Efficacy of Monetary Policy and Limited Asset Market Participation*

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Abstract

A common wisdom argues that limited asset market participation reduces the efficacy of monetary policy. This paper investigates this issue in the context of the New Keynesian dynamic stochastic general equilibrium models. Despite limited participation actually reduces effects of interest rate policies by reducing the effect on inter-temporal allocation of consumption, we find an opposite result. Monetary policy becomes more effective as long as the share of agents who cannot access to the financial market increases. The reason has a very Keynesian flavor.

Keywords: Consumers' heterogeneity, efficacy of monetary policy, rule-of-thumb.
JEL codes: E61, E63.

1. Introduction

New Keynesian dynamic stochastic general equilibrium models are founded on a forward-looking IS curve, which is built on the assumption that consumers have full access to complete financial markets. This assumption is however contradicted by the empirical evidence on the permanent income hypothesis, which supports the view that a significant proportion of consumers do not smooth their consumption.

Mankiw and Zeldes (1991) first propose the idea that limited participation in asset

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markets matters for consumption and asset returns.[1] This idea of limited participation in asset markets has been recently introduced in New Keynesian dynamic stochastic general equilibrium models by Galí *et al*. (2004), who assume that a fraction of households are constrained to consume out of current income.[2]

A common wisdom is that limited asset market participation reduces the efficacy of monetary policy. In New Keynesian dynamic stochastic general equilibrium models this should occur because the transmission mechanism of monetary policy is founded on the *Neo-Classical* mechanism of the inter-temporal allocation of consumption (see Galí *et al*., 2004; and Muscatelli *et al*., 2005). Limited asset market participation also seems to affect the determinacy properties of the equilibrium (see Galí *et al*., 2004).

This paper aims to investigate the efficacy of monetary policy in limited asset market participation economy. By considering limited participation economies, we find that despite real interest rate has a little (direct) effects on real output via consumption inter-temporal allocation, the monetary policy results to be more effective when a large part of the agents have limited access to financial markets. The reason is in an indirect *Keynesian* effect of monetary policy on the expenditure of rule-of-thumb consumers.

2. Asset-market constraints and monetary efficacy

We consider a standard New Keynesian dynamic stochastic general equilibrium model augmented by rule-of-thumb consumers a lá Galí *et al*. (2004); in order to isolate the demand-side effects of rule-of-thumb behavior we do not consider the capital accumulation process. More in detail,[3] a continuum of infinitely-lived heterogeneous agents normalized to one is assumed. A fraction $1-\lambda$ of them consumes and accumulates wealth as in the standard setup (*savers*). The remaining fraction λ is composed by agents who do not own any asset, cannot smooth consumption, and therefore, consume all their current disposable income (*spenders*). All consumers have logarithmic utilities defined

[1] More recent studies are, among others, Fuhrer (2000) and Ahmad (2004).

[2] By doing so, it is also possible to consider Non-Ricardian fiscal policies. See, for further applications, Mankiw (2000), Amato and Laubach (2003) and Muscatelli *et al*. (2005).

[3] The model is only described in its essential features since it is rather standard, we focus on the logic implications. A technical appendix with all derivations and additional proof is available upon request.

over consumption,[4] real money balances, and leisure. Spenders gain no utility in holding money. Formally, the log-linear model is formed by five equations. The first one is a simple equilibrium equation (aggregate resource constraint):

(1) $$y_t = c_t$$

where y_t are c_t is aggregate output and consumption. Equation (1) represents the equilibrium between the aggregate demand and supply since we have assumed no investment and public expenditure for the sake of simplicity.[5]

The aggregate consumption function is found by solving the optimization problem of savers and spenders and then aggregating:

(2) $$c_t = E_t c_{t+1} - (1-\lambda\zeta_N)(i_t - E_t\pi_{t+1}) - \lambda\zeta_N E_t \Delta\omega_{t+1}$$

Equation (2) represents a modified version of the standard Euler equation, where i_t is the nominal interest rate, π_t is the inflation rate, $\zeta^N = (1+\upsilon)\kappa(1+\kappa)^{-1}$ is the steady state share of spenders and υ is the inverse of the Frisch aggregate labor supply elasticity.[6] Consumption today depends on tomorrow expected consumption and on the real interest rate, but differently from the standard Euler equation, the presence of non-optimizing consumers establishes a link between the demand for goods and the real wage ω_t. (see Galí *et al*. 2004; or Muscatelli *et al*. 2005; for further details).

