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Monetary Policy Effects on Financial Risk Premia

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Abstract

The effect of monetary policy on financial risk premia is analysed in a simple general equilibrium model with sticky wages and an optimising central bank. Analytical results show that equity risk premia and term premia are higher under inflation targeting than under output targeting, and that inflation risk premia are higher for policies that strike a balance between output and inflation stability (and achieve a social optimum) than for policies that target only one of them.

Keywords

Inflation risk premium, equity risk premium, term premium

JEL Classification

E52, E44, G12

1 Introduction

This paper uses a simple business cycle model with nominal frictions to analyse how financial risk premia depend on different types of monetary policy. The model is from Bénassy (1995), but extended by money demand shocks and an optimising central bank. This framework generates closed-form solutions (with few parameters) for risk premia, which allows for a simple discussion of the main effects that monetary policy may have on various risk premia.

There is a large literature on both the empirical and theoretical aspects of the link between monetary policy and asset prices. (For a survey of the field, see Sellin (2001).) The contribution of the current paper is to provide simple closed-form solutions for the risk premia. By necessity, this requires the model to be highly stylized—but it shares most main features of current new Keynesian business cycle models.[1]

The most closely related papers are those of Bakshi and Chen (1996) and Boyle and Peterson (1995), which both derive risk premia in monetary business cycle models. Monetary policy is modelled as an exogenous process, possibly correlated with output. The key difference of the current paper is that monetary policy is here systematic in the sense that it minimises a loss function. This allows for a clearer discussion of the relation between policy regimes and risk premia.

The paper is organized as follows: Section 2 summarizes the macro model, Section 3 derives optimal monetary policy for different policy preferences, Section 4 studies the risk premia induced by different types of policies and Section 5 concludes.

2 The Macro Model

This section summarizes the macro model. It relies heavily on Bénassy (1995), but I have added shocks to the money demand equation.

A Cobb-Douglas production function in terms of total factor productivity, Z_t, capital stock, K_t, and labour input, H_t, generates output, Y_t, according to

$$Y_t = Z_t K_t^{\alpha} H_t^{1-\alpha} \text{ with } 0 < \alpha < 1. \tag{1}$$

[1]For a more detailed modelling approach, which certainly is more conducive to empirical analysis, see, for instance, Buraschi and Jiltsov (2005).

Competitive firms rent labour and capital from households. To get a closed-form solution, capital accumulation is modelled as

$$K_{t+1} = AK_t^{1-\delta} I_t^{\delta} \text{ with } 0 < \delta \leq 1, \tag{2}$$

where I_t is investment. Hercowitz and Sampson (1991) interpret δ as the quality of new investment goods relative to old capital. With $\delta = 1$, new investment goods are so superior that old capital is useless—which also could be thought of as complete depreciation.

Households have logarithmic utility functions in terms of consumption, real money balances and leisure. They choose consumption, C_t, money holdings, M_t, and labour supply, H_t, to maximize expected discounted utility

$$\mathrm{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\ln C_t + \theta_t \ln M_t/P_t + V(1 - H_t)\right], \; \theta > 0, \tag{3}$$

where θ_t is a preference shock, P_t the current price level, V is a concave function and labour endowment is normalized to unity. Households spend on consumption, acquiring real money balances and investments. The budget restriction

$$C_t + M_t/P_t + I_t = H_t W_t/P_t + \Gamma_t K_t + \mu_t M_{t-1}/P_t \tag{4}$$

says that the spending must equal the sum of real wage earnings (W_t is the nominal wage rate), rental income from capital, and the real value of cash brought over from the previous period. The capital income is the rental rate times the capital stock, $\Gamma_t K_t$. A simplifying assumption in Bénassy's model is that cash brought over from $t-1$ carries a kind of interest rate ($\mu_t \neq 1$) whereby the "seigniorage" is paid back to the cash holders: money supply is $M_t = \mu_t M_{t-1}$. The aggregate resource constraint is that output equals consumption plus investment. In equilibrium, firms make zero profits. (We could add the value of installed capital, $q_t K_t$, to the right hand side of the budget constraint, and the value of purchased "old" capital to the left hand side—but in equilibrium these terms cancel.)

