

A comparison of monetary and fiscal policy interaction under ‘sound’ and ‘functional’ finance regimes

J. W. Mason¹ | Arjun Jayadev²

¹Department of Economics, John Jay College, City University of New York, New York, USA

²Department of Economics, Azim Premji University, Bangalore, India

Correspondence

Arjun Jayadev

Azim Premji University

Pes Campus, Pixel B. Hosur Road.

Bangalore 560060, India

Email: Arjun.jayadev@apu.edu.in

Abstract

The interest rate and the fiscal balance can be thought of as two independent instruments to be assigned to two targets, the path of output and the path of public debt. Under what we term a ‘sound finance rule’ the interest rate targets output while the fiscal balance targets public debt; under a ‘functional finance rule’ the budget balance targets the output gap and the interest rate targets the debt ratio. The same unique combination of interest rate and fiscal balance will be consistent with output at potential and a constant debt-GDP ratio regardless of which instrument is assigned to which target. The stability characteristics of the two rules differ, however. At low levels of debt, both rules converge to the targets, but there is a threshold debt level above which only the functional finance rule converges. Contrary to conventional wisdom, therefore, the case for countercyclical fiscal policy becomes stronger, not weaker, when the ratio of public debt to GDP is already high. We apply our framework to describe the possibility of policy-generated cycles in the United States over the past five decades.

1 | INTRODUCTION

A central concern in recent debates over macroeconomic policy is the choice between the policy-determined interest rate and the government budget balance as tools for stabilizing output. A second major concern is the perceived need to maintain the ratio of public debt to GDP on a ‘sustainable’ trajectory. In this paper, we argue that these two issues must be addressed within a single framework, since both output and the public debt ratio are jointly determined by both the fiscal balance and the interest rate. We then analyze the behavior of both instruments and both targets together. Our analysis of the dynamics of different policy rules for assigning instruments to targets leads to the unexpected conclusion that the case for countercyclical fiscal policy may become stronger, not weaker, as the debt-to-GDP ratio rises.

Our analysis starts from Tinbergen's familiar language of policy targets and instruments (Tinbergen, 1952). We present a simple framework within which the joint effects of the two policy instruments on the two targets can be analyzed. This consists of a version of the 'three-equation' model familiar from macroeconomics textbooks, plus the law of motion of government debt. From the framework, we draw two conclusions.

First, we show that there will be one set of combinations of interest rates and fiscal balances that will keep output at potential, and another set that will hold the debt ratio constant. A unique combination of fiscal balance and interest rate is in both sets and satisfies both conditions. This can be represented as a pair of loci in interest rate-fiscal balance space, with the unique combination of interest rate and fiscal balance consistent with both debt stability and a zero-output gap found at the intersection of the two loci. The location of this point does not depend on which instrument is assigned to which target. This has a surprising implication: the familiar instrument assignment in which the interest rate is set by the monetary authority to keep output at potential, and the fiscal balance is set to hold the debt-GDP ratio constant (what we term 'sound finance'), will in general imply the exact same values for the interest rate and fiscal balance, as a different rule in which the fiscal balance is set to keep output constant, and the monetary authority sets the interest rate at the level required to hold the debt-GDP ratio constant (what we term 'functional finance').

Second, while the two instrument assignments imply the same equilibrium values for the two instruments, they do not imply the same behavior away from equilibrium and they may have different stability properties. We find that, for realistic parameter values, the 'functional finance' assignment always converges but the orthodox 'sound finance' assignment converges only if the initial debt ratio is below a certain threshold. This is because the higher the debt ratio, the more changes in the debt ratio depend on the effective interest rate, as opposed to the current fiscal balance. Thus, the familiar metaphor of 'fiscal space' is exactly backward. In fact, the higher the current debt ratio, the stronger the argument for countercyclical fiscal policy. This is because at high debt ratios the interest rate instrument will be required to stabilize the debt ratio rather than manage output. This finding is consistent with the historical experience that when public debt ratios are sufficiently high, moderating debt service costs for the government becomes the primary consideration for central bank rate-setting.

In the third section, we explore whether the adjustment dynamics discussed here could be relevant to concrete developments in the United States. In particular, is it plausible that output fluctuations could be, at least in part, the result of instability endogenously generated by interactions between the two policy instruments? We tentatively suggest that much of recent macroeconomic history can be understood as a 'sound finance spiral' of the sort described in Section 3.

1.1 | Relation with the existing literature

Our analysis is in many ways parallel to that of Ryoo and Skott (2017), who similarly find that the conventional instrument assignment may be stable at low debt ratios but become unstable at high ratios. However, their focus is on the ability of alternative policy rules to compensate for Harroldian instability arising from private investment, while our focus is on instability arising from the interaction of the policy rules themselves. The point that the path of the debt ratio depends on the interest rate set by the central bank is forcefully made by Fullwiler (2007), which is close in spirit to the current paper; but there is no formal discussion there of alternative policy rules and their stability properties.

A classic discussion of the instrument assignment problem and the stability properties of alternative assignments is Mundell (1962). Our approach is broadly similar, but we are focused on the output gap and debt ratio as targets, while he was concerned with the output gap and the balance of payments. The seminal discussions of the functional finance instrument assignment, are in Domar (1944) and Lerner (1943) and related work; the terms 'sound finance' and 'functional finance' itself originate with Lerner. Note however

that he, unlike most later writers, did not treat the debt ratio as a target for policy, but rather assumed that it would passively adjust to accommodate fiscal policy and the independently determined interest rate.¹

There is little discussion in more recent mainstream literature of alternative instrument assignments of the sort discussed here, since until recently, the ‘sound finance’ instrument assignment was largely unquestioned in the mainstream. Developments over the past decade have led to some more critical assessments of this assignment – for example, Kirsanova, Leith, and Wren-Lewis (2009). The analysis here bears a family resemblance to the literature on what has been termed the ‘current consensus assignment’, in which monetary policy is preferred for demand management while fiscal policy is assigned to debt stabilization. Representative papers exploring the conditions under which the consensus assignment dominates or does not include Blake, Vines, and Weale (1988), Eser (2006) and Kirsanova and Wren-Lewis (2012) among others. The desirability of the alternative ‘functional finance’ rule at the zero lower bound can be derived within an New Keynesian theoretical framework (Bianchi & Melosi, 2017). But this is explicitly limited to conditions of deep depressions. We argue that the problem is more general. Within more policy-oriented macroeconomics, Jason Furman (2016, pp. 6–7) provides perhaps the most general recognition of the issue that we are addressing, albeit in a non-formal way.²

2 | A SIMPLE FRAMEWORK FOR MACROECONOMIC POLICY ANALYSIS

2.1 | The consensus macroeconomic model

Our starting point is the simple model of aggregate behavior that underlies most contemporary discussions of macroeconomic policy.³ The model embodies four key assumptions, none controversial.

1. The nominal interest rate is set by the monetary authority (Or equivalently, for a given level of inflation, the authority sets the real rate.). The claim that it is both necessary and possible for the monetary authorities to maintain the prevailing interest rate at a level consistent with price stability has been a central tenet of macroeconomic policy at least since it was formulated by Wicksell early in the last century⁴ (Wicksell, 1936).

¹We thank Peter Skott for clarifying this point.