The supply side of the economy is represented by a standard forward-looking Phillips curve:

(3) $$\pi_t = \beta E_t \pi_{t+1} + k(y_t - a_t) + u_t$$

where a_t and u_t are $AR(1)$ processes (representing an exogenous technology and a cost push shock, respectively). It is worth noticing that $x_t = y_t - a_t$ is the output gap with respect to the flexible-price output.

[4] Their introduction complicates the model but does not affect our main argument.

[5] Other usual specifications for utility do not affect the logic of our results. We use the logarithmic function for the sake of exposition. More in detail, by indicating with a suffix *R* (*N*) savers (spenders), consumers maximize $\sum\left[\ln C_t^j + \kappa \ln\left(1-N_t^j\right) + \phi^j \chi \ln\left(M_t^j P_t^{-1}\right)\right]$ subject to: $C_t^j = W_t P_t^{-1} N_t^j + \phi^j \left[\Pi_t^j + TR_t^j - \left(M_t^j - M_{t-1}^j + B_t^j - (1+i_{t-1})B_{t-1}^j\right) P_t^{-1}\right]$, where W_t, Π_t, TR_t are the nominal wage, profit sharing, government lump-sum transfer. Notice that $\phi^N = 0$.

[6] It should be noticed that neither the share of Non-Ricardian consumption nor the Frisch elasticity depend on the fraction of rule-of-thumb consumers.

The real wage is determined by labor supply and demand interactions according to the following wage equation:

(4) $\omega_t = y_t + \upsilon n_t$

Finally, the log-linear representation of the production function is:

(5) $y_t = a_t + n_t$

It follows that $x_t = n_t$.

By considering the log-linear production function (5), the wage equation (4), and $E_t c_{t+1} = E_t y_{t+1}$ (i.e. the expected aggregate resource constraint), equation (2) becomes:

(6) $c_t = -\alpha_R \left(i_t - E_t \pi_{t+1}\right) + \alpha_C y_t + \alpha_S E_t y_{t+1} + \left(\alpha_R - \alpha_S\right) E_t \Delta a_{t+1}$

where $\alpha_R = 1 - \lambda \zeta_N$ and $\alpha_C = \lambda \zeta_N \left(1 + \upsilon\right)$ are the aggregate elasticity of consumption smoothing due to the inter-temporal consumption substitution done by savers and the Keynesian marginal propensity to consume deriving from the spenders behavior. The interpretation of $\alpha_S = 1 - \alpha_C$ is trivial. We only consider the case of a propensity to consume between zero and one, thus we restrict the rule-of-thumb fraction of consumers as $\lambda \in \left[0, \frac{1}{\zeta_N (1+\upsilon)}\right)$.

Current consumption depends on real interest rate (because of the Euler inter-temporal substitution effect) and on current and expected output level. If instead all consumers can save the marginal propensity to consume current output is equal to zero and the standard equation holds.

By using equation (1), the consumption Equation can be written as the following IS curve:

(7) $x_t = E_t x_{t+1} - \Omega\left(i_t - E_t \pi_{t+1}\right) + \Omega \Delta a_{t+1}$

where $\Omega = \frac{1-\lambda\zeta_N}{1-(1+\upsilon)\lambda\zeta_N} = \frac{\alpha_R}{\alpha_S}$ is the income monetary multiplier.