Nominal wage contracts are written one period in advance: the log nominal wage is set equal to the expected log nominal marginal product of labour—and households are obliged to supply any labour demand at the realized real wage.

Let lowercase letters denote logs and assume that log productivity is a stationary

AR(1) process

$$z_t = \rho z_{t-1} + \varepsilon_t, \text{ where } \varepsilon_t \text{ is iid } N(0, \sigma_\varepsilon^2) \text{ and } |\rho| < 1. \tag{5}$$

In practice, $0 \leq \rho < 1$ is the interesting case.

For notational simplicity, let u_t^m be the surprise in money supply ($m_t - \mathrm{E}_{t-1}\, m_t$) and u_t^ψ be the surprise in the money demand shock ($\psi_t - \mathrm{E}_{t-1}\, \psi_t$). Solving the model gives the following key features (see Appendix A for details). First, log consumption equals output plus a constant and the same holds for log investment. Second, a velocity equation holds with the money demand shock playing the role of velocity, $m_t - p_t - c_t = \psi_t$.[2] Third, labour demand equals $u_t^m - u_t^\psi$ plus a constant—so monetary policy can affect the real side of the economy by creating a surprise inflation.

By combining these results with the model equations, we can then write the dynamics of output as (a constant is suppressed)

$$\begin{aligned} y_t &= \mathrm{E}_{t-1}\, y_t + (1-\alpha)\,(u_t^m - u_t^\psi) + \varepsilon_t, \text{ with} \qquad (6) \\ \mathrm{E}_{t-1}\, y_t &= (\rho + \delta - 1) z_{t-1} + (1 - \delta + \delta\alpha) y_{t-1} - (1-\delta)(1-\alpha)(u_{t-1}^m - u_{t-1}^\psi), \end{aligned}$$

and inflation as

$$\begin{aligned} \pi_t &= \mathrm{E}_{t-1}\, \pi_t + \alpha(u_t^m - u_t^\psi) - \varepsilon_t, \text{ with} \qquad (7) \\ \mathrm{E}_{t-1}\, \pi_t &= (\mathrm{E}_{t-1}\, m_t - m_{t-1}) - (\mathrm{E}_{t-1}\, y_t - y_{t-1}) - (\mathrm{E}_{t-1}\, \psi_t - \psi_{t-1}). \end{aligned}$$

This way of writing the equilibrium highlights the innovations in period t, which will be the determinants of the risk premia.

The great advantage of this model is that the dynamic equilibrium is log-linear. This is the key to obtain analytical results for optimal policy and risk premia, without having to resort to approximations.

The model shares a number of key properties with other new Keynesian models: *(i)* money demand shocks move inflation and output in the same direction; *(ii)* productivity (supply) shocks move them in different directions; and *(iii)* monetary policy has an effect on both output and inflation.

[2] The (log) money demand shock, ψ_t, equals the logarithm of the discounted sum of expected future peference shocks, $\Sigma_{s=0}^{\infty} \beta^s\, \mathrm{E}_t\, \theta_{t+s}$.

3 Monetary Policy Rules

This section summarizes several possible monetary policy rules. All policy rules considered here are commitment rules, and there is no issue of inflation bias.

First, a passive policy keeps the money supply constant. This means that all money supply terms (u_t^m, $\mathrm{E}_{t-1}\, m_t$ and m_{t-1}) drop out from the dynamics of output and inflation.

