Should the European Central Bank and the Federal Reserve Be Concerned About Fiscal Policy?*

by

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I. Introduction

Can the Federal Reserve or the European Central Bank be held responsible for price stability regardless of how fiscal policy is conducted? Is legal independence sufficient to allow central banks to carry out their mandates? Or, must legal independence be bolstered by constraints on fiscal policy? The Delors Report (1987) provided a blueprint for EMU and argued that constraints were necessary, and the European Union codified limits on deficits in the Stability and Growth Pact (SGP) of 1997. In the United States, federal balanced budget amendments have been proposed, but the arguments for them have not been as closely tied to central bank independence. The academic literature lends some support to the notion that fiscal discipline is necessary for price stability; Michael Woodford (2001), in his Money, Credit and Banking Lecture, asserts that "a central bank charged with maintaining price stability cannot be indifferent as to how fiscal policy is determined."

In this paper, we describe the fiscal discipline that the recent literature suggests is necessary for central bank independence, and we discuss the price – in terms of foregone fiscal stabilization – at which the required discipline can be obtained. We argue that the US and the EU probably have the discipline that is required, that the Federal Reserve and the ECB probably do not need the protective shield of a SGP or a balanced budget amendment, and that the constraints embodied in the SGP or a balanced budget amendment are in any case much stronger than necessary.[1] We assess recent efforts to refocus the SGP in a way that gives automatic fiscal stabilizers free reign, and we discuss the interaction between automatic stabilizers and monetary policy in the euro area. Fiscal policy also represents a source of potentially destabilizing shocks. We present new evidence on how US fiscal shocks have affected financial markets and output over the last four decades, and how the

[1]Here, we are only concerned with the fiscal requirements for central bank independence. There has been a tendency in Europe to use the EMU process – both the entrance requirements and the SGP – to address a range of fiscal ills.

Federal Reserve has reacted to them.

The interaction between monetary and fiscal policy has been characterized in different ways. Monetary policy discussions in the 60's, 70's and early 80's generally ignored fiscal policy altogether. Those that did not – such as Alan Blinder's 1982 symposium paper – tended to view monetary and fiscal policymakers as having different goals for inflation and output. Independent central banks and their governments were thought to be engaged in strategic games of macroeconomic stabilization, with outcomes that were often bad for the economy. This view of the coordination problem is still popular in the literature.[2]

We take a different approach.[3] We will present evidence suggesting that legislative processes are too slow for the discretionary component of fiscal policy to interact strategically with monetary policy at business cycle frequencies; the delay in passage of a stimulus package until March of this year, after two quarters of positive economic growth, is an example of the political inertia we have in mind. Automatic stabilizers do, of course, provide macroeconomic stabilization. Legislation establishing tax rates, unemployment benefits and other entitlements make fiscal policy react to macroeconomic shocks in a systematic way. But, this legislation affects market efficiency and income distribution, and it has been determined by microeconomic and political considerations; from a macroeconomic perspective, automatic stabilizers can generally be viewed as a nondiscretionary component of fiscal policy.

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[2]Examples include: Alesina and Tabellini (1987), Dobelle and Fischer (1994), Beetsma & Bovenberg (1998), Dixit and Lambertini (2001), Lambertini and Rovelli (2001), Buti, Roeger and in't Veld (2001, 2002), and Hughes-Hallett and Viegi (2002).

[3]Our approach is not really new. It is consistent with the view taken by John Taylor in his 1995 symposium paper, with Laurence Meyer's (2001) observations, with the official views expressed in EC (2002a), and with the discussion in Alesina et al. (2001).

A natural way to proceed is to decompose fiscal policy into a component that responds systematically to economic conditions and the structural primary deficit:

(1) fiscal deficit = [automatic stabilizers + interest payments] + structural primary deficit

= [αy + interest payments] + structural primary deficit

The first component part is composed of automatic stabilizers and interest payments on the existing debt. The automatic stabilizers move countercyclically with the GDP gap (denoted by y); the parameter α measures the strength of the stabilizers. Interest payments depend on the size of the debt and the interest rates at which it was contracted. The second component – the structural primary deficit – includes discretionary fiscal policy as well as mandatory spending.

In section II, we discuss the first component of fiscal policy, and its implication for monetary policy. In the US, monetary policy has presumably adjusted to the existing automatic stabilizers. In the EU, matters are more complicated because of the decentralization of fiscal policy, the asymmetric way macroeconomic shocks and monetary policy affect regions within the euro area, and the existence of the SGP; both monetary and fiscal policies are adjusting to the realities of EMU. The SGP tries to strike a delicate balance: on one hand, the SGP imposes the constraints on national fiscal policy that were thought necessary to protect the ECB from outside political pressures; on the other hand, the SGP – unlike a balanced budget amendment – allows some flexibility for the national fiscal policies to iron out the regional imbalances. Ideally, the appropriate automatic stabilizers – which may not be the same for each country – would be given free reign. We will discuss the effectiveness of the SGP in protecting the ECB from outside pressures, and current attempts to refocus the SGP in a way that will cause less collateral damage to the automatic stabilizers.

In section III, we discuss the second component of fiscal policy and the need for fiscal

discipline. The recent literature suggests that it would be a mistake to dismiss the discretionary part of fiscal policy as simply a macroeconomic shock. As government debt grew in the US and in the EU, a more sinister view of fiscal policy – and its implications for monetary policy – began to develop. Political economists talked of political biases leading to excessive deficits,[4] and discussions of "unpleasant monetarist arithmetic" and the "fiscal theory of the price level" suggested that the government's approach to the question of fiscal solvency can severely limit the options left open to monetary policy. If fiscal policy does not react to the government's debt, monetary policy can in theory lose the ability to control the price level or the real interest rate. Fiscal policy has to have a certain kind of discipline if a central bank is to have the functional independence to achieve price stability. As we shall see, either the EU's SGP or the US's (proposed) balance budget amendment would guarantee the fiscal discipline that is required; indeed, from the narrow view of monetary policy, this may be the best argument for them. However, we will argue that they are heavy-handed solutions to a problem that may not even exist, at least in the US or the EU.

In section IV, we discuss other ways in which fiscal policy interacts with monetary policy. We show that there is very little evidence that discretionary fiscal policy in the US or the EU has been focused on macroeconomic stabilization. Changes in fiscal policy do, however, represent macroeconomic shocks with which monetary policy has to contend. We show that, contrary to the findings of some others, financial markets – long-term interest rates in particular – do react to fiscal deficits.

We then explore these issues further by combining two lines of research. One, following Blanchard and Perotti (2001) and Fatas and Mihov (2000a), examines the effects of fiscal shocks

[4]Alesina and Perotti (1995) survey these political economy models.

in a VAR that abstracts from financial markets and monetary policy. The second, surveyed by Christiano, Eichenbaum, and Evans (1999), examines the effects of monetary policy shocks in a VAR that abstracts from fiscal policy. We find that financial markets do absorb some of the effect of government spending shocks, and mitigate their effect on output; this seems to have made life easier for the Federal Reserve.

The three sections that follow can be read independently. Section II focuses on issues that are of current interest in the euro area, and in particular, the Stability and Growth Pact. Section III focuses on issues raised by the new fiscal theory of the price level; fiscal discipline is clearly a requirement for central bank independence, but if our assessment is correct, it is probably not a matter of immediate concern in either the US or the euro area. Section IV presents new evidence on the way in which fiscal shocks affect the US economy and the Federal Reserve. Conclusions are presented at the end of each section.

II. Automatic Stabilizers and Interest Payments on the Debt

Central banks have to adjust to the nondiscretionary components of fiscal policy in a systematic way. The legislation that defines automatic stabilizers and the political challenge of debt finance in high debt countries are aspects of fiscal policy that do not change every year; they tend to evolve slowly. Curiously, these two aspects of fiscal policy meet in current discussions of the EU's Stability and Growth Pact (SGP). Their interaction, and the implications for monetary policy, is our topic here.

Both the US and the EU saw the need to grant legal independence to their central banks, but the notion that legal independence has to be bolstered by constraints on fiscal policy has only been

popular in the EU. The Delors Report (1987) provided the blueprint for EMU and called for constraints on national fiscal policies to protect the ECB from outside political pressures. Reference values for national deficits (3% of GDP) and debts (60% of GDP) were among the eligibility requirements written into the Maastricht Treaty, and they live on in the SGP. The deficit limit has always played a more prominent role than the debt limit. We suspect that this is because the 3% deficit limit could reasonably be applied to all countries, while the 60% debt limit was simply not feasible for some high-debt countries.[5] The SGP calls for annual submissions of national "stability and convergence programs", surveillance by the European Commission and the European Council, an "early warning" mechanism, and financial penalties if the warnings are not heeded. The recent experiences of Germany and Portugal – who had to take corrective actions to avoid early warnings – suggest that the Pact has some bite; peer pressure appears to be the teeth.[6,7]

First, we ask whether the SGP actually protects the ECB from outside pressures. Then, we ask if the protection it provides comes at too high a price. The ECB might be expected to create stable macroeconomic conditions for the euro area as a whole, but it can not be expected to iron out

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[5]The Maastricht Treaty tried to overcome this obstacle by only requiring that the debt to GDP ratio be "sufficiently diminishing and approaching the reference value at a satisfactory pace". But, this language is open to interpretation, and hard-liners seemed to take comfort in phrases like "3 percent is 3 percent".

[6]Canzoneri and Diba (1999) describe the Pact's "excessive deficits" procedure. EC (2002a; section 2) describes the Pact's surveillance procedure and its "early warnings" mechanism, and their recent application to Germany and Portugal. See also EC (2002b).

[7]Portugal is currently coming under further scrutiny. According to Commissioner Solbe's statement of July 25th, "Today, the Portugese authorities have made public the general govern-ment figures for 2001: the general government deficit in 2001 amounted to 4.1% of GDP ... The Commission will therefore initiate the Excessive Deficit Procedure for Portugal ..." An annex outlines the specific steps that will be taken. See: European Commission Rapid Press Releases.

the regional imbalances that we already see emerging. Automatic fiscal stabilizers are the best solution to regional imbalances, if the SGP is flexible enough to let them work.

II. A. Pressures for Lower Interest Rates and the Effectiveness of Fiscal Constraints

Governments frequently lobby for lower interest rates. In the United States, some administrations (such as the Reagan Administration) have done so quite openly. The Clinton Administration avoided public comment on Federal Reserve policy but was widely believed to be concerned that high interest rates would slow economic growth. When the ECB first came to power, several finance ministers called for a competitive exchange rate; this was implicitly a call for looser monetary policy. (The Maastricht Treaty allows the Council of Ministers to adopt "general orientations"for exchange rate policy, provided that it does not interfere with price stability; so, it may not be surprising to see calls for a looser monetary policy expressed in terms of the exchange rate.) None of these pressures were directly related to fiscal policy, and constraints on deficits or debt levels would presumably have had little effect on them.

There may be a worry that high debt countries will lobby for lower interest rates. A country with a public debt equal to its GDP could lower its interest payments – and its tax collections – by one percent of GDP if it could just persuade the central bank to lower interest rates by one percent. Italy, Belgium and Greece had public debts greater than or equal to their GDPs in 2001, but none of these countries ran afoul of the SGP. Instead, it was Germany and Portugal that narrowly escaped early warnings, and these countries had lower debt to GDP ratios than the Euro area average. The SGP seems to have penalized the wrong countries. The reason for this is that the SGP focuses on deficit limits instead of debt limits. Germany and Portugal ran deficits that were 2.7 and 2.5 percent

of GDP in 2001, close to the 3 percent limit; Italy and Greece ran deficits that were 1.4 and 0.4 percent of GDP, and Belgium had a surplus.[8]

Another worry in some circles is that fiscally irresponsible countries may ask the ECB or other community members for financial bailouts. Here again, it would appear that the SGP's focus on deficits, rather than debt levels, is misplaced. Luxembourg – whose debt is only about 5% of GDP – could presumably run high deficits for quite some time before anyone would worry about its ability to service its debt.

In Canzoneri and Diba (1999), we surveyed a number of arguments for fiscal constraints; in each case, debt limits appeared to be the appropriate remedy (if one was needed). One might argue that deficit limits do penalize high debt countries, since interest payments make it more difficult for a high debt country to live within the deficit limit. One might also argue that constraints on deficits will keep debt levels from building up over time. But, as the previous examples illustrate, the Pact's current focus on the deficit rather than the debt can present a rather distorted picture of where the problems actually lie. Some commentators predict that Italy's debt to GDP ratio will rise this year, even though its deficit to GDP ratio will remain below 3%.[9] It will be interesting to see how the European Commission and the European Council react to this situation. Will the focus on deficits continue, or will some importance actually be attributed to the debt criterion?

In conclusion, deficit limits appear to be a rather blunt instrument for protecting the central bank from outside political pressures. In the next section, we will see that the new "fiscal theory of

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[8]These figures, and projections for 2002, can be found in Tables I.2 and I.3 of EC (2002a).

[9]See the Financial Times, September 4, 2002.

the price level" does provide a logically consistent argument for deficit (or debt) limits; however, we will also see that the argument is probably not relevant for the EU (or the US). Moreover, depending upon how the constraints are actually imposed, they may inhibit the functioning of automatic stabilizers. We turn to this issue in the next section.

II. B. The Optimal Strength of Automatic Stabilizers and Implications for Monetary Policy

How strong should automatic stabilizers be?[10] And how should monetary policy adjust to them? Here, it is useful to think of monetary policy as a rule, analogous to the automatic stabilizers for fiscal policy:

(2) $R_t = \text{constant} + \beta(\pi_t - \pi^*) + \gamma y_t$.

As a number of studies have shown, the Federal Reserve tends to increase the interest rate (R) when inflation (π) rises above its target (π^*) or when the GDP gap (y) increases;[11] the gap term may reflect active demand management, or it may simply serve as an additional predictor of future inflation. In any case, the size of the parameter γ measures the strength of the Federal Reserve's usual response to an increase in the GDP gap, while α in the fiscal policy rule measures the strength of automatic stabilizers.

