.81)	-0.319 (12.5)	-0.009 (-0.53)	0.021 (2.93)	0.030 (2.45)	0.016 (3.20)	0.003 (0.60)
gap[t-1]	-0.106 (-5.89)	-0.010 (-1.21)	0.054 (2.05)	0.015 (0.85)	-0.010 (-1.38)	0.010 (0.76)	-0.019 (-3.78)	-0.008 (-1.67)
gap[t-2]	-0.059 (-3.26)	0.002 (0.30)	0.052 (1.97)	-0.010 (-0.54)	0.002 (0.25)	-0.012 (-0.94)	-0.005 (-1.05)	-0.013 (-2.67)
gap[t-3]	-0.056 (-3.09)	-0.011 (-1.31)	0.006 (0.24)	-0.023 (-1.30)	0.001 (0.08)	-0.016 (-1.28)	-0.001 (-0.02)	-0.002 (-0.41)
gap[t-4]	-0.018 (-1.06)	0.001 (0.16)	0.067 (2.67)	0.006 (0.34)	-0.004 (-0.58)	0.003 (0.26)	-0.008 (-1.71)	0.006 (1.20)
sum of gap coef.	-0.018	0.013	-0.139	-0.021	0.010	0.015	-0.017	-0.014
Adj. R^2	0.55	0.07	0.50	0.02	0.03	0.03	0.12	0.06
D.W.	1.63	1.78	2.20	2.02	2.05	1.27	1.80	1.37

Sample: 1955:1 to 1997:4. Dependent variables are measured as first differences of the variable divided by GDP. Gap terms are first differences of (GDPK-GDP)/GDP.

Table 5
Personal Income Tax Elasticities

Year	Ey		Epersonal
	Single	Non-single	
1951	1.55	1.71	1.48
1952	1.55	1.70	1.47
1953	1.54	1.69	1.46
1954	1.52	1.70	1.46
1955	1.53	1.69	1.45
1956	1.46	1.68	1.44
1957	1.48	1.67	1.43
1958	1.56	1.67	1.44
1959	1.47	1.64	1.41
1960	1.46	1.65	1.41
1961	1.45	1.62	1.39
1962	1.45	1.61	1.38
1963	1.38	1.64	1.39
1964	1.52	1.67	1.43
1965	1.52	1.67	1.43
1966	1.51	1.63	1.40
1967	1.50	1.61	1.39
1968	1.49	1.56	1.35
1969	1.53	1.56	1.36
1970	1.54	1.56	1.36
1971	1.58	1.59	1.38
1972	1.61	1.61	1.39
1973	1.59	1.60	1.39
1974	1.57	1.59	1.38
1975	1.63	1.67	1.45
1976	1.64	1.69	1.46
1977	1.71	1.73	1.50
1978	1.68	1.70	1.48
1979	1.64	1.68	1.47
1980	1.62	1.66	1.45
1981	1.58	1.63	1.43
1982	1.53	1.59	1.40
1983	1.55	1.59	1.40
1984	1.53	1.58	1.40
1985	1.57	1.57	1.40
1986	1.52	1.53	1.36
1987	1.51	1.54	1.37
1988	1.46	1.51	1.34
1989	1.45	1.48	1.33
1990	1.46	1.46	1.31
1991	1.46	1.49	1.33
1992	1.46	1.49	1.33
1993	1.46	1.50	1.33
1994	1.47	1.51	1.34
1995	1.46	1.49	1.32
1996	1.44	1.47	1.31

Table 6

Personal income tax elasticity regressions, number of returns elasticity

Dependent variable	Single returns	Non-single returns
Constant	-0.016 (-3.14)	0.012 (5.28)
Employment	2.33 (10.07)	0.16 (1.49)
Employment*T78	-1.21 (-3.12)	--
Filing requirements	-0.072 (-4.42)	-0.032 (-2.56)
T78	0.014 (1.66)	--
D87	0.064 (3.49)	--
Adjusted R^2	0.77	0.15
Durbin-Watson	1.58	1.54

Sample: 1951 to 1996. All variable in first differences of the log of the series. Employment is civilian payroll employment. Filing requirements is the nominal threshold for filing an income tax return. T78 is a dummy of ones beginning in 1978 and D87 is a dummy to capture the change in filing requirements from TRY 1986 which raised the number of returns from minors.

Table 7

Elasticities of AGI Per Return and AGI to NIPA Adjusted Personal Income

Dependent variable	AGI per return--singles			AGI per return--non-singles			
Sample period	1951-1996	1951-1977	1977-1996	1951-1996	1951-1977	1977-1996	1987-1996
Constant	-0.008 (-1.13)	-0.002 (-1.02)	-0.001 (-0.19)	0.012 (1.57)	-0.006 (-0.50)	0.012 (1.01)	-0.010 (-0.53)
Adjusted NIPA income per employee	1.13 (8.34)	1.07 (3.58)	1.08 (10.06)	0.79 (5.28)	1.18 (5.37)	0.82 (4.15)	1.32 (2.30)
Filing requirements	0.064 (4.05)	0.067 (3.45)	0.004 (0.11)	0.020 (0.82)	-0.008 (-.36)	0.154 (2.72)	.214 (2.30)
Adjusted R2	0.64	0.45	0.86	0.37	0.52	0.47	0.50
All variables are first differences of the log levels.							

Dependent variable	AGI-singles	AGI --non-singles			
Sample period	1951-1996	1951-1996	1951-1977	1977-1996	1987-1996
Constant	-0.027 (-2.55)	0.013 (2.38)	0.011 (2.22)	0.013 (1.34)	-0.010 (-0.67)
Adjusted NIPA income	1.41 (10.14)	0.81 (11.01)	0.84 (11.68)	0.79 (6.30)	1.20 (4.57)
Filing requirements	0.008 (0.31)	0.000 (0.00)	-0.027 (-1.91)	0.086 (1.86)	.161 (2.50)
Adjusted R2	0.70	0.74	0.85	0.67	0.77
All variables are first differences of the log levels.					

