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TRIGGER POINTS AND BUDGET CUTS: EXPLAINING THE EFFECTS OF FISCAL AUSTERITY

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ABSTRACT

We propose and solve an optimizing model which explains counterintuitive effects of fiscal policy in terms of expectations. If government spending follows an upward-trending stochastic process which the public believes may fall sharply when it reaches specific "target points," then optimizing consumption behavior and simple budget constraint arithmetic imply a nonlinear relationship between private consumption and government spending. This theoretical relation is consistent with the experience of several countries.

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I. Introduction

Textbook aggregate demand models suggest simple relationships between the government budget and economic activity, a cut in the government deficit, for example, depressing consumption and output. Though such models heavily influence the design of stabilization policies, their microfoundations are unclear and their sharp predictions are not always consistent with reality. In many countries, large cuts in government spending carried out as part of stabilization programs have led to *expansions* rather than contractions in economic activity.

The absence of simple relationships between economic variables is often explained theoretically by the importance of expectations of future economic variables, including variables reflecting government policy. The idea that expectations of future policy changes are crucial in understanding seemingly counterintuitive macroeconomic dynamics has been explored before. It formed the basis of the now classic Sargent and Wallace paper on "Unpleasant Monetarist Arithmetic" (1981). More recently, Drazen and Helpman considered the effects of future anticipated fiscal changes meant to balance the budget on current inflation in a closed economy (1990) and the current account in an open economy (1987). Their results indicated that depending on what sort of policy change was anticipated, any correlation between inflation (or the current account in an open economy) and changes in the budget deficit could be observed.

In this paper we argue that expectations about the discrete character of future fiscal adjustments can help explain the effects of current fiscal policy. The paper develops a model in which significant government spending cuts take place only when the ratio of government spending to output hits a trigger point, so that sharp policy changes occur only infrequently. We use techniques developed in the exchange rate literature to study such discrete policy interventions. The existence of triggers in a neoclassical model implies a nonlinear relation between the consumption-to-output ratio and the government-spending-to-output ratio. Both the assumptions about the character of fiscal interventions and the implications for the ratio of consumption to output find support in the joint behavior of consumption and government spending observed for several countries. We will look in detail at Denmark and Ireland, where a pattern typical of the relation between private and government consumption in several countries emerges quite strongly: when government spending is a small fraction of GDP, private and government consumption (both relative to GDP) exhibit an inverse relationship, which flattens out as the ratio of government spending to output increases.

The key characteristic of the *expectations view* of fiscal policy is that nonstandard effects of fiscal policy are explained by the role of current policy in shaping expectations of future policy changes. A policy innovation which would be contractionary in a static model may be expansionary if it induces sufficiently strong expectations of future policy changes in the opposite direction. That is, if a cut in government spending induces expectations that future spending *and therefore taxes* will be significantly lower, it may induce an expansion in current private spending. Taken one step further, the effect of increases in government spending may be expansionary if private agents' behavior is based on the expectation that high levels of spending are unsustainable and will soon be cut.

The plan of the paper is as follows. Section II reviews the Danish and Irish experiences. In Section III we present a very simple reference model in which output is constant, and government spending follows a Brownian motion process with positive drift subject to possible discrete adjustment: these simple assumptions, which are suggested by the Danish and Irish experience, make it possible to obtain a closed-form solution and to illustrate the general phenomena we focus on in this paper. In Section IV we propose a solution method for models of stochastic policy changes, and we show that the simple model implies a nonlinear relation between the level of consumption chosen by optimizing agents and the level of government consumption. We discuss the model's implications for consumption behavior and the current account in Section V. In Section VI we discuss the match of the theory to the qualitative features of the experiences of Denmark, Ireland, and other countries, and consider how the simple model may be extended to better match observed phenomena. The final section contains concluding comments.

II. Two examples of fiscal stabilizations

Numerous countries undertook fiscal austerity programs in the 1980's. Denmark and Ireland enacted stabilization programs marked by especially sharp cuts in government expenditures during this period. We begin with a very quick overview of these episodes, based on the excellent analysis of Giavazzi and Pagano (1990).

In the early 1980's the Danish primary government deficit was large relative to GDP and public debt was growing rapidly. In the autumn of 1982 concerns about the sustainability of the fiscal path led to a decision to undertake a sharp fiscal contraction beginning in late 1982. In the four years that followed, the full employment primary deficit fell by 10% of GDP. The stabilization was expansionary: the consumption-to-GDP ratio rose by several percentage points in 1982-86, as shown in Figure 1, where we plot the time path of private consumption c, of government consumption g, and of current account x (all relative to GDP).[1]

In the early 1980's Ireland was in an even worse position. Giavazzi and Pagano report a large budget deficit and total national debt equal to 87% of GDP. The first attempt to stabilize was undertaken in 1982. By 1984, the (full-employment) primary budget deficit was reduced by 7% of GDP, largely via increased taxes. The fiscal contraction had the textbook Keynesian effect, with private consumption falling sharply. A second attempt at stabilization was made in 1987, this time relying on large cuts in government consumption. As in the Danish case, this fiscal retrenchment was quite sharp, with the full-employment budget deficit falling by another 7% of GDP between 1987 and 1989. A further similarity to Denmark was the expansionary effect of the fiscal change. The data are presented in Figure 2.

In both countries we see a similar relation between the private consumption-to-output ratio c and the government consumption-to-output ratio g in the 1957-1989 period, displayed in Figures 3 and 4 for Denmark and Ireland respectively. (A similar relation emerges if we use government expenditure inclusive of transfers and debt service instead of government consumption). From 1957 until the early to mid 1970's we see an inverse relation between c and g in both countries; from the early 1970's until the early 1980's c remains flat even though g rises significantly; finally, from 1982-3 onward there is a significant drop in g with little change in c. Note also that the tax-based stabilization of 1982 in Ireland is associated with a sharp drop in c as g remains constant. The figures suggest, first, that fiscal stabilization takes the form of a sharp retrenchment, following a long upward drift in the government spending to output ratio; and, second, that its effects on private consumption decisions are not as simple as textbook models would suggest.