First and former, it can be easily verified that determinacy of the model given by (3) and (7) requires standard conditions, i.e. monetary policy should respond more than one-to-one to increases in inflation, as in Woodford (2004). Moreover, if monetary policy is set according to a forward-looking interest rate rule, it must be not too aggressive, as in Bernake and Woodford (1997).

Differently from the common wisdom, equation implies that the efficacy of monetary policy is increasing in the fraction of rule-of-thumb consumers. In fact, an increase in the share of rule-of-thumb consumers, on the one hand, reduces the elasticity of aggregate consumption smoothing (and thus the efficacy of monetary policy), but, on the other hand, it also reduces the marginal propensity to save, making monetary policy more effective. The latter effect always dominates the former (at least if the slope of the IS curve is negative) since:

$$\frac{\partial \Omega}{\partial \lambda} = \frac{\upsilon \zeta_N}{\left[1-\left(1+\upsilon\right)\lambda \zeta_N\right]^2} \tag{8}$$

Summarizing the aggregate consumption depends negatively on real interest rates and positively on current output by the marginal propensity to consume. The marginal propensity to consume is increasing in the share of rule-of-thumb consumers, who are insensitive to interest rate movements, and in the extent to which labor supply is inelastic. Higher interest rates reduce current consumption (direct effect) by consumption smoothing of agents who have access to the financial markets, see equation (2); the reduction of consumption demand reduces output and employment; real wage falls (see equation (4)) and thus the aggregate demand further falls (indirect effect) because constrained consumes reduce their consumption. Hence monetary policy efficacy is improved.

3. Conclusions

This paper has shown that the inclusion of limited participation in asset markets in New Keynesian dynamic stochastic general equilibrium models implies an increase of monetary policy efficacy in share of rule-of-thumb consumers instead of a reduction—as often claimed.

The rationale of the result is very Keynesian. As usual, the initial change in the interest rate affect the trade-off between consumption today and consumption tomorrow (direct effect) and wages, but, in limited asset participation economies, the wage change stimulates the revision of the consumption plan of agents who cannot access to the credit (indirect effect) in the same direction of the direct effect. A lower fraction of savers reduces the direct efficacy of monetary policy, but this efficacy reduction is more than compensated by the increases of the direct one as the aggregate marginal propensity to consume increases in the fraction of rule-of-thumb consumers.

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Short Technical Appendix – Not to be published

Representative consumers are indexed by R (savers) and N (spenders), they maximizes the following utility functions:

(a.1) $$E_t \sum_{i=0}^{\infty} \beta^i u\left(C_{t+i}^j, \frac{M_{t+i}^j}{P_{t+i}}, N_{t+i}^j, \phi^j \right) \quad j \in \{R, N\}$$

where $\beta \in (0,1)$ is the discount factor, C_t represents household consumption at time t, while $\frac{M_{t+i}}{P_{t+i}}, N_t$ are respectively, real money balances, and labor. ϕ^j is a binary variable such that when $j = R$, $\phi^R = 1$ and when $j = N$, $\phi^N = 0$. We assume the following logarithmic instantaneous utilities, $u(.) = \ln C_{t+i}^j + \kappa \ln\left(1 - N_{t+i}^j\right) + \phi^j \chi \ln\left(\frac{M_{t+i}^j}{P_{t+i}}\right)$ with $\chi > 0$ and $\kappa > 0$. By solving their optimization problems, consumers face the budget constraints: $C_t^j = \frac{W_t}{P_t} N_t^j + \phi^j \left[\Pi_t^j + TR_t^j - \frac{M_t^j - M_{t-1}^j}{P_t} - \frac{B_t^j - (1+i_{t-1})B_{t-1}^j}{P_t} \right]$, where W_t is the nominal wage at time t, Π_t is profit sharing, TR_t are Government lump-sum transfer Note that real wages are the only source of fluctuations of spenders disposable income and therefore they are subject to a static budget constraint, while savers are the only ones facing a dynamic constraint. In fact, since spenders do not save they consume all their current income and the amount of money they hold at the end of period is equal to zero. By solving the representative saver's and spender's maximization problem, we obtain the following first-order conditions:

