Uncertainty and Fiscal Cliffs*

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Abstract

This paper develops and studies a model of the uncertainty generated by expiring tax provisions, such as those associated with the recent "Fiscal Cliff" in the US. The economy progresses towards a specific date at which a time an change in distortionary tax rates may or may not take effect. This source of uncertainty affects the level of expected values of future variables, not simply their variances. As the cliff nears, uncertainty about future tax rates slows investment, consumption, and labor. If the cliff is avoided, the economy experiences a significant rebound in activity, with above-average growth for several periods after the resolution of uncertainty.

JEL Classification: E20, E60, E62
Keywords: Fiscal Policy, Uncertainty, Distorting taxation

*The views expressed herein are solely those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of Kansas City or the Federal Reserve System.

1. Introduction

2. Literature

Key papers include Bloom (2009) Bloom, Floetto, Jaimovich, Saporta-Eksten, and Terry (2012) Fernández-Villaverde, Guerrón, Rubio-Ramírez, and Uribe (2011) Fernández-Villaverde, Guerrón, Kuester, and Rubio-Ramírez (2012) Basu and Bundick (2012) and Christiano, Motto, and Rostagno (2012).

3. Model Overview

To describe private sector decisions, we initially use a neoclassical growth model with inelastic labor supply and distorting taxes levied on household income. Specifically, the representative agent maximizes the following

$$\max_{\{c_t,k_{t+1},b_{t+1}\}_{t=0}^{\infty}} E_t \sum_{t=0}^{\infty} \beta^t u(c_t), \qquad 0 < \beta < 1, \tag{1}$$

subject to

$$c_t + k_{t+1} + b_{t+1} \leq (1-\tau_t) r_t k_t + (1-\delta) k_t + (1+r_t^b) b_t + h_t, \tag{2}$$

where values for b_t and k_t represent the per-capita stocks of outstanding government bonds and capital at the start of the period. Households take the real return on bonds r_t^b, the income tax rate, τ_t, the real wage, w_t, the real rental rate on capital, r_t, lump-sum transfers, h_t, and the depreciation rate, δ, all as given. Preferences are over consumption, c_t, and are represented by u, which is strictly increasing, concave, and twice continuously differentiable.

The perfectly competitive, representative firm solves a series of one-period problems, given by

$$\max_{k_t} f(k_t) - r_t k_t, \tag{3}$$

where $f(k_t)$, is a constant returns-to-scale production technology. The real rental rate, r_t is taken as given by the firm. Assuming an interior solution, firms maximize profits by equating marginal products with factor prices.

We assume log-utility and Cobb-Douglas production,

$$u(c_t) = \ln(c_t) \tag{4}$$

$$f(k_t) = k_t^{\alpha}. \tag{5}$$

All uncertainty is associated with the income tax rate, which follows

$$\tau_t = \gamma_0(S_t) + \gamma b_{t-1} + \varepsilon_t, \tag{6}$$

where $\varepsilon_t \sim N(0, \sigma^2)$ and $E[\varepsilon_t \varepsilon_s] = 0$ for $s \neq t$. Innovations in ε_t represent intra-regime shocks and changes in S_t represent regime shifts. The intercept in (6) governs the regime-dependent average level of taxation and debt. The government uses all tax revenue to purchases a constant amount of goods from the private sector.

To focus the analysis on the effects of changes in the tax rate, government consumption expenditures, G_t, and aggregate lump-sum transfers, H_t, are constant, so $G_t = \overline{G}$ and $H_t = \overline{H}$ for all t. Given these restrictions, the tax rate must adjust to satisfy the flow constraint for government debt,

$$B_{t+1} = \left(1 + r_t^b\right) B_t + \overline{G} + \overline{H} - \tau_t Y_t, \tag{7}$$

where τ_t is the tax rate, B_t is aggregate government bonds maturing at time t and $Y_t = f(k_t)$ denotes real output. The government must pay the real rate of return of r_t^b on outstanding bonds. In equilibrium, the quantity of bonds willingly held be the representative agent, b_t, must equal the aggregate level of government debt, B_t.

