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Optimal choice of monetary policy instruments under velocity and fiscal shocks

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ABSTRACT

This paper, in the spirit of Poole [Poole, William, 1970. The Optimal Choice of Monetary Policy Instruments in a Simple Macro Model. Quarterly Journal of Economics, 84, 192–216.], studies how differently monetary and fiscal shocks influence the appropriate choice of the monetary policy regime. Velocity shocks are introduced by embedding a stochastic cash-in-advance constraint within the New Keynesian framework. In addition to optimal policy under discretion, three classic rules, interest rate targeting, monetary targeting, and the Taylor rule are ranked under both fiscal and velocity shocks. The non-stationarity of prices under the Taylor rule makes it inferior to the other rules under which prices are stationary. Monetary targeting, by stabilizing aggregate demand under fiscal shocks, outperforms interest rate targeting, while the latter provides a better insulation against velocity shocks. Monetary targeting (under fiscal shocks) and interest rate targeting (under velocity shocks) even outperform the optimal policy under discretion for sufficiently high intertemporal elasticities of consumption substitution.

1. Introduction

How does the nature of shock influence the choice of a monetary policy instrument? Poole (1970), using a stochastic IS-LM model in a closed economy setting with reduction in variability of aggregate output as the yardstick, showed that shocks indeed mattered for the choice of an appropriate monetary policy instrument. The basic conclusion was that a fixed monetary aggregate better stabilizes output by allowing offsetting interest rate movements under demand (IS) shocks, whereas a fixed interest rate insulates the real side of the economy by letting the money supply adjust to the shocks originating in the money market.

This paper revisits the Poole's instrument problem in a closed economy that faces nominal rigidities in the form of Calvo style staggered price adjustment. Within this setting, we study an economy that experiences demand (government expenditure) and monetary (velocity) shocks.[2] For each shock, we welfare-rank three simple rules, namely, interest rate targeting, monetary targeting, and the Taylor rule, by comparing them with the optimal policy under discretion. The welfare metric, expressed in terms of the output gap (defined as the difference between the actual and the *efficient* level of output) and inflation is obtained as a quadratic approximation of the household's utility. Our results identify interest rate targeting as the best rule under velocity shocks, whereas monetary targeting performs best under fiscal shocks. The performance of these rules vis-à-vis discretion however crucially depends on the intertemporal elasticity of consumption substitution. Specifically, for high (low) elasticities we find that interest rate rule under velocity shocks and monetary targeting under fiscal shocks perform better (worse) than discretion.

A key feature of our model is the introduction of a stochastic cash-in-advance constraint within the New Keynesian framework of Clarida, Galí, and Gertler (1999). The standard model as exemplified in Clarida, Galí, and Gertler (1999) is a money-in-the-utility function (MIUF) model with preferences separable in consumption and real balances. Changes in money therefore play a limited role in determining the dynamics of real variables. We follow Alvarez, Lucas, and Weber (2000), and introduce velocity shocks as fluctuations in the fraction of current income that households can utilize for current purchases. The cash-in-advance constraint implicitly taxes labor at a rate that fluctuates endogenously with nominal interest rates and shocks to the velocity of money. As a result, nominal interest rates as well as shocks to velocity now appear in the Phillips curve. Thus, complete price stability is not optimal under velocity shocks (akin to exogenous cost-push shocks). Additionally, the interest rate term in the Phillips curve, by raising the cost of stabilizing inflation in terms of output gap (i.e., the cost push effect), endogenously

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[2] The choice of these two shocks is in the spirit of Poole's analysis, which abstracts from productivity shocks since the 'potential' output is assumed to remain fixed. Moreover, many previous researchers have carefully examined the performance of optimal monetary policy and simple rules in the case of productivity shocks. Gali (2003), for example found the Taylor rule, by responding to the output gap and inflation, allows more flexibility in nominal interest rate adjustment and thus dominates the other two simple rules. Similar conclusions can be drawn in our framework.

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generates an inflation/output gap trade-off. Consequently, complete price stability is never optimal.

Fiscal shocks, as in Ravenna and Walsh (2006), are introduced by assuming that the government spends a stochastic fraction of domestic output. Under our assumption, the more the economy produces the more the government spends (i.e., wastes). The output produced under a competitive equilibrium therefore differs from its efficient level that a planner will choose. Once this distortion is accounted for, as in Ravenna and Walsh (2006), fiscal shock not only affects the IS curve but also appears as a cost-push shock in the Phillips curve. An inflation-output gap trade-off emerges and once again complete price stability is not optimal.

Our work is closely related to Gali (2003) who uses the standard MIUF framework with Calvo style staggered price and compares the optimal policy with the above three rules in a closed economy, but considers only productivity and fiscal shocks. Gali abstracts from the distortionary effects of fiscal shocks, which are modelled as exogenous shocks to government expenditure. This assumption renders complete price stability to be optimal in his framework. Gali's framework therefore does not involve any conflict between stabilizing inflation and the output gap.[3] Then, as a result of the emphasis on price stability, the Taylor rule welfare ranks as the best rule for fiscal shocks. By contrast, monetary targeting, outperforms the Taylor rule in our model due the inclusion of the distortionary effect of fiscal shocks.