(a.2) $$C_t^R = \left[\beta (1 + i_t) P_t \right]^{-1} E_t \left[P_{t+1} C_{t+1}^R \right]$$

(a.3) $$C_t^N = \frac{W_t}{P_t} N_t^N$$

(a.4) $$\left(P_t C_t^R \right)^{-1} = \beta E_t \left[P_{t+1} C_{t+1}^R \right]^{-1} + \chi P_t \left(M_t^R \right)^{-1}$$

(a.5) $$W_t P_t^{-1} = \kappa C_t^j \left(1 - N_t^j \right)^{-1} \qquad j \in \{R, N\}$$

Equations (a.2) and (a.3) are the optimal consumption for savers (i.e. inter-temporal stochastic consumption Euler equation) and spenders (who consume the whole labor income). Equation (a.3) is the optimal demand for real money balances for savers.

Equation (a.4) is; the optimal condition for the labor supply. From equations (a.4) and (a.5), it is easy to find that spenders supply a fixed quantity of labor, i.e. $N_t^N = \frac{1}{1+\kappa}$.

The aggregate consumption and employment are

(a.6) $C_t = (1-\lambda)C_t^R + \lambda C_t^N$

(a.7) $N_t = (1-\lambda)N_t^R + \lambda N_t^N$

From equations (a.5) and (a.7), we obtain the wage aggregate supply:

(a.8) $C_t = \frac{1}{\kappa}\frac{W_t}{P_t}(1-N_t)$

By log-linearizing equation (a.8) we obtain equation (2), recall that $Y_t = C_t$ in equilibrium. By log-linearizing equations (a.2) and (a.3) we find:

(a.10) $c_t = (1-\lambda)\zeta_R c_t^R + \lambda \zeta_N c_t^N$

(a.11) $c_t^R = -(i_i - E_t \pi_{t+1}) + E_t c_{t+1}^R$

(a.12) $c_t^N = w_t - p_t$

Solving equation (a.11) for c_t^R and using equations (a.10) and (a.12) we obtain equation (1).

In order to show that the income monetary multiplier is independent of the fraction of rule-of-thumb consumers, we need to compute the consumption share of spenders in steady state fraction and the inverse Frisch elasticity to deep parameters only. Regarding the former, from the demand side of the economy, i.e. equations (a.3) and (a.8), we obtain $\zeta^N = C^N C^{-1} = (1+\upsilon)\kappa(1+\kappa)^{-1}$, recall that Ricardian consumers supply a fixed amount of labor.

Regarding the steady state value of the employment, we should introduce the supply side of the economy, but since it is rather standard we will only briefly discuss it (a technical appendix is available upon request). As usual, we consider an economy is composed by a continuum of firms (indexed by $z \in [0,1]$) producing differentiated intermediate goods with a constant return to scale technology $Y_t(z) = A_t N_t(z)$. Intermediate goods are used as inputs by a perfectly competitive final goods firm. In such a context, under flexible prices, all firms set their price equal to a constant markup over marginal cost, which, under the hypothesis of symmetric firms, is constant and given by (a.13) $\theta = (\eta - 1)\eta^{-1}$.

where the parameter $\theta = (\eta - 1)\eta^{-1} \in (0,1)$ indicates the markup and η is the elasticity of substitution across differentiated product.

Moreover, given the constant return to scale technology and the aggregate nature of shocks, real marginal costs are the same across the symmetric intermediate good producing firms. Accordingly, from the cost minimization, real marginal cost is:

(a.14) $\theta_t = A_t W_t P_t^{-1}$.

By equating equations (a.8) and (a.14), we obtain that in the steady state:

(a.15) $N = \theta(\kappa + \theta)^{-1}$

that is independent of the fraction of rule-of-thumb consumers.