²While the particular result that fiscal expansion by itself will reduce the debt-to-GDP ratio depends on particular parameters and assumptions, the fact that different models find similar results suggests that the idea that fiscal expansion can improve fiscal sustainability is worth taking seriously. . . . In some respects, this argument may be even more important for high-debt economies like Japan and Italy than for the United States. This is because changes in the debt-to-GDP ratio depend on two factors: (i) the difference between interest rates and the growth rate (strictly speaking, r minus g multiplied by the debt-to-GDP ratio) and (ii) the primary balance (the difference between revenue and non-interest spending). The larger the debt is, the more changes in $r - g$ dwarf the primary balance in the determination of debt dynamics.’

³For critical discussions of the ‘new consensus’ macroeconomic models that we follow here, see Palacio-Vera (2005) and Carlin and Soskice (2009). For examples of major macroeconomic forecasting models fundamentally based on the textbook three-equation model, see Brayton and Tinsley (1996) and Hervé, Pain, Richardson, Sédillot, and Beffy (2011).

⁴Despite the central role of this claim in modern macroeconomics, it is not entirely clear how the monetary authority is able to set the terms of credit transactions throughout the economy; it is sometimes suggested that its apparent ability to do so historically may have depended on institutional conditions that no longer hold, or may cease to hold in the future (Friedman, 1999). These concerns are reinforced by the empirical fact that real economies have many different interest rates, which do not always move together (Jayadev and Mason 2015). Nonetheless, macroeconomic policy discussions are normally conducted in terms of ‘the’ interest rate. In the equations below, we use i to refer to the average inflation-adjusted rate on outstanding government debt. But our model naturally generalizes to the case where the various rates do not move together. How, or whether, the monetary authority is able to set the prevailing rate of interest is an important question, but not one that it is necessary to pursue here, since all modern macroeconomic models begin with the

2. Second, inflation is a positive function of the current level of output, along with its own past or expected values and other variables. Fiscal and monetary policy affect inflation only via output. This assumption is formalized as a Phillips curve:

$$\begin{aligned}\hat{P} &= \hat{P}(Y - Y^*, \hat{P}^E), \\ \hat{P}_{Y-Y^*} &> 0\end{aligned}\quad (1)$$

\hat{P} is the inflation rate, \hat{P}^E is the expected inflation rate, Y is output as measured by GDP or a similar variable and Y^* is potential output.⁵

3. Third, output is a negative function of the interest rate, and a negative function of the fiscal balance (or equivalently a positive function of the government deficit) via the multiplier.

This assumption is formalized as an IS curve:

$$Y = A - \eta i Y^* - \gamma b Y^* + \tau i d Y^* \quad (2)$$

A is autonomous spending, here defined as the level of output when both the interest rate and fiscal balance are zero. i is the average interest rate on government debt. For now, we consider i to be the ‘real’ (that is, inflation-adjusted) interest rate. η is the semielasticity of output with respect to the interest rate, that is, the percentage increase in output resulting from a one-point reduction in the interest rate. The state variables b and d are expressed in terms of potential output Y^* rather than current output Y . Note that the value of η reflects both the responsiveness of real activity to changes in interest rates, and the strength of the correlation of the marginal rate facing private borrowers with the average rate on public debt. No special assumption is needed about whether all interest rates move one for one with the policy rate. If we think they respond less than proportionately, we simply use a lower value of η . b is the primary balance of the government, with positive values indicating a primary surplus and negative values a primary deficit. γ is the multiplier on whatever mix of tax and spending changes are used to adjust the government fiscal balance; it incorporates the response of consumption and any other endogenous components in demand to changes in the output gap.⁶ d is the ratio of government debt to potential output and τ is the multiplier on interest payments. It is helpful to allow the possibility that this multiplier is different from the one on the changes in tax and spending captured by changes in d .

4. Our fourth assumption is simply that the end of period debt is equal to the start of period debt plus the accumulated primary deficits and interest payments. This gives us the law of motion of government debt, ‘the least controversial equation in macroeconomics’ (Hall & Sargent, 2011).

$$\dot{d} = (i - g)d - b \quad (3)$$

assumption that the interest rate is fixed by the monetary authority. For a fuller discussion of this issue, see Woodford (2005, pp. 30–45).

⁵For our purposes, it does not matter how inflation expectations are formed. In modern macroeconomic models, it is normally assumed that there can be no persistent deviations of expected from realized inflation, so that the long-run Phillips curve is vertical, with $Y = Y^*$ the unique level of output at which inflation is stable. Some heterodox economists continue to argue that output and inflation should be treated as distinct policy targets even in the long run (Michl, 2008). But a vertical Phillips curve is not required to treat inflation and output as a single target; it is sufficient that the long-run curve be steep, and/or that there is a well-defined tradeoff between the two targets in the implicit social welfare function maximized by policy (Taylor, 1998).

⁶A multiplier of zero (Ricardian equivalence or full crowding out) is included as a special case of $\gamma = 0$.

where i , d and b are defined as above and g is the growth rate of potential output, again net of inflation.⁷

These four standard assumptions are all that is required of the analysis that follows. In the formal analysis, we can assume that all nominal variables have been appropriately adjusted for inflation, so that we are working with ‘real’ variables.⁸

2.2 | Targets

Any version of the Phillips curve is sufficient to make output and inflation a single target, for the purposes of stabilization policy. So for simplicity, we assume that policy targets an output gap of zero, that is, $Y = Y^*$.

We work in terms of the output gap y and replace autonomous expenditure with z , where

$$y = \frac{Y - Y^*}{Y^*}$$

$$z = \frac{A - Y^*}{Y^*}$$

In other words, z is the output gap when the primary deficit and interest rate are both zero, measured as a fraction of potential output.

We now rewrite the IS relationship as

$$y = z - \eta i - \gamma b + \tau d$$

Then for $y = 0$, we need:

$$i = \frac{z - \gamma b}{\eta - \tau d} \quad (4)$$

Equation 4 simply means that maintaining output at potential requires the interest rate (i) to fall when autonomous expenditure (z) falls or when the primary surplus (b) rises. The degree to which i must fall depends on the relative responsiveness of output to the fiscal balance and to the interest rate, and on how much consumption depends on income from government bond holdings (τd). With a high η , i needs to fall less to compensate for a rising primary surplus; with a high γ , i needs to fall more.

This gives us a locus that we refer to as the zero-output gap locus or ‘price stability’ locus. We refer to it as the latter from now on. This will normally be a downward sloping line in interest rate–fiscal balance space.

⁷Equation 3 is not quite an accounting identity since it will be violated not only in the case of defaults but also by sales of public assets, government assumptions of private debts and other transactions that affect the public debt but are not included in standard measures of the fiscal surplus or deficit. In some cases, such as Ireland in 2009–2011, such transactions may dominate the evolution of the public debt. This possibility complicates the question of what constitutes a stable debt trajectory, but these complexities are beyond the scope of this paper. Here, we assume that Equation 3 holds exactly.

⁸For the purposes of this paper, we are treating potential output as exogenous. Current output may vary but its longer-run path is determined by factors independent of current demand. This is a conventional assumption, but one that is challenged by Post-Keynesian models in which output is demand-determined even in the long run as well as by empirical and policy-oriented work on hysteresis. We treat long run growth as exogenous here not because we believe this is necessarily a true description of the world, but simply in order to focus attention on a different issue, the interaction between the two policy instruments. For our purposes, the assumption of an exogenous growth rate is a conservative one: It means that even if the authorities are successful on average at achieving their targets, it is still possible for there to be destabilizing feedback between the instruments themselves. Similarly, in the stability analysis that follows we treat the debt ratio as fixed; again, the purpose of this is to focus attention on the interactions between the instruments themselves. In future work, it would be desirable to treat the long-run evolution of output and the debt ratio as endogenous.