Table 8
FICA and SECA Tax Elasticities

Year	Ey		Esocial		
	FICA	SECA	FICA	SECA	Total
1951	.49	.26	.81	.72	.80
1952	.45	.26	.79	.72	.79
1953	.41	.25	.78	.72	.77
1954	.40	.25	.77	.72	.77
1955	.46	.34	.80	.75	.79
1956	.43	.31	.79	.74	.78
1957	.41	.29	.78	.73	.77
1958	.40	.29	.77	.73	.77
1959	.45	.31	.79	.74	.79
1960	.43	.31	.78	.74	.78
1961	.41	.30	.78	.74	.77
1962	.39	.27	.77	.73	.76
1963	.37	.25	.76	.72	.76
1964	.35	.23	.75	.71	.75
1965	.33	.18	.75	.69	.74
1966	.48	.25	.80	.72	.80
1967	.45	.22	.79	.71	.78
1968	.52	.26	.82	.72	.81
1969	.47	.25	.80	.72	.79
1970	.45	.23	.79	.71	.79
1971	.41	.22	.78	.71	.77
1972	.45	.25	.79	.72	.79
1973	.52	.26	.82	.72	.81
1974	.61	.30	.85	.74	.84
1975	.60	.31	.85	.74	.84
1976	.60	.32	.85	.74	.84
1977	.60	.34	.85	.75	.84
1978	.58	.32	.84	.74	.83
1979	.68	.40	.88	.77	.87
1980	.71	.45	.89	.79	.88
1981	.73	.49	.90	.81	.89
1982	.74	.51	.90	.81	.90
1983	.76	.52	.91	.82	.90
1984	.75	.49	.91	.81	.90
1985	.75	.48	.90	.80	.90
1986	.75	.48	.91	.80	.90
1987	.74	.47	.90	.80	.90
1988	.72	.43	.89	.79	.89
1989	.73	.45	.90	.79	.89
1990	.75	.47	.90	.80	.90
1991	.77	.52	.91	.82	.91
1992	.76	.53	.91	.82	.90
1993	.77	.54	.91	.83	.91
1994	.80	.60	.92	.85	.92
1995	.78	.60	.92	.85	.91
1996	.78	.60	.92	.85	.91

Table 9

Elasticities of Adjustments to Modified Corporate Profits

Dependent variable	Modified profits	State profits taxes	tax-exempt interest	capital gains	losses	Loss carryovers
Constant	17.4 (4.26)	-2.23 (-13.0)	-1.53 (-17.0)	-0.25 (-0.50)	-1.87 (-2.36)	-0.96 (-5.62)
GAP	-0.262 (-3.34)	-0.003 (-0.94)	-0.001 (-0.72)	-0.048 (-4.97)	0.038 (2.47)	-.005 (-1.66)
Potential GDP	0.063 (19.0)	0.006 (44.5)	0.005 (65.3)	0.007 (17.2)	0.015 (22.9)	0.004 (30.5)
Elasticity with respect to GDP at mean	3.75	0.58	0.37	7.05	-2.90	1.64
Elasticity with respect to modified profits	n.a.	0.16	0.11	2.13	-0.88	0.50
adjusted R2	.94	.99	.99	.93	.96	.98
Sample 1956 to 1994						

Table 10
Corporate Income Tax Elasticities

Year	Eist, income subject to tax relative to modified profits	Ecorporate, corporate tax accruals relative to profits
1954	.94	1.00
1955	.94	1.01
1956	.94	1.01
1957	.90	.97
1958	.88	.96
1959	.92	.99
1960	.85	.92
1961	.89	.98
1962	.90	.98
1963	.90	.99
1964	.92	1.01
1965	.95	1.05
1966	.95	1.06
1967	.94	1.06
1968	.96	1.08
1969	.88	.99
1970	.74	.86
1971	.81	.96
1972	.88	1.05
1973	.87	1.08
1974	.73	1.07
1975	.76	1.11
1976	.84	1.23
1977	.88	1.28
1978	.90	1.26
1979	.85	1.29
1980	.68	.90
1981	.54	.64
1982	.31	.22
1983	.52	.60
1984	.58	.67
1985	.63	.78
1986	.70	.88
1987	.66	.81
1988	.64	.82
1989	.58	.72
1990	.49	.62
1991	.48	.60
1992	.59	.72
1993	.70	.85
1994	.70	.85

Table 11

Indirect Business Taxes: Shares of Receipts for Selected Years
(Percent)

	1955	1965	1975	1980	1985	1990	1995	Elasticity
Share in IBT								
Excise	91	80	71	68	59	54	63	
Customs	7	12	19	18	21	27	21	2.0
Non-taxes	3	8	9	14	20	19	16	
Share in Excise								
Alcohol	30	26	32	21	16	16	13	0.75
Gas	10	18	24	15	26	29	36	0.5
Tobacco	17	15	14	9	13	12	10	0.0
Diesel	0	1	2	2	8	9	11	0.5
Airline	2	1	5	6	7	10	10	1.5
Telephone	6	7	12	3	7	8	7	1.0
Windfall oil profits	0	0	0	35	15	0	0	0.0
Motor vehicle	13	18	4	3	3	4	3	2.7
Other manufacturing	7	10	8	0	0	0	0	2.0
Other	14	3	0	6	6	11	9	1.0
Share in non-taxes								
Off-shore oil	0	9	30	42	30	19	18	0.0
Deposit insurance premiums	33	18	20	12	27	39	29	1.0
Other	67	73	50	46	43	42	52	0.5

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Table 12
Indirect Business Tax Elasticities

year	Excise taxes	Customs duties	Business non-taxes	Indirect Business Tax
1951	1.03	2.0	.75	1.09
1952	0.97	2.0	.75	1.03
1953	1.02	2.0	.75	1.07
1954	1.03	2.0	.75	1.06
1955	1.02	2.0	.67	1.08
1956	1.09	2.0	.67	1.13
1957	1.04	2.0	.67	1.09
1958	1.04	2.0	.67	1.09
1959	1.00	2.0	.66	1.07
1960	1.04	2.0	.67	1.11
1961	0.99	2.0	.54	1.05
1962	1.01	2.0	.55	1.07
1963	1.05	2.0	.55	1.10
1964	1.07	2.0	.55	1.12
1965	1.12	2.0	.55	1.16
1966	1.03	2.0	.55	1.11
1967	0.99	2.0	.52	1.07
1968	0.98	2.0	.53	1.08
1969	1.05	2.0	.52	1.13
1970	1.04	2.0	.51	1.13
1971	1.03	2.0	.46	1.14
1972	0.86	2.0	.44	1.00
1973	0.81	2.0	.49	0.97
1974	0.82	2.0	.49	0.99
1975	0.82	2.0	.45	1.08
1976	0.78	2.0	.44	0.99
1977	0.75	2.0	.42	0.98
1978	0.76	2.0	.42	1.03
1979	0.79	2.0	.39	1.03
1980	0.50	2.0	.35	0.75
1981	0.32	2.0	.34	0.58
1982	0.40	2.0	.36	0.67
1983	0.49	2.0	.40	0.74
1984	0.53	2.0	.41	0.81
1985	0.60	2.0	.49	0.87
1986	0.70	2.0	.55	1.01
1987	0.72	2.0	.57	1.04
1988	0.72	2.0	.58	1.04
1989	0.75	2.0	.56	1.07
1990	0.76	2.0	.60	1.06
1991	0.72	2.0	.65	0.98
1992	0.71	2.0	.64	0.99
1993	0.73	2.0	.67	1.01
1994	0.73	2.0	.65	0.98
1995	0.73	2.0	.55	0.98
1996	0.68	2.0	.62	0.93

