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Inflation and output dynamics with state-dependent pricing decisions ☆

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Abstract

This paper studies a state-dependent pricing model in which firms face a fixed cost of changing their pricing plans. A pricing plan specifies an entire sequence of time-varying future prices. Allowing firms to choose a pricing plan rather than a single price generates inflation inertia in the response of the economy to small changes in the growth rate of money. Allowing firms to choose when to change their pricing plan generates a non-linear response of inflation and output to small and large changes in the money growth rate. The non-linear solution method also reveals that the model generates an asymmetric response of output and inflation to monetary expansions and contractions.

JEL classification: E31; E32; E50

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1. Introduction

There is a large literature that studies the effects of monetary policy on output and inflation in models with sticky prices. The models in the literature can be classified into two

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broad classes. In the first one, commonly referred as *time-dependent* pricing models, the number of firms changing prices is fixed exogenously. Firms only control the degree to which they change their price once they have the opportunity to do so.[1] However, time-dependent models are often viewed as an approximation of more complicated firm behavior. As an alternative, a second class of models, commonly referred as *state-dependent* pricing models, endogenizes the number of firms changing prices. Typically, this extensive margin is modeled by assuming that firms face a fixed cost of changing their nominal price. Dotsey et al. (1999) develop a tractable way to incorporate state-dependent pricing models into a quantitative general equilibrium framework.[2]

In this paper, we study a variation of a standard state-dependent pricing model, in which firms choose dynamic pricing plans. Once a firm pays a fixed cost, it can choose not only its current price, but also a plan specifying an entire sequence of future prices. Nominal rigidities arise because changing the plan is costly, and prices in the plan can be made contingent on the current information set but cannot be made contingent upon future aggregate variables. This pricing behavior is consistent with the fact that the costs of changing prices are broader than menu costs that have prevailed in the literature. There are other costs associated to implementing a new pricing plan such as communication and negotiation costs, as documented by Zbaracki et al. (2004).[3] This pricing assumption resembles Fischer's (1977) contracting model with pre-determined prices. Mankiw and Reis (2002), Calvo et al. (2001), and Devereux and Yetman (2003) are recent papers that study related time-dependent pricing models.[4] In order to isolate the implications of our pricing assumptions, we abstract from other costs of changing prices such as information gathering and processing costs, which are implicit in the analysis of Mankiw and Reis (2002) and Woodford (2001a).

Compared to the previous sticky-price literature, our model has two desirable properties. First, it generates inflation inertia in the response of the economy to small changes in the growth rate of money. Conventional time-dependent and state-dependent pricing models in which firms choose a single price do not.[5] Second, the model is consistent with the view that large, persistent changes in the growth rate of money, have relatively small effects on output. In contrast, standard time-dependent models in which the number of firms changing prices is constant, are not. Since we do not rely on linear

[1]See Taylor (1999) for a comprehensive literature review on time-dependent sticky price models.

[2]Other papers that study state-dependent pricing models include Caballero and Engel (1993a), Caplin and Leahy (1991), Caplin and Spulber (1987), and Ireland (1997). These papers make simplifying assumptions to gain analytical tractability.

[3]In their case studies, Zbaracki et al. (2004) find that only 4% of the costs associated with changing prices are related to physical menu costs. Seasonalities and varying week/weekend prices in restaurants are illustrations of the assumed pricing behavior.

[4]In the model studied by Mankiw and Reis (2002), firms have flexible prices but only a fraction of firms update their information set every period. In the model studied by Calvo et al. (2001), pricing plans are constrained to consist of an initial price level and a constant growth rate of the price over time. Devereux and Yetman (2003) study a time-dependent model with predetermined prices and focus on persistence associated with small changes in monetary policy. Our model extends these papers by combining the ability to set a price plan, versus a single price, and the ability to choose when to change the plan itself. For small changes in the growth rate of money, we obtain similar results to these papers.

[5]See Chari et al. (2000) and Mankiw and Reis (2002) for a criticism of conventional sticky price models. See also Christiano et al. (2005) and Dotsey et al. (2001) for richer sticky price models that can account for the response of the U.S. economy to small monetary shocks.