Second, a policy that accommodates the demand shocks ($u_t^m = u_t^\psi$) will undo the only imperfection: sticky nominal wages. In a flexible-price equilibrium (no pre-contracted wages), labour demand is constant over time, but it equals $h_t = u_t^m - u_t^\psi$ with sticky wages. By increasing the money supply in response to money demand shocks (and thus "accommodating the shock), the policy stops any surprises to the nominal marginal product of labour.[3]

Third, standard monetary policy analysis focuses on a policy that aims at minimising a loss function in terms of the variances of output and inflation

$$L = \lambda\, \mathrm{Var}(y_t) + (1-\lambda)\, \mathrm{Var}(\pi_t) \tag{8}$$

$$= \lambda\, \mathrm{Var}(y_t) + (1-\lambda)\, \mathrm{Var}(\pi_t - \mathrm{E}_{t-1}\, \pi_t) + (1-\lambda)\, \mathrm{Var}(\mathrm{E}_{t-1}\, \pi_t). \tag{9}$$

(The second line follows from the fact that expected inflation and the expectation error must be uncorrelated.) We can directly observe that the policy rule will accommodate the demand shock, since that shock drives output and inflation in the same direction (see (6) and (7)). It is also immediate that the predictable part of the policy rule can be designed to make expected inflation constant—and thereby make $\mathrm{Var}(\mathrm{E}_{t-1}\, \pi_t) = 0$. This follows from the fact that predictable money supply cannot affect employment (compare the earlier discussion of labour demand), and that it (by definition) cannot affect the inflation surprise. The form of this predictable part of the policy rule is easily reconstructed from (7).

Leaving the predictable part aside, the policy surprise is thus of the form

$$u_t^m = u_t^\psi + \nu \varepsilon_t, \tag{10}$$

where ν depends on the model parameters (including the central bank preference parameter λ).

[3] Productivity shocks do not affect the nominal marginal product of labour, since they increase output as much as they decrease the price level.

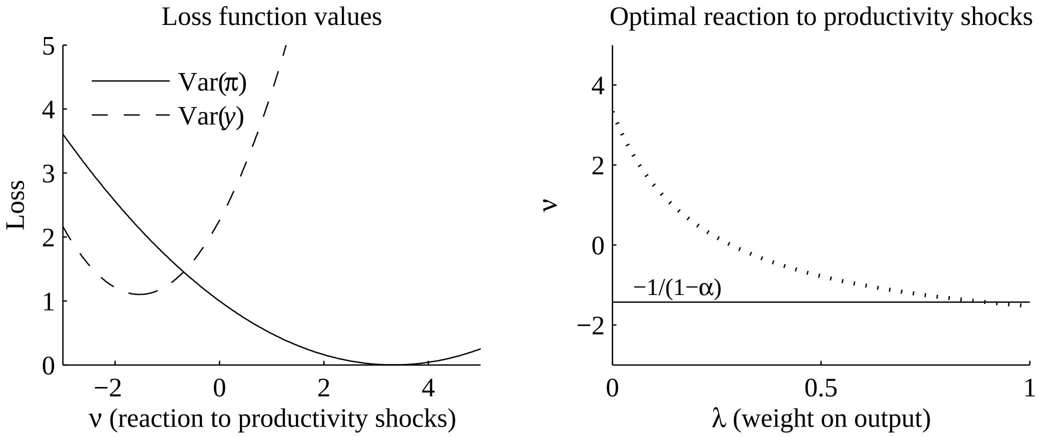

Figure 1: Optimal reaction to a productivity shock, for the loss function $\boldsymbol{\lambda}$ Var(y) $+(\mathbf{1}-\boldsymbol{\lambda})$ Var($\boldsymbol{\pi}$). This figure shows numerical results based on $\rho = 0.7, \alpha = 0.3, \delta = 0.1$.

The optimal value of ν in (10) is a slightly messy expression given in Appendix A. A numerical example is given in *Figure 1*. It is clear that inflation is stabilized at a positive value of ν and output is stabilised at a negative value of ν. To gain some further intuition, I will discuss some special cases.

