



Money, random matching and endogenous growth: A quantitative analysis



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ARTICLE INFO

Article history:

Received 17 October 2012

Received in revised form

8 July 2013

Accepted 17 January 2014

Available online 11 February 2014

JEL classification:

E41

O41

O42

Keywords:

Economic growth

Inflation

Money

Random matching

ABSTRACT

In this study, we develop a search-and-matching monetary growth model to analyze the effects of inflation on economic growth and social welfare by introducing endogenous economic growth via capital externality into a two-sector search-and-matching model. We find that the channel through which inflation affects economic growth in the search-and-matching model is different from the traditional cash-in-advance model. To facilitate the calibration, we obtain an empirical estimate of the effects of inflation on economic growth using panel regressions. In the simulation analysis, we quantitatively evaluate the welfare effect of inflation in the search-and-matching endogenous growth model and compare it to a search-and-matching exogenous growth model. We find that the welfare effect of inflation is nonlinear in the endogenous growth model whereas it is linear in the exogenous growth model. Furthermore, we find that the welfare cost of inflation under endogenous growth is up to four times as large as the welfare cost of inflation under exogenous growth.

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1. Introduction

In this study, we analyze the effects of inflation and monetary policy on economic growth and social welfare. Although this important issue in monetary economics has received much attention and careful analysis in previous studies, our analysis provides novel elements and results. To highlight the novelty of this study, it is helpful to first discuss two related branches of literature in monetary economics. First, this study relates to the search-and-matching literature on money and capital formation; see for example, Shi (1999), Menner (2006), Williamson and Wright (2010), Aruoba et al. (2011), Bencivenga and Camera (2011) and Waller (2011). This branch of literature analyzes the relationship between money and capital formation in a search-theoretic framework without considering economic growth as an endogenous process. Second, this study also relates to the branch of literature on inflation and economic growth; see for example, Wang and Yip (1992), Gomme (1993), Dotsey and Ireland (1996), Mino (1997) and more recently, Itaya and Mino (2003), Itaya and Mino (2007) and Lai and Chin (2010).¹ This branch of literature analyzes the growth and welfare effects of inflation by modeling money

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¹ There is also a sub-branch of this literature that analyzes the relationship between inflation and innovation-driven economic growth; see for example, Marquis and Reffett (1994), Chu and Lai (2013) and Chu and Cozzi (forthcoming).

demand based on the classical approach, such as a cash-in-advance (CIA) constraint, money in utility and transaction costs, without considering a search-and-matching framework. In this study, we attempt to provide a bridge between these two branches of literature by analyzing the growth and welfare effects of inflation in a search-and-matching monetary growth model. In summary, we introduce endogenous economic growth via capital externality as in Romer (1986) into a two-sector search-and-matching model based on Lagos and Wright (2005), Aruoba et al. (2011) and Waller (2011).² In this search-and-matching monetary growth model, we obtain the following results that have novel implications to the two abovementioned branches of literature.

In a canonical monetary growth model with a CIA constraint on consumption, inflation affects economic growth via the consumption-leisure tradeoff. In other words, in the case of inelastic labor supply, inflation has no effect on economic growth in the CIA model. In contrast, in the search-and-matching monetary growth model, the growth effects of inflation operate through a consumption effect in the decentralized market. Intuitively, a higher inflation rate increases the cost of holding money and reduces consumption in the decentralized market that requires the use of money for transactions. As a result of lower consumption in the decentralized market, capital demand decreases causing a reduction in capital accumulation and economic growth regardless of whether or not labor supply is elastic.

To facilitate the calibration of the model, we use cross-country panel data to provide an empirical estimation and find that inflation has a statistically significant negative direct effect on economic growth as well as a statistically significant negative indirect effect on economic growth through the reduction of capital investment. Then, we use these estimates as an empirical moment to calibrate the model in order to quantitatively evaluate the welfare effects of inflation. We compare the welfare effects of inflation under the search-and-matching endogenous growth model to those from a search-and-matching exogenous growth model similar to Aruoba et al. (2011) and Waller (2011) in order to highlight the importance of modelling economic growth as an endogenous process. We find that the welfare effect of inflation is nonlinear in the endogenous growth model,³ whereas it is linear in the exogenous growth model. We discuss the intuition of this result in the main text.⁴ Interestingly, we also find that the welfare cost of inflation under endogenous growth is up to four times as large as the welfare cost of inflation under exogenous growth partly because reducing inflation increases the long-run growth rate in the endogenous growth model but not in the exogenous growth model. Furthermore, given that the welfare effect of inflation is nonlinear in the endogenous growth model, the difference in the welfare costs of inflation across the two models is increasing in the size of the change in the money growth rate.

The rest of this study is organized as follows. Section 2 presents the search-and-matching monetary growth model. Section 3 analyzes the effects of inflation on economic growth and social welfare. In Section 4, we calibrate the model to provide a quantitative analysis. The final section concludes.

2. A search-and-matching monetary growth model

The two-sector search-and-matching model is based on Lagos and Wright (2005). Aruoba et al. (2011) extend the Lagos–Wright model by introducing capital accumulation, whereas Waller (2011) further extends the model in Aruoba et al. (2011) by allowing for exogenous technological progress. Our model is based on Waller (2011), but we introduce capital externality into his model to generate endogenous economic growth. In what follows, we describe the basic features of the search-and-matching monetary growth model.

2.1. Households

There is a unit measure of identical and infinitely lived households in discrete time. In each period, households engage in economic activities first in the decentralized market (hereafter DM) and then in the centralized market (hereafter CM). The DM and the CM are distinguished as follows. In each period t , households first enter the DM where they consume or produce special goods q_t . In this market, each meeting is random and anonymous so that money becomes essential.⁵ Once the round of DM trade is completed, households proceed to the CM where they consume and produce general goods as in standard growth models. Following the common approach in the literature, we assume that there is no discounting between the DM and the CM within each period, and the discount factor between any two consecutive periods is $\beta \in (0, 1)$. In what follows, we first discuss households' optimization in the CM.

² A recent study by Chiu et al. (2011) also provides an interesting analysis on the effects of financial and search frictions on economic growth, but they do not consider money and inflation.

³ Chiu and Molico (2010) also find that in a modified version of the Lagos–Wright model with endogenous participation in the centralized market, the welfare effect of inflation is nonlinear in contrast to the linear welfare effect of inflation in the original Lagos–Wright model.

⁴ See Section 4.3 for a discussion. In an earlier version of this paper (see Chu et al. (2012)), we compare quantitatively the welfare effects of inflation between the search-and-matching model and a CIA model. We find that the welfare effect is in fact linear in the CIA model even with endogenous growth. Therefore, the nonlinear welfare effect in our model is due to a combination of endogenous growth and the search-and-matching structure.

⁵ Following the standard approach in the literature, we assume that capital cannot serve as a medium of exchange; see Williamson and Wright (2010) and Aruoba et al. (2011) for a useful discussion. Lagos and Rocheteau (2008) show that even when capital serves as a competing medium of exchange, fiat money can still be valued and used as a medium of exchange.

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