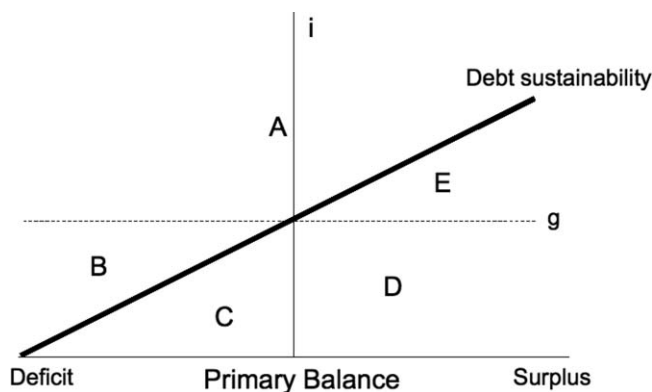


FIGURE 1 Alternative debt sustainability conditions. The line labeled debt sustainability indicates those combinations of interest rates and fiscal balances for which the debt to GDP ratio is constant. It passes through the vertical axis at $i = g$ and has a slope of $\frac{1}{d}$. In area A, above the locus with $i > g$, the debt-GDP ratio rises to infinity. In area B, above the locus but with $i < g$, the debt-GDP ratio rises toward some finite value. In area C, below the locus with a primary deficit, the debt-GDP ratio falls to some finite value. In area D, below the locus with a primary surplus and with $i < g$, the debt-GDP ratio falls to zero and the government then acquires a positive net asset position which rises to some finite fraction of GDP. Finally, in area E, below the locus with a primary surplus and $i > g$, the debt-GDP ratio falls to zero and the government then acquires a positive net asset position which rises without limit as a fraction of GDP.

Moving to debt sustainability, given Equation 3 it is clear that to hold d constant, we need:

$$i = \frac{b}{d} + g \quad (5)$$

This we refer to as the constant debt ratio locus. Again, the interpretation is straightforward. For a given debt-GDP ratio, an increase in the growth rate of GDP (g) or the primary surplus (b) will reduce the debt to GDP ratio unless counteracted by an increase in the interest rate to maintain the current ratio.

There is not a consensus on the meaning of debt sustainability.⁹ The weakest form allows the debt-GDP ratio converge to any finite value. The next strongest is that the ratio remain at or below its current level. The strongest version requires the ratio to remain at or below some exogenously given level. The latter two conditions may be framed as equalities or inequalities; a budget position that implies that the debt fall to zero, or that the government ends up with a positive asset position, may or may not be considered sustainable. In the absence of any strong reason for preferring one or the other, we use the middle condition, that the debt ratio remain constant at its current level. Our results could be easily be extended to the third, strongest case. We have chosen not to do so here, since this would involve adding one or more additional parameters for only a small gain in generality.

Alternative definitions of debt sustainability are shown in Figure 1. Only area A does not satisfy any definition of debt sustainability.

If we define debt sustainability as the debt ratio being stable at its current level, then Equation 5 is the condition for debt sustainability. If we define debt sustainability as a constant or falling debt ratio, then we can write:

⁹See the discussion of alternative debt-sustainability targets in Aspromourgos, Rees, and White (2010) and Pasinetti (1998). Portes and Wren-Lewis (2014) expresses the common view that optimal fiscal policy implies that the debt ratio follows a random walk; this is equivalent to our debt-sustainability condition that the authorities target the current debt ratio, whatever it may be.

$$i \leq \frac{b}{d} + g$$

If we define debt sustainability as the condition that the debt ratio not rise without limit, then it is sufficient to meet either the above condition or $i < g$.

Combining our price stability locus (Equation 4) and constant debt ratio locus (Equation 5) gives us the unique values for i and b for which output is at potential and the debt-GDP ratio is constant.

$$i = \frac{z - g(\eta - \tau d)}{\eta + d(\gamma - \tau)} + g \approx \frac{z}{\eta + (\gamma - \tau)d} \quad (6)$$

$$b = \frac{z - g(\eta - \tau d)}{\frac{\eta}{d} + (\gamma - \tau)} \approx \frac{z}{(\gamma - \tau) + \frac{\eta}{d}} \quad (7)$$

Both approximations are derived from the assumption that g will always be much smaller than one.

The equations each have a natural interpretation. The value for i indicates that for a given τ and γ , when debt (d) is low, the equilibrium interest rate depends mostly on autonomous expenditure. The dependence of the equilibrium interest rate on autonomous expenditure also depends on η , with a greater dependence when η is lower (i.e., the interest elasticity of output is lower). With high levels of d , the equilibrium interest rate depends less on autonomous expenditure, unless the fiscal multiplier is close to zero. The equilibrium value of b indicates that as d rises, b must approach $z/(\gamma - \tau)$. In other word, as the debt ratio rises, the equilibrium primary surplus depends more on autonomous expenditure and less on the debt ratio. The two equations together telegraph a finding that we discuss in greater detail later. Simply put, as the debt ratio rises, the role of i in maintaining potential output must diminish while that of the budget balance b increases.

We can represent the two loci graphically with the interest rate on the vertical axis and the primary balance on the horizontal axis, as shown in Figure 2. The constant debt ratio locus slopes downward, and passes through the point ($d = 0, i = g$). The slope of the locus depends on the current debt ratio: It is vertical through $b = 0$ when the debt ratio is zero, and approaches a horizontal line at $i = g$ as the debt ratio rises to infinity (This expresses graphically the same point made above, that debt stability depends mostly on the fiscal balance when the debt ratio is low, and increasingly on the interest rate as the debt ratio grows higher.). If τ is zero, the price stability locus must slope upward. If τd is large, it may slope downward instead; in this case the sound finance policy rule will move the economy away from potential output.¹⁰ If $\eta - \tau d = 0$ —changes in interest rates do not affect output—then the price stability locus will be a vertical line at some value of d . Conversely, if $\gamma = 0$ —that is, full crowding out or Ricardian equivalence—the price stability locus will be horizontal at $i = \frac{1}{\eta}z$.

A change in autonomous demand z —which captures any exogenous change in demand that policy must respond to—shifts the price stability locus horizontally by an amount equal to $\frac{z}{\gamma}$. In any period in which the economy is not on the constant debt ratio locus, there is a change in d . An increase in d rotates the constant debt ratio locus clockwise around the point ($d = 0, i = g$). With $\tau > 0$, an increase in d also shifts the price stability locus downward and rotates it clockwise, eventually through the vertical (when $\tau d = \eta$) and, as d goes to infinity, to a horizontal line at $i = 0$.

¹⁰This corresponds to a situation in which the expansionary effects of increased government interest payments to the private sector outweigh the contractionary effects of higher rates on new borrowing. While logically possible, it seems unlikely that this describes any real economy.