Table 13
High-Employment Receipts

Year	HEB receipts $, billions	Actual receipts $, billions	Cyclical receipts $, billions	Cyclical receipts % GDPK	GDP gap	Response of Taxes to 1% GDP Change, % of GDP
1951	60.2	64.7	-4.5	-1.4	-3.7	0.37
1952	64.5	67.8	-3.3	-1.0	-2.9	0.33
1953	66.5	70.5	-4.0	-1.1	-3.4	0.32
1954	65.7	64.3	1.4	0.4	0.7	0.54
1955	69.3	73.2	-3.8	-1.0	-3.2	0.30
1956	75.9	78.6	-2.7	-0.6	-2.0	0.31
1957	82.2	82.6	-0.4	-0.1	-0.6	0.15
1958	85.7	79.5	6.2	1.3	3.8	0.34
1959	91.2	90.6	0.6	0.1	0.3	0.45
1960	99.3	97.0	2.3	0.4	1.5	0.29
1961	105.0	99.0	6.0	1.1	3.1	0.35
1962	109.1	107.2	1.9	0.3	1.1	0.29
1963	117.0	115.5	1.5	0.2	0.8	0.29
1964	114.5	116.2	-1.7	-0.3	-0.8	0.30
1965	119.5	125.8	-6.4	-0.9	-2.9	0.31
1966	131.5	143.5	-12.0	-1.6	-5.1	0.32
1967	144.8	152.6	-7.8	-1.0	-3.2	0.30
1968	167.2	176.9	-9.6	-1.1	-3.6	0.31
1969	192.0	199.5	-7.5	-0.8	-2.6	0.30
1970	199.5	195.1	4.4	0.4	1.0	0.43
1971	208.9	203.3	5.6	0.5	1.1	0.44
1972	230.5	232.6	-2.0	-0.2	-0.9	0.18
1973	250.9	264.0	-13.1	-1.0	-3.2	0.30
1974	299.5	295.2	4.4	0.3	0.8	0.34
1975	321.9	297.4	24.5	1.4	4.4	0.32
1976	357.6	343.1	14.5	0.8	2.3	0.33
1977	395.0	389.6	5.4	0.3	0.9	0.28
1978	438.8	446.5	-7.7	-0.3	-0.9	0.36
1979	504.1	511.1	-6.9	-0.3	-0.5	0.52
1980	581.9	561.5	20.3	0.7	2.6	0.27
1981	674.3	649.3	25.0	0.8	2.9	0.27
1982	696.9	646.4	50.5	1.4	7.0	0.21
1983	725.5	671.9	53.6	1.4	5.6	0.26
1984	757.5	746.9	10.6	0.3	1.4	0.19
1985	812.4	811.3	1.2	0.0	0.6	0.04
1986	850.5	850.1	0.5	0.0	0.4	0.02
1987	937.5	937.5	0.1	0.0	0.4	0.00
1988	983.9	997.2	-13.3	-0.3	-0.7	0.40
1989	1056.9	1079.4	-22.4	-0.4	-1.4	0.31
1990	1124.8	1129.8	-5.0	-0.1	-0.2	0.56
1991	1192.8	1149.0	43.8	0.7	2.9	0.25
1992	1240.7	1198.5	42.2	0.7	2.2	0.30
1993	1307.1	1275.1	32.1	0.5	1.8	0.26
1994	1380.4	1374.7	5.7	0.1	0.5	0.16
1995	1466.1	1460.4	5.8	0.1	0.6	0.14
1996	1577.8	1584.7	-6.9	-0.1	-0.2	0.42
1997	1687.1	1720.0	-32.8	-0.4	-1.3	0.31
1998	1788.1	1844.2	-56.1	-0.7	-2.2	0.31

Table 14

Decomposition of Cyclical Taxes
(Billions of dollars)

Year	Total Cyclical Receipts	Personal taxes	Corporate Income taxes	Social insurance	Indirect business taxes
1951	-4.5	-1.4	-2.6	-0.1	-0.4
1952	-3.3	-1.4	-1.8	0.2	-0.3
1953	-4.0	-1.7	-2.3	0.4	-0.4
1954	1.4	0.0	0.8	0.5	0.1
1955	-3.8	-1.1	-2.7	0.3	-0.4
1956	-2.7	-1.3	-1.3	0.1	-0.3
1957	-0.4	-0.6	-0.2	0.5	-0.1
1958	6.2	1.9	3.2	0.6	0.5
1959	0.6	0.5	-0.1	0.2	0.0
1960	2.3	0.7	1.4	-0.1	0.2
1961	6.0	2.2	2.9	0.5	0.5
1962	1.9	1.0	0.8	-0.1	0.2
1963	1.5	0.8	0.8	-0.2	0.1
1964	-1.7	-0.4	-1.1	-0.1	-0.2
1965	-6.4	-1.8	-3.6	-0.4	-0.5
1966	-12.0	-4.2	-6.3	-0.7	-0.8
1967	-7.8	-3.5	-3.6	-0.1	-0.5
1968	-9.6	-3.7	-5.4	0.2	-0.7
1969	-7.5	-3.8	-3.6	0.5	-0.5
1970	4.4	0.3	2.1	1.9	0.2
1971	5.6	1.5	1.7	2.1	0.3
1972	-2.0	-0.4	-2.3	0.8	-0.2
1973	-13.1	-4.8	-6.8	-0.8	-0.7
1974	4.4	-0.2	3.3	1.0	0.2
1975	24.5	8.0	11.4	3.9	1.2
1976	14.5	6.4	5.9	1.6	0.6
1977	5.4	3.7	2.3	-0.8	0.2
1978	-7.7	-1.4	-4.5	-1.6	-0.3
1979	-6.9	-3.0	-1.6	-2.2	-0.2
1980	20.3	7.8	9.6	2.0	0.9
1981	25.0	13.3	6.9	3.8	1.0
1982	50.5	30.4	8.6	9.0	2.5
1983	53.6	29.7	13.5	8.0	2.3
1984	10.6	10.2	3.0	-3.3	0.7
1985	1.2	4.1	2.1	-5.4	0.3
1986	0.5	2.1	2.6	-4.5	0.2
1987	0.1	2.9	1.7	-4.8	0.2
1988	-13.3	-2.8	-4.5	-5.6	-0.4
1989	-22.4	-8.3	-8.0	-5.2	-0.9
1990	-5.0	-3.8	0.3	-1.5	-0.1
1991	43.8	16.5	15.1	9.8	2.3
1992	42.2	19.8	11.7	8.9	1.8
1993	32.1	13.8	12.8	3.8	1.6
1994	5.7	4.4	2.3	-1.5	0.5
1995	5.8	2.3	4.5	-1.6	0.5
1996	-6.9	-1.4	-2.7	-2.5	-0.2
1997	-32.8	-12.2	-12.8	-6.6	-1.1
1998	-56.1	-24.1	-20.6	-9.4	-1.9