How should the monetary and fiscal policy rules be coordinated? Suppose Congress legislates stronger automatic stabilizers. One might think that the Federal Reserve would respond by decreasing γ:[12] with stronger stabilizers in place, a shock to aggregate demand would have a

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[10]Auerbach and Feenberg (2000), Cohen and Follette (2000), Taylor (2000) and Sala-i-Martin and Sachs (1992) discuss the strength of US automatic stabilizers. EC (2001, 2002a) discuss the strength of EU stabilizers.

[11]Rules of this form provide a reasonably good explanation of both Federal Reserve and (earlier) Bundesbank behavior; see Taylor (1999).

[12]Taylor's (1995) simulations suggest that this would be the right response.

smaller effect on output and inflation, and the Federal Reserve would not need to respond as aggressively. Conceptually, fiscal policy could also adapt to changes in monetary policy. The Maastricht Treaty specifies price stability as the primary goal of the ECB. If over time we observe that the ECB responds to this mandate by choosing a smaller γ than was in effect before EMU, then it may make sense for national legislatures in the euro area to strengthen their automatic stabilizers.[13]

Taxes and transfers affect market efficiency and the distribution of income, and legislation establishing automatic stabilizers has generally been determined by microeconomic and political considerations. EC (2002a) reports that the average deficit elasticity in the EU (and in the euro area as well) is 0.5; that is, when the GDP gap increases by 1%, the deficit goes up by ½% of GDP. There is, however, considerable variation across the EU. Nordic countries favor more progressive tax structures, and their deficit elasticities are around 0.7 or 0.8; Ireland, Portugal and Austria are on the low end with elasticities around 0.3 or 0.35. EC (2002a) and Cohen and Follette (2000) report deficit elasticities of 0.25 and 0.30 for the US, which is about half the euro area average.

In the US, there may not be a coordination problem. Legislation establishing the automatic stabilizers may not have taken macroeconomic stabilization into account, but the Federal Reserve has presumably adapted to the existing legislation. In the euro area, the situation is more complicated, for at least two reasons: First, the "federal" budget is small in comparison to the national budgets, and it has no automatic stabilizers to speak of.[14] Twelve national governments have

[13]Again, Taylor's (2000) simulations lend support for this.

[14]The biggest EU programs are the Common Agricultural Policy and the Structural Development Funds; neither has a strong cyclical component.

legislated twelve sets of automatic stabilizers, with twelve different deficit elasticities. Second, the SGP limits deficits to 3% of GDP, and this may not allow the legislated stabilizers to function freely.

We begin with the diversity of deficit elasticities. From a macroeconomic point of view, one might think that there is an argument for uniformity: how can the ECB adapt to twelve different automatic stabilizers? However, fiscal policy plays a more complicated role in the euro area than it does in the US. As noted earlier, the literature on EMU suggests that national shocks will be larger in the euro area than are regional in the US, and that monetary policy will have more uneven effects across countries in the euro area than across regions in the US.[15] Figure 1 illustrates the diversity of current macroeconomic performance. Ireland is currently on the expansionary end (with 4.8% inflation and 11.5% growth), while Belgium and Finland are on the recessionary end (with about 1.5% inflation and negative growth). Now that there is a single monetary policy in the euro area, national fiscal policies are all that is left to iron out these regional imbalances. From this perspective, it is not at all clear that uniform automatic stabilizers are the best policy. Regions that experience larger idiosyncratic shocks and/or show a smaller response to a change in the common monetary policy may well benefit from stronger automatic stabilizers; it would be interesting to know if the observed variation in deficit elasticities lines up with these criteria.[16] However, there

[15]See for example Bayoumi and Eichengreen (1993) and Carlino and DeFina (2000). The ECB's staff argues that there has been some convergence; see Angeloni and Dedola (1999).

[16] Fatas and Mihov (2000a) consider a cross section of twenty OECD countries and find that the volatility of real GDP growth is inversely related to government expenditures, revenues, and transfers (each as a fraction of GDP). They then examine the relationship between automatic stabilizers and output volatility and find the evidence is mixed.

has been little research on this coordination problem,[17] and we have heard no discussion of it in the official community.

By contrast, there has been an extensive discussion of the SGP's effect on the existing automatic stabilizers, and there is a concerted effort to change the focus of the SGP so as to give the automatic stabilizers free reign. The SGP limits actual deficits to 3% of GDP, but it also commits EU governments to bring "medium term budgets" to "close to balance". Medium term budgets are generally being interpreted as structural or cyclically adjusted budgets, and the effort underway is to change the emphasis from a constraint on actual deficits to a constraint on structural deficits.[18] In the latest updates of the stability and convergence programs, EU countries confirm their commitment to reach structural balance by 2003 or 2004.

The logic of this switch in emphasis can be illustrated by a simple example. Suppose an EU country is producing at full capacity, that its budget is in balance, and that its deficit elasticity is 0.5 (the EU average). Now suppose that GDP falls by 6%, which may be viewed as a major recession for this country. The automatic stabilizers will produce a deficit of just 3% (= 0.5x6) of GDP. In other words, if the government brings its budget into structural balance, then it can be reasonably assured that its automatic stabilizers will not be impeded by the 3% limit on actual deficits.

Of course, EU countries vary in their deficit elasticities and in their cyclical volatilities. A country with strong automatic stabilizers and high output volatility will need to achieve a stronger

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[17]Current research is hampered by the fact that most New Neoclassical Synthesis models exhibit Ricardian equivalence, which implies that transfers have no effect.

[18] On page 31, EC (2002a) states that "The core commitment of the SGP is for Member States to achieve and maintain medium term budget positions that are close to balance or in surplus". The emphasis on structural balance is quite evident throughout this EC document.

structural balance than a country with weak stabilizers and low volatility. Measurement issues abound.[19] However, EC (2002a) reports a set of "minimal benchmarks" for structural deficits which – if achieved – will "allow automatic stabilizers to play fully while respecting the 3 % limit."[20] The euro area average is a structural deficit of 1.4%. Some of the smaller countries, and the Nordic countries, have to tighten their belts even further: Belgium, the Netherlands, Denmark and Sweden have minimal structural deficits in the range of .03% to .08% of GDP; Finland and Luxembourg need structural surpluses. We hear that this is causing some discontent. Why should countries be "penalized" for favoring a more progressive tax system and a more egalitarian distribution of income? The SGP is forcing a weighing of the microeconomic and macroeconomic factors that should go into the determination of automatic stabilizers.

II. C. Conclusions: The SGP and Automatic Stabilizers

If the purpose of the SGP is to protect the ECB from outside political pressures, then debt targets would appear to be the appropriate remedy. As the recent experiences of Germany and Portugal show, the emphasis on "excessive deficits" may be misleading. Moreover, deficit constraints seem to be having an asymmetric affect in practice. The "stick" is strong when the economy is weak and deficits are nearing the 3% limit, but the "carrot" is weak when the economy is strong

[19]The volume edited by Brunila, Buti and Franco (2001) contains several studies of this and other aspects of the SGP.

[20]Actually, these are a revised – and somewhat weaker – set of numbers. There were technical issues in finding a consensus on these benchmarks. Measurement of the deficit elasticities was not too contentious, but measurement of GDP gaps was. In November of 2001, ECOFIN endorsed a method of measuring gaps; essentially a production function approach replaced HP filtering (see EC (2002a)). There is also a "Lucas critique" problem here: cyclical volatility under EMU may be different than the pre-EMU volatility.

and deficits are out of the news. Germany, for example, would probably not be experiencing its current difficulties if it had strengthened its structural balance when the opportunity presented itself.

While we are not convinced that any kind of fiscal constraint is necessary for price stability, Canzoneri and Diba (1999) recommended switching the emphasis of the SGP from actual deficits to structural deficits, and we are pleased to see movement in this direction; it is an effective means of allowing the automatic stabilizers to function freely. For those in the US who advocate a balanced budget amendment to keep government debt in line, the EU experience provides a valuable lesson.

Many in Europe think that growth in public debt should be limited for a host of reasons that extend well beyond monetary policy, and indeed fiscal constraints were written into the Maastricht Treaty and the SGP to address a broad range of problems.[21] However, the Maastricht Treaty and the SGP are closely identified with EMU in the public view, and this is perhaps unfortunate. It may be dangerous to burden the EMU project with concerns that are not directly related to monetary policy.

III. Discretionary Fiscal Policy and the Need for Fiscal Discipline

Recent theoretical contributions suggest that the government's approach to fiscal solvency has strong implications for the options that are left open to the central bank. To us, the main message from the "fiscal theory of the price level" – and from an earlier literature on "unpleasant

[21] Evidence of this is not hard to find. The European Commission WP n.45 (July 2002) states that "the Maastricht Treaty represents a clear commitment to sound public finances, both in response to the preceding secular upward drift in government spending, deficits and debt, and in view of EMU, in which sound budgets are necessary to support price stability ...". Moreover, EU members who are not in the euro area (UK, Denmark and Sweden) are required by the SGP to submit annual stability programs, and they are monitored by the European Commission, though they are not subject to the Pact's financial penalties.

monetarist arithmetic" – is that fiscal policy has to be disciplined if the central bank is to have the functional independence to carry out a mandate for price stability. We have a very specific notion of discipline in mind: fiscal policy has to assure fiscal solvency for any price path that the central bank might deliver. In practice, the central bank may choose its inflation target in consultation with the government, but a disciplined fiscal policy will accommodate any conceivable price path.

We begin by describing the new fiscal theory of the price level. Then, we ask whether US and EU governments have the discipline that is required for functional central bank independence. And finally, we identify constraints on fiscal policy that assure the required discipline if it is lacking. A balanced budget amendment or the constraints specified in the SGP would suffice, though they appear to be much stronger than is necessary.

Much of our discussion will revolve around public sector budget constraints. Flow budget constraints say that the treasury has to finance fiscal deficits by selling bonds to the public or to the central bank. These annual budget constraints can be aggregated into a single present value budget constraint (PVBC); it says that over time the (expected and discounted) stream of government revenue has to pay for the stream of government spending plus the existing public sector debt:[22]

$$(3)\quad E_0 \sum_{t=0}^{\infty} \delta_t (T_t + CBT_t) = (M_{-1} + B_{-1}) + E_0 \sum_{t=0}^{\infty} \delta_t G_t \ .$$

Existing government liabilities consist of base money (M_{-1}) and treasury bonds (B_{-1}) held by the private sector. Government revenue consists of taxes (T) and central bank transfers (CBT). Central

[22]The present value budget constraint is found by iterating the government's flow budget constraint forward, and applying the household transversality condition; (3) may therefore be viewed as an equilibrium condition. See Canzoneri, Cumby and Diba (2001a) for a more detailed derivation. For algebraic simplicity, we have assumed that all government bonds mature after one year. This simplification is not necessary; see Woodford (1998) and Cochrane (2001).

bank transfers are the interest payments on bonds held by the central bank; they are returned to the treasury. Assuming that money was introduced by open market operations, the central bank's bond holdings are equal to the private sector's base money holdings. So, for future reference, CBT – or what is more commonly known as seigniorage – can be expressed as R times M: M is the base for the seigniorage tax, and R is the tax rate. The discount factors (δ_t) are the price of a dollar to be delivered t years in the future; they vary inversely with interest rates.

For empirical work, it is convenient to scale variables by nominal GDP. Canzoneri, Cumby and Diba (2001a) show that (3) can be rewritten as:

$$(4)\quad \frac{M_{-1} + B_{-1}}{P_0 Y_0} = E_0 \sum_{t=0}^{\infty} D_t \left[\frac{\text{Primary Surplus}_t}{P_t Y_t} \right] = E_0 \sum_{t=0}^{\infty} D_t \left[\frac{T_t - G_t}{P_t Y_t} + \frac{CBT_t}{P_t Y_t} \right].$$

The liabilities-to-GDP ratio has to equal the expected present value of present and future primary surpluses, inclusive of central bank transfers, and scaled by GDP. Here, the discount factors (D_t) vary directly with real growth in the economy and inversely with real interest rates.

Over the last three decades, a large literature has examined the dynamics of the government budget constraint. This literature began with Blinder and Solow's (1973) theoretical analysis of different approaches – money verus debt – to the financing of a deficit. Following Hamilton and Flavin (1986), several contributions to the literature tried to develop empirical tests of government solvency. The critical insight behind the new fiscal theory of the price level is that the PVBC, (4),

is an equilibrium condition.[23] The fundamental question, according to the new theory, is not *whether* the PVBC is satisfied, but *how* the PVBC is satisfied?

III. A. The Fiscal Theory of the Price Level

The fiscal theory of the price level provides a new insight into the ways in which the government's approach to fiscal solvency can limit the options that are left open to the central bank.[24] Woodford (1995) characterized the government's approach to solvency by classifying fiscal policies as Ricardian or Non-Ricardian. In a "Ricardian" regime, primary surpluses are expected to move over time so as to guarantee that the PVBC holds, no matter what prices or discount factors are fed into it; in a "Non-Ricardian" regime, there is no such guarantee.[25] Our notion of discipline is motivated by Woodford's classification scheme: the government is disciplined (in our sense) if its fiscal policy is Ricardian (in Woodford's sense).

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[23] Woodford (1995) articulates this argument most clearly: the private sector's PVBC must hold as a consequence of the households' utility maximization. And, in equilibrium, the public sector's PVBC is the mirror image of the private sector's PVBC.

[24]Important early contributions to this literature include: Leeper (1991), Woodford (1994, 1995), Sims (1994), and Cochrane (1998). Canzoneri, Cumby and Diba's (2001b) first footnote and Woodford's (2001) third footnote point to more recent contributions. Interesting precursors include: Sargent (1982), Begg and Haque (1984), Masson (1987), and Auernheimer and Contreras (1990). Notable critics include: McCallum (1998) and Buiter (2001). Our own contributions are: Canzoneri and Diba (2000) and Canzoneri, Cumby and Diba (2001a,b).

[25]Why the "Ricardian" label? Later on, we will see that government bonds have wealth effects in Non-Ricardian regimes. Woodford (2001) offers another motivation. In discussions of "Ricardian Equivalence", it is asserted that a tax cut financed by government borrowing must necessarily be accompanied by tax increases at some time in the future that hold the present value of tax liabilities constant *at current prices and discount factors*; this will be true by definition in a Ricardian fiscal regime.