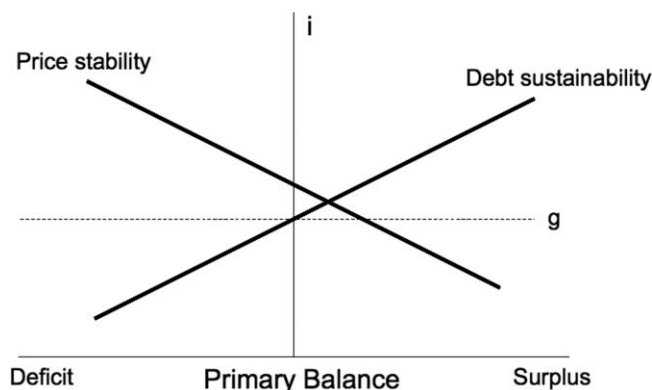


FIGURE 2 Price stability and debt sustainability conditions. The line labeled price stability indicates those combinations of interest rates and fiscal balances for which $Y = Y^*$. It passes through the vertical axis at $i = \frac{1}{\eta} Z$ and has a slope of $\frac{\gamma}{\eta}$. The line labeled debt sustainability indicates those combinations of interest rates and fiscal balances for which the debt to GDP ratio is constant. It passes through the vertical axis at $i = g$ and has a slope of $1/d$. The ‘sound finance’ instrument assignment implies that interest rates are adjusted toward the price stability locus and the fiscal balance is adjusted toward the debt sustainability locus; out of equilibrium, this implies movement in a clockwise direction. The ‘functional finance’ instrument assignment implies that interest rates are adjusted toward the debt sustainability locus and the fiscal balance is adjusted toward the price stability locus; out of equilibrium, this implies movement in a counterclockwise direction.

3 | ALTERNATIVE POLICY RULES

3.1 | Sound finance and functional finance

A useful way of thinking about policy in this framework is in terms of two alternative instrument assignments. The ‘sound finance’ assignment sets i^* as whatever value of i satisfies Equation 2 at last period’s (or expected) b , and b^* at whatever level of b satisfies Equation 3 at last period’s (or expected) i . In other words, the interest rate instrument is assigned to the output target, and the budget balance is assigned to the debt ratio target. The ‘functional finance’ assignment sets b^* as whatever value of b satisfies Equation 2 at last period’s (or expected) i , and i^* at whatever level of i satisfies Equation 3 at last period’s (or expected) b . In other words, the budget balance instrument is assigned to the output target and the interest rate instrument is assigned to the debt ratio target.

Equations 6 and 7 describe the unique equilibrium combination of i and b for which the output gap is zero and the debt-GDP ratio is constant. Thus, if the policy rules converge at all they will bring the economy to the same final state regardless of which set of policy rules is being followed. Suppose the budget authority is following some fiscal rule that satisfies the conditions for debt sustainability, whatever they may be. Suppose further that, given that fiscal rule, the monetary authority is able to follow an interest rate rule that keeps output at its target level. Then, it must also be possible for the fiscal authority to set the budget balance at whatever level leads to the target level of output, ignoring the debt ratio and the monetary authority to then set the interest rate at whatever level stabilizes the debt ratio. This equivalence between the superficially contrasting ‘sound finance’ and ‘functional finance’ policy rules is the first significant result of our analysis.

That the functional finance and sound finance rules imply identical outcomes for the two instruments and two targets is a straightforward implication of the assumptions adopted here. But it is not widely recognized, even by many who would regard the assumptions themselves as uncontroversial, at least for policy purposes. So we should be clear about exactly what is being claimed. The point is that if there is a single target for demand—that is, a ‘divine coincidence’ (Blanchard, Dell’ariccia, & Mauro, 2010) in which keeping output at potential is sufficient to achieve both price stability and full

employment—and a target for the debt ratio, and if each instrument can freely adjusted to meet one of those targets, then the combination of instrument values that achieves both of these targets does not depend on which instrument is assigned to which target. It is in this limited but important sense that the two rules are equivalent.

Conversely, if those assumptions are not satisfied, then in general neither policy rule will be able to hit both targets. Obviously, if the levels of output consistent with full employment, price stability and normal or desired capacity utilization are distinct, then there will be no level of demand that can satisfy all three conditions, regardless of which policy instrument is targeting demand. Similarly, if one or both instruments cannot be freely adjusted because of institutional constraints or because it is committed to some third target, then it will not be possible to hit both the potential output/price stability target and the debt ratio target.

3.2 | Special cases

There are a number of interesting cases that fall into this second category. While we limit ourselves in the remainder of the paper to the case where there are two targets and two instruments that can be freely adjusted, it is worth briefly discussing some of these other cases here, both because they feature prominently in macroeconomic policy discussions and because they fit naturally into our framework.

1. **Fiscal dominance.** The functional finance claim, restated here, is that the fiscal authorities can freely set the fiscal balance at whatever level is needed to bring output to its target level, without concern for the path of the debt ratio. Some versions of this claim, including Lerner's original statement, base this claim on an argument that the debt ratio does not need to concern policy-makers. In this paper, we argue that the claim is true even if the debt level is a policy target, since if fiscal policy is targeting the output gap, the monetary authorities are free to target the debt ratio. But in either case, this is not an argument that the fiscal balance may be set at any level whatsoever without macroeconomic consequences. It is only an argument that the fiscal balance may be set at the particular level that generates a zero output gap. Functional finance does not describe a situation in which the political authorities for whatever reason choose some other fiscal balance independent of either the debt ratio or the output gap. In this case, the fiscal balance is exogenous and the monetary authority will be able to achieve a stable debt ratio or output at potential, but not both. We can think of this as constraining the system to a set of points along a vertical line in the space of Figure 2. Except by lucky coincidence, this line will not pass through the intersection of the debt stability and price stability loci. It is easy to think of historical examples that fit this case; the response has been variously to introduce new policy instruments, such as the price controls and financial repression used to control the price ratio and debt ratio during wartime; to maintain the price stability target and allow the debt ratio to move away from the target level; or to maintain the debt ratio target and allow the price level to move away from the target. It is the last of these that is properly called fiscal dominance.
2. **Exogenously fixed r .** Conversely, the interest rate may not be freely adjustable. Two obvious reasons for this are the zero lower bound on nominal interest rates, and the difficulty in sustaining a large divergence from world interest rates in a setting of freely mobile capital. In terms of Figure 2, we may think of these as constraining outcomes to a space above a horizontal line at $-\pi$, in the first case, or between two horizontal lines reflecting the maximum attainable spread with world interest rates, in the second. In this case, it is quite possible that the intersection between the price stability and debt stability loci will fall within the permitted range. But a sufficient shift in one of the loci—perhaps a large shock to z —can move the

intersection outside this range. In this case, it will no longer be possible to achieve both targets. With the interest rate at its lowest possible level (or perhaps its highest possible level, in the case of the global- r constraint), the fiscal authorities will be able to achieve the target debt ratio, or the target level of output, but not both.

Which target is achieved and which one is abandoned will depend on the policy rule in force. At the zero lower bound, for example, a sound finance instrument assignment will result in a stable debt ratio but output below potential (or, equivalently in this context, inflation below target and unemployment above target); a functional finance rule will result in output at potential and a rising debt ratio.

3. An investment target. In this paper, we are interested in the effect of the interest rate on aggregate demand (and on the public debt ratio) but not on specific components of spending. But insofar as investment disproportionately responds to interest rate changes, any policy goal for investment spending implies a third independent target.¹¹ If investment responds to the interest rate but not to the output gap, this is analytically equivalent to the exogenous r case discussed above. If, as seems more reasonable, we regard investment as a function of the output gap as well as the interest rate, then the target investment rate constitutes a third locus. In the space of Figure 2, this locus will slope downward, but more shallowly than the price stability locus. Above this investment locus, investment will be below the target level; below the locus, investment will be above the target level. If the interest rate is set to target the investment level, then fiscal policy will move the economy to the intersection of this locus with either the debt stability or price stability loci, according to whether a sound finance or functional finance rule is being followed. But there is no way to say a priori where this intersection will lie, and hence in which direction the other target will be missed.

