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A note on error-correcting parameters in the fiscal reaction function for ADAM

Resumé:

This note presents how varying error-correction parameters influence the response of income tax rate and unemployment rate in an experiment on higher public purchase. The result shows that if we speed up the adjustment of primary surplus and unemployment gap towards their targets, the reaction of the income tax rate and unemployment rate becomes more volatile.

Introduction

In the paper 'Fiscal Reaction function for ADAM targeting primary surplus and unemployment gap', we made the fiscal reaction function for ADAM target primary surplus and unemployment gap where the income tax rate responds negatively whenever the public primary surplus is positive and whenever the unemployment rate is higher than the long-run unemployment rate. As described, the inclusion of unemployment gap in the reaction function combined with small error-correction parameters of 0.05 make the income tax rate attain its long-run solution without overshooting. In addition, the labor market response exhibits lower volatility. We now make a sensitivity analysis asking how changes in the error-correcting parameters affect the dynamics of the income tax rate and unemployment rate.

The error-correction parameters determine how the tax rate reacts whenever the primary surplus and unemployment gap deviate from their targets. In this regard, the error-correction parameters indicate how strongly the tax rate reacts in order to 1) correct the primary surplus toward its target bt (normally zero) and 2) correct the unemployment gap toward its target ut (normally zero).

In this note we consider a public purchase experiment and evaluate how higher and lower error-correcting parameters affect the response of the unemployment rate and income tax rate.

Error-correction parameters $ctsysp1$ and cu

The error-correcting parameters, $ctsysp1$ and cu, have been set by trial and error and the fiscal reaction function is formulated as:

$$tsysp1 = \frac{\left(5 * tsysp1_{-1} + \sum_{i=1}^{i=15} tsysp1_i\right)}{20} - ctsysp1\left[\frac{\left(Tfn\_o - \left(Tin\_o - Tirn\_o\right)\right)}{Y} - bt\right] - cu\left[\left(bulb - bulbw\right) - ut\right]$$

In the previous paper, we used $ctsysp1 = cu = 0.05$. The choice of error-correcting parameters is based on two conditions: the parameters should reduce the volatility in the labor market and make the income tax rate constant in steady state.

In the long run, the primary surplus target, bt, is zero as long as we have a growth-corrected interest rate of zero in a normal baseline, and the unemployment gap target, ut, is zero if the constant term in the Phillips curve balances the impact from inflation and productivity growth. The parameter size of 0.05 indicates that the primary surplus and unemployment gap are corrected at a speed of 5% per year their target. Obviously, one cannot reach two goals with one instrument, but in the long run, the unemployment gap is set to zero by the crowding out mechanism in ADAM. Thus, in the long run we are using the income tax to reach only one goal, which is to stabilize the public budget.

As depicted in figure 1, when $ctsysp1$ increases to 0.1, the response of unemployment becomes slightly more volatile and this reflects the slight impact on the income tax rate, tsysp1 (figure 2). A higher speed in the primary surplus adjustment seems to increase the cyclicality in the labor market. Consequently, it is tempting to reduce $ctsysp1$, but we get no convergence for $ctsysp1 = 0.025$, so the chosen 0.05 seems close to the lower bound.