Much of what is familiar to us from monetary economics comes from reasoning in which fiscal policy is assumed – sometimes only implicitly – to be Ricardian. A Ricardian fiscal policy takes care of the PVBC; so, prices and discount factors can be determined elsewhere, by say the forces of money supply and demand or a Phillips Curve. A Non-Ricardian fiscal policy can have some very unfamiliar implications. For example, suppose real primary surpluses (inclusive of central bank transfers) are determined by a political process that takes no account of fiscal solvency. What makes the PVBC hold? Nominal income, P_0Y_0, and/or the discount factors, D_t, have to move to keep (4) in balance. Fiscal surpluses replace the monetary supply as the nominal anchor; hence, the name – *fiscal* theory of the price level.

Non-Ricardian regimes are what is new and controversial about the fiscal theory of the price level. To get a feel for how prices and real interest rates are determined when fiscal policy is Non-Ricardian, we consider the effects of a tax cut in two different economies: one has relatively flexible wages and prices, and the other has a high degree of nominal rigidity.

In an economy with flexible wages and prices, real output and real interest rates (and therefore the discount factors, D_t) are determined by real factors such as productivity; they are fixed at their "natural" rates.[26] A tax cut lowers the right-hand side of (4), and the price level, P_0, rises to bring the left-hand side in line. Why does the price level rise? Surely, price increases are caused by excess demand, and not by accountants somewhere in the bowels of the treasury. Woodford (1995) describes the price adjustment process as a wealth effect: after taxes are cut (and the right hand side of (4) falls), real household wealth (the left hand side of (4)) is too high; so, aggregate demand is too strong and prices rise, restoring the balance in (4). In any event, the price level is

[26]We assume that tax distortions are small; the tax cut does not affect these variables.

determined by fiscal policy, and fluctuations in real primary surpluses become the main source of price instability.

Of course, there are fiscal aspects to monetary policy. Even in a Non-Ricardian regime, a central bank could in principle work through the seigniorage term in (4) to control the price level. For example, when taxes are cut, the central bank would raise the interest rate enough to make the increase in seigniorage offset the decrease in tax revenue, holding the right hand side of (4) constant. However, Canzoneri and Diba (1998) and Canzoneri, Cumby and Diba (2001a) show that such a policy would not be feasible in practice; actual and potential seigniorage revenues are too small in OECD countries to be used in this way. In the US, for example, base money was only 6% of GDP in 1995, and a typical surplus shock would be conservatively estimated at 1% of GDP. The Federal Reserve would have to raise the interest rate on government bonds by 1700 basis points to make seigniorage revenues offset a surplus shock of this size![27] Interest rate hikes of this magnitude are simply not feasible. The central bank would not be able to stabilize prices in this Non-Ricardian regime.

In an economy with significant wage and price rigidities, real interest rates and output will rise after a tax cut. Here, P_0, Y_0, and the discount factors, D_t, move in equilibrium to satisfy (4). Once again, the central bank could work through seigniorage to offset fluctuations in the govern-

[27]Canzoneri, Cumby and Diba (2001a) used the standard error from an AR1 regression to estimate the conditional standard deviation of the surplus to GDP ratio. For the US, they found this "typical" surplus shock to be a little over 1% of GDP. This estimate is conservative since the surplus process is serially correlated, and a 1% shock to the current surplus would raise the right hand side of (4) by more than 1%. To make the increase in seigniorage offset this "typical" shock to the surplus, we need: $0.01 = 0.06 \times \Delta R$, or $\Delta R = 1/6 \approx 0.17$. Notice that this estimate is also conservative in that we have assumed money demand does not fall as the interest rate rises.

ment's primary surplus, but seigniorage revenues are just too small for this to be feasible in practice. In a Non-Ricardian regime, the central bank loses control of aggregate demand.

The assumption that the government has nominal, rather than real, liabilities is essential for this to be a theory of the price level.[28] Provided the government has some nominal liabilities, the government's present value budget constraint will always be satisfied in equilibrium – either by Ricardian fiscal policy or by price level movements. If however all liabilities are real, changes in the price level cannot satisfy the present value budget constraint. Either government spending, taxes or seigniorage must adjust to assure fiscal solvency. An earlier literature on "unpleasant monetarist arithmetic" discussed these issues.[29]

The bottom line on the fiscal theory of the price level is similar to the message of unpleasant monetarist arithmetic. Legal central-bank independence does not confer functional independence. If the central bank is to be held accountable for price stability, legal independence must be bolstered by the fiscal discipline of a Ricardian regime. The next questions are: Do governments in the US and the EU have the discipline of a Ricardian regime? And if not, what constraints on fiscal policy would guarantee the required discipline?

III. B. Are Governments in the US and the EU disciplined?

This is not an easy question to answer. There is no formal statistical test that will discriminate between Ricardian and Non-Ricardian regimes. In any given model of the economy, the same structural equations hold for Ricardian regimes and for Non-Ricardian regimes; there is no

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[28] This theory also applies to an economy in which some government debt is denominated in a foreign currency or indexed to the price level; see Woodford (1998).

[29] See Sargent and Wallace (1981) and Sargent (1987, pg. 176-177).

parameter value or exclusion restriction to be tested. The distinction between regimes is in how we solve the model: do we let primary surpluses move to satisfy the PVBC, or do we take them to be exogenous and force other variables to do the adjusting? Put another way (essentially by Cochrane (1998)), for any given view of how the economy works and any given data set, there will be a Ricardian way of explaining historical events, and there will also be a Non-Ricardian way.

In a series of papers, we have taken a different approach to the question:[30] we have analyzed the theoretical and historical plausibility of the two regimes. One might think that the discipline required of Ricardian regimes is unrealistic, and that they are unlikely to be observed in reality. To establish the theoretical plausibility of Ricardian regimes, we have shown that Ricardian policies can actually be quite lax; the discipline required is not as strong as it might at first seem. To establish the historical plausibility of Ricardian regimes, we have argued that a Ricardian interpretation of a variety of historical events and statistical regularities is more plausible than the Non-Ricardian interpretation. We will begin with the theoretical plausibility of Ricardian regimes.

III. B. 1 Theoretical Plausibility of Ricardian Regimes

Is the discipline required of a Ricardian regime plausible? In the US, we have seen government debt as a fraction of GDP rise during the Reagan and (first) Bush Administrations, and then stabilize and decline in the Clinton Administration; now, it seems likely to rise again. In the EU, some worry that debt is out of control in certain countries. Just how disciplined does a government have to be to have a Ricardian policy?

There is, so far as we know, no way of writing an equation that characterizes all Ricardian policies. However, in Canzoneri, Cumby and Diba (2001b), we were able to characterize a large

[30]See Canzoneri and Diba (2000), Canzoneri, Cumby and Diba (2001a,b).

class of them. To get some intuition as to why our class of policies work, think about what the PVBC actually says, and what it has to rule out. (3) says that over time expenditures can not exceed revenues: the government can not run a "Ponzi scheme" in which it borrows and then continually rolls the debt over, never paying it off.

Consider a fiscal policy that relates the surplus to GDP ratio to the liabilities to GDP ratio:

(5) $S_t/P_tY_t = \phi_t(L_t/P_tY_t) + \epsilon_t$,

where $\phi_t \geq 0$. S_t is the primary surplus inclusive of central bank transfers, and L_t is the sum of base money and government debt. ϵ_t is a random variable representing automatic stabilizers or political factors unrelated to fiscal solvency. The parameter ϕ_t measures the responsiveness of primary surpluses to changes in the level of government liabilities. ϕ_t may vary from year to year; when ϕ_t is positive, the government is paying off some of its debt. Intuitively, the government will have to do this continually, or at least from time to time, if it is to avoid running a Ponzi scheme. In Canzoneri, Cumby and Diba (2001b), we prove a proposition saying that (subject to some regularity conditions) if ϕ_t is expected to be positive infinitely often, then the PVBC holds for any prices and discount factors; the policy (5) is Ricardian.[31,32]

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[31]More precisely, ϕ_t has to be bounded away from zero infinitely often, but the bound can be arbitrarily small.

[32]To gain some intuition for how this rule works, consider an example where $\epsilon_t = 0$, and where the real interest rate and real GDP are constant. (5) reduces to $s_t = \phi_t w_t$, where "s" is the surplus to GDP ratio and "w" is the liabilities to GDP ratio. The flow budget constraint can be written as $w_{t+1} = (1+r)w_t - (1+r)s_t$, where r (> 0) is the real interest rate. Substituting the surplus rule into the flow budget constraint, debt dynamics are governed by $w_{t+1} = (1+r)(1-\phi_t)w_t$. Iterating this equation forward, $w_{t+T} = (1+r)^T[(1-\phi_t)(1-\phi_{t+1})\bullet\bullet\bullet(1-\phi_{t+T-1})]w_t$. Debt dynamics would be stable if ϕ_t were between r and 1 infinitely often, so that $\lim_{T\to\infty} w_{t+T} = 0$. However, the "no Ponzi game" restriction that is equivalent to the PVBC, (4), only requires that the present value of $w_T - (1+r)^{-T}w_T$ – go to zero as $T\to\infty$. If ϕ_t is between 0 and 1 infinitely often, then the PVBC holds for any r or P_t that is fed into it, and we have a Ricardian regime.

Note that, in principle anyway, the policy can be quite lax. ϕ_t could be positive after every election, at the beginning of every decade, or even at the beginning of every century; ϕ_t only has to be positive infinitely often. However, our proposition probably overstates the case. Financial markets have to believe that fiscal retrenchments will eventually occur, and on a recurring basis. This credibility requirement may put stronger constraints on Ricardian policies than our proposition indicates. In any case, our proposition establishes the theoretical plausibility of Ricardian regimes.

III. C. 2 Historical Implausibility of Non-Ricardian Regimes

Next, we consider two historical episodes: (1) the 1999 - 2001 pegging of exchange rates prior to the introduction of the euro; and (2) the post war behavior of US surpluses and government debt. Both of these episodes have plausible Ricardian interpretations, and – we think – quite implausible Non-Ricardian interpretations. In Canzoneri and Diba (2000), we argue that the fiscal theory's interpretation of the purported shift in monetary and fiscal policy in the US around 1980 is also implausible.

The 1999 - 2001 Period of Fixed Exchange Rates in Europe

The first historical episode we consider is the successful pegging of exchange rates at the outset of EMU.[33] A grid of exchange rates was announced, and the exchange rates were maintained for three years, until the national currencies were replaced by the euro at the beginning of this year.

Standard monetary theory gives the Ricardian interpretation of this period: central banks in the euro area maintained the fixed parities by coordinating monetary policies. We can illustrate the Ricardian interpretation a simple analytical example; the argument generalizes to more realistic

[33]Canzoneri, Cumby and Diba (2001a) provides a more detailed discussion of this historical episode.

settings. Let $\bar{E}$ be the official franc/DM parity, and let R_F and R_G be the French and German interest rates. The interest parity condition,

(6) $R_F = R_G + (E^e - \bar{E})/\bar{E}$,

says that French and German bonds have to pay the same expected rate of return. The French and German central banks made the peg credible ($E^e = \bar{E}$) by forcing their interest rates to converge. The French and German PVBCs are in the background, but in the Ricardian interpretation, they are being maintained by the fiscal policies of the French and German governments. The price levels in France and Germany are determined by monetary policy.[34] In the simplest example, purchasing power parity, (7) $P_F = \bar{E}P_G$, links the French price level, P_F, to the German price level, P_G.

The Non-Ricardian interpretation of this period is quite different: governments in the euro area maintained the fixed parities by coordinating fiscal policies. We can illustrate the Non-Ricardian interpretation using the same equations as above; again, the argument generalizes to more realistic settings. French surpluses determined the French price level, P_F, via the French PVBC, while German surpluses determined the German price level, P_G, via the German PVBC. The French and German governments coordinated surpluses so that the two price levels were consistent with purchasing power parity, (7), at the announced parity. Monetary policy made the interest rates converge in (6), since the peg was credible.

Central banks coordinated policy to maintain fixed parities in the Ricardian interpretation; governments coordinated policy to maintain fixed parities in the Non-Ricardian interpretation. This dichotomy should not be surprising. The exchange rate is a nominal variable, and monetary policy

[34]The model is closed by money market equations for each country.

provides the nominal anchor in a Ricardian regime, while fiscal policy provides the nominal anchor in a Non-Ricardian regime.

The Ricardian interpretation of this period seems quite plausible to us. National central banks had already joined forces in Frankfurt to implement a common monetary policy across the euro area. On the other hand, the Non-Ricardian interpretation seems quite implausible. We heard of little or no effort to coordinate surpluses across the euro area. The SGP came nowhere near to calling for that, and the "euro club" of finance ministers hardly seems to have that as an objective.[35]

The same analysis can be applied to other successful exchange rate systems. For example, the Benelux and Austrian currencies were closely tied to the DM well before the advent of EMU. These arrangements are generally thought to have been maintained by central banks, with relatively little help from fiscal policy. We conclude that the governments of these countries have probably had the discipline of a Ricardian regime for some time, and that all the governments in the euro zone have had that discipline for at least the last three years.

The Post-war Behavior of US Government Surpluses and Liabilities

In section III. B. 1, we noted that the fiscal policy (5) would be Ricardian if ϕ_t is expected to be positive infinitely often. That discussion seems to invite a statistical study of the relationship between primary surpluses and government liabilities. This is, however, not as straightforward as it may at first seem. What, for example, would we learn from a regression of surpluses on current or lagged liabilities? Figure 2 plots US surpluses and liabilities from 1951 to 1995, and there appears to be a loose positive relationship. Suppose however the regression coefficient was not significant. Would this be evidence against Ricardian regimes? Not necessarily. The proposition

[35]Indeed, as we shall soon see, adherence to the SGP would assure a Ricardian Regime.

referred to in section III.B.1 does not require ϕ_t to be positive each period; indeed, ϕ_t does not even have to be positive in a finite data set. Suppose the regression coefficient was positive and significant. Is this evidence in favor of Ricardian regimes, and against Non-Ricardian regimes? Again, not necessarily. A positive correlation between surpluses and liabilities is certainly consistent with a Ricardian regime; the surplus is responding to the debt. However, it is also consistent with a Non-Ricardian regime, with the direction of causation going the other way: changes in the surplus induce price level changes that in turn change the real value of the debt. It is clear from the PVBC that the current value of government liabilities will respond positively to an increase in present or expected future surpluses. As indicated earlier, there is probably no formal statistical test that will distinguish between these two regimes.

