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Toward a Taylor rule for fiscal policy

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ABSTRACT

In DSGE models, fiscal policy is typically described by simple rules in which tax rates respond to the level of output. We show that there is only weak empirical evidence in favor of such specifications in US data. Instead, the cyclical movements of labor and capital income tax rates are better described by a contemporaneous response to hours worked and investment, respectively. We show that conditioning on these variables is also desirable from a normative perspective as it significantly improves welfare relative to output-based rules.

1. Introduction

Recent empirical work provides evidence that there is a systematic contemporaneous response of fiscal policy to the state of the economy (e.g. Taylor, 2000; Auerbach, 2002). DSGE modelers seek to capture this fact by specifying simple fiscal rules where tax rates respond to output (e.g. Leeper et al., 2010; Forni et al., 2009; Traum and Yang, 2011). Nevertheless, the empirical plausibility of output-dependent tax rates has never been conclusively investigated. As we show by estimating a DSGE model with such output-dependent tax rules using US data, it is hard to find evidence in favor of this specification. For this reason, we use the estimated model to investigate, whether conditioning on output is justified from a normative perspective. In particular, we determine which simple tax rules best approximate Ramsey optimal policies. In doing so, we find that the capital income tax rate optimally conditions on investment and that the labor income tax rate optimally conditions on hours worked. Re-estimating the model provides empirical evidence in favor for such a specification and, moreover, provides reaction coefficients which are significantly different from zero. We conclude that empirical researchers should use such tax rule specifications for describing fiscal policy. As we show, the response of output to an unanticipated tax change would otherwise be systematically overestimated.

In a related study, Benigno and Woodford (2006) determine the feedback variables in fiscal feedback rules and show that a complete description of optimal policy delivers complex rules depending on a large number of variables. For the sake of empirical relevance, this paper limits its focus to simple feedback rules rather than a complete description of optimal policy (e.g. Kirsanova et al., 2007). We follow the approach in Schmitt-Grohé and Uribe (2006), who use simple rules which "[...] are defined over a small set of readily available macro indicators and are designed to ensure local uniqueness of the

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rational expectations equilibrium". We consider nine such macroeconomic indicators as potential conditioning variables for our simple rules.

The paper also contributes to the literature by proposing a new way of approximating optimal policy using simple linear rules. This is motivated by the observation that the standard approach for constructing optimal simple rules pioneered by Schmitt-Grohé and Uribe (2007) becomes computationally burdensome once a large number of conditioning variables are considered. In our approach we first solve for Ramsey optimal policy in the estimated model. Then, we simulate the model and estimate policy feedback rules using Bayesian methods which incorporate all nine potential variables. We employ the method postulated by Iskrev (2010) to select the variable which influences most the tax rates' variance at the optimal allocation. Applying this procedure points to using investment for the capital income tax rule and hours for the labor income tax rule. Conditioning on these variables leads to significant improvements in welfare relative to optimal simple rules that condition on output. In particular, it eliminates welfare losses equivalent to more than 0.4% consumption units (relative to Ramsey optimal policy).

The remainder of the paper is organized as follows: Section 2 presents the DSGE model with the tax rules. In Section 3, we estimate the model and show that there is only weak empirical evidence in favor of output in tax rules. Section 4 determines the conditioning variable that is most important for approximating optimal policy. In Section 5, we discuss the relevance of variable selection in fiscal policy rules with respect to welfare, empirical evidence, and policy analysis. The last section concludes.

2. The model

We assume that the private sector and the monetary authority can be described by a conventional New Keynesian DSGE model in the succession of Smets and Wouters (2007). The model includes several real frictions: internal habit formation, capital utilization, and investment adjustment costs. It also features two nominal rigidities, one for wages and one for prices. The fiscal policy sector is modeled by wasteful government spending, transfers, and distortionary taxes on capital and wages.

Since the model is well known, we keep the description brief. The maximization problem of households, final goods firms, and intermediate goods firms together with the corresponding first-order conditions can be found in the online appendix. There, we also provide the solution of the steady-state and a complete list of the log-linear equations, which are necessary to solve the model.

2.1. Households and firms

The economy features a continuum of households indexed by $i \in [0,1]$. We assume that households are homogeneous with respect to consumption and asset holdings in equilibrium, i.e. households receive the net cash flow from state-contingent securities (ι). Households are heterogeneous with respect to wages and hours worked in equilibrium. Therefore, only labor services $l(i)$ provided by household i and wages $w(i)$ are indexed by i. Consumption c, bond holdings b, and capital k are not indexed.[1]

Consumers' preferences are characterized by the discount factor β, the inverse of the intertemporal substitution elasticity σ_c, and the inverse of the labor supply elasticity with respect to wages σ_l. The parameter h measures the internal habit persistence regarding consumption. ψ_l normalizes the steady-state number of hours worked. Life-time utility takes the following functional form:

$$E_t \sum_{t=1}^{\infty} \beta^t \left[\varepsilon_{q,t} \frac{(c_t - hc_{t-1})^{1-\sigma_c}}{1-\sigma_c} - \psi_l \frac{l_t(i)^{1+\sigma_l}}{1+\sigma_l} \right], \tag{1}$$

where $\varepsilon_{c,t}$ denotes a shock to the intertemporal choice of consumption. This shock follows a first-order autoregressive process. The flow budget constraint of household i is given by:

$$c_t + I_t + b_t = \left(1 - \tau_t^w\right) \frac{W_t(i)}{P_t} l_t(i) + \left(\left(1 - \tau_t^k\right) r_t^k u_t - \phi_t(u_t)\right) k_{t-1} + \frac{R_{t-1} b_{t-1}}{\pi_t} + \left(1 - \tau_t^k\right) d_t + \iota_t(i) + \tau_t^T. \tag{2}$$

The household invests I into capital k. The rental rate on capital is denoted by r^k and firms' dividends by d. The household receives transfers τ^T and pays distortionary taxes τ^w and τ^k on labor income and capital income respectively. Households hold government bonds b yielding nominal risk-free return R. Additionally, the model features varying utilization of private capital. The cost of varying the intensity of capacity utilization is given by $\phi(\cdot)$. The law of motion for private capital is given by

$$k_t = (1-\delta) k_{t-1} + \varepsilon_{i,t} \left[1 - s\left(\frac{I_t}{I_{t-1}} \right) \right] I_t. \tag{3}$$

[1] Throughout the model description, upper-case letters denote nominal variables and lower-case letters real variables. An exception is investment, which is always expressed in real terms as I.