Behavioral Pattern of Heterogeneous Agent and Optimal Monetary Policy for Solving Heterogeneous Expectation Model

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Abstract

The use of agent-based models on the heterogeneous behavior of agents has expanded considerably over the past years. This paper investigates the model based on the behavior of agents and considers the heterogeneity of agent models. The current study examines the effect of different forming of individuals' expectations on macroeconomic variables and the re-distributional effects of monetary policy. This paper revisit the transmission mechanism from monetary policy to household consumption in a Heterogeneous Agent New Keynesian (HANK) model. The model yields empirically realistic distributions of wealth and marginal propensities to consume because of two features: uninsurable income shocks and multiple assets with different degrees of liquidity and different returns. In this model, the indirect effects of an unexpected monetary policy, which operate through a general equilibrium increase in labor demand, far outweigh direct effects such as intertemporal substitution. This finding is in Representative Agent New Keynesian (RANK) economies, where the substitution channel drives virtually all of the transmission from monetary policy to consumption then failure of Ricardian equivalence implies that, in HANK models, the fiscal reaction to the monetary expansion is a key determinant of the overall size of the macroeconomic response. The results indicate that under discretionary circumstances, the attempt of the monetary authority to redistribute wealth to the borrower's households, which have a higher utility of net wealth than the other households, leads to changes in inflationary biases. However, under commitment circumstances, this inflationary pressure will be offset by changes in expectations for future inflation over time.

Keywords: Heterogeneous Agent New Keynesian Model (HANK), Representative Agent New Keynesian Model (RANK), Expectations, Wealth Distribution, Monetary Policy, Rule, Discretion.

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1. Introduction

A growing literature has emerged in recent years aiming at re-examining some important macro questions through the lens of monetary models with

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heterogeneous agents. Such models commonly assume the presence of idiosyncratic shocks to individuals' income, together with the existence of incomplete markets and borrowing constraints. Those features are combined with the kind of nominal rigidities and monetary non-neutralities that are the hallmark of New Keynesian models (Kaplan and et al, 2016).

Nuo and Thomas (2017) considered the optimal monetary policy with heterogeneous agents. They showed that under discretion, an inflationary bias arises from the central banks attempt to redistribute wealth from creditors to debtors, who have a higher marginal utility of consumption. Under commitment, this inflationary force is counteracted over time by the incentive to prevent expected future inflation from lowering the price at which issuers of new bonds do so; under certain conditions, long-run inflation is zero as both effects are canceled out asymptotically.

Khalili Araghi and Gudarzi (2016) investigated the inflation persistency regarding the heterogeneous behavior of economic agents. For this purpose, they used the data from 1991-2015 based on seasonal data and Dynamic Stochastic General Equilibrium models. The innovation of this paper is Calvo pricing assumption regarding the lag in inflation rate and indexing parameter in which inflation persistency conditions computing will be more relevant to Iran's economy. The results showed that inflation expectations have a major role in inflation rate formation so that even if the inflation rate declines it will occur in a longer time due to inflation persistency. It was cleared the prices have less reaction ability in relation to inflation persistency. It is suggested to the monetary authorities by considering the domestic inflation targeting rule in addition to inflation control, they stabilize the domestic production in the natural level in which it is required the monetary authorities to have credibility in views of economic agents.

Optimal monetary policy with heterogeneous households depends on the balance of monetary and financial policy in economic efficiency and redistributing wealth among households. If the outstanding government debt is not large, the optimal monetary policy under the commitment is time consistent when more weight is given to households that hold large fraction of their wealth as cash. If outstanding government debt is large in the economy, then for achieving Pareto optimal, households should use a large fraction of their wealth to buy credit good or government debt securities because under these conditions the government seeks to reduce the rate of monetary growth and increase taxes on labor supply. Therefore, when the government debt is large in the economy and households hold a high fraction of government securities, the optimal monetary and fiscal policy is time consistent. Accordingly, the main question of this paper is whether the optimal monetary policy is time consistent or not under the conditions that economic agents have heterogeneous decision-making behaviors.

2. Method

In this study, seasonal data of Iran's economy for the period Q1 1989 to Q4 2017 have been used in order to estimate the equations. We used Hodrick–Prescott filter to calculate the output gap as a difference between GDP and potential output. Consumer price index (base year= 2004) was used to calculate the inflation rate.

In this research, the Bayesian method is used to estimate the parameters of the model, in which the initial values for the parameters are determined as the prior distribution, and these initial values are combined with the results of estimating maximum likelihood based on actual data. If the initial information in the prior distribution is large and accurate and the maximum likelihood estimation cannot help to estimate the model, the calibration method can be used. But if the prior distribution is totally inaccurate, the maximum likelihood can be used. In the middle, the Bayesian method is a combination of two calibration methods and maximum likelihood.

3. Results

The purpose of this paper is considering the behavioral pattern of heterogeneous agent and optimal monetary policy for solving heterogeneous expectation model. In this study we utilize time series data on a quarterly basis from Q1 1989 to Q4 2017. A new Keynesian dynamic stochastic general equilibrium (DSGE) models have been developed for monetary policy analysis in open economies. Our first result concerns Representative Agent New Keynesian (RANK) models. In these commonly used benchmark economies, the aggregate consumption response to a change in interest rates is driven entirely by the Euler equation of the representative household. This implies that for any reasonable parameterization, monetary policy in RANK models works almost exclusively through intertemporal substitution: direct effects account for the full impact of interest rate changes on the macroeconomy, and indirect effects are negligible.

The results indicate that under discretionary circumstances, the attempt of the monetary authority to redistribute wealth to the borrower's households, which have a higher utility of net wealth than the other households, leads to changes in inflationary biases. However, under commitment circumstances, this inflationary pressure will be offset by changes in expectations for future inflation over time. This finding is in Representative Agent New Keynesian (RANK) economies, where the substitution channel drives virtually all of the transmission from monetary policy to consumption then failure of Ricardian equivalence implies that, in HANK models, the fiscal reaction to the monetary expansion is a key determinant of the overall size of the macroeconomic response. The results indicate that under discretionary circumstances, the attempt of the monetary authority to redistribute wealth to the borrower's households, which have a higher utility of net wealth than the other households, leads to changes in

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