The data on surpluses and liabilities do exhibit significant regularities or patterns. These patterns have Ricardian and Non-Ricardian interpretations, and we can ask which interpretation is more plausible. In Canzoneri, Cumby and Diba (2001b), we documented various patterns using vector autoregressions (VAR) in the surplus, liabilities, and other variables. Figure 3 shows impulse response functions from a VAR in just the surplus and liabilities (both normalized on GDP). A surplus innovation produces a significant fall in next year's liabilities, and an additional fall in the following year; moreover, a surplus innovation produces a significant increase in next year's surplus.

The Ricardian interpretation of these patterns is quite straightforward. A primary surplus pays off some of the current debt; so, next year's liabilities are smaller. Since next year's surplus is also higher, even more of the debt is payed off and liabilities fall in the following year as well.

The Non-Ricardian interpretation is somewhat more complicated, but it can be discerned from the present value budget constraint. To see the effect of surplus innovation on next year's liabilities, we have to move (4) forward by one period. A positive innovation in this year's surplus would not have any effect on next year's liabilities if it did not affect next year's surplus, or the following years' surpluses. From Figure 3, we see that an innovation in this year's surplus increases next year's surplus; so equation (4) (moved forward by one period) would predict a rise in next year's liabilities, and not the fall depicted in Figure 3. The Non-Ricardian interpretation of the patterns in Figure 3 has to be that this year's surplus innovation will produce rather large decreases in surpluses that are in the rather distant future. The decreases have to be in the rather distant future, because they do not appear in Figure 3, or in a decade of autocorrelations of the univariate surplus process. The decreases have to be rather large, because they have to offset the earlier surplus increase and they will be heavily discounted.

The Non-Ricardian interpretation of the patters in Figure 3 is logically consistent, but how plausible is it? What is the political theory that would predict large surpluses ten or more years after an observed deficit innovation? The answer can not be something like: politicians (or voters) wake up every decade and respond to the growing debt, or politicians fight wars (against poverty, terrorists, other countries, or other politicians) and pay off the debt later. These fiscal policies fit the requirements of our proposition; they result in Ricardian regimes. The explanation has to be a political theory that is unrelated to the debt. Politicians would have to remember that they ran primary surpluses a decade or more in the past, and then they would have to have a reason to make up for them by running a deficits. The plausibility of the Non-Ricardian interpretation rests on making such an argument.

III. C. Constraints that Assure Fiscal Discipline

Section III. B suggests that governments in the US and the EU do have the fiscal discipline of a Ricardian regime. However, not everyone will be convinced by our arguments, and governments may act differently in the future. It may therefore be prudent to identify – and perhaps enact – constraints on fiscal policy that will guarantee that governments have discipline. It is also important to identify constraints that will cause the least collateral damage.

The deficit constraint in the SGP is a sufficient condition, and this may be the best argument for it.[36] The rule says that total deficits (inclusive of interest payments) may not exceed 3% of GDP:

(8) $(G_t - T_t - CBT_t) + B_tR_t \leq .03P_tY_t$.

Rearranging terms:

$$(9)\ \frac{T_t + CBT_t - G_t}{P_tY_t} \geq R_t\left[\frac{M_t + B_t}{P_tY_t}\right] - \left[0.03 + R_t\left(\frac{M_t}{P_tY_t}\right)\right].$$

(9) is a fiscal policy rule of the form (5); the interest rate is the coefficient ϕ_t, and the last term is the random variable ϵ_t. If the constraint is expected to be binding infinitely often, then the proposition discussed in section III.B.1 applies. Woodford (1997) has shown that the 60% debt limit is also a sufficient condition.

Much weaker fiscal restrictions would suffice, as the discussion in section III. B. 1 makes clear. For example, the cap on the deficit could be five percent of GDP instead of three. Or, the rule could apply to the sum of the primary surplus and half of the interest payments on the debt. More generally, the rule could be stated in terms of the structural deficit, instead of the actual deficit; this would lessen the collateral damage, as discussed in Section II.

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[36]See Canzoneri and Diba (1998, 1999) or Canzoneri, Cumby and Diba (2001a).

III. D. Conclusions: Fiscal Discipline and Functional Central Bank Independence

The fiscal theory of the price level – like the earlier "monetarist arithmetic" – makes the point that, if the government's present value budget constraint is to hold, the government's approach to the debt and fiscal solvency can limit the options open to a central bank, even if it has been granted legal independence. If the central bank is to have the functional independence to achieve price stability, then the government must have the discipline of a Ricardian regime: it has to assure fiscal solvency for any path the price level might take.

We find it theoretically and historically plausible that governments in the United States and the European Union have this discipline, but it is difficult – if not impossible – to test the hypothesis formally. The SGP guarantees the required discipline (assuming that it is enforced) in the euro area, and this may be the best argument in its favor.[37] The traditional arguments for the SGP (given in the last section) are really arguments for debt limits, and not the deficits limits that have figured prominently in recent applications of the SGP. The fiscal theory of the price level gives a logically consistent argument for deficit limits, but it is probably not relevant for governments in the euro area.

IV. Discretionary Fiscal Policy and Macroeconomic Stabilization

Taylor (2000) has argued that discretionary fiscal policy in the US has not been, and indeed should not be, actively engaged in macroeconomic stabilization. EC (2002a) seems to make a very similar case for the EU. In the first subsection, we review the evidence on discretionary fiscal policy

[37] The balanced budget amendments that have been proposed in the United States would also produce the required discipline.

and conclude that there is little reason to think that the President and Congress interact strategically with the Federal Reserve over stabilization policy. In the second subsection, we view discretionary fiscal policy as a macroeconomic shock. We present new evidence on how US fiscal shocks affect US financial markets and output. And, we show how the Federal Reserve has reacted to this source of instability.

IV.A. Is Discretionary Fiscal Policy Geared Towards Macroeconomic Stabilization?

Recent attempts to legislate countercyclical policies have not been very successful, which is not surprising given the fact that post-war recessions have averaged 11 months (peak to trough) and Federal budget decisions are taken more-or-less annually. Taylor (2000) notes that "In 1992, President Bush proposed legislation intended to speed up the recovery from the 1990-91 recession. Congress rejected this proposal for countercyclical fiscal stimulus. In early 1993, President Clinton proposed his own stimulus package, but Congress rejected this proposal too." After much Congressional debate, in March of this year, President Bush signed into law the Economic Security and Recovery Act. However, this was preceded by two quarters of positive growth, and as of this writing, the recovery still appears to be under way. Political institutions in the US are not very conducive to timely countercyclical actions.

Figure 4 gives a historical perspective on the actual stance of fiscal policy; it plots changes in the structural surplus (normalized on potential output) against the GDP gap (measured in percentages).[38] One might think that countercyclical stances are located in the SW quadrant (expansions

[38] The change in surpluses is forward looking. For example, the change in the surplus between 1963 and 1964 is plotted against the output gap for 1963. The standardized primary surplus as a percent of potential GDP and the output gap are from Table F-11 of the Congressional Budget Office's, The Budget and Economic Outlook: Fiscal Years 2003-2012.

when the gap is negative) and the NE quadrant (contractions when the gap is positive); procyclical stances are located in the NW and SE quadrants. Viewed in this way, there were 22 countercyclical budgets and 19 procyclical budgets. The regressions in the top panel of Table 1 support the visual impression in Figure 4. There appears to be little evidence that actual discretionary policy has been countercyclical.

We should, however, be a little careful in interpreting these data: figure 4 does not illustrate the intent of the observed policy stance; and the change in structural surpluses has some defects as a measure of the stance of fiscal policy. Examination of some the points in figure 4 is instructive. The 1963 expansion was President Kennedy's tax cut; it was intended to be countercyclical. The 1965, 1966 and 1967 expansions were President Johnson's spending on the Vietnam War and the War on Poverty; clearly, they were not intended as countercyclical measures, but they resulted in the 1968 tax increase which was. The 1975 expansion was President Ford's tax cut, following the oil price increase; his predecessor's famous assertion – "We are all Keynesians now" – suggests its intent. The 1982 expansion was President Reagan's tax cut. This tax cut was proposed before the 1980 election, and it was not intended as a countercyclical measure; however, it appears in figure 4 as the most aggressive example of a countercyclical measure. Meyer (2001) refers to President Reagan as "an accidental Keynesian." The 1983 point in figure 4 illustrates a defect in our measure of the fiscal stance: it shows no change in the structural surplus, but 1983 clearly saw a continuation of the expansionary policy begun in 1982.[39]

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[39]An alternative measure would be the level of the surplus (rather than its change). Taylor (2000) used the level and reported regressions like those in the bottom panel of Table 1. The regressions show a significantly procyclical policy prior to 1980, and a significantly counter-cyclical policy post 1980. Taylor argues that the post-1980 result is misleading for two reasons: (1) the Reagan tax policy we have already discussed; and (2) the late 1990s change in

All in all, there is little evidence in the US – especially over the last two decades – that discretionary fiscal actions have been effectively focused on macroeconomic stabilization. EC (2002a) presents similar evidence for the EU.

IV. B. The Aggregate Effects of Fiscal Policy and Their Implications for Monetary Policy

In this section we consider two questions – how intermediate-term and long-term bond markets have reacted to fiscal shocks and how the Federal Reserve has reacted to fiscal shocks. There is a widespread view in policy discussions and financial market commentary that higher fiscal deficits are associated with higher intermediate-term and long-term interest rates. (Short-term rates are presumably determined by Federal Reserve policy.) This view is also reflected in large-scale econometric models and in Federal Reserve Board documents. In contrast, much of the academic literature – for example Plosser (1982, 1987) and Evans (1985, 1987a, 1987b) – has concluded that there is no evidence to support a statistically significant positive relationship between fiscal deficits and interest rates. Recent empirical work on the effects of fiscal policy – for example Blanchard and Perotti (2001) and Fatas and Mihov (2001a, 2001b) – has not examined the link between fiscal shocks and interest rates.

We examine the role played by financial markets in two ways. In section IV. B. 1, using Congressional Budget Office budget forecasts, we find that there is a sizable and statistically significant effect of projected surpluses on the spread between intermediate-term (or long-term) Treasury yields and Treasury bill yields. An increase in the projected surplus averaging one

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income distribution (to richer tax payers in high brackets), which gave the impression of a discretionary tax increase. He concludes that "the seemingly well-timed countercyclical fiscal movements of the structural surplus during the 1980s and 1990s is best interpreted as a coincidence."

percentage point of GDP is associated with a decline in the spread of about 55 - 60 basis points. In section IV. B. 2, we expand on Blanchard and Perotti's (2001) approach to identifying fiscal shocks and estimating their effect on output, by introducing the reactions of financial markets and monetary policy. We find that positive spending shocks lead to increases in interest rates, and that this reaction by the financial markets attenuates the effect of spending shocks on real GDP. The results for tax shocks are not as clear as those for spending shocks and some puzzles remain. In section IV. B. 3, we examine the response of monetary policy – and the federal funds rate in particular – to fiscal shocks. We ask whether the response can be described by a simple Taylor rule. A more detailed discussion of econometric identification issues can be found in an appendix.

IV. B. 1. The Reaction of Financial Markets to Fiscal Policy

Interest rates and other asset prices may be affected by tax and spending shocks. Discussions of the financial markets' reaction to fiscal shocks generally focus on intermediate-term or long-term interest rates. For example, fiscal policy is cited (along with expectations about the state of the economy and, to a lesser extent, expected inflation) as the cause of long-term interest rate developments in the Federal Reserve's two most recent semiannual monetary policy reports to the Congress.[40]

The effects of fiscal policy on long-term interest rates are also embedded in large-scale macro-econometric models such as FRB/US (which was developed at the Federal Reserve Board and is used there for policy analysis and forecasting), DRI/WEFA, and Macroeconomic Advisers models. Elmendorf and Reifschneider (2002) simulate the effects of sustained tax cuts and spending

[40] Federal Reserve Board (2001) pp. 163-164 and (2002), p. 520. The view that fiscal deficits affect long-term rates is also reflected in Chairman Greenspan's speeches and testimony. See Greenspan (2001, 2002).

increases in the FRB/US model, in which asset prices are set in financial markets by forward looking agents. They find that the ten-year note rate rises immediately when taxes are cut and then continues to rise for several years. In contrast, the federal funds rate, which is determined by a simple Taylor rule, rises only slowly. Thus the spread between the ten-year note rate and the federal funds rate rises. Elmendorf and Reifschneider also find that financial market responses to a tax cut significantly attenuate the tax cut's effect on real output. An increase in spending also raises the ten-year bond rate immediately; the federal funds rate rises as well, but more gradually than the ten-year note rate.

Policy discussions of the aggregate effects of fiscal policy often involve the implications for monetary policy. For example, with the emergence of both actual and projected fiscal surpluses in 1999 and 2000, a number of commentators in the press and in financial markets worried that the declines in long-term interest rates induced by these surpluses would conflict with attempts by the Federal Reserve to dampen aggregate demand.[41] More recently, some discussions of the slow phase in of the tax cuts enacted in 2001 focused on the resulting increases in long-term interest rates and the potentially contractionary effects that these would have on aggregate demand.[42]

It is perhaps surprising, given the widespread view that fiscal policy affects financial markets, that a significant part of the academic literature finds that budget deficits do not have a statistically significant effect on interest rates. In two closely related paper, Plosser (1982, 1987) looks at the effect of innovations to government debt on excess holding period returns on Treasury

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[41] These discussions tended to be somewhat confused. The only real alternative to running surpluses was to make fiscal policy more expansionary, which would not have assisted the Federal Reserve in dampening aggregate demand.