Table 15

Temporary Unemployment Insurance Extended Benefits

Year	Provisions	Expenditures
1958-59	Temporary Unemployment Compensation Act provided a voluntary program under which states could extend benefits up to 13 weeks. Financed by interest-free loans to the states.	2 million workers received $0.6 billion from 6/58 to 4/59
1961-62	Temporary Extended Unemployment Compensation Act extended benefits 13 weeks. Financed by a temporary tax.	2.8 million workers received $0.82 billion 3/61 to 6/62.
1970	Extended Unemployment Compensation Act initiated permanent extended benefit program.	Outlays under this program have been made every year.
1971-72	Emergency Unemployment Act provided 13 weeks beyond the extended benefits period, for a total of 52 weeks.	$0.6 billion in 1971 and 1972
1974-78	Emergency Unemployment Compensation Act of 1974 (plus three subsequent extensions) extended benefits up to 65 weeks.	$6.5 billion in 1975-78.
1974	Emergency Jobs and Unemployment assistance Act provided a temporary program for the uninsured: farm workers, domestic workers and S&L employees	$2.5 billion
1982-85	Federal Supplemental Compensation Program (and six subsequent extensions) provided up to 14 weeks assistance to workers who had exhausted their benefits	$9.3 billion: $1.2 billion in 1982; $5.4 billion in 1983; $2.3 billion in 1984 and $0.7 billion in 1985.
1991-94	Emergency Unemployment Compensation Act (and 4 extensions)	$27.8 billion: $0.8 billion in 1991 $13.6 billion in 1992 $11.9 billion in 1993 $1.4 billion in 1994

Table 16

High Employment Current Expenditures
(Billions of dollars, except where noted)

Year	Total expenditures		Cyclical expenditures		Unemployment
	HEB	Actual	Billions $	% of GDPK	rate gap
1951	55.0	54.4	0.6	0.2	-2.0
1952	64.2	63.3	1.0	0.3	-2.3
1953	69.2	68.1	1.1	0.3	-2.4
1954	65.4	65.5	-0.1	-0.0	0.2
1955	67.2	66.9	0.3	0.1	-1.0
1956	70.6	70.0	0.5	0.1	-1.3
1957	78.9	78.4	0.6	0.1	-1.1
1958	84.0	84.9	-0.9	-0.2	1.4
1959	87.9	88.0	-0.1	-0.0	0.0
1960	89.6	89.6	-0.0	-0.0	0.0
1961	95.4	96.1	-0.7	-0.1	1.2
1962	104.3	104.4	-0.1	-0.0	0.1
1963	110.1	110.2	-0.0	-0.0	0.1
1964	115.6	115.4	0.3	0.0	-0.4
1965	123.1	122.5	0.7	0.1	-1.2
1966	142.1	140.9	1.2	0.2	-2.0
1967	162.3	160.9	1.4	0.2	-1.9
1968	181.3	179.7	1.6	0.2	-2.2
1969	192.7	190.8	1.9	0.2	-2.4
1970	210.1	209.1	1.0	0.1	-0.9
1971	228.5	228.6	-0.1	-0.0	0.0
1972	253.3	253.1	0.2	0.0	-0.4
1973	276.5	275.1	1.4	0.1	-1.3
1974	313.1	312.1	1.1	0.1	-0.5
1975	367.2	371.3	-4.1	-0.2	2.3
1976	397.0	400.3	-3.3	-0.2	1.5
1977	434.2	435.9	-1.7	-0.1	0.8
1978	478.6	478.1	0.4	0.0	-0.2
1979	530.7	529.5	1.2	0.0	-0.4
1980	620.4	622.5	-2.0	-0.1	1.0
1981	703.1	707.1	-4.0	-0.1	1.4
1982	770.8	781.1	-10.3	-0.3	3.6
1983	836.0	846.4	-10.3	-0.3	3.5
1984	898.3	902.9	-4.6	-0.1	1.5
1985	971.7	974.2	-2.5	-0.1	1.2
1986	1024.9	1027.6	-2.7	-0.1	1.0
1987	1065.5	1066.3	-0.8	-0.0	0.2
1988	1120.1	1118.5	1.7	0.0	-0.4
1989	1195.7	1192.7	3.0	0.1	-0.6
1990	1286.3	1284.5	1.7	0.0	-0.3
1991	1340.3	1345.0	-4.8	-0.1	1.0
1992	1479.8	1479.4	-9.6	-0.1	1.7
1993	1518.4	1525.8	-7.3	-0.1	1.1
1994	1559.0	1561.4	-2.4	-0.0	0.3
1995	1636.3	1634.7	1.6	0.0	-0.1
1996	1697.6	1695.0	2.6	0.0	-0.3
1997	1745.1	1741.0	4.1	0.1	-0.7
1998	1778.8	1771.4	7.4	0.1	-1.1

Table 17

Decomposition of Cyclical Expenditures
(Billions of dollars)