In the remainder of the paper, we focus on the case in which the fiscal and monetary instruments can be freely adjusted and are targeted at the output gap and the debt ratio. but it is worth pointing out, especially for pedagogical purposes, how neatly the three cases above fit into the framework of Figure 2.

If the debt-targeting instrument adjusts much faster than the output-targeting instrument, then the economy, if it converges at all, will arrive at the point which satisfies Equations 6 and 7 for initial debt d_0 , regardless of the initial interest rate and budget balance. Otherwise, the debt ratio will change over the course of the adjustment process, and the final state will in general depend on which set of rules are being followed, as well as on the initial state of the economy and the values of the adjustment speed parameters. In our stability analysis in the next sections, we are treating the debt ratio as a 'slow variable'. We focus on the dynamics of the two fast policy variables b and i , conditional on a near constant debt-ratio. Treating d as constant during the adjustment process for b and i can be justified if the adjustment in b and i is fast and produces convergence to a stationary point.¹² Since we are defining the fiscal balance and debt ratio in terms of potential output Y^* rather than actual output Y , the adjustment speed of the output gap does not matter for our analysis.

Next, we explore convergence conditions under the two assignments.

3.3 | Convergence under alternative instrument assignments

We now move to the behavior of the two rules in achieving convergence to equilibrium from different starting points in (b, i) space.

The IS curve from the previous sections is now given by

¹¹A version of this argument is found in Ryoo and Skott (2017).

¹²We thank an anonymous referee for clarifying this point.

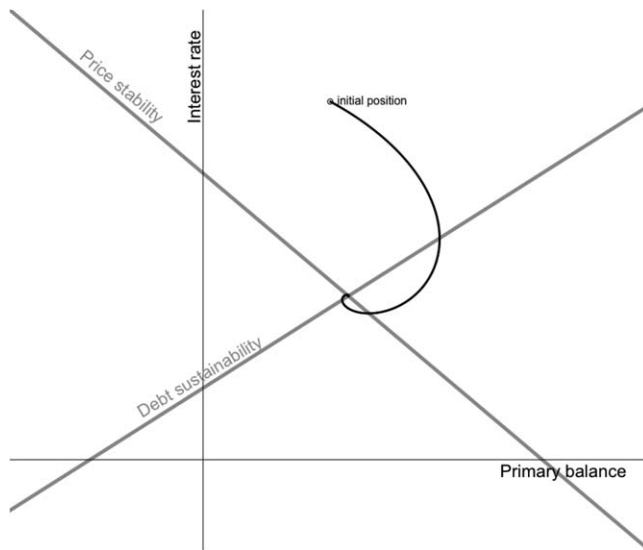


FIGURE 3 Convergence using sound finance rule

$$y = z - \gamma b - \eta i + \tau di \quad (8)$$

The equation of motion of the debt-to-income ratio is

$$\dot{d} = -b + (i - g)d \quad (9)$$

Our targets therefore are $y = 0$ and $\dot{d} = 0$.

In a sound finance regime, interest rates rise when output rises above the level consistent with full employment and price stability, and fall when output falls below this level. The fiscal balance is adjusted toward surplus when the debt ratio is rising and allowed to move toward deficit when the debt ratio is falling. The equations of adjustment are, therefore, given by:

$$\dot{i} = \alpha \left[\frac{1}{\eta} (z - \gamma b + \tau di) - i \right] \quad (10)$$

$$\dot{b} = \beta [(i - g)d - b] \quad (11)$$

where α and β are adjustment speed parameters.

The interpretation of α and β requires some explanation. In reality, the speed with which fiscal and monetary policy respond to macroeconomic variables depends on a whole range of political and institutional factors particular to the country and time period. We do not want to incorporate any strong assumptions about the policy adjustment process. What α and β reflect is simply how fast the fiscal balance and interest rate are generally adjusted in a particular context, relative to the frequency with which the authorities receive news about the target variable. This parameter therefore is purely descriptive, and will have some value for *any* policy adjustment process. This value will range from one when the policy instrument moves instantaneously in response to a change in the target variable, to zero when the instrument does not respond to changes in the target.

To illustrate the process of adjustment let us assume that we are at a point of rising debt (i.e., above the debt stability locus), but also below potential output. The sound finance implies moving vertically toward potential output locus and horizontally toward debt stability locus as depicted in Figure 3. In the figure shown, the budget is moved towards surplus in order to achieve debt sustainability, while the interest rate is set to target output. As drawn, despite overshooting initially, the system spirals clockwise inwards toward the equilibrium.

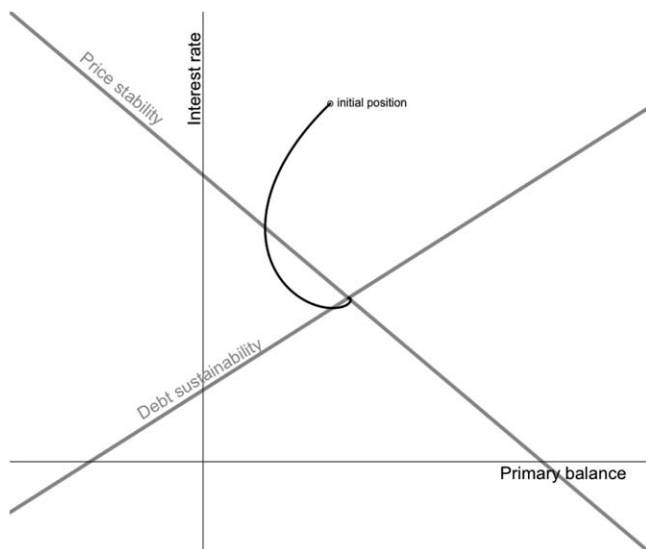


FIGURE 4 Convergence using functional finance rule

In a functional finance regime, the fiscal balance moves toward surplus when output rises above the level consistent with full employment and price stability, and toward deficit when output falls below this level (The defining feature of functional finance is that the fiscal balance is *not* responsive to the debt ratio.). The interest rate is adjusted to keep the debt ratio stable so it is reduced when the debt ratio is rising. The rules can therefore be written as:

$$\dot{i} = \alpha \left[g + \frac{b}{d} - i \right] \quad (12)$$

$$\dot{b} = \beta \left[\frac{1}{\gamma} (z - \eta i + \tau d i) - b \right] \quad (13)$$

This can be depicted in Figure 4. Starting from the same position as before, the budget balance is moved to deficit in order to hit full employment while the interest rate is lowered to achieve debt sustainability. This is drawn as a counterclockwise spiral inwards toward the equilibrium.

While we have drawn both spirals converging, whether the system converges depends on the parameters and on the initial values of the debt ratio and output gap.