III. A simple model

We consider a non-monetary small open economy facing a perfect world capital market. Let the world interest rate be r and let this also be the consumer's discount rate. Suppose that all goods are tradable, that output of tradables is fixed, and that the government finances its purchases of tradable goods by lump-sum taxes. (We discuss below the implications of assuming instead that part of government expenditure falls on nontraded goods, or that taxation is distortionary.) Government spending is assumed to follow a known process, which we will specify below. Here, we will relate current consumption of

[1] The data are from *International Financial Statistics*: lines 96f, 91f, 90c minus 98c, divided by line 99b.

the representative individual to the expected present discounted value of future government spending.

The individual's choice problem may be written as

$$\max \int_t^{\infty} e^{-r(z-t)} E_t\{u(C_z)\}\, dz \tag{1}$$

subject to

$$\int_t^{\infty} (C_z + \tau_z - Y)\, e^{-r(z-t)}\, dz \leq A_t \tag{2}$$

where $\{C_z\}$ and $\{\tau_z\}$ are, respectively, the consumption and taxation processes; Y is (constant) income; A_t is total private assets, including claims on foreigners and on the government; and $E_t\{.\}$ denotes expectation conditional on the relevant information available at time t.

If government expenditures are stochastic, so are taxes via the government's budget constraint. The first order condition for the problem in (1) and (2) is

$$E_t\{u'(C_z)\} = \lambda_t \tag{3}$$

where λ_t is the multiplier on the integral budget constraint. If utility is quadratic in C, the first order condition implies constant expected consumption over time, $E_t\{C_z\} = C_t$ for all $z \geq t$.[2] Taking expectations on both sides of the integral budget constraint, we obtain

$$C_t = Y + r\, A_t - r \int_t^{\infty} E_t\{\tau_z\}\, e^{-r(z-t)}\, dz \tag{4}$$

The government's intertemporal budget constraint implies

$$\int_t^{\infty} \tau_z\, e^{-r(z-t)}\, dz = B_t + \int_t^{\infty} G_z\, e^{-r(z-t)}\, dz \tag{5}$$

where $\{G_z\}$ is the government spending process and B_t is government debt, i.e. cumulated past deficits. Substituting (5) into (4) we obtain

$$C_t = Y + r\,(A_t - B_t) - r \int_t^{\infty} E_t\{G_z\}\, e^{-r(z-t)}\, dz \tag{6}$$

We note at this point that $A_t - B_t$ equals the country's net foreign assets, since we do not consider capital accumulation. Dividing through by output, we obtain a simple inverse

[2] Our interest is in the inverse relation between current consumption and expected future taxes for a forward-looking consumer. This relation is obviously general; we use quadratic utility to derive a simple functional form.

relation between the consumption to output ratio and the present discounted value of the future government expenditure to output ratios, given the ratio f_t of net foreign assets to GDP:

$$c_t = 1 + r\, f_t - r\, v_t, \tag{6a}$$

where v_t denotes the present discounted value of the ratio of expected future government spending to output, that is

$$v_t = \int_t^{\infty} E_t\{g_z\}\, e^{-r(z-t)}\, dz. \tag{7}$$

Expectations are unobservable as such. To obtain a relation between (observable) consumption and government spending, we need to specify a process for the latter and to find how expectations of its present discounted value depend on current observables. A number of state variables may be relevant for this purpose. In general, however, any movement in current government spending must imply a change in future spending or taxation to ensure sustainability. To see this, consider a case in which changes in current government spending do *not* give rise to expectations of future offsetting movements: suppose that the government spending to output ratio, denoted by g_t, follows a random walk (in continuous time, for analytical convenience), so that

$$dg_t = \vartheta\, dt + \sigma\, dW_t \tag{8}$$

where $\{W_t\}$ is a standard Wiener process.[3] We assume the drift ϑ to be strictly positive, reflecting the tendency of government outlays relative to GDP to rise over time in the absence of feasibility concerns. If equation (8) always described the dynamics of $\{g_t\}$, we would have $E_t\{g_z\} = g_t + \vartheta(z-t)$ for all t, all $z \geq t$, and integration of (8) would yield

$$v_t = \frac{g_t}{r} + \frac{\vartheta}{r^2}. \tag{9}$$

Using (9) in (6a), we see that when g displays no tendency to reverse its upward movements, changes in current government spending imply changes in expected future taxation in the same direction, and hence movements in *current* consumption in the opposite direction.

But with g following a random walk, the present discounted value of future government spending and taxes would exceed the present discounted value of output with probability

[3] Modeling g_t as a (regulated) Brownian motion, we can use the technical apparatus developed in the literature on exchange-rate bands (see the papers in Krugman and Miller [1990], and Bertola [1991] for a survey). The application of this approach to issues of fiscal sustainability was considered by Miller, Skidelsky, and Weller (1990) and Bertola (1990).

approaching one. Government solvency, however, requires that continuing increases in current government spending must eventually be slowed or reversed. Such stabilizations of an upward trend in the government spending to output ratio often have a discrete character: there are infrequent sharp changes in government expenditure patterns, with a sharp cut in government spending or its rate of increase occurring only after a significant upward drift, as exemplified by the Danish and Irish experience reviewed above. The infrequency of fiscal regime changes may reflect political constraints blocking agreement on fiscal retrenchment, which can be reached only when the government expenditure to output ratio reaches levels which are sufficiently high to be deemed critical. (The argument that the enactment of an inevitable stabilization may require the pre-stabilization situation to deteriorate markedly is explored in Alesina and Drazen [1990] and Drazen and Grilli [1991].)