If the other parameter cu is increased from 0.05 to 0.2, the effect on the volatility of unemployment is not clear (figure 3) but the unemployment rate seems to respond a little faster while the income tax rate becomes a little more cyclical (figure 4). In general, when we increase the error-correcting parameter cu from 0.05, it decreases the medium term stability of the income tax rate without clearly reducing the volatility of unemployment.
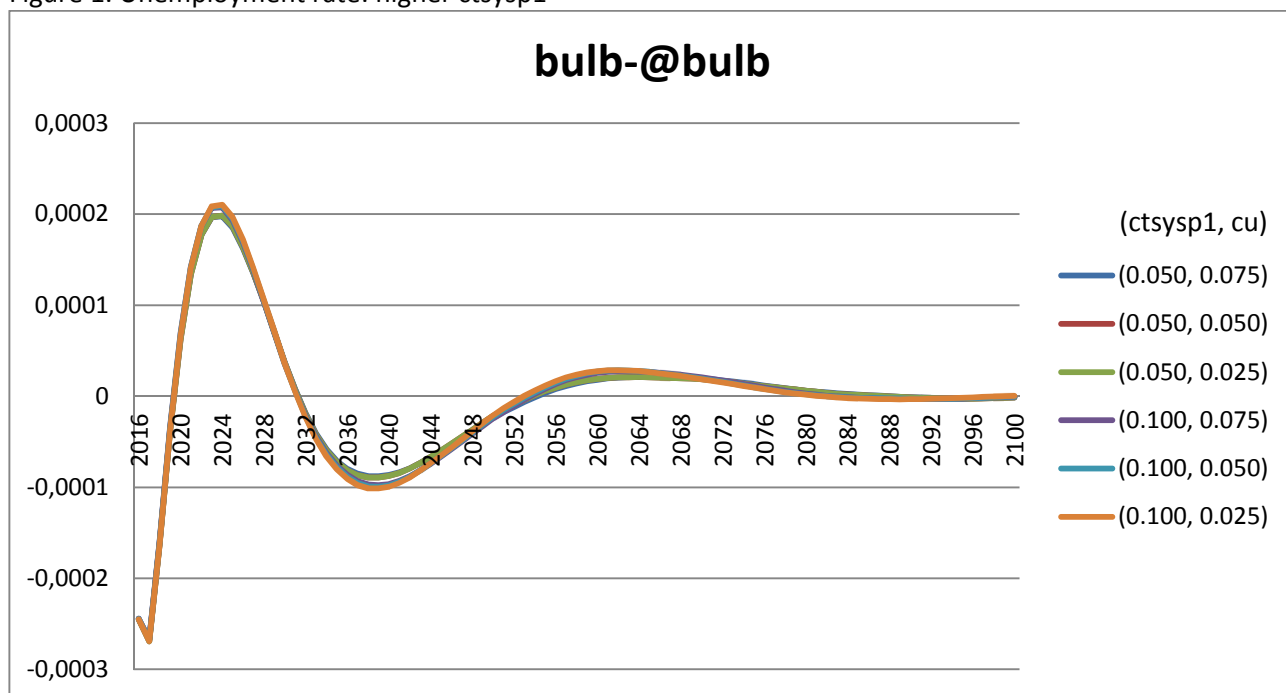
Figure 1. Unemployment rate: higher ctsysp1
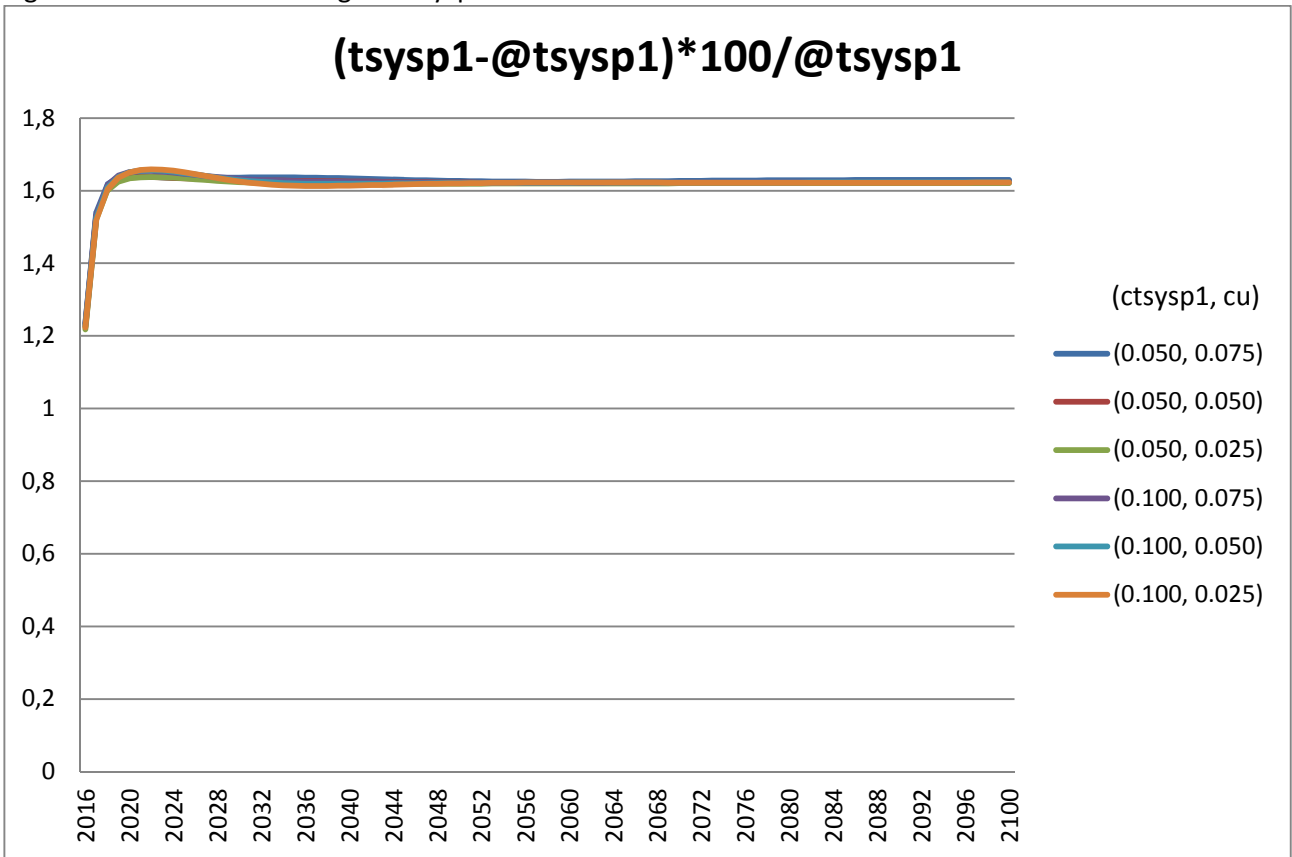
Figure 2. Income tax rate: higher ctsysp1