Given a set of linear differential equations as we have with both rules, for stability of the equilibrium we need (from the Routh–Hurwitz conditions) that the Jacobian Matrix satisfies the following:

- A. $tr(J) < 0$
- B. $det(J) > 0$

3.3.1 | Convergence conditions for the sound finance rule

For the sound finance rule, the Jacobian Matrix is given by

$$J_{sf} = \begin{bmatrix} -\alpha \left(1 - \frac{\tau d}{\eta} \right) & -\alpha \frac{\gamma}{\eta} \\ \beta d & -\beta \end{bmatrix}$$

This gives us

$$tr(J_{sf}) = -\left(\alpha\left(1 - \frac{\tau d}{\eta}\right) + \beta\right)$$

$$det(J_{sf}) = \alpha\beta\left(1 - \frac{\tau d}{\eta} + \frac{\gamma d}{\eta}\right) = \alpha\beta\left(1 - \frac{d}{\eta}(\tau - \gamma)\right)$$

Condition B requires that $\alpha\beta(1 - \frac{d}{\eta}(\tau - \gamma)) > 0$. This always holds for $\gamma > \tau$. If $\gamma < \tau$, this condition can be rearranged to be

$$d < \frac{\eta}{\tau - \gamma} \quad (14)$$

Condition A requires (whether or not $\gamma > \tau$) that:

$$d < \left(1 + \frac{\beta}{\alpha}\right) \frac{\eta}{\tau} \quad (15)$$

Putting these together, for the sound finance assignment to converge, we require

$$d < \min \left[\left(1 + \frac{\beta}{\alpha}\right) \frac{\eta}{\tau}, \frac{\eta}{\tau - \gamma} \right] \quad (16)$$

We can summarize the implications of Equations 14 and 15 as follows:

The sound finance rule will only converge below some critical value of the debt ratio. That critical value will depend on the three parameters. A low threshold—and hence a greater probability of divergence under the sound finance rule—will result if η is small relative to τ and both are small relative to γ . Below this debt ratio, a small departure of the instruments from their equilibrium values will still result in convergence to the targets. Above this ratio, a small departure of the instruments from their equilibrium values will result in explosively larger adjustments away from equilibrium.

As discussed above, we have ignored here changes in the debt ratio and the output gap resulting from movements of the instruments out of equilibrium. Incorporating these effects would only strengthen the conclusion that the sound finance rule converges only at low debt ratios. We return to this point in the conclusion.

3.3.2 | Convergence conditions for the functional finance rule

For the functional finance instrument assignment, the Jacobian Matrix is given by

$$J_{ff} = \begin{bmatrix} -\alpha & \frac{\alpha}{d} \\ -\beta \frac{\eta - \tau d}{\gamma} & -\beta \end{bmatrix}$$

This gives us

$$tr(J_{ff}) = -(\alpha + \beta)$$

$$det(J_{ff}) = \alpha\beta\left(1 - \frac{\tau d - \eta}{\gamma d}\right)$$

Condition A is always satisfied.

Condition B requires that:

$$\alpha\beta\left(1 - \frac{\tau d - \eta}{\gamma d}\right) > 0 \quad (17)$$

This is always satisfied for: $\gamma > \tau$. If $\tau > \gamma$, the condition requires that

$$d < \frac{\eta}{\tau - \gamma} \quad (18)$$

Thus, from Equation 17 all that is required is for the multiplier to be larger than the effect of income from interest receipts. For virtually all historically based parameters, this will be the case. Even in the implausible case of $\tau > \gamma$ (i.e., private expenditure more sensitive to interest payments than to the baseline mix of spending and tax changes), the difference must be large for instability to arise.

Combining Equations 16 through 17, we draw a general conclusion about the stability properties of the two rules. Both rules are stable for a range of debt values. Beyond a certain value of debt, only functional finance will remain a viable assignment for convergence to equilibrium.

Specifically, if $\tau > \gamma$ for

$$\left(1 + \frac{\beta}{\alpha}\right) \frac{\eta}{\tau} < d < \frac{\eta}{\tau - \gamma} \quad (19)$$

only the functional finance assignment will converge.

If $\gamma > \tau$, as is most likely to be the case, the functional finance assignment will always converge, but the sound finance assignment will only converge if (from Equation 15):

$$d < \left(1 + \frac{\beta}{\alpha}\right) \frac{\eta}{\tau} \quad (20)$$

Intuitively, given adjustment parameters α and β , the lower a given level of η relative to τ the lower the debt ratio for which the sound finance assignment will converge.

These conclusions have implications beyond the exact convergence conditions. They imply that even where both rules converge, convergence will be relatively faster under the sound finance rule when the debt ratio is low, and relatively faster under the functional finance rule when the debt ratio is higher. The qualitative conclusion that the functional finance rule becomes relatively more consistent with macroeconomic stability, and the sound finance rule less so, as the debt ratio rises, does not depend on whether the convergence criteria are satisfied in any particular case.

Based on this analysis, we can see that when the debt-GDP ratio is sufficiently high, stability *requires* that the interest rate instrument target the stability of the debt ratio, and the fiscal balance target the output gap. Thus, under a very general set of assumptions, the common metaphor of ‘fiscal space’ gets the relationships between debt levels and policy backward. Stability of the debt ratio requires that the fiscal authorities make *less* effort, rather than greater effort, to stabilize the public debt as the debt to GDP ratio rises. Countercyclical fiscal policy not only remains possible at high debt levels, but becomes obligatory.

While the results are clear, the intuition behind them may not be immediately obvious. So it is worth thinking through why instability arises.

Instability occurs because when the monetary authority adjusts interest rates to move output to potential, it also raises or lowers the interest expense of the government. This changes the fiscal position, requiring a response from the debt-ratio-targeting fiscal authority. The fiscal response, intended to bring the debt ratio back to its target level, will however also have effects on aggregate demand, requiring a further adjustment from the monetary authority. Why is this feedback between the instruments more likely to diverge when the debt ratio is high? The reason is simple: The larger the stock of debt, the greater the effect on the fiscal balance of a given change in interest rates.

In effect, the sound finance assignment suggests that the budget authority should respond to signals from the debt path to decide on spending and tax levels. A rising debt-GDP ratio is a signal that spending is excessively high and/or taxes are excessively low, and a falling debt-GDP ratio is a signal that spending is needlessly low and/or taxes are needlessly high. Interest rates as well as tax and spending decisions influence the debt path. If the monetary authorities do not take into account the signals that changes in policy send to the budget authorities, then changes in monetary policy will induce additional, unintended changes in the fiscal balance that will amplify the initial effect on output. The larger the current debt, the larger these unintended effects will be, since the bigger an impact a change in interest rates will have on the budget position. Changes in the fiscal position carried out to stabilize the debt ratio will, in turn, affect demand and induce further interest rate changes. When the cross-effects are large, this will lead to a situation where each adjustment in one instrument induces a larger adjustment in the other.

It is important to stress that this conclusion does not depend on interest payments having any effect on output. They require only the mathematical fact that the higher the level of existing debt, the more changes in debt depend on interest rates and the less they depend on the primary balance.

In our stability analysis, we do not treat the level of output as a state variable. This may be justified either by assuming that policy successfully keeps actual output near potential, or, as we do, by calculating the debt ratio with respect to potential output rather than current output. A natural extension would be to introduce output as a third state variable, which would introduce an additional feedback channel as any shortfall of output relative to its target level would now raise the debt ratio. A number of recent papers have criticized orthodox policy rules from this direction: representative mainstream and heterodox examples are Delong and Summers (2012) and Skott (2015), respectively.

One may ask whether, even if this analysis is formally correct, it offers a useful tool for understanding the evolution of macroeconomic targets and instruments in real economies. In the final section of the paper, we address this question, using the framework developed here to analyze the trajectory of U. S. macroeconomic policy over recent decades.