We proceed to model discrete interventions by assuming that the government spending to output ratio follows the dynamics in (8) but jumps downward discontinuously when it reaches excessively high levels, terming such discrete shifts *stabilizations*. For simplicity, we let all stabilizations result in g_t dropping to a given, common knowledge level g_s, and we assume that stabilizations may occur either when $g_t = g_c$ or when $g_t = \overline{g}$.[4] Here, $\overline{g}$ represents a ratio of government spending to output sufficiently high to trigger a stabilization with certainty, and g_c is a lower value which the government may or may not consider crucial. We denote the probability of a stabilization when $g_t = g_c$ with p, and we let $p = p_c$ initially. If the stabilization does not take place when g_t reaches g_c for the first time, however, the public recognizes that g_c is not considered "too high" by the government. Thereafter, g_c is no longer deemed critical, and $p = 0$: if the noise component in (8) brings the spending-to-output ratio back to g_c, a stabilization is assigned zero probability. The inevitability of an eventual stabilization follows from the fact that the Brownian motion dynamics would bring the government's tax obligations to infinity with probability one. Thus if g_t goes past g_c, it eventually drops back to g_s with probability one when it reaches $\overline{g}$. At that point p is reset to its initial value p_c, implying that g_c is once again a candidate for a stabilization. We further assume that there is no analogous feasibility problem for low values of g_t, which are not likely to be observed anyway given the positive drift.

[4] More generally there may be a number of possible trigger points or return points. This simple case illustrates the main results. An alternative approach would be to focus on the inference problem of discovering the true process generating government spending for an observed time series, as suggested in Drazen (1990).

The modelling of stabilizations is not meant to be fully realistic, of course, but we believe that its assumptions do capture politico-economic phenomena of some interest. The public's uncertainty about whether a specific value g_c is high enough to induce an agreement reflects the same constraints that rationalize the existence of trigger points, namely the difficulty of reaching political agreement on fiscal retrenchment. When no stabilization takes place at a potential trigger point, it is realized that the threat of fiscal unsustainability is not strong enough to induce agreement under current circumstances; if stabilization does occur at g_c, on the other hand, there is no guarantee that the same point will necessarily induce agreement the next time it is hit. The assumption that lower values of g are once again possible critical points after a drastic stabilization at $\overline{g}$ is appealing on theoretical grounds, as it ensures that the economy repeatedly returns to the two possible situations and that (if the economy under consideration were observed for a long enough time) initial conditions would eventually become irrelevant. It may be rationalized considering that if government spending has been allowed to drift off, this experience may provide more political will not to let it happen again.

IV. Solution

The model outlined above admits a closed-form solution. Stabilizations occur (with given probability) only when the ratio of government expenditures to output reaches "trigger" values, and the dynamics between stabilizations are given by the process (8) which is Markov in levels. The likelihood of stabilizations at every time in the future is then determined, as of time t, by the current level of g_t only, and $\{g_t, p_t\}$ form a bivariate Markov process. All conditional expectations in the integral (7) defining v_t are then functions of g_t and p_t, to imply that $v_t = v(g_t; p_t)$.

By Ito's lemma, whenever $\{g_t\}$ follows Brownian motion dynamics (and, by our assumptions, p_t is not changing) we have

$$\frac{1}{dt}E_t\{dv\} = \vartheta v'(g_t; p_t) + \tfrac{1}{2}\sigma^2 v''(g_t; p_t).$$

where the primes denote the partial derivatives of v with respect to g. From the differential form of (7),

$$r\, v_t = g_t + \frac{1}{dt}E_t\{dv_t\}, \tag{7a}$$

we obtain a differential equation for $v(g_t; p_t)$:

$$r\, v(g) = g + \vartheta v'(g_t; p_t) + \tfrac{1}{2}\sigma^2 v''(g_t; p_t), \tag{10}$$

which must be satisfied by the $v(\cdot)$ function for all values of g for which the probability of a stabilization is zero. The expression in (9) is a particular integral of (10), corresponding to the (unsustainable) case in which stabilizations never occur. All solutions of (10) are then linear combinations of (9) and of solutions of its homogeneous part, in the form

$$h(g) = K_1 e^{\alpha_1 g} + K_2 e^{\alpha_2 g}, \tag{11}$$

where α_1 and α_2 solve the characteristic equation

$$\tfrac{1}{2}\sigma^2\alpha^2 + \vartheta\alpha - r = 0. \tag{12}$$

The roots of this equation are real, distinct and of opposite sign if $r\sigma^2 > 0$.

The two terms in (11) reflect the upward or downward bias in the discounted expectation of future spending due to the possibility of upward or downward jumps. By the assumptions above, no discrete upward jumps in government spending are triggered by "too low" values of g. Hence, the likelihood of future stabilizations becomes smaller and smaller as g approaches minus infinity, and it must be the case that

$$\lim_{g \to -\infty} h(g) = 0.$$

This implies that if α_1 is the negative root of (12), then the solution sets K_1 in (11) to zero, while the current probability of stabilization at point g_c will be reflected in the value of the constant integration associated to the positive α root, which we will denote $K(p)$. Combining (9) and (11), solutions of (10) must then take the form

$$v(g_t;p) = \frac{g_t}{r} + \frac{\vartheta}{r^2} + K(p)e^{\alpha g_t}. \tag{13}$$

where

$$\alpha = \frac{-\vartheta + \sqrt{\vartheta^2 + 2r\sigma^2}}{\sigma^2} > 0.$$

The model under consideration allows for two possible values of p_t: p_c, when g_c is a possible stabilization point, and 0, when it is not. At times when a stabilization may occur, $v(g)$ must satisfy the boundary conditions implied by the requirement that the expectation of future government spending not be *expected* to change, i.e. the law of iterated expectations. Consider first the case in which g_t has passed through g_c with no stabilization, so that we are considering the function $v(g_t;0)$. Since g drops to g_s with probability one whenever it reaches $\overline{g}$, the present discounted value of expected future taxes must be identical at $\overline{g}$ and g_s, that is,

$$v(\overline{g};0) = v(g_s;p_c). \tag{14a}$$

Similarly, when stabilization at g_c is perceived as possible, there can be no expected jump in $v(g;p)$. Thus, it must be true that

$$v(g_c;p_c) = p_c\, v(g_s;p_c) + (1-p_c)\, v(g_c;0) \tag{14b}$$

when the expenditure to output ratio reaches the critical value g_c and the public is uncertain ex ante as to whether a stabilization may occur at that point.