[42] See, for example, Gale and Potter (2002).

bills with two to twelve months to maturity, and on bonds and notes with up to five years to maturity, all relative to the one-month bill rate. He finds no evidence of a significant positive effect – estimates are negative and marginally significant. Plosser does find some evidence that shocks to military spending raise rates, but the results are sensitive to the choice of sample.

Plosser's findings are echoed in a series of papers. Boothe and Reid (1989) apply the methods in Plosser (1982, 1987) to Canadian data and find no evidence of a statistically significant positive effect of deficits (or government spending) on interest rates. Evans (1987b) applies Plosser's approach to data from five countries in addition to the United States; he finds no evidence of a statistically significant positive effect of deficits on interest rates. Evans (1987a) looks at U.S. data from 1908 to1984 (and eleven subsamples), and he finds no evidence of a statistically significant positive effect of deficits on either the interest rate on commercial paper or the AAA bond rate. Evans (1985) looks at three wartime periods in the United States – the Civil War, World War I, and World War II – in which fiscal deficits increased substantially without any discernable effect on nominal or real interest rates. In fact, he presents regressions in which higher deficits are associated with interest rate declines (holding government spending constant).

Many people have remained unconvinced by this literature – Elmendorf and Mankiw (2000) characterize it as "uninformative" and Bernheim (1989) is even more critical. And the academic literature does not all reach the same conclusion. Wachtel and Young (1987) find that revisions in CBO and OMB forecasts for current fiscal year deficits have a positive and statistically significant effect on daily changes in interest rates all along the yield curve. Kitchen (1996) also finds statistically significant effects of changes in OMB forecasts (in this case both one year and multi-year forecasts) on overnight changes in interest rates on Treasury securities of various maturities.

Elmendorf (1993) uses forecasts of budget deficits from Data Resources, Inc. and finds that forecasts of larger deficits are associated with higher intermediate-term and long-term interest rates. And Elmendorf (1996) examines financial market responses to news about the Gramm-Rudman-Hollings law of 1985; he finds that higher expected spending and larger expected budget deficits are associated with higher real interest rates.

Here, we present new evidence on the link between fiscal surpluses and interest rates. The Congressional Budget Office forecasts budget balances each year in January or February (after the release of the President's Budget) and again in mid-summer.[43] For the past ten years, the CBO has been forecasting over a ten-year horizon; prior to that, their horizon was only five years. We look at the effect of CBO surplus forecasts on interest rates over both samples: semi-annual data for five-year forecasts beginning in 1984 and ten-year forecasts beginning in 1992.[44] Our sample ends at the beginning of 2002.

Rather than looking at the level of interest rates, we look at two spreads: the spread between five-year Treasury notes and three-month Treasury bills, and between ten-year notes and three-month bills.[45] We do so for two reasons: first, discussions of fiscal policy's effect on interest rates

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[43] We have regular data on the mid-summer update only beginning in 1984.

[44] We follow the literature in working with deficits rather than the level of the debt. Feldstein (1986) argues that interest rates are probably more responsive to expected deficits than to either current deficits or outstanding debt and presents some evidence that expected future deficits affect current interest rates.

[45] We use the constant maturity Treasury series for the five-year and ten-year notes and express the bill rate as a bond equivalent yield.

often focus on intermediate and long-term rates;[46] and second, by looking at the spread, we avoid having to model the level of interest rates.

The top panel of Figure 5 plots the spread between the five-year note rate and the three-month bill rate on the vertical axis and the CBO five-year surplus forecast on the horizontal axis, using semi-annual data from 1984 to 2002.[47] The bottom panel plots the first differences in these two series. As is apparent from the two plots, there is a clear inverse relationship between the interest rate spreads and the CBO forecasts. Higher projected budget surpluses are associated with lower interest rate spreads. There is one outlier in the top panel, January 2002. Two factors may account for its outlier status. This forecast revised both the five-year and ten-year surpluses downward rather dramatically, but in the view of many observers, not by enough. The sizable August revisions suggest that those observers were correct. In addition, the Federal Reserve had pushed short-term rates down considerably in the preceding year.

Table 2 contains the results of two sets of regressions that correspond to the two panels of Figure 5. The left-hand panel contains the estimated slope coefficients (and the estimated t-ratios) for the regression,

(10) $RL_t - R3_t = a + b\, S_t + u_t$,

where RL_t is the yield on either the ten-year note or the five-year note (expressed as percent per annum), $R3_t$ is the yield on three month bills, and S_t is the annual average of the CBO's cumulative

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[46] John Kitchen suggested this specification to one of the authors. The evidence in Elmendorf and Reifschneider (2002) is consistent with a greater impact of tax change on longer-term rates than on shorter-term rates.

[47] All surplus numbers are cumulative and expressed as the average annual surplus relative to lagged nominal GDP.

five-year or ten-year surplus forecasts (expressed as a percent of GDP). The estimates are corrected for first-order serial correlation. The right-hand panel contains the estimated slope coefficients (and the estimated t-ratios) for the regression,

(11) $\Delta RL_t - \Delta R3_t = a + b\ \Delta S_t + v_t$.

All of the estimates confirm a statistically significant link between higher projected budget surpluses and lower spreads of long-term rates over short-term rates. The magnitude of the effect is substantial in both samples and somewhat larger for five-year projections than for ten-year projections, probably reflecting greater uncertainty about the second five years of those forecasts. The estimates computed using the five-year projections suggest that an increase in projected future deficits averaging one percent of current GDP is associated with an increase in long-term rates over short-term rates of between 53 and 60 basis points.

Measurement error is almost certainly a serious problem that biases all of these estimates towards zero. The baselines used reflect provisions in existing tax laws, such as sunset provisions and alternative minimum tax problems, that are widely recognized as almost certain to be changed. Thus the effects of projected surpluses are likely to be larger than the estimates in Table 2. A second consideration might also impart a downward bias to the slope coefficients. To the extent that positive supply shocks, such as increases in trend productivity growth, both raise projected surpluses and raise interest rates, the measured effect of projected surpluses on interest rates will be understated.

The last row of Table 2 provides estimates of the effects of current, rather than projected, surpluses on interest rate spreads. Instead of regressing interest rate spreads on projected surpluses,

we regress spreads on the actual surplus (as a percent of GDP, both lagged one quarter). These results also suggest that higher budget surpluses are associated with lower spreads.

These results present strong evidence that budget deficits exert a substantial and statistically significant effect on interest rates. The reaction of intermediate-term and long-term rates to projected fiscal surpluses suggests that, even if monetary policy is characterized by strict interest rate targeting and does not react to fiscal policy, financial market reaction may attenuate the effect of fiscal policy on aggregate demand.[48] The results do not, however, distinguish between the interest rate effects resulting from the actions of automatic stabilizers and those arising from discretionary policy or between the effects of fiscal shocks and those of anticipated fiscal policies. In addition, the results tell us only about the response of intermediate-term and long-term rates over and above any Federal Reserve reaction. They do not tell us about the full interest rate effect of fiscal policy. In the next section we attempt to remedy these two shortcomings by considering the effects of fiscal policy shocks over time in a structural vector autoregression.

IV. B. 2. The Reaction of Inflation and Output to Fiscal Shocks

Blanchard and Perotti (2001) estimate the dynamic effects of tax and government spending shocks on real output in a three-equation structural vector auto-regression. In order to identify these shocks, they assume that legislative action takes sufficiently long that tax and spending decisions are not affected by current quarter changes in output. Therefore, within the quarter, spending shocks do not respond at all to output and net taxes respond to output only through the operation of automatic stabilizers.

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[48] Macroeconomic Advisers (2000) reports that about three-fourths of the interest-rate sensitivity of aggregate demand in their model is tied to long-term yields.

Blanchard and Perotti (2001) decompose net taxes into several categories and use detailed estimates of the output elasticity of each of these categories to compute the aggregate output elasticity (which varies over time due to changes in tax laws and to changes in the composition of net taxes across the categories). This allows them to estimate the effect of output on net taxes and identify tax shocks.[49]

Blanchard and Perotti (2001) find that both taxes and spending have a sizable and persistent effect on real output. A positive one-dollar tax shock (a tax increase) reduces output initially by about 70 cents. The effect rises slightly, with the peak effect – a decline in GDP of about 80 cents – occurring about 5 quarters after the shock. After that, output returns gradually to trend.[50] A one-dollar spending shock (an increase in spending) raises GDP by about 84 cents within a quarter. The effect of the shock grows and is quite persistent, reaching a peak effect on GDP of about 1.3 dollars about 15 quarters after the shock.

These results raise several questions, which we address here. What is the impact of fiscal shocks on inflation? Is there evidence of reaction by the Federal Reserve to fiscal policy shocks? Does it differ from the response predicted by a simple Taylor rule? Does financial market (and Federal Reserve) reaction to fiscal shocks attenuate the effect of the shocks on real output?

We provide answers to these questions by bringing together two pieces of the literature. The first, typified by Blanchard and Perotti (2001) and Fatas and Mihov (2000), considers the aggregate

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[49] Identifying the shocks is completed in two alternative ways: by allowing spending to affect net taxes within the quarter (but not vice-versa) and the other way around.

[50] Blanchard and Perotti (1999) look at two specifications of trends, one deterministic and the other stochastic. The effects described above are for the deterministic trend specification. The effects of a tax shock are greater with stochastic trends, with a peak effect on GDP of -1.33 occurring after 7 quarters.

impact of fiscal shocks. The second, typified by Bernanke and Blinder (1992), Bernanke and Mihov (1998), and Chistiano, Eichenbaum, and Evans (1999), considers the effect of monetary policy shocks. Interestingly, the analysis of fiscal shocks ignores potential interactions with monetary policy and the analysis of monetary policy ignores potential interactions with fiscal policy.

We begin by estimating Blanchard and Perotti's structural vector autoregression, which describes the dynamics of net taxes, government spending (government consumption and investment), and real output. We then add a core set of variables typically used in VAR analysis of monetary policy: inflation (measured by the GDP deflator), commodity prices (the index of sensitive materials prices from the index of leading economic indicators), bank reserves, and the federal funds rate.[51] In addition, we include the ten-year constant maturity Treasury rate. Identification of these shocks uses the standard triangularization method with two important exceptions. First, we take account of the effect of interest rate changes on federal government net interest payments, and therefore on net taxes. Second, we take account of the effect of price level changes on tax receipts. Failing to do so would raise the possibility of attributing an increase in government interest costs resulting from a positive interest rate shock to a negative tax shock.[52]

Figure 6 presents the impulse response functions for shocks to net taxes and government spending from our estimates of the original (three variable) Blanchard-Perotti model.[53] Although our sample differs from the one used by Blanchard and Perotti (2001), the impulse responses computed

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[51] To keep the number of variables as small as possible, we chose to use only one of the three monetary aggregates used by Christiano, Eichenbaum, and Evans (1999).

[52] We present the details of how we adjust for interest costs in net taxes in the appendix.

[53] Because the VAR is estimated in logs, we need to transform the impulse responses to get the multipliers that we plot. To do so, we multiply the responses by the ratio of the levels of the variables at the end of the sample (more precisely, their average values during 1999).

from the structural VARs are quite similar. A one-dollar increase in taxes reduces GDP by about 60 cents on impact. The effect grows, reaching a peak effect on GDP of about -80 cents four quarters after the shock. Output then gradually returns to its trend. The impact of a spending shock is both greater and more persistent than the impact of a tax shock. A one-dollar increase in spending raises GDP by about 85 cents on impact. The effect grows, reaching a peak effect on GDP of about 1.05 dollars around 14 quarters after the shock. The decline from the peak effect is quite gradual. Figure 6 also displays the standard error bands computed using 500 bootstrap replications.[54] As is the case with the estimates presented in Blanchard and Perotti (2001), the impulse response functions are imprecisely estimated – the standard error bands are fairly wide.

Figure 7 presents the impulse response functions from our estimates of the expanded (eight variable) model. Both tax and spending shocks are normalized to one percent of GDP. Figure 7 shows the dynamic responses of real GDP, inflation, the federal funds rate, and the ten-year bond yield.[55,56] The response of output is measured in percent and the response of interest rates and inflation are measured in percentage points (expressed at an annual rate).

The left-hand column displays the effects of a spending shock. The impact effect on real GDP is larger than in the system without interest rates (shown in Figure 6); the impact multiplier is 1.1 rather than 0.85. The peak effect is also larger (1.2 rather than 1.05), but both of these

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[54] For comparability with the results presented in Blanchard and Perotti (2001), we plot the responses plus and minus one standard error.

[55] We also examined the impulse response from a 100 basis point increase in the federal funds rate, but because they are very similar to those reported in, for example, Christiano, Eichenbaum, and Evans (1999), we do not report them.

[56] As in Figure 6, we plot one-standard-error bands along with the estimated impulse response.

differences are fairly small given the precision with which we are able to estimate the responses. The most striking difference between the two sets of estimates is the more rapid return of real GDP to trend when we allow for an interest rate response. The peak effect of a spending shock on output is reached after about one year. Although the output effects of a spending shock are still quite persistent, they are much less persistent than when interest rate effects are ignored. The multiplier after five years is just under 0.4, which is less than half of its estimated value without an interest rate response.

Inflation rises temporarily in response to a spending shock. After a brief (and difficult to explain) two quarter decline, inflation gradually rises, reaching a peak of about 0.5 percentage points two years after the shock. The impact on inflation then declines, with inflation returning to its trend value about five years after the peak. The inflation effects are estimated even less precisely than the output effects – even the peak effect is only slightly more than one standard error above zero.

The ten-year note rate is estimated to rise by about 45 basis points on impact. After reaching a peak of about 65 basis points in the next quarter, the effect of a spending shock on the ten-year note rate declines slowly. Only after about ten quarters does the effect fall below 50 basis points.