4 | HISTORICAL APPLICATIONS

4.1 | A role for endogenous policy cycles in recent macroeconomic history?

Analysis of macroeconomic policy typically focuses on optimal policy rules. The concrete conduct of policy is less often an object of analysis.¹³ But a natural extension of the analysis in the previous sections is to ask, has the interaction between policy instruments played a part in macroeconomic instability historically?

The logic is straightforward. Under the policy orthodoxy of the postwar period, the policy interest rate (or equivalent monetary instrument) has been used to target output, while the federal budget position has been adjusted to target debt stability. These rules were, of course, suspended during World War II, and were contested to some extent into the 1970s. But since 1980 or so, this ‘sound finance’ instrument assignment has been held to fairly strictly. Indeed, the delegation of responsibility for output stabilization exclusively to the central bank has been seen as a major step forward in macroeconomic policy, a ‘glorious counterrevolution’ that was ‘directly responsible... for the virtual disappearance of the business cycle’ (Romer, 2007).

¹³The obvious exception is the public choice literature, and the related idea of time-inconsistency of policy, as well as the broader but less explicitly theorized presumption that macroeconomic policy in democratic polities suffers from a bias toward deficits and inflation (Portes & Wren-Lewis, 2014). For a critical assessment of time-inconsistency arguments about macroeconomic policy, see Bibow (2004).

Under this assignment, we would expect to see the policy instruments follow clockwise cycles as in Figure 3. An increase in the interest rate will tend to increase the debt ratio at a given primary balance, requiring the budget authorities to shift the primary balance toward surplus. A surplus will tend to reduce demand, leading the monetary authorities to reduce interest rates. Lower interest rates will imply slower growth of the debt ratio, allowing the fiscal authorities to shift the budget back toward deficit. And so on. The amplitude and frequency of these cycles will depend on the speed with which aggregate expenditure responds to the policy variables, the speed with which the effective interest rate facing the government responds to the policy interest rate, and the speed with which each instrument responds to deviations in its target, as well as on exogenous shifts in aggregate expenditure. In Section 3.3, we suggested that for plausible parameter values, these cycles may even amplify rather than dampen over time—that is, there may not be convergence, especially under the sound finance rule when the debt-GDP ratio is already high. Even if policy cycles are dampened, they still represent an independent source of macroeconomic instability, since any initial shift in demand will produce ‘echoes’ as the policy variables spiral back toward equilibrium. In principle, some large fraction of business cycles could be explained in terms of endogenous interaction between policy instruments, rather than exogenous ‘shocks’.

The view that business cycles are largely produced by stabilization policy is most commonly associated with Milton Friedman and more recent monetarists. The monetarist story involves only a single policy instrument, with cycles being the result of lags in both the implementation and effects of policy changes (Friedman, 1960). An account of destabilizing interaction between monetary and fiscal policy closer in spirit to the one proposed here, is found in Woodford (2001). Woodford argues that the question of what monetary policy rule is the best route to price stabilization cannot be separated from what fiscal rule is followed by the budget authorities. Similarly, any target for the public debt cannot be reduced to a budget rule, but depends on the policy followed by the monetary authorities.¹⁴ Woodford considers the ways in which a failure to take this interdependence into account, can lead to destabilizing interactions between the policy instruments. We suggest that this is more than a theoretical possibility. In particular, we suggest that the evolution of output and the federal budget position over the last 40 years can be understood as a long ‘policy cycle’ of the kind analyzed in Section 3.3. The narrative we suggest is the following:

In the immediate postwar period, the United States was effectively operating under a functional finance instrument assignment, with interest rates set to stabilize the federal debt and fiscal policy playing the central role in keeping output at potential. Over the next 25 years, the assignment of instruments was gradually switched, with interest rates moving to target mainly output in the 1950s, and

¹⁴As Woodford observes, this interdependence between the policy instruments is rejected by today’s macroeconomic orthodoxy: ‘It is now widely accepted that the choice of monetary policy to achieve a target path of inflation can. . . , and ought, to be separated from. . . the choice of fiscal policy’. Most macroeconomists think that monetary policy is irrelevant for the debt-GDP ratio, he says,

because seignorage revenues are such a small fraction of total government revenues. . . . [This] neglects a more important channel. . . the effects of monetary policy upon the real value of outstanding government debt, through its effects on the price level and upon the real debt service required. . . insofar as monetary policy can affect real as well as nominal rates.

Similarly, ‘fiscal policy is thought to be unimportant for inflation [because] inflation is a purely monetary phenomenon’, or else because ‘insofar as consumers have rational expectations, fiscal policy should have no effect on aggregate demand’. But this is not correct, Woodford argues: Even if people are individually rational, the economy as a whole can be ‘non-Ricardian’ in the sense that changes in government spending will not be offset one for one by changes in private spending. ‘This happens essentially through the effects of fiscal disturbances upon private sector budget constraints and hence on aggregate demand’. For this reason, ‘A central bank charged with maintaining price stability cannot be indifferent as to how fiscal policy is set’.

TABLE 1 Annual contributions to changes in the federal debt ratio, selected periods

Period	Change in debt-GDP ratio	Due to...		
		Primary balance	Interest payments	GDP growth
1950–1981	−1.6	−0.3	1.5	−3.0
1982–1989	1.8	1.0	3.4	−2.5
1990–2014	1.4	1.2	2.2	−2.0

Source. Kogan, Stone, DaSilva, and Rejeski (2015), authors' analysis.

The first column shows the average annual change in the federal debt-GDP ratio during the given period. The next three columns show the contributions of the primary balance, interest payments and the growth of GDP respectively to the change in the debt ratio. The three columns do not sum exactly to the change in the ratio due to interaction effects. All values are in percentage points. Interest and growth rates are nominal; adding an inflation term would change the contributions of inflation and growth but would not affect the total debt change or the contribution of the primary balance.

fiscal policy coming to exclusively target government debt by the end of the 1970s (Sylla, 1988). At this time, the debt ratio was stable but output was above the level consistent with price stability (in the eye of policymakers), so the application of the sound finance rule implied a large upward movement in interest rates.¹⁵ Higher interest rates brought output to its desired level, but increased government interest payments, moving the economy off the debt-stability locus to a path of rising debt. Fiscal policy eventually responded to this monetary policy-induced rise in federal borrowing as the sound finance rule requires, by shifting the primary balance toward surplus. Large surpluses reduced aggregate demand, as became evident in the early 2000s, when interest rates were reduced to then-unprecedented levels in order to bring output up to potential. Low interest rates opened up space for the move toward primary deficits under G. W. Bush, which might have carried the cycle back toward its starting point if it had not been cut short by the collision of the interest rate instrument with the zero lower bound.

In this context, it is important to realize that the majority of the rise in federal debt during the 1980s was due to higher interest rates, not to the tax and expenditure decisions of the Reagan administration. As Table 1 shows, over fiscal years 1950 through 1981 (the last pre-Reagan budget), the primary budget balance was on average in surplus of 0.3% of GDP, while interest payments averaged 1.5% of GDP, giving an average overall budget deficit of 1.2% of GDP. These deficits were more than offset by nominal growth of GDP, resulting in a decline of the debt-GDP ratio during this period of 1.6 percentage points per year. Between fiscal 1982 and 1990, the overall federal deficit averaged 4.4% of GDP, with the average primary deficit equal to 1.0% of GDP and interest payments equal to 3.4%. During this period, the debt-GDP ratio rose by 1.8 points per year. In other words, while the annual change in the debt-GDP ratio was 3.4 points higher under the Reagan administration than in the preceding three decades, only about a third of this difference is attributable to increased spending and lower taxes. The majority of the difference is accounted for by higher interest payments.¹⁶ (By contrast, the increase in the debt ratio over 2008–2014, not shown, is mainly attributable to a shift toward primary deficits.) The numbers reported in Table 1 are important for our analysis because they demonstrate that the cross-effects of changes in the policy interest rate on the federal debt ratio are quantitatively important.