Using (13) in (14), we find that $K(p_c)$ and $K(0)$ must solve the system

$$\begin{bmatrix} e^{\alpha g_s} & -e^{\alpha \overline{g}} \\ e^{\alpha g_c} - p_c\, e^{\alpha g_s} & -(1-p_c)\, e^{\alpha g_c} \end{bmatrix} \begin{bmatrix} K(p_c) \\ K(0) \end{bmatrix} = \begin{bmatrix} (\overline{g} - g_s)/r \\ p_c(g_s - g_c)/r \end{bmatrix}. \tag{15}$$

This yields values for $K(p_c)$ and $K(0)$, and hence solutions for $v(g_t;p_c)$ and $v(g_t;0)$ in (13). Quite intuitively, both K values are negative, reflecting the expectation of future downward jumps in the level of g.

To summarize, the changes in future government spending necessary to ensure solvency in response to increases in current government spending imply that a current increase in the government spending-to-output ratio, in general, has nonlinear effects on the expected present discounted value of the ratio of future government spending to output. It may therefore be misleading to use simple VAR's to predict future government policies, as was done for example by Giavazzi and Pagano. The mean reversion in government spending which characterizes stabilization has the further implication that the present discounted value of expected future g_t rises less and less as g_t rises. One should note that this nonlinearity does *not* depend on intervention being discrete. A number of other models would have similar implications: for example, modelling stabilizations as discrete changes in the drift ϑ of g_t would have a similar implication, as would assuming that interventions are infinitesimal rather than discrete. What is crucial is mean reversion, with increases in g making it more likely that it will come back to some return point.

V. Observable implications: consumption and the current account

We can now study the relation between observable changes in government spending on the one hand, and observable changes in consumption and the current account on the other. Using the results of the previous section we may write (6a) as

$$c_t - r\, f_t = 1 - r\, v(g_t;p). \tag{16}$$

Theoretically, f_t is a function of the realized history of $\{g_t\}$; over short intervals, however, f will be roughly constant since changes in f represent the *cumulated* effect of flow consumption decisions from (16). Over longer intervals, changes in f will complicate the relation of c and g in Figure 5 below, but will not change the underlying characteristic, namely, the flattening out for high values of g which is the object of our interest. As we do not have information on f, we choose to concentrate on the relationship of c to g, and to work with equation (16) for given f.

We graph the relation (16) in Figure 5 choosing parameter values which are realistic for the Danish and Irish experience. The upper, solid curve shows the behavior of consumption for $g_t < g_c$ when there is probability $p_c > 0$ that a discrete policy shift will occur when g_t hits g_c. The lower, dashed curve shows the behavior of consumption when there is no probability of a discrete change in government spending at g_c. The diagonal dashed-dotted line is a 45^o line corresponding to a zero trade balance.

Using the solution from (13) for $v(g_t;p)$ in (16) and differentiating, the slope of the relation between c and g is

$$\frac{\partial c_t}{\partial g_t} = -r\,\frac{\partial v(g_t;p)}{\partial g_t} = -1 - r\,\alpha\,K(p)\,e^{\alpha g} \tag{17}$$

at points where $v(g_t;p)$ is differentiable, that is at all points other than g_c along $v(g_t;p_c)$ and $\overline{g}$ along $v(g_t;0)$. (Note that for a change in g occurring in infinitesimal time f is constant to first order; hence, (17) is strictly correct.)

Several points should be noted. First, if discrete stabilizations were ruled out, movements in g_t would be matched by equal size movements in c_t in the opposite direction (see equation 9): we would then have $\partial c_t/\partial g_t = -1$, and c and g would move along a 45^o line in Figure 5. When discrete cuts in spending are included, the relationship of $c - rf$ to g is flatter than a 45^o line, and may even slope upwards. At low levels of g, c falls less than dollar-for-dollar with increases in current government spending: this of course reflects the fact that increases in current government spending imply increases in the probability of a future discrete spending cut and hence a lower increase in future expected taxes than in the no-expected-intervention case. Thus, higher government expenditure only partially crowds out consumption, and the model — in spite of its extreme neoclassical structure — has distinctly Keynesian observable implications. With fixed output, the difference between the change in consumption and government spending is reflected in the current account.

Consider now the upper curve. When g_c is reached at point A, there is a probability p_c of discrete cut to level g_s of the government spending to output ratio. If the cut is realized, we jump to point D: consumption jumps up, reflecting the discrete fall in the present discounted value of future taxes. Note however that consumption rises by less than government spending falls. Alternatively, with probability $1 - p_c$, there is no stabilization when we hit A. This indicates that g_c was not a critical level of spending for the current government, so that expected future spending and thus expected future taxes are discretely higher. Hence consumption falls discretely, as indicated by the jump to point B on the lower curve. That is, a small increase in current government spending may induce a large, discrete fall in consumption. Put another way, the expectation that a stabilization is possible at some perceived critical value will be contractionary if the stabilization doesn't materialize. Changes in the perceived probability of a discrete cut in government spending will have a similar effect, generating discrete jumps in the consumption to output ratio with little change in the government spending to output ratio.

