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ScienceDirect
ELSEVIER Journal of Economic Dynamics & Control 32 (2008) 2398–2427
JOURNAL OF Economic Dynamics & Control
www.elsevier.com/locate/jedc

A dynamic new Keynesian life-cycle model: Societal aging, demographics, and monetary policy

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Received 24 October 2006; accepted 10 May 2007
Available online 22 September 2007

Abstract

In this paper, we first construct a dynamic new Keynesian model that incorporates life-cycle behavior *a la* Gertler [1999. Government debt and social security in a life-cycle economy. Carnegie–Rochester Conference Series on Public Policy 50, 61–110], in order to study whether structural shocks to the economy have asymmetric effects on heterogeneous agents, namely workers and retirees. We also examine whether considerations of life-cycle and demographic structure alter the dynamic properties of the monetary business cycle model, specifically the degree of amplification in impulse responses. According to our simulation results, shocks indeed have asymmetric impacts on different households and the demographic structure does alter the size of responses against shocks by changing the trade-off between substitution and income effects.

JEL classification: E32; E50; J14

Keywords: Heterogenous agents; Life-cycle; New Keynesian model

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doi:10.1016/j.jedc.2007.09.002

1. Introduction

Societal aging is one of the biggest economic issues facing many industrial countries. In Japan, in particular, society is aging so rapidly that not only is the working population (those older than 15 but younger than 65) already shrinking, but the total population is also expected to start decreasing by 2007. This movement suggests that the central bank should have an even greater interest in how monetary policy affects heterogenous agents, namely workers and retirees, differently and how the consideration of this demographic structure may alter the reaction of variables to structural shocks.[1] Seminal research by Woodford (2003) depicts the various forms of the dynamic New Keynesian model corresponding to different economic conditions and has had a significant influence on central banks' views of monetary business cycle. However, to date very little research has paid attention to monetary business cycle model with heterogenous agents, particularly within a life-cycle setting.[2]

In this paper, we first set up a dynamic stochastic general equilibrium model with nominal rigidities and investment adjustment costs that incorporates life-cycle behavior *a la* Gertler (1999). Then, we show whether the structural shocks to the economy have asymmetric effects on heterogeneous agents and whether the considerations of the life-cycle and demographic structure alter the dynamic properties of the solution, under different settings of life-cycle behavior.[3] Of course, as mentioned in Bean (2004), it is true that 'the glacial nature of demographic change appears to suggest that the implications for monetary policy should be modest'. We, however, believe that it becomes more important for central banks to acknowledge the asymmetric effects on heterogeneous agents within a life-cycle economy with a stationary population, since societal aging in many industrial countries necessitates the consideration of the distributional consequences of monetary policy.[4] Furthermore, central banks must always understand the monetary transmission mechanism as well as macroeconomic responses to structural shocks in

[1]For example, 'The Coming Demographic Transition: Will We Treat Future Generations Fairly', the chairman, Ben Bernanke, discusses the societal ageing and comments that 'the broader perspective shows clearly that adequate preparation for the coming demographic transition may well involve significant adjustments in our patterns of consumption, work effort and saving', although the remarks are mainly on the sharing the burden of population ageing.

[2]As a large-scale dynamic general equilibrium model used for central bank projections and policy simulations, Bank of Finland constructs a model with lifecycle behavior as examined in this paper (see Kilponen et al., 2004).

[3]This aim is similar to those in recent literature on real rigidities that try to explain realistic inflation persistence with reasonable calibration, such as Sveen and Weinke (2005), Altig et al. (2005), and Levin et al. (2006). Yet, the demographic structure does not alter the persistence but the volatility of the endogenous variables against structural shocks.

[4]Williamson (2005) analyzes monetary policy and resulting distribution in an island economy. Furthermore, Doepke and Schneider (2005) shows that young borrowers benefit more from inflation than retirees, and inflation can be welfare-enhancing since it acts like a tax on foreign share holders. Their analyses are, however, not based on the canonical dynamic new Keynesian model, heavily used among central banks.