The right-hand column of Figure 7 contains the response to a tax shock (a tax increase) equivalent to one percent of GDP. The impact multiplier, about 0.6, is virtually identical to that obtained without any interest rate response. Surprisingly, the estimated response after that exceeds the response depicted in Figure 6. The output effect grows, reaching a peak multiplier of -1.7 after three years. The inflation response to a tax shock is more muted than is the response to a spending shock. After an initial (and once again puzzling) uptick, the inflation response declines steadily and is about 0.2 percent below trend after 5 years. The effect of the tax shock on the long-term interest

rate is similarly small. After rising slightly, the ten-year note yield falls; five years after the shock, it is down by only 12 basis points.

IV. B. 3. The Reaction of Monetary Policy to Fiscal Shocks

Monetary policy in the United States is frequently characterized with a simple Taylor rule – like equation (2) – linking the federal funds rate to the equilibrium real interest rate, the output gap (with a coefficient of 0.5), and the gap between inflation and its target value (with a coefficient of 1.5). Using the output and inflation responses found in Figure 7, the rule suggests that a positive spending shock ought to lead to an increase in the federal funds rate (even assuming that the equilibrium real interest rate is unchanged). More precisely, the rule suggests that the federal funds rate ought to rise by about 50 basis points on impact and reach a peak effect of about 120 basis points after about two years. The results from our structural VAR are roughly consistent with the rule's predictions: the estimated impact effect of a spending shock on the federal funds rate is 60 basis points; the federal funds rate then rises for about a year, reaching a peak of about 75 basis points before declining. These effects are, however, measured quite imprecisely.

A positive tax shock would be expected to reduce the federal funds rate in response to the declines in output and inflation resulting from the shock. The simple Taylor rule would predict that the federal funds rate would fall by about 30 basis points for a few quarters and, beginning in the third quarter after the shock, decline further. The peak effect predicted by the Taylor rule is about -110 basis points, about 4 years after the shock. By contrast, the response of the federal funds rate in our VAR (pictured in the right panel of Figure 7) is positive for nearly two years before turning negative. Recall that for tax shocks (in contrast with spending shocks), our VAR found a greater estimated effect on output when interest rate responses were taken into account. Part of the

explanation for this anomaly may lie in the behavior of the federal funds rate. The initial rise in the federal funds rate (and the long-term rate) seems to reinforce the effect of the tax increase on aggregate demand. This behavior of the federal funds rate is rather puzzling: why would the Federal Reserve tighten monetary policy in response to a tax increase? Omitted variables are a potential problem in any small VAR, and we suspect that an omitted variable may lie behind this puzzle.

IV. C. Conclusions: Fiscal Shocks and Monetary Policy

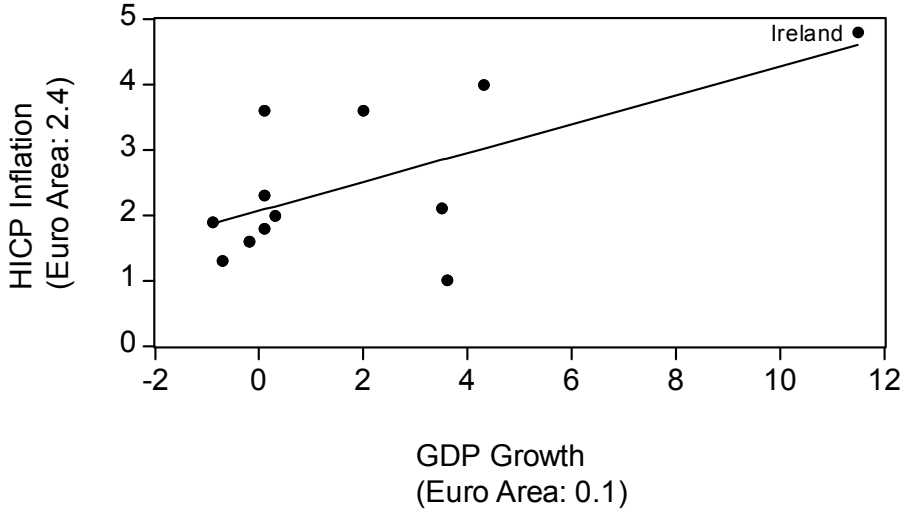
Discretionary fiscal policy does not appear to have been effectively focused on macro-economic stabilization, at least not in the last two decades. We find little reason to think that the President and Congress interact strategically with the Federal Reserve over stabilization policy; this view of the policy coordination problem seems to be dated.

Fiscal policy does, however, affect the economic environment in which monetary policy acts. Fiscal policy provides automatic stabilizers, but it is also the source of macroeconomic shocks that may destabilize prices and output. In contrast to much of the academic literature, we find a strong and statistically significant correlation between fiscal deficits and intermediate-term and long-term interest rates. Moreover, our structural vector autoregression implies that positive spending shocks lead to increases in interest rates, and that this reaction by the financial markets attenuates the effect of spending shocks on real GDP.[57] These findings reconcile the empirical evidence with structural models that have been developed at the Federal Reserve Board, and with what appears to be the conventional Federal Reserve wisdom.

[57] The results for tax shocks are not as clear as those for spending shocks. Some puzzles remain for future work.

We also estimate the Federal Reserve's reaction to fiscal shocks. The Federal Reserve appears to have reacted to government spending shocks in a way that is consistent with standard calibrations of the Taylor rule. So, these spending shocks do appear to be a concern for the Federal Reserve, but they are of no greater concern than any other shock that affects the GDP gap and inflation.

Figure 1: Inflation and Growth Across the Euro Area



From OECD Key Short-term Indicators, June 2002
Percentage change from previous year
Dates vary slightly across countries

Figure 2: Primary Surpluses and Liabilities, 1951 - 1995

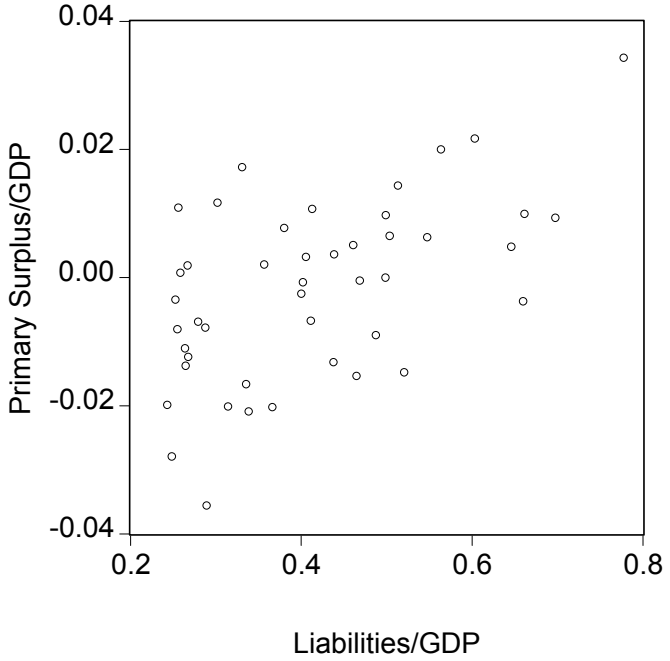
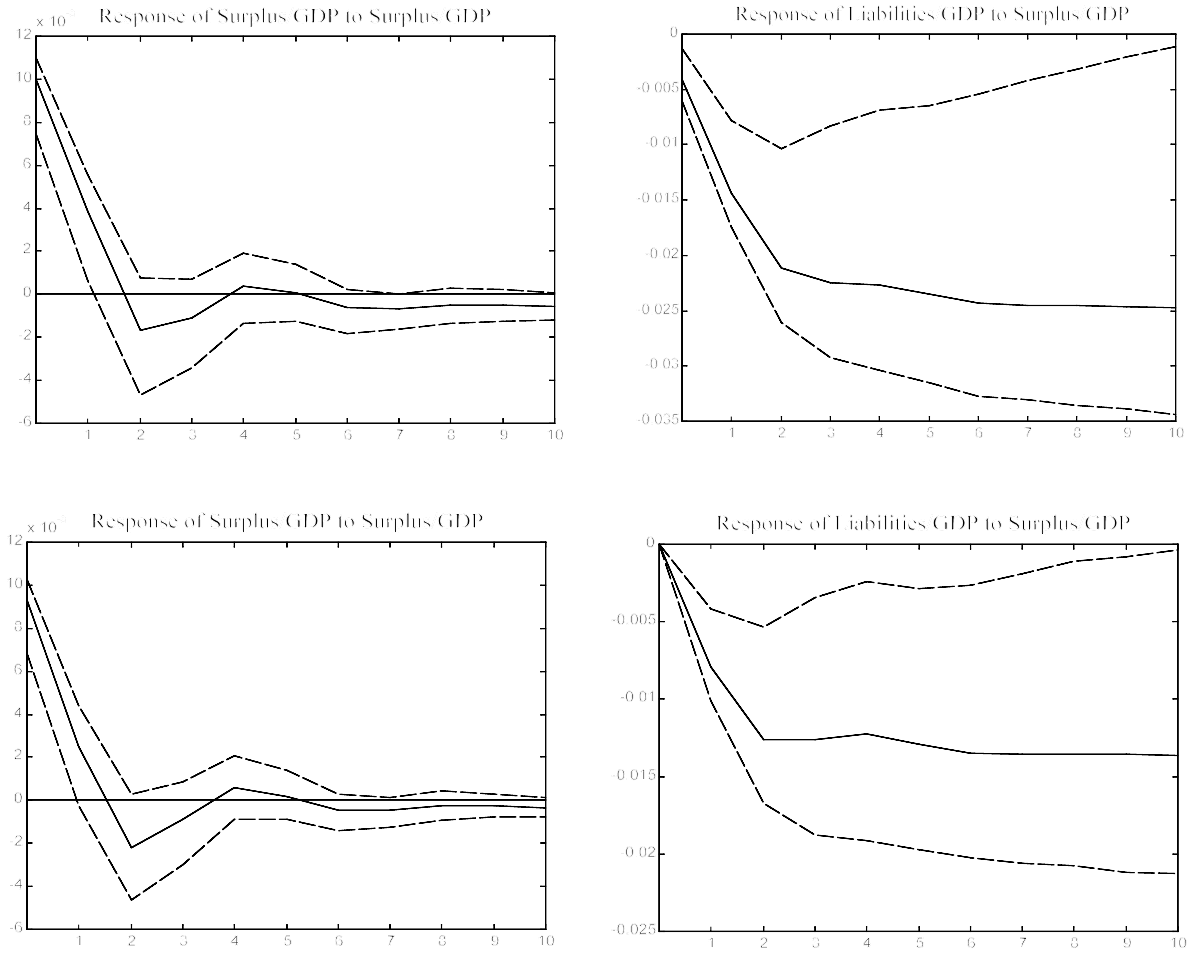


Figure 3: VAR in Surplus/GDP and Liabilities/GDP



Notes: VAR is estimated with two lags and a constant over the sample 1951-1995.
Standard error bounds estimated with bias-adjusted bootstrap procedure.
Top panel ordering, Surplus/GDP, Liabilities/GDP.
Bottom panel ordering, Liabilities/GDP, Surplus/GDP.

Figure 4: Discretionary Policy and GDP Gaps
(US data, 1960 - 2001, Fiscal Year)

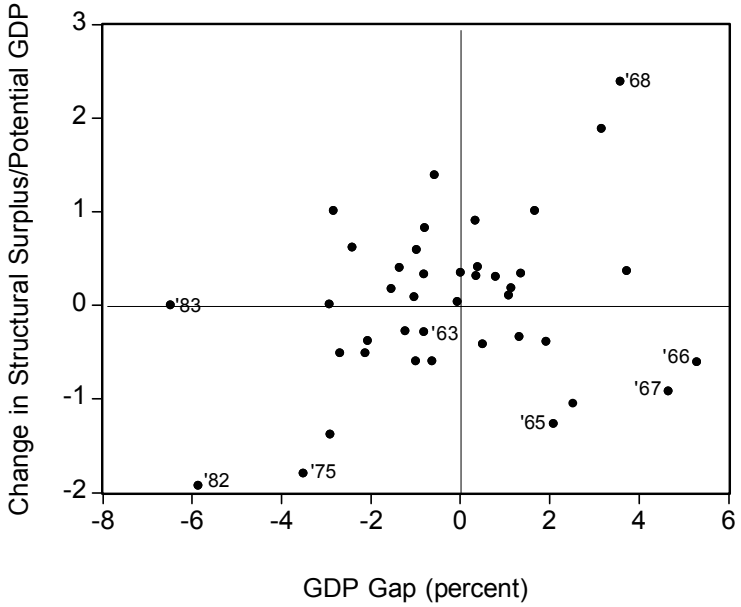
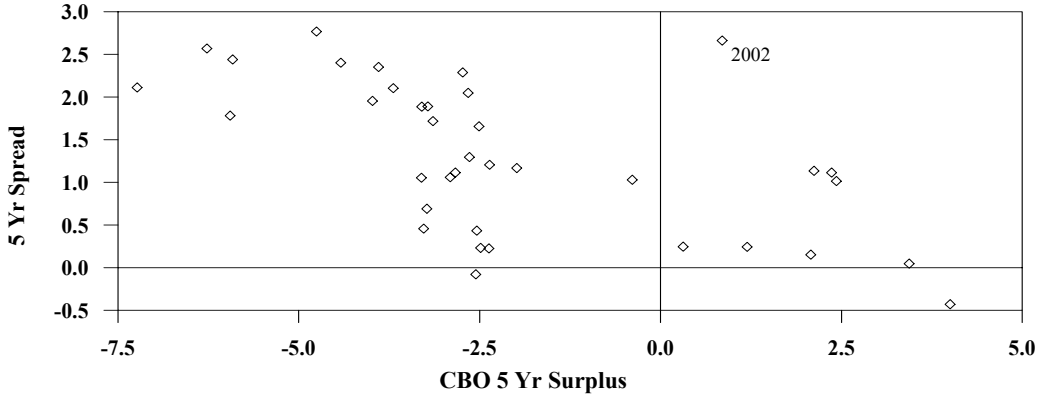