Along the lower curve, stabilization is expected to occur with certainty when ***and only when*** the government consumption to output ratio reaches $\overline{g}$. This curve also bends away from the 45^o line, the bend being progressively greater for higher values of g_t. For g_t sufficiently high, increases in g_t induce *increases* in c_t (again, for given f). This is because at high levels of g_t further increases in government spending so increase the probability of a discrete cut in future government spending as to lower the present discounted value of future expected taxes. This result is reminiscent of the inflation overshooting result found in Drazen and Helpman (1990) and occurs for basically the same reason.

The response of the current account to changes in government spending is, of course, fully determined by the above results since output is fixed. To derive this more formally, we first write the ratio of the current account to output, denoted x_t, as

$$x_t = 1 - c_t - g_t + rf_t. \tag{18}$$

Differentiating with respect to g_t and using (17), we obtain, for values such that $v(g;p)$ is differentiable,

$$\frac{\partial x_t}{\partial g_t} = r\alpha K(p)e^{\alpha g}. \tag{19}$$

Since $K(p)$ is negative this derivative is negative and increasing in g_t, so that along a curve the current account always worsens with increases in g_t. This is identical to the above observation that the $c_t - rf_t$ line bends away from the 45^o line, with the bend being greater the larger is g_t.

We quickly note some further features of movements in the current account. At point A, an improvement in the current account occurs with probability one. If a stabilization occurs (implying a move to D) c_t rises by less than g_t falls, so the current account improves. If no stabilization takes place, we move to B, c_t falls with no change in g_t, and the current account improves. Similarly along the lower curve a stabilization at $\overline{g}$ induces a current account improvement. Note further that along the upward sloping portion of $c(g_t; 0)$ curve, increases in g_t induce large deteriorations in the current account, as private consumption rises in anticipation of a stabilization.

VI. Discussion and extensions

In this section we compare the implications of the simple model with the experience of Denmark, Ireland, and other countries; to the extent that they don't match, we suggest extensions of the model.

Recalling the evidence reviewed in Section II, our model appears capable of explaining the qualitative features of Danish and Irish consumption data; for realistic parameters, the quantitative match between theory and data is satisfactory as well. Figures 3 and 4 (where dashes plot a 45^0 line) display a nonlinear relation between the private consumption-to-output and government consumption-to-output ratios which is quite similar to the theoretical one in Figure 5. The main puzzling feature of the Danish and Irish data, namely the sharp drop in government spending with no similar change in private consumption at the time of stabilization (or the "expansionary effects of stabilization"), is readily explained by the model on the assumption that the stabilization was anticipated.

Our theoretical model was kept simple in order to make clear the general insight of the expectations approach to fiscal policy: solvency of the government and forward-looking consumer behavior imply that in a neoclassical model, current consumption will fall less than one-for-one with increases in current government spending because changes in current government spending engender expectations of future fiscal changes in the opposite direction. Other models of the process generating government spending would generate the same nonlinearity, as long as they maintained the characteristic of mean reversion that fiscal sustainability implies. As mentioned above, intervention need not be infrequent, as long as the present discounted value of future government spending increases less fast than g_t itself. Assuming that some g level acts as a reflecting barrier would also imply a flattening out of the relation between the private consumption to output and government consumption to output ratios, though in this case there would be no upward sloping portion (corresponding to the case of *infinitesimal* intervention in the exchange rate literature). Modeling the intervention as a discrete change in the *drift* of the government spending to output ratio, rather than a discrete change in the ratio, would yield similar nonlinearities and might better fit the pattern observed in Figures 1 and 2. The mathematics of switching drifts are more complex, however, and we defer this refinement to future research.

The simple model we present has another feature which is consistent with the data, namely the effect of changes in the perceived probability of a discrete cut in government spending. The 1982 drop in consumption in Ireland is often attributed to the Keynesian effects of the sharp increase in taxes with the first stabilization attempt (Giavazzi and Pagano [1990]). Our model suggests how expectational effects could explain this drop. It has been argued (Dornbusch [1989]) that the need for fiscal austerity was recognized already in 1981. In our framework, then, the crucial event in 1982 was not the tax increase (which in a neoclassical model should have little effect on current consumption) but the *absence* of a significant cut in g when this had come to be expected. According to the model, the failure of the cut to materialize at what had been perceived as a critical point should and did result in a drop in c with no change in g, and in a "failed" stabilization.[6]

As shown in Figure 5, similar patterns of an inverse relation between c and g for low values of g which flattens out as g rises are observed elsewhere, for example in Belgium, Sweden, and the United Kingdom, all of which enacted programs of fiscal austerity in the 1980s. (The dashed line is again a 45^0 line.)

Plotting the current account to GDP ratio against g using Irish and Danish data yielded a significantly worse match of the model to the data than the plots of c against g. We do not report these plots, and briefly discuss the possible reasons for the poor fit between the simple model above and the data.

First, the relation derived in (19) arises because of the accounting identity (18). Changes in the sum of c and g must be mirrored by changes in x in the opposite direction when output is constant. If investment were added as the final component of output, the relation in (19) would apply to the derivative of the *sum* of investment and the current account (relative to GDP). The relation of this sum to g observed in the data for our sample of countries (not shown here) is indeed closer to that predicted by the model, but contains no new information. Of course, this raises the issue of extending the model to include investment behavior. Changes in the anticipated fiscal environment should strongly influence current investment decisions, as for example the current investment boom in Mexico suggests. The precise effect of future fiscal policy on the forward-looking investment decisions of firms, however, would depend crucially on the nature of the adjustment costs they face. We plan in future research to model forward looking investment behavior along with consumption decisions. The point of this paper however was to emphasize the

[6] For Denmark, our model would similarly associate the sharp vertical drop in the consumption-to-GDP ratio in 1972 with a fall in the perceived probability of a government spending cut; we do not know whether this was indeed the case.

general message of how expectations of future fiscal shifts affect consumption in a nonlinear way, not to set out a complete macro model. The effects of expected fiscal policy on consumption that we focus on would not be qualitatively changed by explicit consideration of investment.