Year	Cyclical Expenditures	UI benefits	Other	Memo: Extended UI benefits
1951	0.6	0.6	0.0	0.0
1952	1.0	0.9	0.1	0.0
1953	1.1	1.0	0.1	0.0
1954	-0.1	-0.1	0.0	0.0
1955	0.3	0.4	-0.0	0.0
1956	0.5	0.5	0.0	0.0
1957	0.6	0.5	0.1	0.0
1958	-0.9	-0.9	-0.0	0.0
1959	-0.1	-0.0	-0.1	0.0
1960	-0.0	-0.0	0.0	0.0
1961	-0.7	-0.7	-0.0	0.6
1962	-0.1	-0.0	-0.1	0.2
1963	-0.0	-0.1	0.0	-0.0
1964	0.3	0.2	0.0	-0.0
1965	0.7	0.6	0.1	-0.0
1966	1.2	1.0	0.2	-0.0
1967	1.4	1.1	0.2	-0.0
1968	1.6	1.4	0.2	-0.0
1969	1.9	1.6	0.3	-0.0
1970	1.0	0.7	0.3	-0.0
1971	-0.1	-0.0	-0.1	0.7
1972	0.2	0.4	-0.2	0.5
1973	1.4	1.2	0.2	0.0
1974	1.1	0.6	0.5	0.0
1975	-4.1	-3.5	-0.6	5.3
1976	-3.3	-2.0	-1.3	6.0
1977	-1.7	-1.1	-0.6	3.6
1978	0.4	0.3	0.2	0.9
1979	1.2	0.6	0.6	0.2
1980	-2.0	-2.0	0.0	1.6
1981	-4.0	-2.8	-1.3	1.3
1982	-10.3	-8.1	-2.2	3.5
1983	-10.3	-7.1	-3.2	7.2
1984	-4.6	-2.7	-1.9	2.3
1985	-2.5	-2.4	-0.1	0.8
1986	-2.8	-2.3	-0.4	0.1
1987	-0.8	-0.5	-0.3	0.1
1988	1.7	1.1	0.6	0.0
1989	3.0	1.8	1.2	0.0
1990	1.7	0.9	0.9	0.0
1991	-4.8	-3.7	-1.0	1.0
1992	-9.6	-5.9	-3.7	13.5
1993	-7.3	-3.7	-3.6	12.0
1994	-2.4	-1.2	-1.2	1.8
1995	1.6	0.5	1.1	0.0
1996	2.6	1.2	1.3	0.0
1997	4.1	3.0	1.1	0.0
1998	7.4	5.1	2.2	0.0

The temporary portion of extended benefits is not included in cyclical expenditures.

Table 18

Current Surplus

	HEB	Actual	Cyclical	HEB	Actual	Cyclical
	----------billions of dollars----------			-----------percent of GDP-----------		
1951	5.2	10.3	-5.1	1.6	3.1	-1.6
1952	0.2	4.5	-4.3	0.1	1.3	-1.2
1953	-2.7	2.4	-5.1	-0.7	0.7	-1.4
1954	0.3	-1.2	1.5	0.1	-0.3	0.4
1955	2.1	6.3	-4.2	0.5	1.6	-1.0
1956	5.3	8.6	-3.3	1.2	2.0	-0.8
1957	3.3	4.2	-1.0	0.7	0.9	-0.2
1958	1.7	-5.5	7.1	0.3	-1.1	1.5
1959	3.3	2.6	0.7	0.6	0.5	0.1
1960	9.7	7.3	2.4	1.8	1.4	0.4
1961	9.5	2.8	6.7	1.7	0.5	1.2
1962	4.8	2.8	2.0	0.8	0.5	0.3
1963	6.9	5.3	1.5	1.1	0.9	0.2
1964	-1.1	0.9	-2.0	-0.2	0.1	-0.3
1965	-3.7	3.4	-7.1	-0.5	0.5	-1.0
1966	-10.6	2.6	-13.2	-1.4	0.4	-1.8
1967	-17.5	-8.3	-9.2	-2.2	-1.0	-1.1
1968	-14.1	-2.8	-11.3	-1.6	-0.3	-1.3
1969	-0.7	8.7	-9.4	-0.1	0.9	-1.0
1970	-10.7	-14.1	3.4	-1.0	-1.3	0.3
1971	-19.6	-25.4	5.7	-1.7	-2.2	0.5
1972	-22.8	-20.5	-2.3	-1.9	-1.7	-0.2
1973	-25.6	-11.1	-14.5	-1.9	-0.8	-1.1
1974	-13.6	-16.9	3.3	-0.9	-1.1	0.2
1975	-45.3	-73.9	28.6	-2.7	-4.3	1.7
1976	-39.4	-57.2	17.8	-2.1	-3.1	1.0
1977	-39.2	-46.3	7.1	-1.9	-2.3	0.3
1978	-39.8	-31.7	-8.1	-1.8	-1.4	-0.4
1979	-26.6	-18.5	-8.1	-1.0	-0.7	-0.3
1980	-38.5	-60.9	22.4	-1.3	-2.1	0.8
1981	-28.8	-57.8	29.0	-0.9	-1.8	0.9
1982	-73.9	-134.7	60.8	-2.1	-3.9	1.7
1983	-110.5	-174.4	63.9	-3.0	-4.7	1.7
1984	-140.8	-156.0	15.2	-3.6	-3.9	0.4
1985	-159.3	-163.0	3.7	-3.8	-3.9	0.1
1986	-174.3	-177.5	3.2	-3.9	-4.0	0.1
1987	-128.0	-128.9	0.9	-2.7	-2.7	0.0
1988	-136.3	-121.3	-15.0	-2.7	-2.4	-0.3
1989	-138.7	-113.3	-25.4	-2.6	-2.1	-0.5
1990	-161.5	-154.7	-6.8	-2.8	-2.7	-0.1
1991	-147.5	-196.1	48.5	-2.4	-3.2	0.8
1992	-229.1	-280.9	51.8	-3.6	-4.4	0.8
1993	-211.3	-250.7	39.4	-3.2	-3.8	0.6
1994	-178.6	-186.7	8.0	-2.6	-2.7	0.1
1995	-170.2	-174.3	4.2	-2.3	-2.4	0.1
1996	-119.8	-110.3	-9.5	-1.6	-1.4	-0.1
1997	-58.0	-21.1	-36.9	-0.7	-0.3	-0.5
1998	9.3	72.8	-63.5	0.1	0.9	-0.8

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Figure 1.
Personal Receipts
(Growth Rate, SAAR, NIPA)
1946:2 to 1999:1

