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Optimal inflation rates with the trending relative price of investment

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ABSTRACT

I study the effect of the trending relative price of investment on the optimal target rate of inflation in an estimated dynamic general equilibrium model of the U.S. economy. The price of investment has a decreasing trend relative to that of consumption because of investment-specific technological progress. If the prices of investment goods are sticky, a benevolent planner puts weight on stabilizing these prices, which works to raise the optimal target rate of inflation in terms of the price of consumption. The estimated model shows a high degree of price stickiness in an investment sector and the resulting optimal target rate of inflation is significantly positive. This result is robust to an extended model in which the prices of some categories of investment goods are flexible.

1. Introduction

One of the biggest gaps between theory and practice in monetary policy appears in an optimal inflation rate. Many central banks around the world focus on a consumer price index (CPI) or a price index for personal consumption expenditures (PCE) and set an inflation objective around two percent.[1] This inflation objective makes a stark contrast with a standard monetary theory. Schmitt-Grohé and Uribe (2010) review many mechanisms in a dynamic stochastic general equilibrium (DSGE) framework and conclude that the optimal rate of inflation targeted by a benevolent planner — the optimal target rate of inflation — is not significantly above zero.[2]

In this paper I consider the role of trending relative prices and study their effect on the optimal target rate of inflation. In many countries the price of investment has a decreasing trend relative to that of consumption due to investment-specific technological (IST) progress. If the prices of investment goods are sticky, a benevolent planner puts weight on stabilizing these prices, which works to raise the optimal target rate of inflation.

High price stickiness in an investment sector (an I-sector) is supported by some micro-evidence on producer price index for possible categories of investment goods. According to Nakamura and Steinsson (2008), a median implied duration of

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[1] According to Hammond (2012), some 27 countries operate full-fledged inflation-targeting regimes at the start of 2012.

[2] The mechanisms considered by Schmitt-Grohé and Uribe (2010) include sticky prices in a one-sector model, downward nominal wage rigidities, a zero lower bound on nominal interest rates, a quality bias, untaxed income, and foreign demand for domestic currency. Also, Coibion et al. (2012) consider the role of the zero lower bound explicitly and conclude that the optimal target rate of inflation is low, typically less than two percent.

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prices of finished producer goods for the U.S. is 8.7 months and some categories exhibit an even higher duration: 26.5 months for machinery and equipment and 19.1 months for furniture and household durables.[3] Similarly, for the euro area, a median implied duration of prices is 9.5 months for durable products and 10.6 months for capital goods according to Vermeulen et al. (2012). These evidences, although not conclusive, suggest that prices in an I-sector are somewhat sticky.

Motivated by these observations I build and estimate a medium scale monetary DSGE model with trending relative prices of investment goods and sticky prices in an I-sector. The estimation on U.S. data reveals a high degree of price stickiness in the I-sector. The resulting optimal target rate of inflation is significantly positive with a median of 1.5 in annual percentage rate (APR), and with a 90 percent interval of the posterior distribution of [1.2, 1.8].

Main mechanisms that affect the optimal target rate of inflation in the model are illustrated in Fig. 1. It plots the optimal target rate of inflation in the consumption sector (the C-sector) and the associated inflation rate in the I-sector for various degrees of price stickiness in the two sectors. When prices are nearly flexible in both sectors, the effect of transaction costs dominates and the Friedman rule holds as shown by the thick line in the left side of Fig. 1(a). As prices in the C-sector become sticky, the prices would become more disperse without the complete stabilization of the prices. To mitigate the loss of output caused by the price dispersion, the optimal target rate of inflation is raised towards zero as shown by the thick line on the right side of Fig. 1(a), consistent with Khan et al. (2003) and Schmitt-Grohé and Uribe (2007, 2010). In addition, if prices in the I-sector become sticky, it would generate price dispersion and cause the loss of investment without the complete stabilization of the prices. Because it is impossible to stabilize the prices in both sectors simultaneously, a benevolent planner has to trade off relative price distortions in the two sectors. In particular, when price stickiness in the I-sector is high, the planner puts weight on stabilizing the prices in the I-sector, and the optimal target rate of inflation becomes positive as shown by the thick line in Fig. 1(b).

The above argument clarifies that this paper's result of the positive optimal target rate of inflation depends crucially on high price stickiness in the I-sector. The high price stickiness, however, is not without controversy because the prices of some investment goods are considered to be more flexible than those of consumption goods. For example, Carlstrom and Fuerst (2010) argue that it seems unlikely that there is much price rigidity in the residential housing sector.

To address this conflicting view on price stickiness in the I-sector I extend the model to allow for heterogeneous investment sectors where prices in a construction sector are perfectly flexible and those in an equipment sector are sticky. The estimation of this extended model shows that the optimal target rate of inflation is still significantly positive.

In this paper the optimal target rate of inflation is defined as the inflation rate of the price of consumption targeted by a benevolent planner in the Ramsey equilibrium in which the planner maximizes welfare with respect to a monetary policy instrument. The planner is assumed to honor commitments made in the past, which is referred to as "optimal from the timeless perspective" (Woodford, 2003). Also, a meaningful role of fiscal policy is abstracted by assuming lump-sum transfers as in Khan et al. (2003) and Schmitt-Grohé and Uribe (2007). Hence, commitment and fiscal issues are abstracted from the model to focus on the direct effects of the aforementioned three elements on the optimal target rate of inflation.[4]

This paper is related to Aoki (2001) and Huang and Liu (2005) who focus on the effect of heterogeneous nominal rigidities on an optimal monetary policy rule but not on the optimal target rate of inflation. A lesson from their papers is that a stickier price should be stabilized more.

This paper is also closely related to Shirota (2007) and Wolman (2011) who consider the role of trending relative prices on the optimal target rate of inflation. Shirota (2007) focuses on trending prices in an intermediate-good sector relative to prices in a final-good sector, while Wolman (2011) focuses on a heterogeneity among different categories of consumption goods and shows that the heterogeneity does not raise the optimal target rate of inflation above zero.[5] This paper's contribution differs from theirs in two respects. First, this paper focuses on a heterogeneity between consumption and investment sectors. Second, this paper builds a medium scale DSGE model by incorporating several frictions as in Christiano et al. (2005) and Smets and Wouters (2007), estimates the model on U.S. data, and shows that the optimal target rate of inflation is significantly positive.

The rest of the paper proceeds as follows. Section 2 presents the model and defines the optimal target rate of inflation. Section 3 presents the main result of the paper. Section 4 presents robustness checks including the extension of the model. Section 5 concludes with some caveats on the main result of the paper.

2. The model

The model is a two-sector version of the medium scale monetary DSGE model developed by Christiano et al. (2005) and Smets and Wouters (2007), allowing for sticky prices in an I-sector, non-stationary IST progress, and transaction costs.

[3] As in Nakamura and Steinsson (2008), a median implied duration of prices is calculated as $d = -1/\log(1-f)$, where f is a monthly median probability of a price change.

[4] Another branch of literature such as Schmitt-Grohè and Uribe (2004) and Siu (2004) considers monetary and fiscal policy jointly by allowing for distortionary state-contingent taxes, but the optimal target rate of inflation is not significantly positive.

[5] Relatedly, Schmitt-Grohé and Uribe (2012) consider the heterogeneity of nominal rigidity in the context of quality-bias. They show that as long as nonhedonic prices are sticky, the conventional view, according to which it is optimal to adjust the inflation target upward by the size of quality bias, is misguided.