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Quantitative easing in the economy with heterogeneous agents: does it work in theory as well?

Recent years world economy faces shock by shock. In these circumstances policymakers are looking for effective instruments to boosts and stabilize economy, recover recession. The situation makes more difficult the fact that in some countries there are limits of traditional instrument such as interest rate. The latter is at the zero lower bound (ZLB) and has no scope for further decreasing to stimulate economy. One of the possible solutions is to switch on unconventional monetary policy, f.e. quantitative easing (QE). Despite the fact Russian economy is now far from facing ZLB interest rate, it seems also a good question for Bank of Russia, whether unconventional monetary policy can be implemented interchangeable with traditional tools and which effects can be reached.

The popularity of QE begins with financial crisis. In some countries central banks, including FED, Bank of England, ECB, launched large scale assets purchase program by buying government bonds. Moreover, during Coronavirus crisis this instrument was also implemented extensively. By 2021 year purchases within QE programs are estimated around 40% of GDP in the UK and around 30%, 32% and 106% of GDP in the US, Eurozone and Japan respectively (according to estimation by Economic Affairs Committee (2021)).

But it is still a question whether QE is unconventional policy instrument or new reality. Are interest rate and QE substitutes or does QE work only during abnormal times when interest rate encounters ZLB? These and other questions are urgent for answering today.

In the present research we try to make contribution for answering some of them with the help of heterogeneous agent New Keynesian (NK) general equilibrium model.

Method. Because of increasing popularity of QE in practice it is reasonably to suppose that macroeconomists face demand on appropriate instruments for its analysis. One of the tools that is actively used by modern macroeconomists is New Keynesian (NK) general equilibrium models. They became popular at the end of 20th century as an alternativity of large-scale macroeconometric models, subjecting to critiques by Sims and Lucas (Sims (1980), Lucas (1976)). Nowadays these models are in the toolbox of various central banks and international research organizations as well as some ministries of finance (f.e. IMF, Bank of Russia, Bank of Canada, Bank of England, European Central Bank and others).

However, the financial crisis of 2008 years revealed the scope for improvement of NK general equilibrium models. For example, the necessity to incorporate into the model nontrivial financial sector, heterogeneity of agents and channels that will allow to study unconventional policies as well. As a result, post-crisis macro models show relevance of QE via incorporating different forms of frictions and market incompleteness (f.e. Araújo et al.(2015), Del Negro et al. (2017), Driffill and Miller (2013), Gertler and Karadi (2011), Chen et al. (2012), Ellison and Tischbirek (2014)). In other words, they all try to overcome the problem postulated by Bernanke (2014): "The problem with QE is it works in practice, but it doesn't work in theory".

The fast-growing interest nowadays is the models of new generation, so called Heterogeneous Agent New Keynesian (HANK) models. Idiosyncratic income shock and assets with different types of liquidity are incorporate into them. That provides the model with more realistic assumptions and reflects economy where individuals have different marginal propensity to consume (MPC) that obtained in the data. In the literature HANK models are connected predominantly with names G. Kaplan, B. Moll, G. L. Violante.

The model. In our research we consider Heterogeneous Agent New Keynesian (HANK) model that has the following feature:

- Time is continous.
- Households are heterogeneous by income. They face uninsurable idiosyncratic income risk and save money in government bonds.
- Firms act in a competitive market and receive profit that redistribute to households. Price stickiness is Roremberg adjustment costs (1983).
- Government issues bonds, taxes, consume and make transfers to households.
- Central bank can implement two regimes of monetary policy: Taylor rule for interest rate and Quantitative easing (QE). In order to finance QE Central bank can issue reserves above stead-state level.

Results. Research of QE effects inside simple HANK model provide us with following results. **First,** QE can have a great stimulating effect especially in the situation of the interest rate ZLB. Increasing amount of households' liquidity (through fiscal stimulus) boosts aggregate spending and therefore, GDP. **Second,** the effects are stronger when QE is launched for the first time compared to the situation when QE is reached to certain amount of GDP. **Third,** government debt does play the role for the QE effects. When debt is smaller, the effects are greater. **Fourth,** the main transmission channels that the model demonstrates are liquidity and interest rate channels. Increasing demand on government bonds due to QE leads to interest rate diminishing and therefore, decreasing of government interest expenses. As a result, the government has scope for stimulation effects through higher transfers to households.

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