(tsysp1-@tsysp1)*100/@tsysp1

(ctsysp1, cu)
- (0.050, 0.075)
- (0.050, 0.050)
- (0.050, 0.025)
- (0.100, 0.075)
- (0.100, 0.050)
- (0.100, 0.025)

Figure 3. Unemployment rate: higher cu

bulb-@bulb

(ctsysp1, cu)
- (0.050, 0.200)
- (0.050, 0.150)
- (0.050, 0.075)
- (0.050, 0.050)
- (0.050, 0.025)

Figure 4. Income tax rate: higher cu

(tsysp1-@tsysp1)*100/@tsysp1

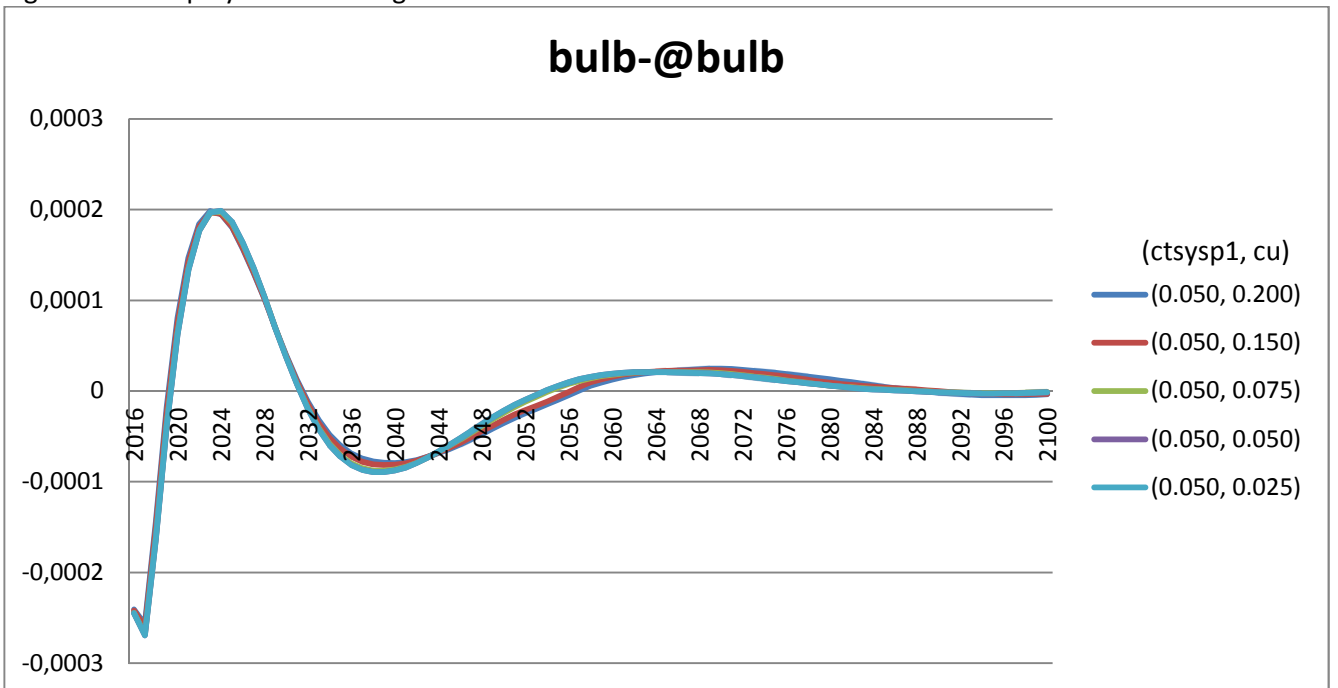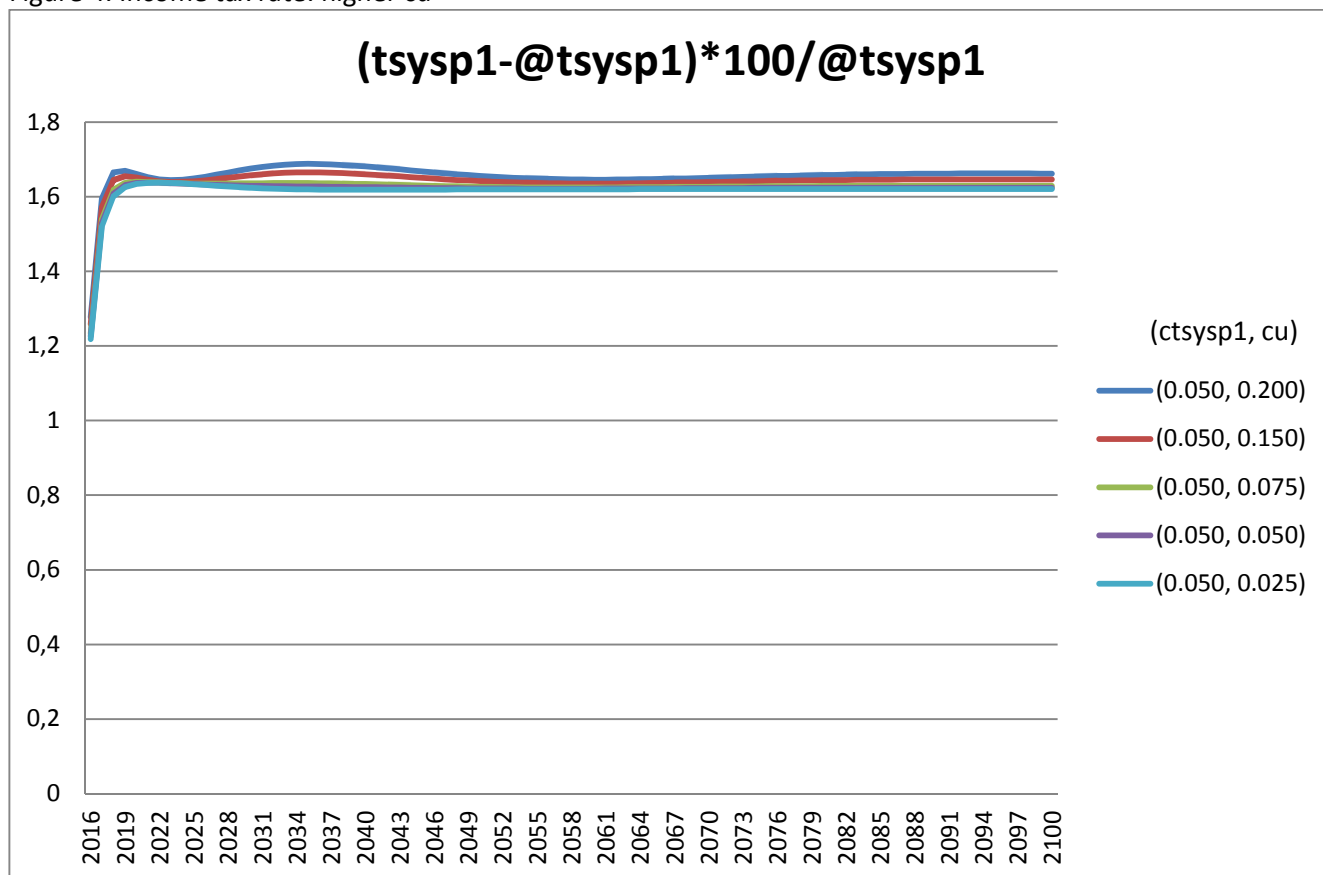**Conclusion**

This note highlights how changes in the error-correction parameters of the fiscal reaction function affect the multiplier response of unemployment and income tax rates for increased public purchase experiment. The experiments indicate that setting error-correcting parameters $ctsysp1 = cu = 0.05$ may be an appropriate choice.

References:

Amenu Temesgen Kitesa and Dan Knudsen (2015), Fiscal Reaction function for ADAM targeting primary surplus and unemployment gap, working paper, Denmark Statistics.