With inflation targeting ($\lambda = 0$) we get

$$\nu = 1/\alpha \text{ (if } \lambda = 0), \tag{11}$$

which is positive. It is immediate from (7) that this completely stabilizes inflation surprises. The basic intuition is that a productivity shock increases money demand (by increasing output), so a money injection is necessary to restore money market equilibrium (at unchanged prices).

With output targeting ($\lambda = 1$) the policy parameter is more complicated. However, as long as the productivity shock has a non-negative autocorrelation ($\rho \geq 0$), we can establish the upper boundary as

$$\nu \leq -1/\left(1-\alpha\right) \text{ (if } \lambda = 1 \text{ and } \rho \geq 0), \tag{12}$$

which is negative. In the very special case of complete capital depreciation ($\delta = 1$) and zero autocorrelation of productivity ($\rho = 0$), we reach this upper boundary. More generally, this boundary value wipes out all one-period innovations to output, that is, it minimises $\text{Var}_{t-1}(y_t)$. The basic intuition is that a positive productivity shock is met by a contractionary monetary policy, which increases the real wage and reduces labour demand. For most parameter values, output targeting gives a coefficient ν which is very close to the upper boundary.

Macroeconomic models typically allow for exogenous monetary policy shocks. In this model (and most others), this is precisely the same as (negative) money demand shocks. We can therefore apply two different interpretations to the latter.[4]

The main conclusions are that all the different optimal policies would accommodate the money demand shocks (or alternatively, not generate any policy shocks). Once that is done, we can think of three different types of responses to a productivity shock: an accommodating response (inflation targeting, $\nu > 0$), no response (social optimum, $\nu = 0$), and a counter response (output or output surprise targeting, $\nu < 0$).

4 Risk Premia

This section analyzes how risk premia on various assets depend on monetary policy. The focus is on three different risk premia: the inflation risk premium on nominal interest rates (the Fisher equation), the risk premium on a long-lived consumption claim (the "equity risk premium") and the term premia in the yield curve.[5]

Although these assets do not show up in the budget restriction, adding them would not change the equilibrium (markets are already complete). Adding them and deriving the first order conditions shows that any gross real return (R_{t+1}) must satisfy $\text{E}_t[\beta(C_t/C_{t+1})R_{t+1}] = 1$. To get simple expressions, I assume that the shocks in the model are normally distributed. (See Appendix B for details on the derivations.)

4.1 The Inflation Risk Premium on a Nominal Bond

The (modern) Fisher equation says that a nominal interest rate equals the sum of three components: the real interest rate, expected inflation and an inflation risk premium. The reason for the risk premium is that future inflation is uncertain, which carries over to the real (ex post) return on the nominal bond.

[4]For a study which focuses on the exogenous monetary policy shocks, see, for instance, Thorbecke (1997).

[5]The analysis is done in a framework where the policy rule is constant and all shocks have constant volatilities. Both assumptions can be relaxed without changing the structure of the equilibrium.

It is straightforward to show (see Appendix B) that, in this model, the inflation risk premium (denoted RP^{π}) of a one-period nominal bond is

$$RP^{\pi} = -\operatorname{Cov}_t\left(\Delta c_{t+1}, \pi_{t+1}\right). \tag{13}$$

This is the negative of the conditional covariance of consumption growth and future inflation. In essence, the nominal bond is risky if the real return on the nominal bond (nominal return minus inflation) tends to be low when consumption is scarce.

We first look at the case with demand shocks only and passive policy. From (6)–(7) we immediately get

$$RP^{\pi} = -(1-\alpha)\,\alpha\,\operatorname{Var}(u_t^{\psi}), \tag{14}$$

where $\operatorname{Var}(u_t^{\psi})$ is the variance of the surprise in the money demand shock. The inflation risk premium is clearly negative: money demand shocks move inflation and output in the same direction, so the real return of nominal bonds is high when consumption is low (marginal utility is high). An active monetary policy that accommodates the demand shocks (effectively making them disappear) therefore increases the inflation risk premium.