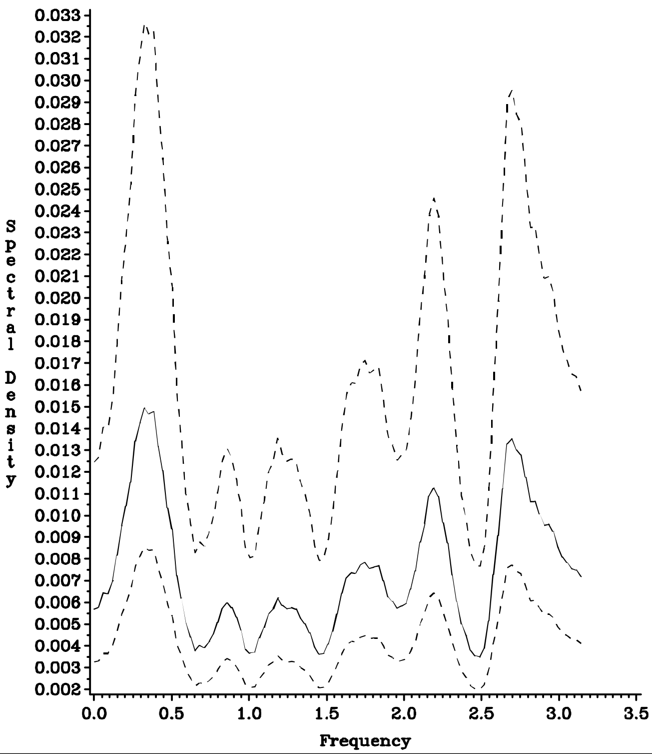

Figure 2.
Corporate Receipts
(Growth Rate, SAAR, NIPA)
1946:2 to 1999:1

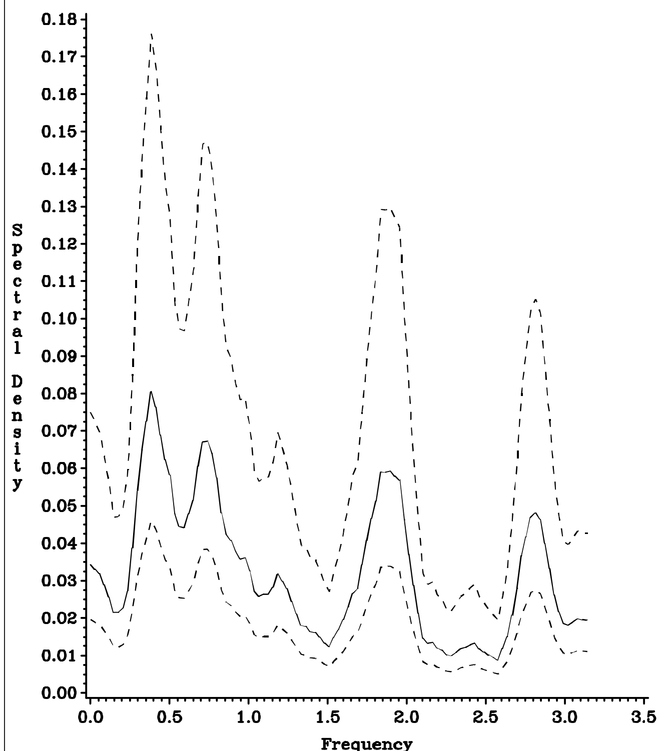

Figure 3.
SI Contributions
(Growth Rate, SAAR, NIPA)
1946:2 to 1999:1

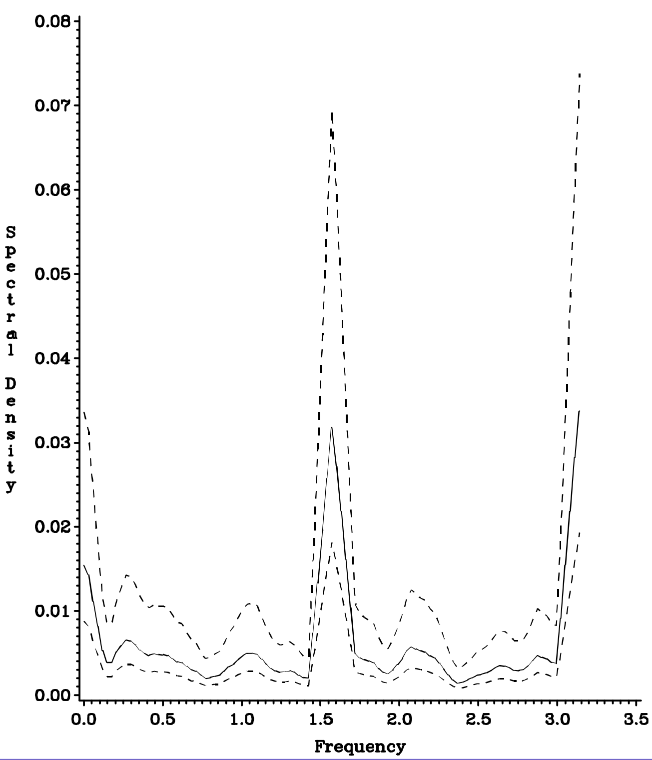

Figure 4.
Indirect Business Taxes
(Growth Rate, SAAR, NIPA)
1946:2 to 1999:1

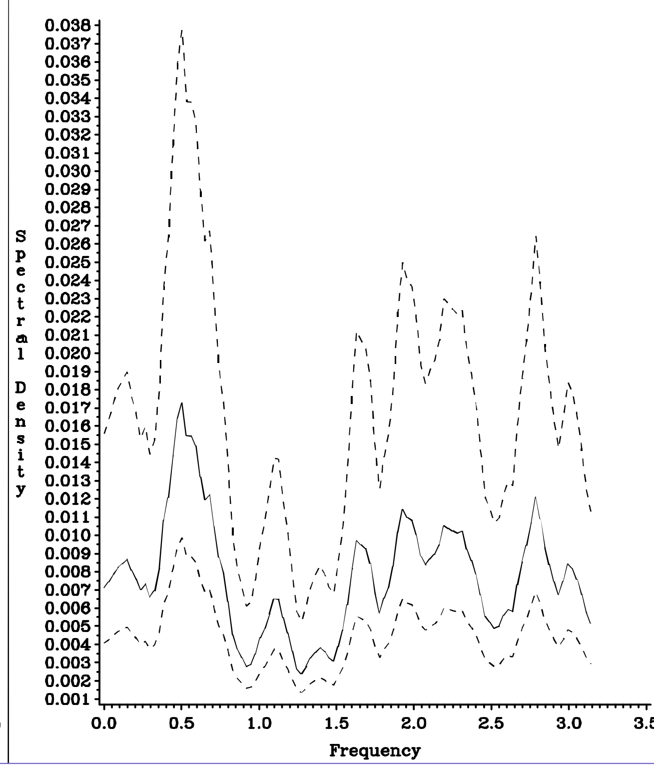

Figure 5.
Growth Rate of Personal Income Taxes
and the Growth Rate of Tax Base
1946:2 to 1999:1