Collard and Dellas (2005) carry out a similar exercise in a closed economy MIUF setup with Calvo style staggered prices where they compare interest rate targeting with monetary targeting for productivity, fiscal, and money demand shocks. Their paper however focusses only on the simple rules and does not compare them with the optimal policy. Contrary to the popular notion, they find that monetary targeting outperforms interest rate targeting for money demand shocks (modelled as preference shocks). The key to this result, is the non-separabilty of consumption, leisure, and real balances in the utility function. While there is greater stability of output and inflation under interest rate-targeting, it is still welfare dominated by monetary targeting due to the strong negative covariance between consumption and leisure under the latter. By contrast we find that an interest rate peg not only better stabilizes output and inflation but also outperforms a monetary targeting regime from a welfare perspective. Our results differ because we introduce money demand shocks through a stochastic cash-in-advance constraint. This allows us to abstract from the money's direct role in the utility function: a feature that is in line with the contemporary literature on optimal monetary policy. Furthermore, the separability of consumption and leisure in the utility function in our model not only facilitates a simple, sharp, and insightful presentation of optimal policies, but also allows us to compare it with simple ad hoc rules in a straightforward manner.[4] Importantly, we find that for that for low values of intertemporal elasticity of consumption substitution discretionary policy outperforms the simple rules in the case of both fiscal and velocity shocks. However the money rule in the case of fiscal shocks and the interest rate rule in the case of velocity shocks outperform discretionary policy for high elasticities.

2. The model

The model consists of households, firms, and a government interacting in goods, asset, and labor markets. Households supply labor to firms and consume a composite good that can only be purchased with cash. Additionally, households can hold a risk free bond. Firms hire labor, produce, and sell differentiated goods to households and the government in monopolistically competitive goods markets. Households maximize the present value of expected utility, and firms maximize profits. It is assumed that the government's preference for consuming differentiated goods are identical to that of the households.

In what follows, variables with capital letters denote their levels, bars over them denote steady states, and lower case letters denote their log deviations from steady state, respectively, i.e., $x \equiv \ln(X) - \ln(\bar{X})$.

2.1. Households

A representative household consumes a composite consumption good, C_t, and values leisure, $1-N_t$, where N_t is the time devoted to market employment. The household maximizes its expected present value of utility:

$$E_t \sum_{s=1}^{\infty} \beta^i \left[\frac{C_{t+s}^{1-\sigma}}{1-\sigma} - \chi \frac{N_{t+s}^{1+\varphi}}{1+\varphi} \right], \tag{1}$$

where C_t is defined as

$$C_t = \left[\int_0^1 C_{it}^{\frac{\varepsilon-1}{\varepsilon}} dj \right]^{\frac{\varepsilon}{\varepsilon-1}} \quad \varepsilon > 1, \tag{2}$$

and where C_{it} denotes the consumption of good i produced by a monopolostically competitive firm i; there is a unit measure of such firms. Under this specification ε governs the price elasticity for the individual goods. The optimal allocation of expenditure within each category of goods yields the demand function

$$C_{it} = \left(\frac{P_{it}}{P_t} \right)^{-\varepsilon} C_t; \; P_t \equiv \left(\int_0^1 P_{it}^{1-\varepsilon} di \right)^{\frac{1}{1-\varepsilon}}, \tag{3}$$

where P_{it} is the price of good i and P_t is the price index.

The household begins any period with assets in the form of money balances and riskless bonds carried over from the previous period. Asset markets open first, where the household rebalances its asset portfolio and pays lump-sum taxes to the government. The household's accounting identity for the asset market transactions is given by

$$\hat{M}_t = M_{t-1} + R_{t-1} D_{t-1} - D_t - T_t, \tag{4}$$

where $\hat{M}_t$ denotes the cash balances that household carries to the goods market; R_{t-1} is the gross nominal interest rate on bonds; T_t is lump-sum taxes paid to the government.

After the asset markets close, the household proceeds to the goods market to purchase a consumption basket C_t, the price of which is given by P_t. Following Alvarez, Lucas and Weber (2000), we assume that the household gets to use only a fraction $V_t \geq 0$ of the current income (wages plus dividends) to purchase consumption goods in the current period. The cash-in-advance constraint in period t becomes

$$P_t \, C_t \leq \hat{M}_t + V_t [W_t \, N_t + \Pi_t], \tag{5}$$

where W_t is the household's nominal wage and Π_t are the profits from the firms. The remaining $(1-V_t)$ fraction of period t income and the cash left after purchasing consumption goods constitute the cash balances for the next period

$$M_t = (1 - V_t)[W_t N_t + \Pi_t] - P_t \, C_t + \hat{M}_t + V_t [W_t \, N_t + \Pi_t]. \tag{6}$$

[3] This property termed as "*divine coincidence*" by Gali and Blanchard (2006) arises because the gap between the flexible and the efficient level of output is constant and invariant to shocks.

[4] Ireland (2000) contrasts monetary targeting with a variant of the Taylor rule in a closed economy and finds that the interest rate rule performs better for both productivity and money demand shocks. However Ireland does not consider an interest rate peg and abstracts from an analysis of optimal policy.