Second, a distinction between traded and nontraded goods could also help explain the poor fit of theory and current-account data. If we added nontraded goods to the model and assumed that the government purchased both types of goods, the results for consumption would be similar, but those for the current account could change significantly. As with tradables, an increase in government expenditure on nontraded goods would increase the probability of a future cut in government consumption of nontraded goods. With fixed output in each sector, market clearing implies that current private consumption of nontraded goods would fall by exactly the amount that government consumption rose. Hence the sign of the consumption results would be unaffected, except perhaps in the upward sloping region of the curve. For the current account, however, a future anticipated cut in government consumption of nontraded goods could induce a surplus rather than a deficit for any value of g_t if traded and nontraded goods were complements (see Drazen and Helpman [1987]). That is, with fixed output, the spending cut implies an increase in consumption of nontraded goods and thus, via complementarity, increased consumption of tradables *on the date it takes place.* This effect taken alone implies that a current account surplus will be run in anticipation of a stabilization in order to finance higher future expected consumption of tradables. The net effect might therefore be ambiguous.

A further problem of the match of theory and data is that while the nondistortionary tax model implies that the relation between c and g should be everywhere flatter than the 45° line, the data often display a steeper relation (for example in Denmark in the 1960s and early 1970s). One way to explain this is that net foreign assets are falling over time, so that permanent income is below the present discounted value of the endowment flow minus the present discounted value of future taxes. A second mechanism that might explain this feature of the data is distortionary taxation. We therefore explore briefly how the theoretical results would be affected if taxes were distortionary and current output depended negatively on the current level of distortionary taxation.[7]

[7] Alternatively, current output could depend on the expected level of future distortionary taxation, which would arise from factor accumulation decisions or intertemporal substitution in factor supply, suggesting the importance of carefully modelling investment. We believe this to be an important possibility, but leave a formal analysis for a later paper. Manasse (1991) extends the model proposed here to allow for tax-smoothing behavior on the part of the fiscal authorities.

Consider first an increase in current government spending with no increase in current taxes. Current output is unaffected, while current consumption will be "doubly" affected, relative to the earlier model. The increase in current government spending raises the expected value of future government spending and hence taxes. This reduces consumption for a given level of permanent income, as before. In addition it reduces permanent income due to the distortionary nature of (future) taxation. Hence, the fall in the consumption to output ratio in response to an observed increase in the government spending to output ratio will be greater than in the earlier model (or the rise will be smaller if we are on the upward sloping portion of the curve). If this distortionary effect were strong enough, the relation would be steeper than the 45^o line. A discrete cut in government spending would similarly cause a greater consumption boom in the case where it was not expected with certainty.

At the other extreme, consider an increase in current taxes with no change in current government spending and hence expected future spending and suppose that the current level of taxes gives no information about the future level of taxes not already contained in government spending. In the previous model with Ricardian equivalence, this had no effect. In this model, total consumption C_t is still unaffected, since permanent income is unaffected. There is however a transitory fall in income and hence a rise in the ratio c_t. Therefore, a fall in the consumption to GDP ratio, such as we saw in Ireland in 1982 after the tax-based stabilization attempt, requires a fall in the perceived probability of government spending cuts in both the distortionary tax case and the nondistortionary tax case. An increase in distortionary taxes would imply an unambiguous worsening of the current account to GDP ratio.

To summarize, we would argue that the general implication of letting taxes be distortionary in a neoclassical model is that reductions in the deficit via tax increases can have real effects, effects different than those arising from deficit reductions due to government spending cuts. In the latter case, private consumption will increase, while output will at worst remain unchanged and may rise if current output depends negatively on future expected taxes. In the former case of tax increases with no change in expected government spending, output will fall and consumption will at best remain unchanged and may fall if a government spending cut had been expected. The expectations view of fiscal policy therefore appears capable of explaining the very different effects of government spending cuts and tax increases which Giavazzi and Pagano (1990) argued characterized numerous countries in the 1980's.

VII. Conclusions

We proposed a model in which the effects of fiscal policy on current economic activity depend on what sort of expectations of future policy are engendered, focusing in particular on the consumption effects of expected discrete changes in future fiscal policy. A simple model in which the ratio of government spending to GDP follows regulated Brownian motion predicts a nonlinear relation between consumption and government spending, with jumps in the consumption to GDP ratio at certain points. We observe this type of nonlinear relation between the consumption to GDP ratio and the government spending to GDP ratio in Denmark, Ireland, and several other countries. Other specifications for the process of government spending which capture the qualitative nature of stabilizations would have similar effects.

We believe that the results we obtain are more general than the specific application we present, and that the simple model in this paper should be read as an illustration of a general phenomenon. The results indicate several directions for further research.

The expectations view of fiscal policy indicates, among other things, that a neoclassical model may generate observable implications that look quite Keynesian. In a nonmonetary closed economy with fixed output, an increase in government spending which induces the expectation of a future cut will cause interest rates to rise. If effort were endogenous, increases in g would imply expansions in output as consumers attempt to increase current income. We are currently working on a two country model in which increases in g at home induce increases in world interest rates and world output, and a deterioration of the home country's trade balance. On the empirical side, verification of the role of net foreign assets and distortionary taxation is important.

It would of course be beneficial to develop a way of formally estimating and testing a model stressing fiscal expectations. Unfortunately, however, this is very difficult, or even impossible, given the infrequent nature of stabilizations and drastic changes in fiscal regimes and the short data span. The model does however deliver predictions that are in broad agreement with the experiences of a number of countries and, on a more general methodological level, points out possible problems with applying simple time series methods when economic considerations suggest significant nonlinearities in behavior.

