# Inflation and fertility in a Schumpeterian growth model: Theory and evidence[1]

## Qichun He

*Central University of Finance and Economics, No. 39 South College Road, Haidian District, Beijing 100081, China*

ARTICLE INFO

ABSTRACT

This study explores a novel channel for monetary policy to impact growth and welfare—through fertility choice. In a scale-invariant Schumpeterian growth model with endogenous fertility and a cash-in-advance constraint on consumption, we find a positive effect of an increase in the nominal interest rate on fertility. The increase in fertility decreases labor supplied to production and R&D, which in turn decreases long-run growth. Calibration shows that long-run growth increases 0.12% by reducing the nominal interest rate from 9.6% to 0%, and the welfare gain is equivalent to a permanent increase in consumption of 3.14%. As an empirical test, we build panel data for 12 advanced countries during 2000–2014. We use the degree of central bank independence and money growth as the instruments for inflation. We find that the effect of inflation on population growth is positive and significant in instrumental variables estimation. Our results remain robust to using birth rate or fertility rate as the dependent variable. An increase in annual inflation of 1 percentage point would bring an increase of 0.06 percentage point in the annual growth of the total population. Our empirical findings provide support for our theory.

## 1. Introduction

Researchers have studied many issues concerning fertility (discussed below). In this paper we reveal a novel channel—fertility choice—through which monetary policy may impact growth and welfare. It may sound counter-intuitive to investigate the effect of monetary policy on population growth (i.e., to link people's fertility choice to monetary policy). However, if humans were rational, they would also optimize their fertility decision together with the other choices such as consumption and investment. In a scale-invariant Schumpeterian growth model with endogenous fertility and a cash-in-advance (CIA) constraint on consumption, we find that an increase in the nominal interest rate has a positive effect on fertility, which in turn decreases long-run growth. As an empirical test, we build panel data for 12 advanced countries during 2000–2014. We find that inflation has a significant, positive effect on population growth in instrumental variables (IV) estimation, which provides support for our theory. The motivation of our paper is as follows.

First, our study offers a novel channel—fertility choice/population growth—for monetary policy to impact economic growth and social welfare. Population growth is assumed to be exogenous within the existing R&D-driven growth-theoretic framework (e.g., Chen, 2015; Chu & Cozzi, 2014; Chu, Cozzi, Lai, & Liao, 2015; Chu, Furukawa, & Ji, 2016; Chu et al., 2017; Chu, Cozzi, Fan, Furukawa, & Liao, 2018; He, 2015; Huang, Chang, & Ji, 2015; Marquis & Reffett, 1994). The only exception is Chu, Cozzi, and Liao (2013), who have

---

endogenized fertility choice and human capital accumulation in Schumpeterian growth models. Our study complements theirs by further analyzing the effect of monetary policy on fertility choice. Doing so reveals that monetary policy may have an impact on people's fertility choice, which in turn affects long-run growth and welfare. Therefore, our study helps us to understand the entire mechanism through which monetary policy may impact long-run growth and welfare.

Second, our study helps in understanding the long-run dynamics of total population. In many studies total population growth is regarded as exogenous (e.g., population growth is treated as an exogenous instrument for international trade in evaluating its causal effect on income; see discussion in Frankel & Romer, 1999). Researchers have investigated many issues related to fertility. For instance, Li, Zhang, and Zhu (2008) and Rosenzweig and Zhang (2009) have tested the quantity-quality trade-off in having children. The unified growth framework has endogenized people's fertility in explaining the long-run growth and population dynamics (e.g., Galor & Mountfold, 2008; Strulik & Weisdorf, 2008). Our study complements the existing studies by endogenizing people's fertility within a Schumpeterian growth framework, similar to Chu et al. (2013). However, in existing studies, the role of monetary policy is ignored. Considering monetary policy is important because there is always a trade-off between consumption and raising children when parents are rational. Monetary policy is one important exogenous factor that may impact the trade-off faced by each rational individual. Moreover, by taking our model to data, we can test the effect of the inflation rate (a proxy for monetary policy) on the fertility rate to check the validity of our theory and further evaluate the importance/magnitude of the channel that we emphasize. In other words, we can also evaluate how much our channel (the monetary policy) can explain total population growth. This not only helps us to understand the long-run dynamics of the total population but also has rich policy implications.