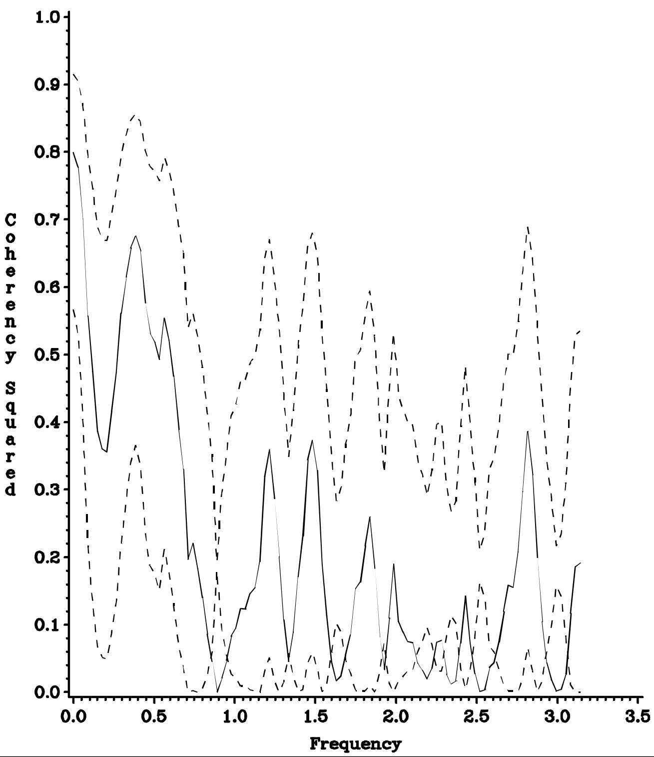

Figure 6.
Growth Rate of Corporate Taxes
and the Growth Rate of Tax Base
1946:2 to 1999:1

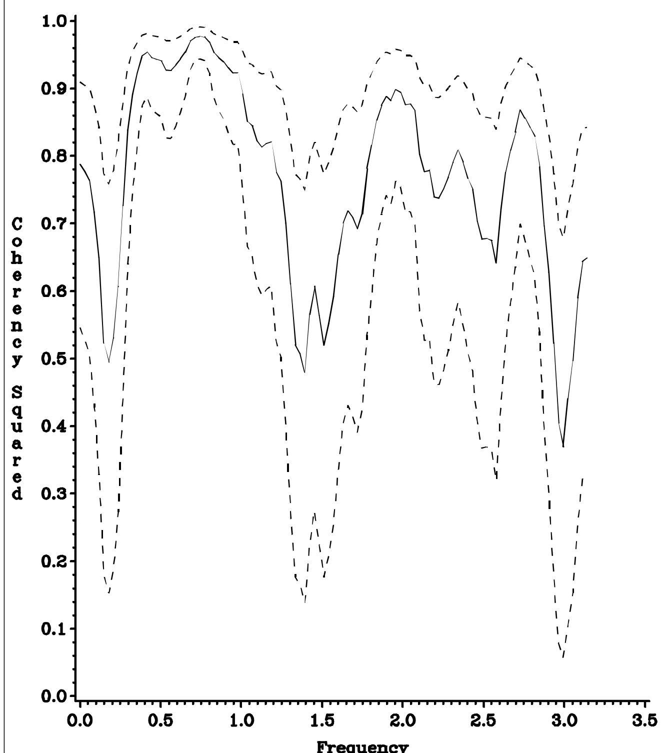

Figure 7.
Growth Rate of SI Contributions
and the Growth Rate of Base
1946:2 to 1999:1

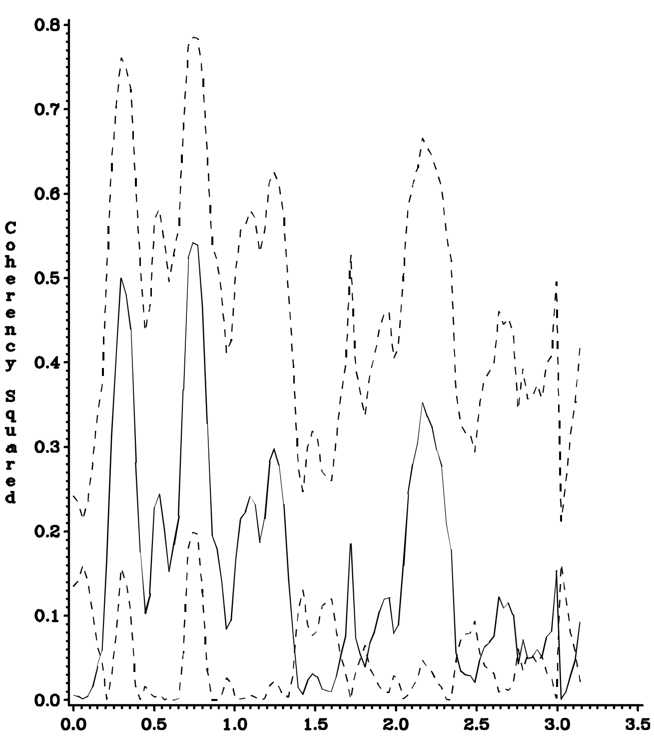

Figure 8.
Growth Rate of Indirect Business Taxes
and the Growth Rate of Nominal GDP
1946:2 to 1999:1