We now study the case of productivity shocks. With the policy rule (10) that accommodates the demand shocks and reacts to productivity shocks with the coefficient ν, the model immediately gives

$$RP^{\pi} = -[(1-\alpha)\nu + 1](\alpha\nu - 1)\sigma_{\varepsilon}^2. \tag{15}$$

Figure 2 gives an illustration by plotting the inflation risk premium against the coefficient ν: the inflation risk premium shows an inverted U-shape. Indeed, the risk premium is zero at both strict inflation targeting ($\lambda = 0, \nu = 1/\alpha$) and output surprise targeting ($\nu = -1/(1-\alpha)$). If either output or inflation surprises are zero, then the real return on the nominal bond is considered to be riskfree. The case of output targeting is typically very similar to output surprise targeting.

In the intermediate case of passive policy ($\nu = 0$), the risk premium equals σ_{ε}^2, which is clearly positive. The intuition is that productivity shocks move inflation and output in different directions, so the real return on a nominal bond is low at the same time as consumption is low (marginal utility is high)—this is a risky asset. This feature is shared by all policies from balanced preferences (intermediate values of λ), since such policies are not sufficiently aggressive to either stabilize inflation or output.

To summarize, extreme policy preferences (λ close to zero or unity) generate low inflation risk premia, while more balanced preferences give positive risk premia.

4.2 The Risk Premium on a Consumption Claim

A claim on the future stream of consumption pays out (a constant fraction of) aggregate consumption as a "dividend" in every period. It is an interesting proxy for equity in models where firms make no profits.