Given there is no long-run growth and the real interest rate is positive, the transversality condition holds as long as debt does not grow faster than the real interest rate. To satisfy this condition, we calibrate the tax rule to generate sufficient tax revenue to return the debt-to-output ratio to its long-run average. In linearized versions of this model, the condition requires $\gamma > 1/\beta$, which is satisfied in each fiscal regime.

In this framework, a shift from a low average tax regime to a high average tax regime entails transition dynamics that may not immediately be intuitive. For example, a low average tax regime has a steady state level of debt lower than a regime with higher taxes on average. The reason being that higher taxes can support higher interest costs in the steady state, so debt is correspondingly higher. In the simulations below, we consider a transition from an average high tax regime, which has a higher average debt level, to a lower tax regime. However, the transition to the low tax regime requires a transitional period when debt is paid down, which requires taxes to temporarily rise.

Figure 1 illustrates the flow of information and how uncertainty is resolved. For $S_t = 0$, there is probability p_1 that the fiscal authorities will set the existing tax rate to sunset after N periods. After N periods, households attach probability q_0 to the outcome that keeps the average tax rate at τ_0 permanently. Households, however, also attach probability q_1 to the outcome that adjusts the average tax rate to τ_1. As an example, the transition matrix for $N = 4$ is as follows

$$\Pi = \begin{bmatrix} p_0 & p_1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & q_0 & q_1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}. \tag{8}$$

Since households understand tax rates could change after the N period horizon, they begin adjusting their behavior once the sunset provision is passed - that is, once $S_t = 1$. Several practical examples of such legislation exist. In the US, the tax reforms originally passed in 2001 and 2003 were set to expire at the end of 2010, but were subsequently extended for a year. The debt ceiling negotiations in the US in August of 2011 set up the 2012 ”fiscal cliff” scenario that many analysts pointed to as weighing on the economy in the latter portion of 2012. More broadly, several tax and spending provisions are often set to expire after a given period, so households and firms understand the timing of when future fiscal policies are most likely to change.

Figure 2 illustrates the impact of transition from $S_t = 0$ to $S_t = 1$ in period 1. The tax rates does not adjust in any meaningful amount, but investment falls due to the expectation of higher taxes starting in period 5. In this example, tax rates are ultimately held at τ_0, but the spectre of higher taxes on capital income in the future caused households to substitute away from investment and towards consumption.

(Aside: From this point, we can address uncertainty in several different ways. One approach would be to keep the expected value of average taxes across regimes the same, but have larger variation in possible outcomes. We can also play around with the variance to the shock in the tax rule, uncertainty about the feedback coefficient int the tax rule (γ) etc. Also, since we solve the nonlinear model, we can play around with skewed shock structures.)

Key messages:

- Uncertainty shocks work most powerfully through shifting expected values of future variables, not just the variances of their distributions.
- If expected values shift, then there should be some form of “payback” after uncertainty is resolved. A pure mean-preserving shock should not necessarily result in payback, or at least only a modest amount.

Next steps:

- Extend the model, most importantly by adding GHH preferences to generate positive comovement of consumption and investment.
- An empirical section assessing the impact of policy uncertainty across different categories of investment.