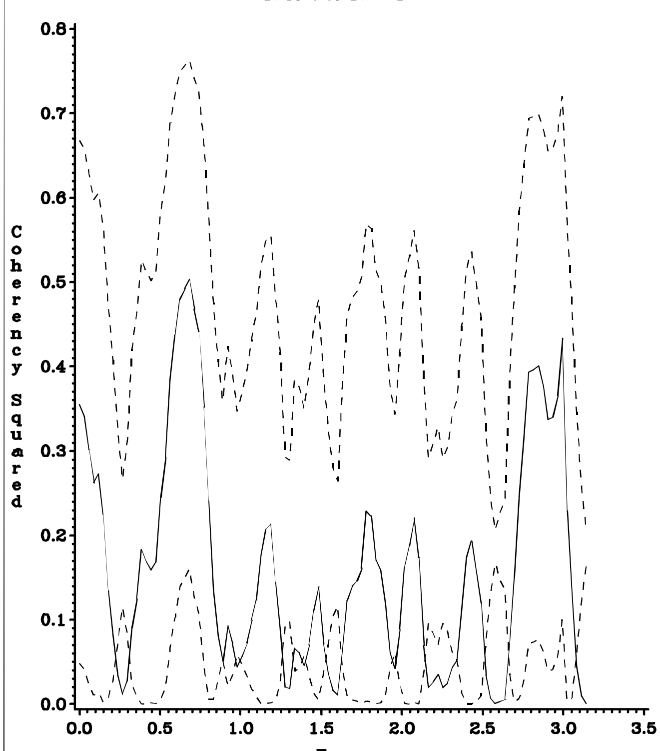

Figure 9.
Growth Rate of Withheld Taxes (NSA) and
the Growth Rate of Nominal GDP (NSA)
1955:1 to 1997:4

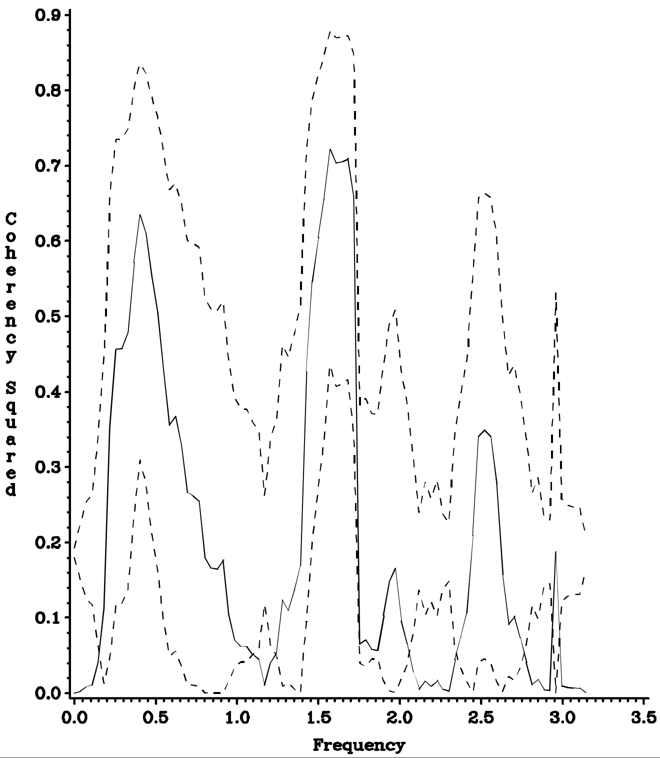

Figure 10.
Growth Rate of Declarations (NSA) and
the Growth Rate of Nominal GDP (NSA)
1968:1 to 1997:4

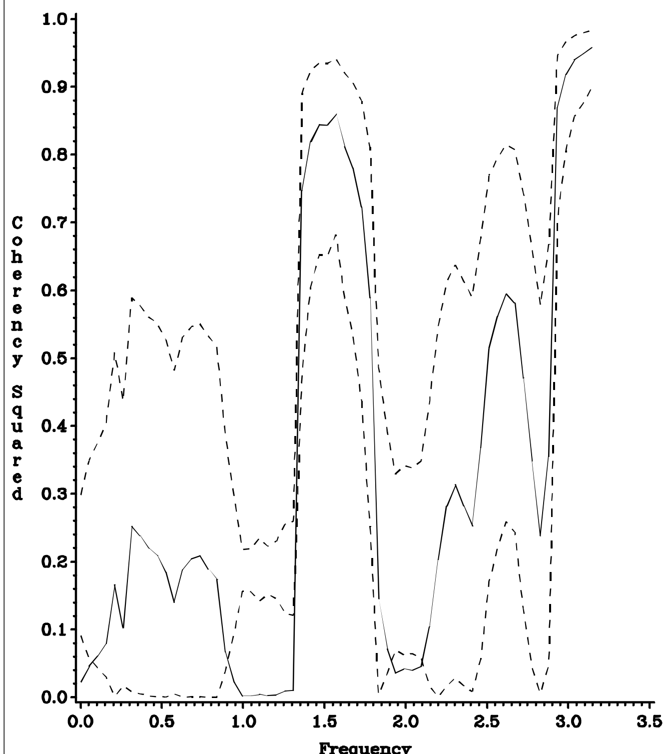

Figure 11.
Growth Rate of Final Payments (NSA) and
the Growth Rate of Nominal GDP (NSA)
1968:1 to 1997:4

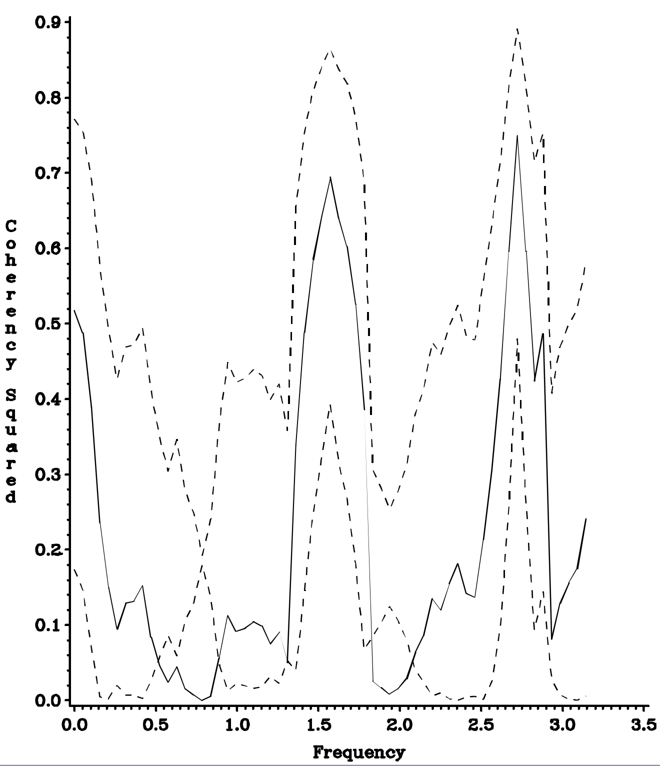

Figure 12.
Unemployment Insurance as a Percent of Nominal GDP
and the Unemployment Rate
1959:2 to 1997:1