Figure 5: Interest Rate Spreads and Budget Forecasts



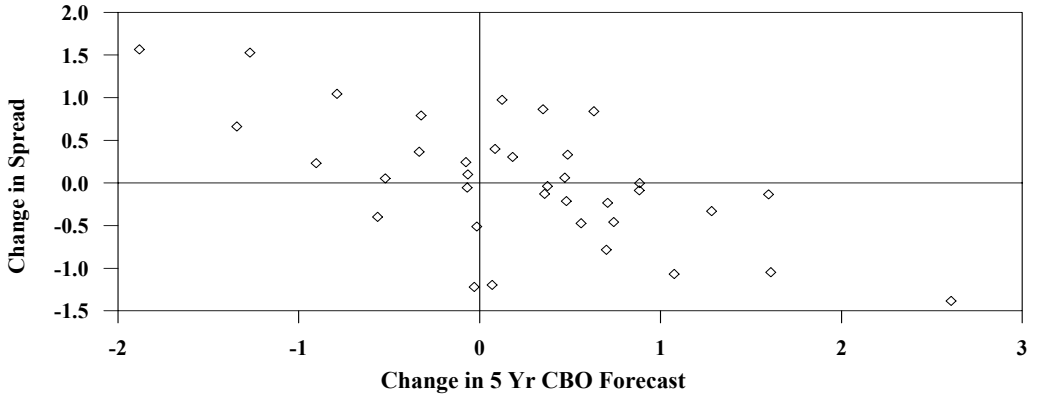


Figure 6: Response of Real U.S. GDP to Fiscal Shocks

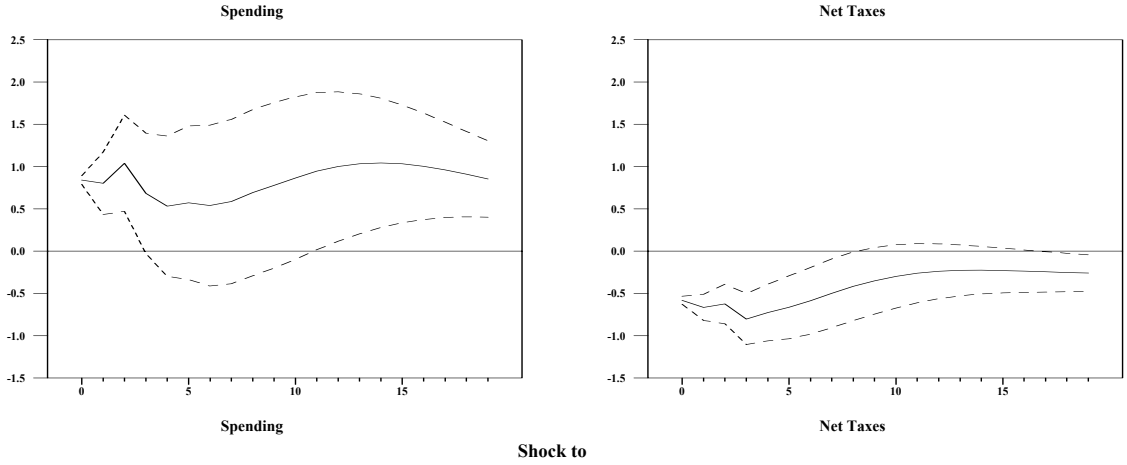


Figure 7:Response of Real GDP, Fed Funds, Long Rate, and Prices

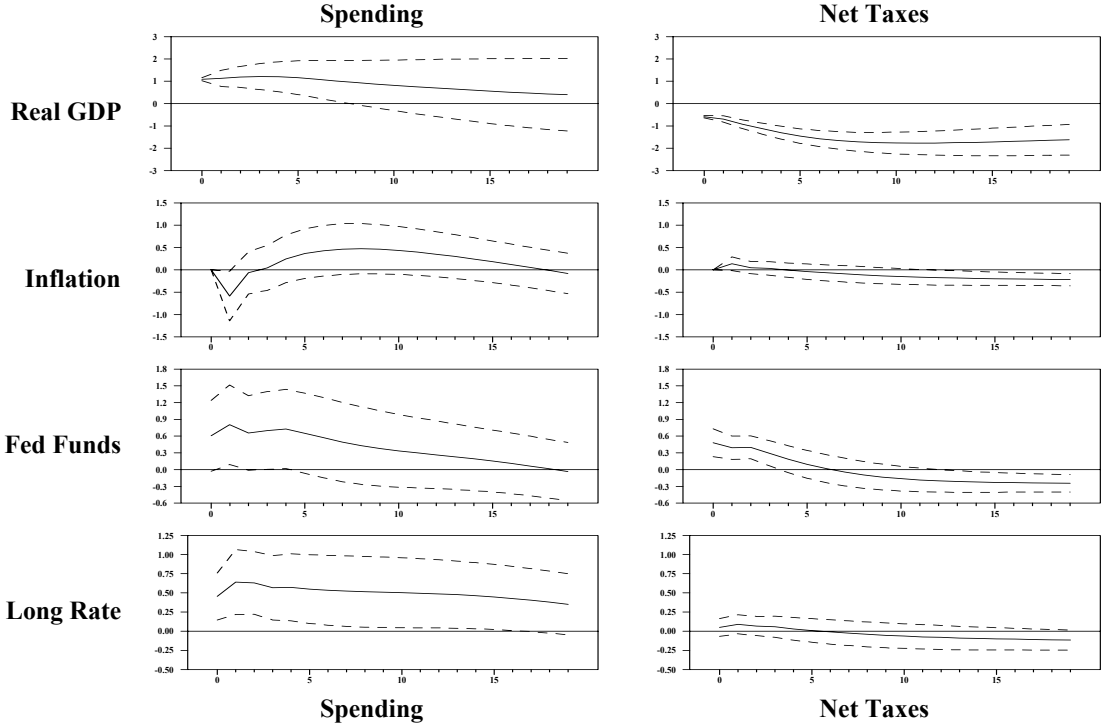


Table 1: Regressions of Structural Surplus/Potential GDP on the GDP Gap

	Dependent Variable: First Difference of Ratio		Dependent Variable: Level of Ratio	
Sample Period	GDP Gap Coefficient	R-Squared	GDP Gap Coefficient	R-Squared
1960 - 2001	0.093 (1.730)	0.071	-0.015 (-0.197)	0.001
1960 - 1979	0.117 (1.255)	0.080	-0.203 (-2.584)	0.271
1980 - 2001	0.111 (1.544)	0.111	0.316 (2.676)	0.264

Note: All regressions included a constant. T-ratios are in parentheses.

Table 2: Regressions of Interest Rate Spreads on CBO Budget Surplus Projections

	Levels		First Differences	
	5 Year Note - 3 Month Bill	10 Year Note - 3 Month Bill	5 Year Note - 3 Month Bill	10 Year Note - 3 Month Bill
5-Year Projections 1984-2002	-0.524 (-4.625)	-0.591 (-4.555)	-0.538 (-4.950)	-0.603 (-4.846)
10-Year Projections 1992-2002	-0.415 (-3.308)	-0.451 (-3.348)	-0.410 (-3.429)	-0.446 (-3.468)
Actual Surpluses 1984-2002	-0.200 (-1.809)	-0.279 (-1.792)	-0.487 (-1.921)	-0.679 (-2.428)

Note: All regressions included a constant. T-ratios are in parentheses.

Appendix: Econometric and Identification Issues

In section IV we examine the effects of shocks to net taxes (taxes net of transfers, including net interest payments) and spending (government consumption and investment) separately, allowing the effects of the two to differ. We use the vector autoregression,

$$X_t = \sum_{j=1}^{q} A_j X_{t-j} + u_t ,$$

where q is the data-determined lag length, $X_t = (T_t, G_t, Y_t, \pi_t, C_t, RFF_t, R_t, R10_t)'$, T_t is the log of real per capita net taxes, G_t is the log of real per capita government consumption and investment, Y_t is the log of real per capita GDP, π_t is the change in the log of the GDP deflator, C_t is the log of the index of sensitive commodity prices from the index of leading economic indicators, RFF_t is the federal funds rate, R_t is the log of per capita bank reserves, and $R10_t$ is the ten-year constant maturity Treasury yield. The vector autoregression combines the variables used by Christiano, Eichenbaum, and Evans (1999) – with the exception that we use only one monetary aggregate rather than the three that they use – and those used by Blanchard and Perotti (2001).

The reduced form disturbances in the vector autoregression, u_t, will be correlated and $E(u_t u_t') = \Sigma$. As a result, these disturbances cannot be interpreted as fiscal shocks. In order to identify shocks to U.S. fiscal policy, we need to impose some structure on the covariance matrix of the reduced form disturbances. The standard approach to doing so is to choose a "causal ordering" in which variables earlier in the ordering are assumed to exert a contemporaneous effect on variables later in the ordering, but the reverse is assumed not to be true. This has the effect of decomposing

the covariance matrix Σ into GG', where G is triangular and is then used to recover the effects of orthogonal, structural shocks. ($G^{-1}u_t = v_t$, where the structural shocks, v_t, are uncorrelated).

Rather than adopting this standard approach, we follow Blanchard and Perotti (2001) and identify the shocks using institutional features of the U.S. tax and transfer systems and the timing of revenue collections to identify the "automatic" responses of net taxes and spending to changes in GDP in a structural VAR. In addition, because we include both prices and interest rates in our VAR, we adjust for the effects of price and interest-rate changes on net taxes. These automatic responses are then subtracted from the reduced form disturbances to identify structural tax shocks. Spending shocks are then identified by the assumption that the timing of spending decisions is such that there is no response of spending to GDP within a quarter. Prices can, however, affect real spending within the quarter because many spending decisions are set in nominal terms and are not adjusted for within-quarter inflation. The remaining shocks are then indentified with the causal ordering used by Chistiano, Eichenbaum, and Evans (1999).

More formally, the reduced form shock in the net taxes equation is assumed to be related to the other shocks by,

$$u_t^T = a_1 u_t^Y + a_2 v_t^G + a_3 u_t^{\pi} + a_4 u_t^{R10} + a_5 u_t^{RFF} + v_t^T .$$

Blanchard and Perotti (2001) draw on Giorno, Richardson, Roseveare, and van den Noord (1995) to estimate the GDP elasticity of five components of net taxes and compute the share-weighted average of these elasticities to determine a_1 and we follow their procedures to obtain our estimate. We follow Perotti (2002) in estimating a_3. In order to compute the price elasticity of income tax and social security tax receipts we assume that tax rates are not indexed within the quarter and therefore move with nominal wages. We then use the estimates of the elasticities of individual income taxes

and social security taxes with respect to real wages in Giorno et al. (1995) and subtract one to get the price elasticities. Transfers do not adjust within the quarter to price shocks so the price elasticity of real transfers is -1.0. Real indirect tax receipts and real corporate income tax receipts are assumed to unaffected by price shocks.

Estimating a_4 and a_5 is a bit more involved. As interest rates change, the change in net taxes is,

$$dT = \sum_{k=1}^{M} D_k dR_k ,$$

where the sum is over debt maturities, D_k is the value of new debt issues of maturity k, and R_k is the yield on new issues of maturity k. As we are interested in the effects of shocks to the short rate and the 10-year note rate, we approximate,

$$dR_k = \beta_1 dRFF + \beta_2 dR10$$

and estimate the parameters β_1 and β_2 by regressing the constant maturity Treasury yield for each maturity on the federal funds rate and the 10-year note rate. Next we estimate D_k for each quarter by taking the quantity of debt outstanding by maturity category (taken from the Treasury Bulletin) and adjusting by the ratio of new issues to the amount outstanding for each maturity category. (We compute this ratio using auction data from the Bureau of Public Debt web site for three years.) Finally, we assume that auctions, on average, occur mid-way through the quarter so that interest on new issues is paid for only one half of the quarter.

In order to identify spending shocks, we follow Blanchard and Perotti (2001) and assume that there is no discretionary response of spending to any other shocks within a quarter and use Perotti's (2002) assumption that the price elasticity of real spending is -0.5. The structural spending shock

is equal to the reduced form spending shock adjusted for the reduced form price shock, $u_t^G + 0.5\, u_t^P = v_t^G$.

We identify real GDP shocks by assuming (as do Christiano, Eichenbaum, and Evans (1999)) that shocks to interest rates, prices, and monetary aggregates have no contemporaneous effect on GDP. The reduced form GDP shock is then,

$$u_t^Y = c_1 u_t^T + c_2 u_t^G + v_t^Y .$$

Again, we follow Blanchard and Perotti (2001) and estimate the parameters c_1 and c_2 with an instrumental variables regression v_t^G and v_t^Y as instruments.

We identify the shock to the federal funds rate by assuming that the monetary authority follows an augmented Taylor rule, which allows for a reaction to taxes and spending directly rather than restricting that reaction to occur through the impact of taxes and spending on output and inflation. In addition, we allow commodity prices to affect the federal funds rate, although removing this effect would have no noticeable impact on the results we report. The reduced form federal funds rate shock is then,

$$u_t^{RFF} = g_1 u_t^T + g_2 u_t^G + g_3 u_t^Y + g_4 u_t^{\pi} + g_5 u_t^C + v_t^{RFF} .$$

In order to deal with the simultaneity that arises due to the interest rate effects on net taxes, we estimate the parameters using instrumental variables.

Combining these identifying assumptions with the causal ordering used by Christiano, Eichenbaum, and Evans (1999), and allowing the Federal Reserve to react to tax and spending shocks in setting the federal funds rate yields the system that we estimate.

$$\begin{bmatrix} 1 & 0 & -a_1 & -a_3 & 0 & -a4 & 0 & -a5 \\ 0 & 1 & -b_1 & 0 & 0 & 0 & 0 & 0 \\ -c_1 & -c_2 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ -g_1 & -g_2 & -g_3 & -g_4 & -g_5 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} u_t^T \\ u_t^G \\ u_t^Y \\ u_t^\pi \\ u_t^C \\ u_t^{RFF} \\ u_t^R \\ u_t^{R10} \end{bmatrix} = \begin{bmatrix} 1 & a_2 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & d_1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & f_1 & f_2 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & h_1 & h_1 & h_1 & h_1 & 1 & 0 \\ 0 & 0 & k_1 & k_2 & k_3 & k_4 & k_5 & 1 \end{bmatrix} \begin{bmatrix} v_t^T \\ v_t^G \\ v_t^Y \\ v_t^\pi \\ v_t^C \\ v_t^{RFF} \\ v_t^R \\ v_t^{R10} \end{bmatrix}$$

References:

Alesina, Alberto and Roberto Perotti, "The Political Economy of Budget Deficits," IMF Staff Papers, 42, 1995, pg. 1 - 31.