¹⁵This is intended as an alternative way of describing, rather than an alternative explanation for, the Volcker shock.

¹⁶The data for these calculations is taken from the online appendix of Kogan et al. (2015). A similar argument is made there that most of the historical variation in the federal debt-GDP ratio is explained by changes in the interest rate on federal debt and in nominal GDP growth rates, and that the relative importance of these latter factors is greatest when the debt-GDP ratio is already high.

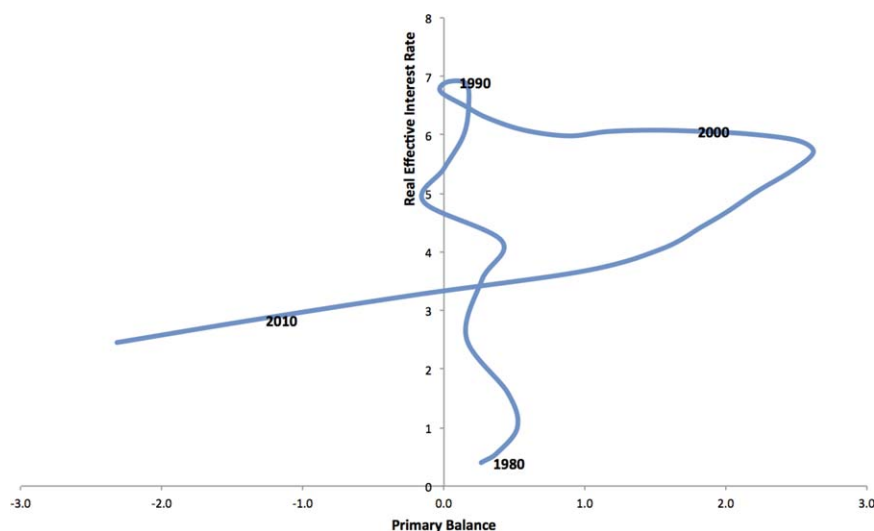


FIGURE 5 Price stability and debt sustainability conditions. The figure shows rolling 10-year averages for the primary balance and the inflation-adjusted effective interest rate on public debt. The labels show the ending date, so the starting point, at the bottom, represents average values for 1971–1980 while the ending point, on the left, shows the average values for the period 2005–2014. The trajectory is approximately a clockwise spiral, similar to what we suggest might be expected given destabilizing feedback between policy instruments under a ‘sound finance’ policy rule [Colour figure can be viewed at wileyonlinelibrary.com]

These movements are illustrated in Figure 5, which shows 10-year moving averages of the inflation-adjusted policy rate and the primary balance from 1971 to 2013. The figure shows a clear counterclockwise movement, as predicted for policy interactions under a sound finance rule. Note again that the movement in the 1980s is mainly vertical—that is, it reflects an increase in prevailing interest rates, not a shift toward primary deficits.

5 | CONCLUSION

The starting point of this paper is a simple observation: both the output gap and the trajectory of public debt-output ratio are jointly determined by both the fiscal balance and the interest rate. Both targets and both instruments must be analyzed within a single framework—rather than, as is more often the case, discussing the stabilization of output through monetary policy and the stabilization of public debt ratios through appropriate budget rules as if they were two independent questions. It follows that there is no such thing as a Wicksellian natural interest rate, but at best a schedule of such rates, one for each value of the primary balance. And similarly, we cannot specify a budget rule consistent with a stable debt-GDP ratio unless we also describe the behavior of (policy-determined) interest rates. It is no secret that periods of very high debt ratios have seen a shift in the primary target of monetary policy from price stability to the public debt ratio (Reinhart, Kirkegaard, & Sbrancia, 2011). But this historical fact is not well reflected in most formal discussions of macroeconomic policy.

From the perspective adopted here, the distinction between an orthodox ‘sound finance’ instrument assignment and the alternative ‘functional finance’ assignment takes on a different appearance. The case for functional finance does not depend on arguments about the economic costs, or lack thereof, of changes in the debt-GDP ratio, since that ratio can in general be held constant under either rule. If both policy instruments can be set instantly to their optimal values, then the two rules are in general equivalent.¹⁷ If the

¹⁷The exception is the kind of cases discussed in Section 3.2.

instruments are adjusted incrementally in response to deviations of the targets from their desired values, then the rules are distinguished by the different adjustment paths they follow. We show that while both policy rules converge at low debt-GDP ratios, only the functional finance rule converges at high debt ratios. Thus, counterintuitively, the case for countercyclical fiscal policy becomes stronger, not weaker, when public debt ratios are already high.

In the final part of the paper, we apply this framework to historical data for the postwar United States. We ask whether medium-term fluctuations can be explained, at least in part, by interactions between the two policy instruments. We tentatively suggest that the macroeconomic history of the past 40 years can be understood in these terms. Monetary tightening in response to inflation causes the debt ratio to increase, inducing (with a lag) a shift toward primary surpluses. The contractionary effects of surpluses lead the monetary authority to lower interest rates, which reduces debt service costs for the government, contributing to the fall in the debt ratio. Falling debt ratios encourage an increase in public spending, boosting demand until the monetary authority tightens again. And so on, at least potentially—only one full cycle is visible in the record. This is the result of each instrument being adjusted only in response to one of the targets, even though both instruments affect both; the result is cycles in policy space, with destabilizing economic effects. This suggests a greater role for endogenous policy cycles in macroeconomic fluctuations, and correspondingly lesser role for exogenous shocks.

The framework offered here is limited in some important respects. Most obviously, we take no view on why, or whether, a stable debt-GDP ratio should be a target of policy. We simply accept this goal as a premise, since it is today a presupposition of most discussions of macroeconomic policy, and evidently shapes the choices of policymakers. We also ignore the effects of changes in output and inflation on the debt-GDP ratio, though these have been important historically. Taking these effects into account would probably strengthen the case for endogenous interactions between policy instruments as a source of macroeconomic instability, since it introduces another channel by which an increase in the policy interest rate can raise the debt-output ratio. Perhaps most importantly, we ignore open-economy complications. For the United States, this is probably not a serious limitation. But for most other countries it is unclear whether the analysis here would be meaningful, at least as applied to concrete historical developments, without considering the balance of payments and exchange rate fluctuations. In small open economies, the exchange rate is, at least potentially, a target for policy on a level with the output gap and the debt ratio (Ghosh, Ostry and Chamon, 2016). Clearly this dimension cannot be ignored when a significant fraction of public debt is financed in a foreign currency. In a somewhat different direction, this paper invites, but does not attempt to answer, a political economy question: If the sound finance and functional finance rules are formally equivalent, why is there such a strong commitment—among both policymakers and the economics profession—to the idea that the fiscal balance instrument must be assigned to the debt ratio and the interest rate instrument to the output gap? Answering this question would be an important step in understanding the political constraints on macroeconomic policymaking, which may in the end be more important than the economic constraints explored here.

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