It can be shown (see Appendix B) that the risk premium on a claim on the future

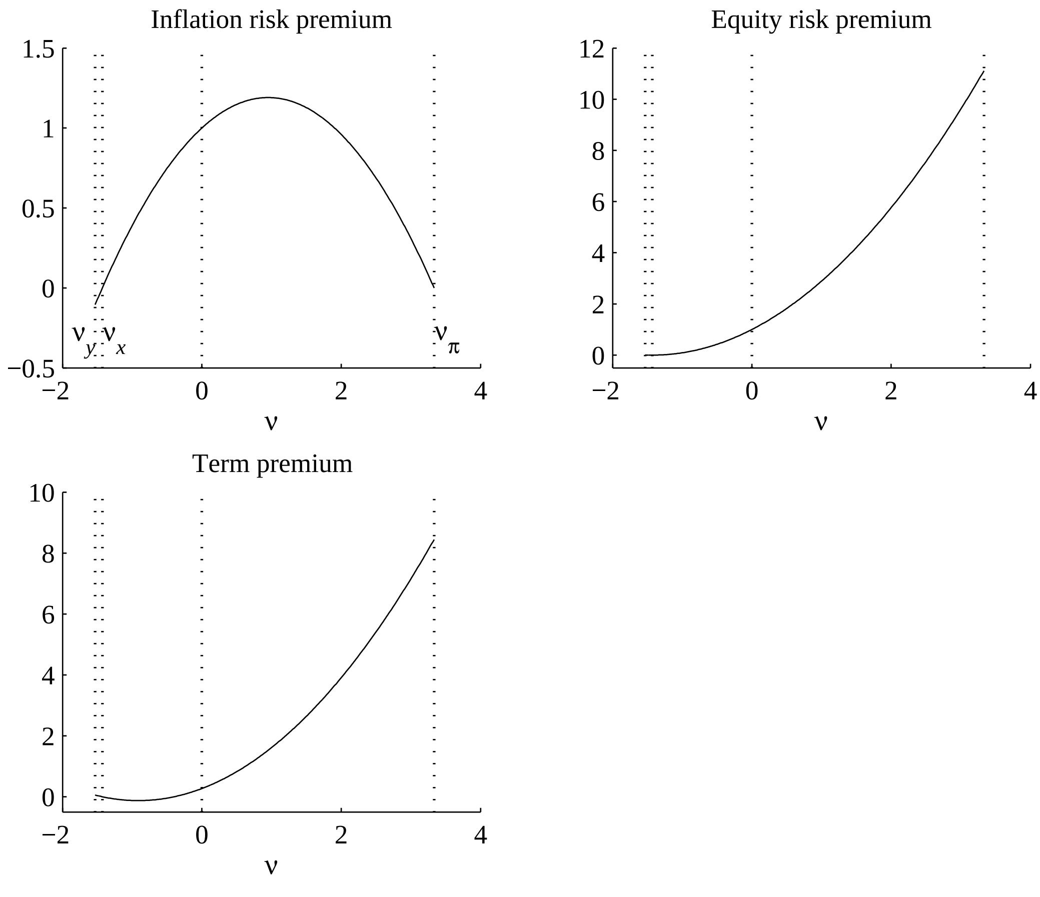

Figure 2: Risk premia as a function of the reaction to productivity shocks, ν. This figure shows numerical results based on $\rho = 0.7, \alpha = 0.3, \delta = 0.1$. Demand shocks are assumed to be accommodated. The vertical lines indicate the locations of the following policies: minimise the variance of output (ν_y), minimise the variance of output surprises (ν_x), passive policy (0), and minimise the variance of inflation (ν_π).

stream of consumption is

$$RP^c = \mathrm{Var}_t(\Delta c_{t+1}), \tag{16}$$

which is the conditional variance of consumption growth (clearly non-negative). The intuition is that the next period's payoff (the "dividend" and also the price of the claim) is proportional to the consumption level, which is perfectly negatively correlated with marginal utility. This makes the consumption claim the most risky asset possible (per unit of volatility). It therefore provides an interesting boundary for the risk premium on equity (this is yet another version of the Hansen and Jagannathan (1991) bound).

With money demand shocks only and passive policy, the risk premium is

$$RP^c = (1-\alpha)^2 \,\mathrm{Var}(u_t^\psi), \tag{17}$$

which is positive. Money demand shocks contribute to output surprises by affecting the price level and thereby the real wage—and thus make consumption claims risky. A policy that accommodates the demand shocks therefore contributes to reducing the premium.

With productivity shocks (and accommodated demand shocks), the risk premium is

$$RP^c = [(1-\alpha)\nu + 1]^2 \sigma_\varepsilon^2. \tag{18}$$

See Figure 2 for an illustration. The risk premium is zero at output surprise targeting ($\nu = -1/(1-\alpha)$) and then increasing in the reaction coefficient ν. For instance, at passive policy ($\nu = 0$) the risk premium is positive (σ_ε^2) and at inflation targeting ($\lambda = 0, \nu = 1/\alpha$) it is even higher ($\sigma_\varepsilon^2/\alpha^2$).

To summarize, a strong policy preference for output stability (λ close to unity) will buffer most of the output surprises—and thereby reduce the risk premium on a consumption claim. A policy aimed at inflation stability will do just the opposite.

4.3 The Term Premium of a Real Bond

Holding a long real bond for one period could be risky if the price changes are correlated with marginal utility. This would create a term premium—and thus govern the average (over time) slope of the real yield curve.

It can be shown (see Appendix B) that the real term premium (of a two-period real bond) is

$$RP^T = -\mathrm{Cov}_t(\Delta c_{t+1}, \Delta c_{t+2}), \tag{19}$$

which is the negative of the conditional autocovariance of consumption growth. The intuition is that a long real bond gives a capital loss in $t+1$ if $\mathrm{E}_{t+1}(\Delta c_{t+2})$ is high (investors then want to save less for $t+2$, making the real bond less attractive). If this typically happens when consumption is scarce in $t+1$ (negative autocorrelation), then the long real bond is considered risky.

