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Robust monetary policy in a model with financial distress

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A B S T R A C T

We characterise optimal discretionary monetary policy responses to cost-push shocks and to financial distress in the presence of model uncertainty. Under robust control, the central bank reacts more aggressively to both types of shocks, and less to the lagged policy rate, than if the true model is known. We document how the objective to stabilise the policy instrument conflicts with the concern for robustness to model misspecification: the higher the weight on interest rate stabilisation in the loss function, the more the robust policy deviates from the optimal policy under rational expectations. Financial distress is akin to a contractionary demand shock and does not induce a policy trade-off; thus model uncertainty does not constrain monetary policy in the face of financial shocks.

1. Introduction

We characterise optimal monetary policy responses to cost-push shocks and to financial distress in the presence of model uncertainty. In particular, we examine the interaction between the policy maker's concern for robustness and his desire to avoid excessive volatility in interest rates. We do so by including a penalty on interest rate changes in the central bank's loss function, in addition to inflation and output gap volatility. There is no commitment device for future policy; the central bank sets the policy rate in a discretionary fashion.

The analysis is based on Goodfriend and McCallum's (2007) New Keynesian model with banking, where households need bank loans to make consumption purchases. Loan production uses labour and collateral as inputs. Financial distress is modelled as a negative shock to collateral.

We adopt the robust control approach of Hansen and Sargent (2008). The true data generating process, unknown to the agents, lies in the neighbourhood of a so-called reference model. Facing Knightian uncertainty, the policy maker is unable to formulate a probability distribution over plausible models. A robust policy is one that performs well in the worst possible outcome of a pre-specified set of models.

The paper aims to fill two gaps in the literature. First, robust monetary policy has not previously been applied to financial shocks. Second, the two policy objectives interest rate stability and robustness have not been analysed jointly in existing research.

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Our results can be summarised as follows. First, taking model uncertainty into account, the robust instrument rule implies stronger responses. The policy maker is more aggressive to both cost-push shocks and financial shocks. The more aggressive response is mirrored by a smaller degree of interest rate smoothing in the instrument rule. Second, the concern for instrument stability conflicts with the concern for robustness: the higher the weight on interest rate smoothing, the more the robust policy deviates from the optimal policy under rational expectations. Third, financial distress is akin to a demand shock in that it does not generate a policy trade-off. Consequently, the impulse responses to a financial shock in the worst possible outcome do not differ much from those under rational expectations. Thus, model uncertainty plays a minor role for policy in the face of financial distress.

The remainder of the paper is organised as follows. Section 2 presents the New Keynesian model augmented with a banking sector. In Section 3, we analyse optimal robust monetary policy under discretion. As an extension, we consider in Section 4 an alternative policy objective including the external finance premium. Section 5 concludes.

2. Model

Our analysis is based on the two-sector model of Goodfriend and McCallum (2007) to which we refer for a complete exposition. To keep the analysis simple, the model is specified in terms of an optimising problem for a representative household, which not only consumes a bundle of differentiated goods, supplies labour, and saves, but also produces the differentiated goods. In addition, the household operates a competitive bank. Bank loans are needed in order to purchase goods and are produced using monitoring effort (i.e. labour) and collateral as inputs. Collateral consists of government bonds and capital.

The representative household has a time endowment of unity, supplies labour to firms n_t^s and to the bank m_t^s, and consumes a Dixit–Stiglitz consumption bundle c_t^A. It maximises lifetime utility

$$E_0 \sum_{t=0}^{\infty} \beta^t [\phi \log(c_t^A) + (1-\phi)\log(1-n_t^s-m_t^s)], \tag{1}$$

where β is the subjective discount factor and ϕ denotes the weight on consumption in the utility function, subject to two constraints. The first is a budget constraint

$$c_t^A + tax_t + \frac{B_{t+1}}{P_t^A(1+R_t^B)} + \frac{H_t}{P_t^A} + q_t K_{t+1} = w_t(n_t^s + m_t^s) + \frac{B_t}{P_t^A} + \frac{H_{t-1}}{P_t^A} + q_t(1-\delta)K_t, \tag{2}$$

where tax_t represents lump-sum taxes, P_t^A is the price of one unit of the consumption bundle, B_{t+1} are government bonds that are purchased in t at price $1/[P_t^A(1+R_t^B)]$ and pay a return of one currency unit in $t+1$, H_t denotes money holdings and K_{t+1} is capital purchased at price q_t. Capital depreciates at rate δ. The household receives wage income $w_t(n_t^s+m_t^s)$.

The second constraint is a transaction constraint according to which consumption spending must be paid for with bank deposits D_t,

$$c_t^A = \frac{VD_t}{P_t^A}, \tag{3}$$

where V denotes velocity.

Firms use capital K_t and labour n_t to produce a differentiated good c_t subject to a Cobb–Douglas production function

$$c_t = K_t^{\eta} n_t^{1-\eta} \tag{4}$$

and a demand function

$$c_t = \left(\frac{P_t}{P_t^A}\right)^{-\sigma} c_t^A, \tag{5}$$

where P_t is the price of the differentiated good and σ denotes the elasticity of substitution between these goods.

The bank's balance sheet consists of high-powered money H_t plus loans L_t on the asset side and household deposits D_t on the liability side

$$H_t + L_t = D_t. \tag{6}$$

Let rr denote the (constant) ratio of high-powered money to deposits. Loan production is constrained by the following technology:

$$\frac{L_t}{P_t^A} = \mathcal{F}(b_{t+1} + A_t k q_t K_{t+1})^{\alpha} m_t^{1-\alpha} \quad 0 < \alpha < 1, \tag{7}$$

where $\mathcal{F}$ denotes banking productivity and k determines the relative efficiency of capital as collateral. Factor inputs are labour m_t and collateral $b_{t+1} + A_t k q_t K_{t+1}$, where $b_{t+1} = \frac{B_{t+1}}{P_t^A(1+R_t^B)}$. The variable A_t captures financial distress or a shock to the value of capital as collateral in loan production.