Alesina, Alberto and Guido Tabellini, Rules and Discretion with Non-coordinated Monetary and Fiscal Policy," Economic Inquiry, 25, October, 1987, pg. 619-630.

Alesina, Alberto, Olivier Blanchard, Jordi Gali, Francesco Giavazzi, and Harald Uhlig, Defining a Macroeconomic Framework for the Euro Area, MECB3, CEPR, 2001.

Angeloni, Ignazio and Luca Dedola, "From the ERM to the Euro: New Evidence on Economic and Policy Convergence Among EU Countries," ECB Working Paper #4, 1999.

Auerbach, Alan and Daniel Feenberg, "The Significance of Federal Taxes as Automatic Stabilizers," Journal of Economic Perspectives, Vol. 14, No. 3, Summer 2000, pg. 37-56.

Auernheimer, Leonardo and Benjamin Contreras, "Control of the Interest Rate with a Government Budget Constraint: Determinacy of the Price Level, and Other Results," mimeo, 1990.

Bayoumi, Tamim and Barry Eichengreen, "Shocking Aspects of European Monetary Integration", in Torres, Francisco and Francesco Giavazzi (eds), Adjustment and Growth in the European Monetary Union, CU Press 1993.

Beetsma, Roel and Lans Bovenberg, "Monetary Union without Fiscal Coordination May Discipline Policymakers," Journal of International Economics, 45, 1998, pg. 239 - 258.

Begg, David and B. Haque, "A nominal Interest Rate Rule and the Price Level Indeterminacy Reconsidered," Greek Economic Review, Vol. 6(1), 1984, pg. 31-46.

Bernanke, Ben S. and Alan S. Blinder (1992), "The federal funds rate and the channels of monetary transmission," American Economic Review 82, no.4, September 1992, pp. 901-921

Bernanke, Ben S. and Ilian Mihov (1998), "Measuring monetary policy," Quarterly Journal of Economics 113, August 1998, pp. 869-902.

Bernheim, B. Douglas (1989), "Ricardian equivalence: An evaluation of theory and evidence," NBER Macroeconomic Annual,

Blanchard, Olivier J. and Roberto Perotti (2001), "An empirical characterization of the dynamic effects of changes in government spending and taxes on output," Mimeo, Massachusetts Institute of Technology, November.

Blinder, Alan, "Issues in the Coordination of Monetary and Fiscal Policy," which Jackson Hole issue?

_____, Central Banking in Theory and Practice, Lionel Robbins Lecture, MIT Press, Cambridge, 1998.

Blinder, Alan and Robert Solow (1973), "Does Fiscal Policy Matter?" Journal of Public Economics, Vol. 2, No. 4, November 1973, p. 319-337.

Boothe, Paul M. and Bradford G. Reid (1989), "Asset returns and government budgets in a small open economy," Journal of Monetary Economics 23, no. 1, January 1989, pp. 65-77.

Brunila, Anne, Marco Buti, and Daniele Franco (eds.), The Stability and Growth Pact, Palgrave, 2001.

Buiter, Willem, "The Fallacy of the Fiscal Theory of the Price Level, Again," Bank of England Working Paper, 2001.

Buti, Marco, W. Roeger and J. in't Veld, "Stabilizing Output and Inflation in EMU: Policy Conflicts and Co-operation under the Stability Pact," Journal of Common Market Studies, 39, 2001, pg. 801 - 828.

_____, "Monetary and Fiscal Policy Interactions Under a Stability Pact," in Marco Buti, Jurgen von Hagen and Carlos Martinez-Mongay (eds.), The Behavior of Fiscal Authorities, Palgrave, 2002.

Canzoneri, Matthew and Behzad Diba, "Fiscal Constraints on Central Bank Independence and Price Stability," in J. Malo de Molina, J. Vinals, F. Gutierrez (eds) Monetary Policy and Inflation in Spain, MacMillan, 1998.

_____, "The Stability and Growth Pact: A Delicate Balance or an Albatross?", Empirica, Volume 26, No. 3, 1999, pg. 241 - 258; reprinted in Brunila, Buti and Franco (2001).

_____, "Interest Rate Rules and Price Determinacy: the Role of Transactions Services of Bonds,"mimeo, 2000.

Canzoneri, Matthew, Robert Cumby, Behzad Diba, "Fiscal Discipline and Exchange Rate Regimes," The Economic Journal, 111, No. 474, October, 2001a, p. 667 - 690.

_____, Canzoneri, Matthew, Robert Cumby, Behzad Diba, "Is the Price Level Determined by the Needs of Fiscal Solvency," American Economic Review, Vol. 91, No. 5, 2001b, pg.1221 - 1238.

_____, "Monetary Policy in Models with Sticky Prices and Non-Ricardian Fiscal Policy," mimeo, 2002.

Carlino, Gerald & Robert DeFina, "Monetary Policy and the U.S. States and Regions: Some Implications for EMU," in Juergen von Hagen & Christopher Waller (ed), Regional Aspects of Monetary Policy in Europe, Kluwer, 2000.

_____, "Fiscal Discipline and Exchange Rate Regimes,"The Economic Journal, 111, No. 474, October, 2001, p. 667 - 690.

Cochrane, John, "A Frictionless View of US Inflation," NBER Macroeconomics Annual, 1998.

Cochrane, John, "Long Term Debt and Optimal Policy in the Fiscal Theory of the Price Level," Econometrica, Vol. 69, No. 1, 2001, p. 69-116.

Cohen, Darrel and Glenn Follette, "The Automatic Fiscal Stabilizers: Quietly Doing their Thing," Economic Policy Review, FRB of New York, April, 2000.

Committee for the Study of Economic and Monetary Union, "Report on Economic and Monetary Union in the European Community," [commonly known as the Delors Report], 1989.

Delors Report, see Committee of the Study of Economic and Monetary Union.

Dixit, Avinash and Luisa Lambertini, "Monetary-Fiscal Policy Interactions and Commitment versus Discretion in a Monetary Union," European Economic Review, 45, 2001, pg. 977 - 987.

Dobelle, Guy and Stanley Fischer, "How Independent Should a Central Bank Be?" in Goals, Guidelines, and Constraints Facing Monetary Policymakers, Federal Reserve Bank of Boston, Conference Series No. 38, 1994.

Elmendorf, Douglas W. and N. Gregory Mankiw (1999), "Government debt," in John B. Taylor and Michael Woodford (eds), Handbook of Macroeconomics, New York: North Holland, pp. 1615-1669.

Elmendorf, Douglas W. (1993), "Actual budget deficit expectations and interest rates," working paper, Harvard Institute of Economic Research.

Elmendorf, Douglas W. (1996), "The effects of deficit-reduction laws on real interest rates," Federal Reserve Board, Finance and Economics Discussion Series no. 1966-44.

Elmendorf, Douglas W. and David L. Reifschneider (2002), "Short-run effects of fiscal policy with forward-looking financial markets," Working paper, Board of Governors of the Federal Reserve System.

Evans, Paul (1985), "Do large deficits produce high interest rates?," American Economic Review 75, pp. 68-87.

Evans, Paul (1987a), "Interest rates and expected future budget deficits in the United States," Journal of Political Economy 95, no. 1, February 1987, pp. 34-58.

Evans, Paul (1987b), "Do budget deficits raise nominal interest rates? Evidence from six countries," Journal of Monetary Economics 20, no. 2, September 1987, pp. 281-300.

European Commission, Public Finances in EMU – 2001, 2002a; see: europa.eu.int/comm/economy_finance/publications/european_economy/public_finances2002_en.htm.

European Commission, "Co-ordination of Economic Policies in the EU: a Presentation of Key Features of the Main Procedures," Euro Papers, Number 45, 2002b; see: europa.eu.int/comm/economy_finance.

Fatas, Antonio and Ilian Mihov (2000a), "Fiscal policy and business cycles: An empirical investigation," mimeo, INSEAD.

Fatas, Antonio and Ilian Mihov (2000b), "The effects of fiscal policy on consumption and employment: Theory and Evidence," mimeo, INSEAD.

Federal Reserve Board (2001), "Monetary policy report to the Congress," Federal Reserve Bulletin, August 2001, pp. 501-527.

Federal Reserve Board (2002), "Monetary policy report to the Congress," Federal Reserve Bulletin, March 2002, pp. 141-172.

Feldstein, Martin S. (1986), "Budget deficits, tax rules, and real interest rates," National Bureau of Economic Research Working Paper no. 1970.

Gale, William G. and Samara R. Potter (2002), "An evaluation of the Economic Growth and Tax Relief Reconciliation Act of 2001," National Tax Journal, forthcoming.

Giorno, Claude, Pete Richardson, Deborah Roseveare, and Paul van den Noord (1995), "Estimating potential output, output gaps, and structural budget balances," OECD Economics Department working paper no. 152, 1995.

Greenspan, Alan, "Federal Reserve Board's semiannual monetary policy report to the Congress," Testimony of Alan Greenspan before Committee on Banking, Housing, and Urban Affairs, U.S. Senate, July 24, 2001.

Greenspan, Alan (2002), "The Economy," Remarks at the Bay Area Council Conference, San Francisco, January 11, 2002.

Hamilton, James and Marjorie Flavin, "On the Limitations of Government Borrowing: A Framework for Empirical Testing," American Economic Review, Vol. 76, No. 4, 1986, p. 808-819.

Hughes Hallett, Andrew and Nicola Viegi, "Central Bank Independence, Political Uncertainty and the Assignment of Instruments to Targets," in Marco Buti, Jurgen von Hagen and Carlos Martinez-Mongay (eds.), The Behavior of Fiscal Authorities, Palgrave, 2002.

Kitchen, John (1996), "Domestic and international financial market responses to Federal deficit announcements," Journal of International Money and Finance 15, March 1996, 239-54.

Lambertini, Luca and Riccardo Rovelli, "Independent or Coordinated? Monetary and Fiscal Policy in EMU," mimeo, October, 2001.

Leeper, Eric, "Equilibria Under Active and Passive Monetary Policies," Journal of Monetary Economics, 27, 1991, p. 129-147.

Loyo, E. (1997), "Going International with the Fiscal Theory of the Price Level," mimeo, Nov.

Macroeconomic Advisers (2000), "Economic outlook," volume 18, no. 1, February 15, 2000.

Masson, Paul, "The Dynamics of a Two-Country Minimodel Under Rational Expectations," Annales d'Economie et de Statistique, No. 6/7, 1987, p. 37-69.

McCallum, Bennett, "Indeterminacy, Bubbles and the Fiscal Theory of Price Level Determination," NBER Working Paper #6,456, 1998.

Meyer, Laurence H. (2001), "Macro Policy Coordination: Domestic and International," mimeo.

Patinkin, Don, Money, Interest, and Prices: An Integration of Monetary and Value Theory, 2nd ed, New York: Harper & Row, 1965.

Plosser, Charles I., (1982), "Government financing decisions and asset returns," Journal of Monetary Economics 9, pp. 325-352.

Plosser, Charles I., (1987), "Fiscal policy and the term structure," Journal of Monetary Economics 20, no. 2, September 1987, pp. 343-367.

Sargent, Thomas, Dynamic Macroeconomic Theory, Harvard University Press, Cambridge, 1987.

Sargent, Thomas and Neil Wallace, "Some Unpleasant Monetarist Arithmetic", the Federal Reserve Bank of Minneapolis' Quarterly Review, Fall, 1981, p. 1-17.

Sims, Christopher, "A Simple Model for Study of the Price Level and the Interaction of Monetary and Fiscal Policy," Economic Theory, 4, 1994, p. 381-399.

Snowdon, Brian and Howard Vane (eds.), Conversations with Leading Economists, Edward Elgar Publishing, 1999.

Sala-i-Martin, Xavier and Jeff Sachs, "Fiscal Federalism and Optimum Currency Areas: Evidence for Europe from the United States," in Canzoneri, Matthew, Vittorio Grilli, and Paul Masson (eds), Establishing a Central Bank: Issues in Europe and Lessons from the US, Cambridge University Press, Cambridge, 1992.

Taylor, John, "Monetary Policy Implications of Greater Fiscal Discipline," Symposium Proceedings, Budget Deficits and Debt: Issues and Options, FRB of Kansas City, 1995.

_____, "A Historical Analysis of Monetary Policy Rules," in John Taylor (ed.), Monetary Policy Rules, NBER Studies in Business Cycles, Vol. 31, U. of Chicago Press, Chicago, 1999.

_____, "The Policy Rule Mix: A Macroeconomic Policy Evaluation," in Guillermo Calvo, Rudiger Dornbusch, and Maurice Obstfeld (eds.), Money, Capital Mobility and Trade, Essays in Honor of Robert Mundell, MIT Press, 2000, pg. 505-518.

_____, "Reassessing Discretionary Fiscal Policy," Journal of Economic Perspectives, Vol. 14, No. 3, Summer, 2000, pg. 21-36.

Wachtel, Paul, and John Young, (1987), "Deficit announcements and interest rates," American Economic Review 77, pp. 1007-1012.

Woodford, Michael, "Monetary Policy and Price Level Determinacy in a Cash-in-Advance Economy, Economic Theory, 4, 1994, p. 345-380.

_____, (1995), "Price Level Determinacy without Control of a Monetary Aggregate," Carnegie Rochester Conference Series on Public Policy, 43, p.1-46.

_____, (1996), "Control of the Public Debt: An Requirement for Price Stability?", in Guillermo Calvo and Mervyn King, eds., The Debt Burden and Monetary Policy, London: Macmillan, 1997.

_____, "Public Debt and the Price Level," mimeo, June 1998.

_____, "Fiscal Requirements for Price Stability," Lecture, published in: Journal of Money, Credit and Banking, 33, 2001, pg. 669-728.