The intuition of our results is as follows. We introduce money via a CIA constraint on consumption into a Schumpeterian growth model, following Chu and Cozzi (2014). With exogenous population growth, the nominal interest rate has no effect on economic growth when there is an inelastic labor supply (see also Chu & Cozzi, 2014). With an inelastic labor supply, a higher nominal interest rate would not distort the labor supply through consumption-leisure choice (i.e., the choice for leisure is absent). When the CIA constraint applies only on consumption (i.e., not on R&D labor or manufacturing), a higher nominal interest would not distort the allocation of labor between manufacturing and R&D, leaving the balanced growth rate unaffected. In contrast, with endogenizing fertility choice, in choosing optimal fertility, households equate the marginal utility of fertility to the marginal cost of fertility. The marginal cost of fertility consists of three terms: the asset-diluting effect of fertility, the foregone-wage effect of fertility, and the real money balance-diluting effect, all of which depend negatively on the nominal interest rate due to the CIA constraint on consumption. Therefore, all else being equal, a higher nominal interest rate decreases the marginal cost of fertility and thereby increases fertility. In other words, a higher nominal interest rate and thereby a higher inflation rate via the CIA constraint on consumption makes fertility cheaper relative to consumption, thus increasing fertility. The increase in fertility decreases the amount of labor supplied to production and R&D, leading to a decreased long-run growth.

We calibrate the model to estimate the growth and welfare effects of a change in the nominal interest rate. We find that long-run growth increases 0.12% by reducing the nominal interest rate from 9.6% (the sample mean, elaborated below) to 0%. The corresponding welfare gain is equivalent to a permanent increase in consumption of 3.14%. As a counterfactual, we find that the growth and welfare losses are smaller when people prefer more children. Additionally, there are substantial growth and welfare losses when people's preference for children increases, all else being equal.

As an empirical test, we build panel data for 12 advanced countries during 2000–2014. We use the degree of central bank independence (CBI) and money growth as the instruments for inflation. We find the following. The effect of inflation on population growth is positive and significant in IV estimation. Our results remain robust to using birth rate or fertility rate as the dependent variable. Our empirical findings provide support for our theory. Additionally, we find that an increase in annual inflation of one percentage point would bring an increase of 0.06 percentage points in annual growth of the total population. Given the average annual inflation rate of 2.71 in our data sample, inflation explains 0.17% annual growth in the total population (approximately 20% of the average 0.89% annual growth rate in total population in the 12 advanced economies during 2000–2014). Therefore, the magnitude of the estimated effect of inflation on total population growth is large.

This study relates to the large body of literature on fertility/population growth and its effect on the economy (see Nishimura & Zhang, 1992; Davies & Zhang, 1997, and references therein).

The rest of this paper is organized as follows. Section 2 sets up the monetary Schumpeterian growth model to analyze the fertility and growth effects of monetary policy. Section 3 provides the empirical evidence. The final section concludes the paper.

## 2. A monetary Schumpeterian model with endogenous fertility

Built on existing studies (e.g., Chu & Cozzi, 2014; He & Zou, 2016), we introduce money with a CIA constraint on consumption into a Schumpeterian growth model.

### 2.1. Households

There is a unit continuum of identical households. At time $t$, the population size of each household is $L_t$. There is a unit continuum of identical households, which have a lifetime utility function as

$$U = \int_0^\infty e^{-\rho t}[ln(c_t) + \theta ln(n_t)]dt \tag{1}$$

where $c_t$ is per capita real consumption of final goods (numeraire) and $n_t$ is the per capita number of births at time $t$. $\rho > 0$ is the rate of