References

Alesina, Alberto and Allan Drazen (1990), "Why Are Stabilizations Delayed?," *American Economic Review*, forthcoming

Bertola, Giuseppe (1990), "Discussion of Miller, Skidelsky, and Weller," in Rudiger Dornbusch and Mario Draghi (eds.), *Capital Markets and Debt Management*

Bertola, Giuseppe (1991), "Continuous-Time Models of Exchange Rates and Intervention," working paper

Dornbusch, Rudiger (1989), "Credibility, Debt and Unemployment: Ireland's failed stabilization," *Economic Policy* **7**, 173-209

Drazen, Allan (1990), "Discussion of Giavazzi and Pagano," in Olivier Blanchard and Stan Fischer (eds.), *NBER Macroeconomics Annual 1990*, Cambridge, MA: MIT Press

Drazen, Allan and Vittorio U.Grilli (1991), "The Benefits of Crises for Economic Reform," NBER working paper no.3527

Drazen, Allan and Elhanan Helpman (1987), "Stabilization with Exchange Rate Management," *Quarterly Journal of Economics* **11**, 835-855

Drazen, Allan and Elhanan Helpman (1990), "Inflationary Consequences of Anticipated Macroeconomic Policies," *Review of Economic Studies* **57**, 147-64

Giavazzi, Francesco and Marco Pagano (1990), "Can Severe Fiscal Contraction be Expansionary? Tales of Two Small European Countries," in Olivier Blanchard and Stan Fischer (eds.), *NBER Macroeconomics Annual 1990*, Cambridge, MA: MIT Press

Krugman, Paul K., and Marcus Miller (eds.)(1990) *Exchange Rates and Currency Bands*

Manasse, Paolo (1991), "Are Taxes Too Low?," working paper, I.G.I.E.R., Università Bocconi

Miller, Marcus, Robert Skidelsky, and Paul Weller (1990), "Fear of Deficit Financing: Is it rational?," in Rudiger Dornbusch and Mario Draghi (eds.), *Capital Markets and Debt Management*

Sargent, Thomas and Neil Wallace (1981), "Some Unpleasant Monetarist Arithmetic," *Federal Reserve Bank of Minneapolis Quarterly Review* **5**, 1-17