With money demand shocks only and passive policy, the term premium is

$$RP^T = (1-\delta\alpha)RP^c, \tag{20}$$

which is proportional to the risk premium on a consumption claim (17)—and thus positive. The basic mechanism is that a money demand shock in $t+1$ drives down output. Due to the drop in capital accumulation, this will also have a negative effect on the expected output in $t+2$, but to a smaller extent. Investors will thus have small incentives to save in $t+1$, so bond prices drop: a capital loss when consumption is scarce. A policy that accommodates the demand shocks therefore contributes to flatting the yield curve (on average).

With productivity shocks (and accommodated demand shocks), the risk premium is

$$RP^T = (1-\delta\alpha)RP^c - \rho[(1-\alpha)\nu + 1]\sigma_\varepsilon^2, \tag{21}$$

which is typically also very similar to the risk premium on the consumption claim (now (18)). The basic mechanism is the same as with the money demand shocks, even if output is now driven by productivity shocks. See Figure 2 for an illustration. In particular, at output surprise targeting ($\nu = -1/(1-\alpha)$) the term premium is zero, and at inflation targeting the term premium is likely to be positive; it is $(1/\alpha - \rho - \delta)\sigma_\varepsilon^2/\alpha$ which is positive for all plausible values of the capital share of output α (typically estimated to be below 0.4, see Cooley and Prescott (1995)).

To summarize, output (inflation) targeting will flatten (steepen) the real yield curve (on average).

5 Conclusion

This paper uses a simple monetary business cycle model with optimal monetary policy to arrive at closed-form expressions for three different types of financial risk premia: the inflation risk premium on nominal bonds, the equity risk premium and the term premium on long bonds.

There are two main results of the paper. *First*, policies that aim at stabilizing demand shocks are likely to increase the inflation risk premium (of nominal bonds), but decrease the equity premium and the term premium (of long real bonds). *Second*, in the face of supply shocks, the effects depend crucially on whether the policy targets output stability, inflation stability or a social optimum: output targeting is likely to decrease all risk premia, inflation targeting is likely to increase risk premia on real assets and decrease them on nominal assets, while the socially optimal policy has the side effect of generating a high inflation risk premium.

A Model Appendix

This appendix gives some details on the equilibrium dynamics of the model. All the first order conditions, except for real money balances, are the same as in Bénassy (1995).

Combining the first order conditions gives the money demand equation (after solving forward and assuming non-explosive expectations) $M_t/(P_t C_t) = \exp(\psi_t)$, where $\exp(\psi_t) = \sum_{s=0}^{\infty} \beta^s \mathrm{E}_t \, \theta_{t+s}$. (This corresponds to eq. 16 in Bénassy (1995), but with a stochastic θ_t). In logs, we have $m_t - p_t - c_t = \psi_t$.

Log employment with a Cobb-Douglas production function satisfies $h_t = p_t + y_t - w_t$ plus a constant (equate the marginal product of labour with the real wage to see this). In equilibrium C_t is proportional to Y_t and the money demand equation holds, so we can write this as $h_t = m_t - \psi_t - w_t$. Set w_t such that $\mathrm{E}_{t-1} \, h_t$ is a constant (at the Walrasian level) to get $w_t = \mathrm{E}_{t-1}(m_t - \psi_t)$. Combining gives $h_t = (m_t - \mathrm{E}_{t-1} \, m_t) - (\psi_t - \mathrm{E}_{t-1} \, \psi_t)$ plus a constant. (This corresponds to eq. 32 in Bénassy (1995), but with a money demand shock).

The production function gives $y_t = z_t + \alpha k_t + (1-\alpha) h_t$. Taking logs of the capital accumulation equation and using the fact that, in equilibrium, I_{t-1} is proportional to Y_{t-1} gives $k_t = (1-\delta) k_{t-1} + \delta y_{t-1}$ plus a constant. Combining gives $y_t = z_t + \alpha(1-\delta) k_{t-1} + \alpha\delta y_{t-1} + (1-\alpha) h_t$. To substitute for k_{t-1} use the production function to see that $y_{t-1} - z_{t-1} - (1-\alpha) h_{t-1} = \alpha k_{t-1}$. Combine and use the AR(1) process for z_t to get $y_t = (\rho + \delta - 1) z_{t-1} + (1 - \delta + \alpha\delta) y_{t-1} - (1-\alpha)(1-\delta) h_{t-1} + (1-\alpha) \, h_t + \varepsilon_t$.