Figure 1: Fiscal uncertainty

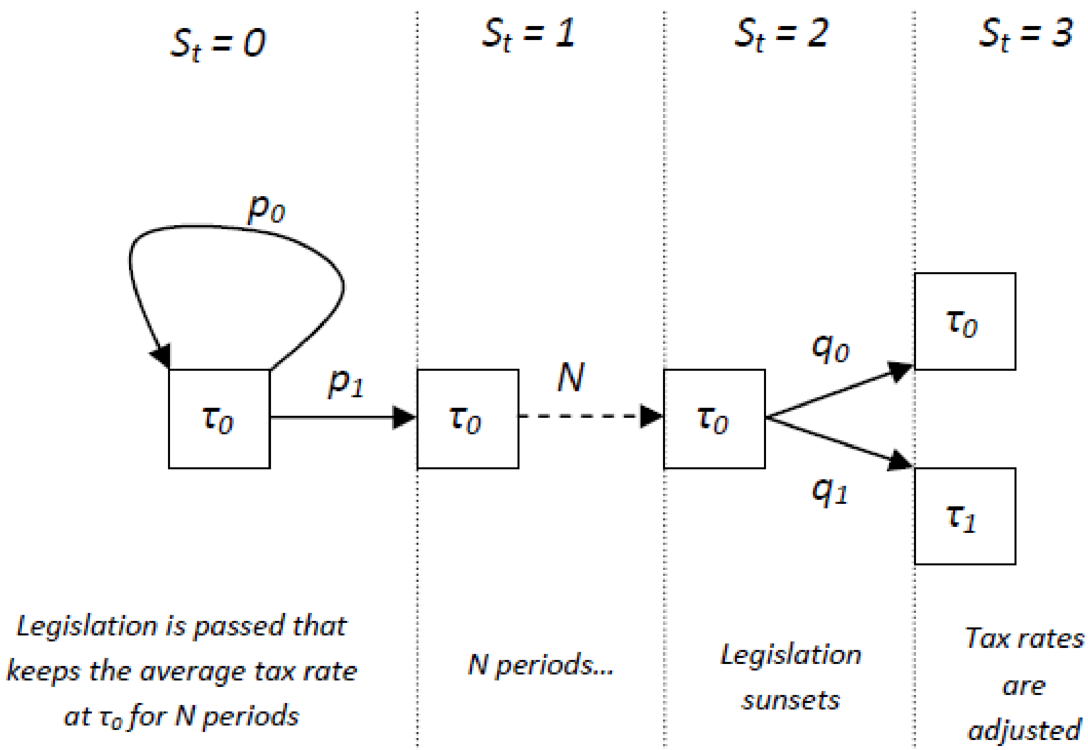
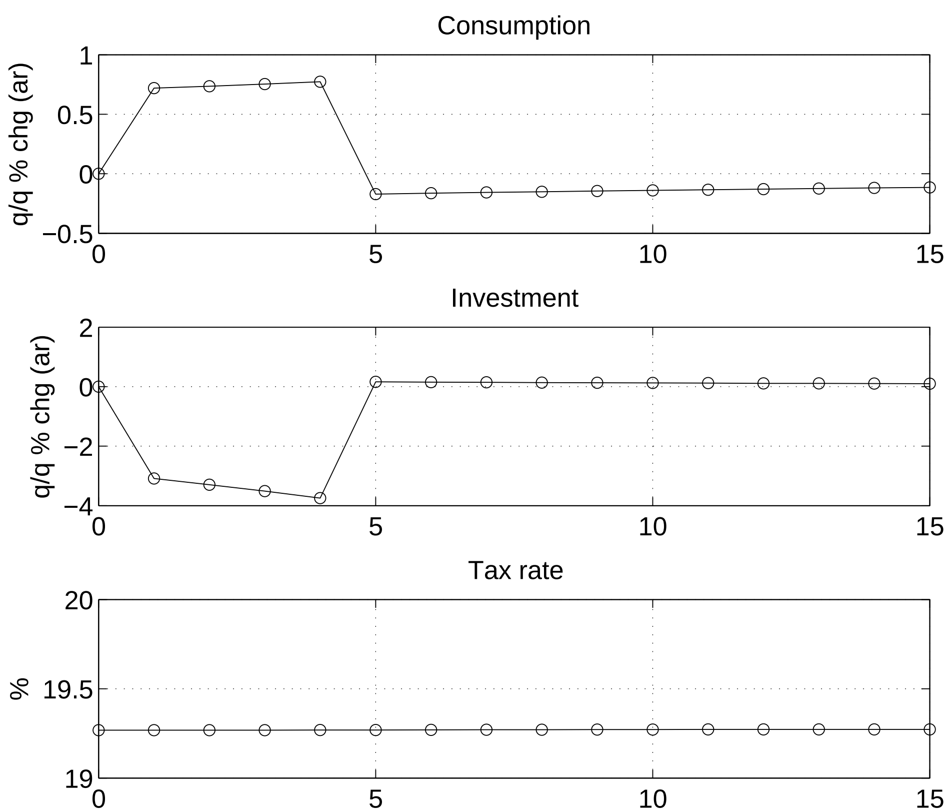


Figure 2: IMPACT OF A SHOCK TO EXPECTED FUTURE TAXES



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