Figure 1: Denmark

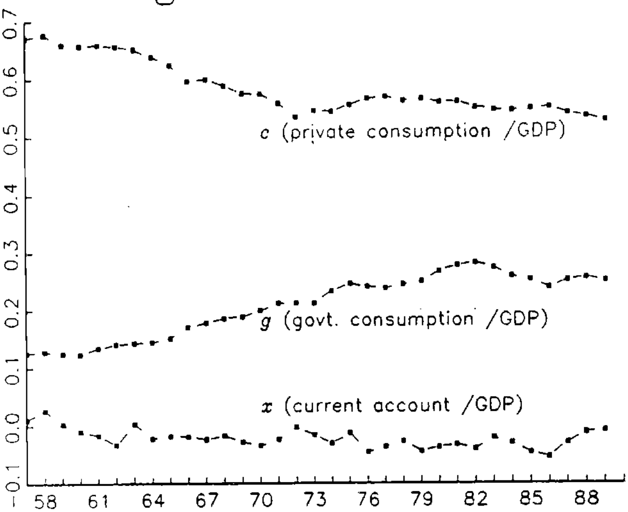


Figure 2: Ireland

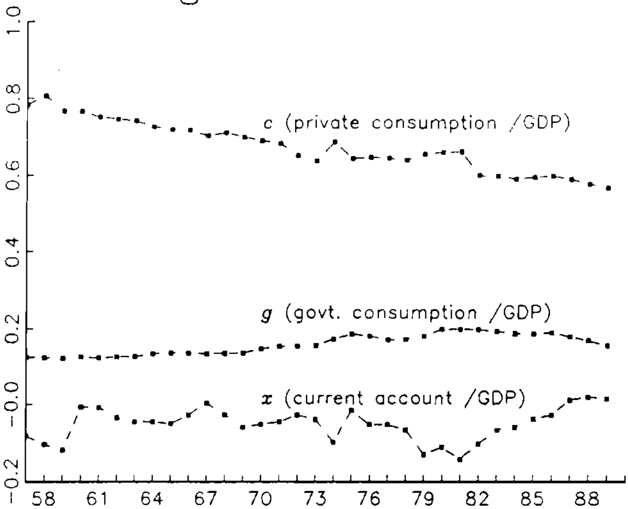


Figure 3: Denmark

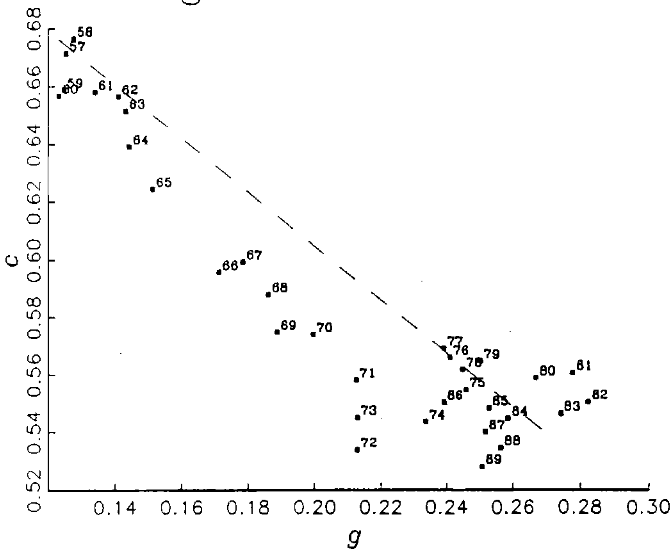


Figure 4: Ireland

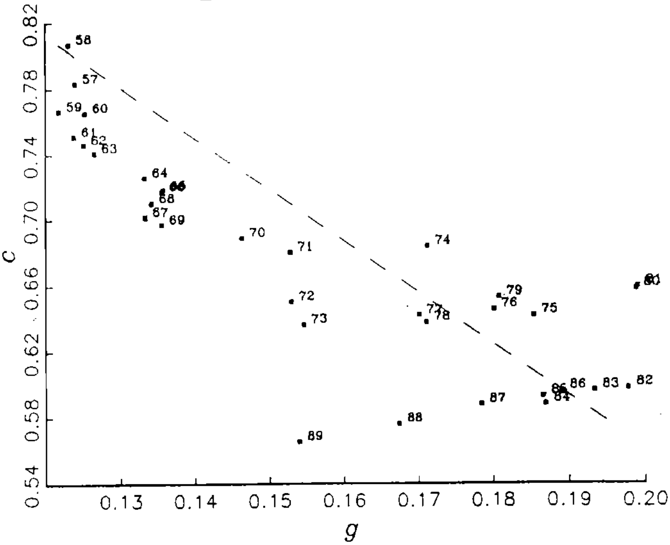


Figure 5: Model

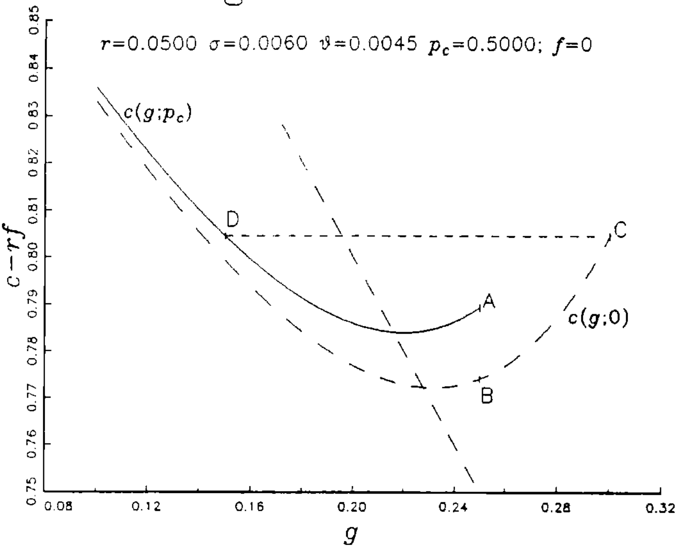


Figure 6a: Belgium

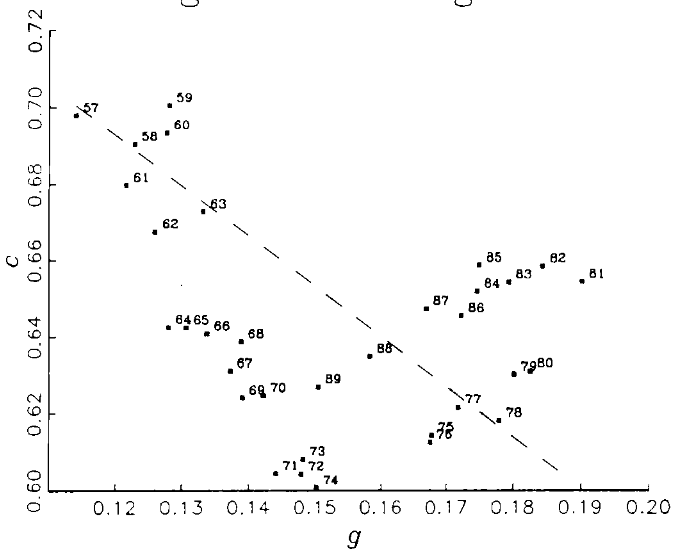


Figure 6b: Sweden

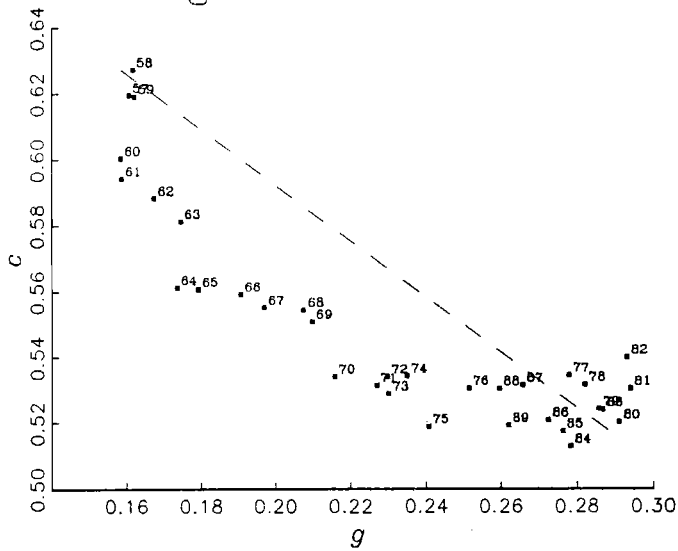
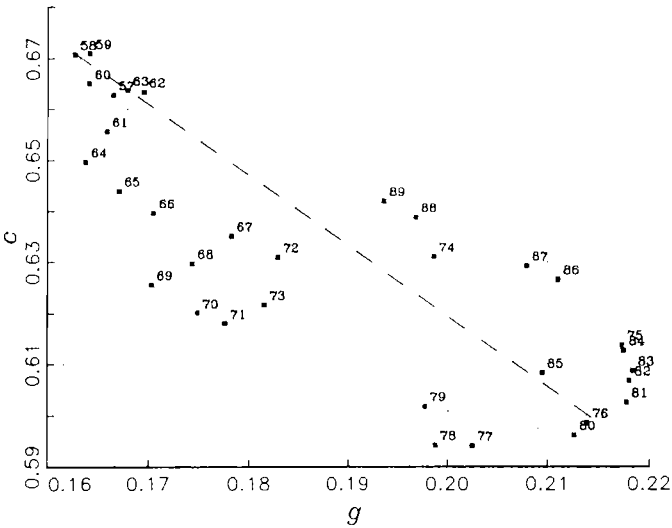


Figure 6c: U.K.



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