minimising the loss function $\lambda \, \mathrm{Var}(y_t) + (1-\lambda) \, \mathrm{Var}(\pi_t - \mathrm{E}_{t-1} \, \pi_t)$ gives the first order condition $\lambda \partial \operatorname{Var}(y_t)/\partial \nu + (1-\lambda)\partial \nu \operatorname{Var}(\pi_t - \mathrm{E}_{t-1}\pi_t)/\partial \nu = 0$. The expressions for these derivatives are given in Söderlind (2003). Tedious calculations show that the optimal policy coefficient is

$$\nu = \frac{-\left(\alpha^2+\alpha-1+2/\delta\right)\delta\lambda + ((\alpha-1)\delta+2)\left(\alpha+(\lambda-1)\delta\alpha^2\rho+(1-\delta)(\lambda-\alpha)\rho\right)}{\{(\delta+\alpha^3\delta+\alpha^2\delta-3\alpha\delta+4\alpha-2)\lambda-\alpha^2[(\alpha-1)\delta+2]\}[(\alpha-1)\delta\rho+\rho-1]}.$$

B Asset Pricing Appendix

All expressions here are based on the first order condition $B_t = \mathrm{E}_t[\beta(C_t/C_{t+1})X_{t+1}]$, which says that an asset price equals the conditional expected value of the product of the stochastic discount factor ($\beta(C_t/C_{t+1})$) and the real payoff of the asset, X_{t+1}. For log returns ($r_{t+1} = \ln R_{t+1}$ where $R_{t+1} = X_{t+1}/B_t$) that are normally distributed, it is then straightforward to calculate the risk premium (over the gross real interest rate, R_{ft}) as

$$\ln\left(\mathrm{E}_t\, R_{t+1}/R_{ft}\right) = \operatorname{Cov}_t\left(\Delta c_{t+1}, r_{t+1}\right).$$

A nominal bond has a real payoff of $X_{t+1} = P_t/P_{t+1}$, so the (inflation) risk premium is $-\operatorname{Cov}_t\left(\Delta c_{t+1}, \pi_{t+1}\right)$.

A claim on next period's consumption (paying $X_{t+1} = C_{t+1}$) has the price $B_t^{(1)} = \beta C_t$. Accordingly, a claim on the consumption in $t+2$ has the price $B_t^{(2)} = \mathrm{E}_t[\beta(C_t/C_{t+1})B_{t+1}^{(1)}] = \beta^2 C_t$. Further claims are priced similarly. Summing gives the price on a claim on the future consumption stream as $C_t\beta/(1-\beta)$. The payoff in the next period of this infinitely lived consumption claim is C_{t+1} plus the price in $t+1$, which gives $X_{t+1} = C_{t+1}/(1-\beta)$. The risk premium on the consumption claim is therefore $\operatorname{Var}_t(\Delta c_{t+1})$. That no autocovariances show up is due to the logarithmic utility function.

A real one-period bond has a payoff of $X_{t+1} = 1$, so the price must satisfy $B_t^{(1)} = \mathrm{E}_t\,\beta(C_t/C_{t+1})$. Holding a two-period bond from t to $t+1$ gives the (holding period) return $R_{t+1} = B_{t+1}^{(1)}/B_t^{(2)} = \mathrm{E}_{t+1}\,\beta(C_{t+1}/C_{t+2})/B_t^{(2)}$, so the real term premium is $-\operatorname{Cov}_t(\Delta c_{t+1}, \mathrm{E}_{t+1}\,\Delta c_{t+2}) = -\operatorname{Cov}_t(\Delta c_{t+1}, \Delta c_{t+2})$.

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