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Customer markets and the welfare effects of monetary policy

Johan Söderberg *

Department of Economics, Uppsala University, Box 513, SE-751 20 Uppsala, Sweden

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ABSTRACT

A customer market model in which firms and customers form long-term relations is developed and integrated into the canonical New Keynesian framework. This leads to two important differences compared to the standard model. First, the purely forward-looking Phillips curve is replaced by a hybrid variant where current inflation also depends on past inflation. Second, the welfare cost of inflation is much lower, which leads to an optimal monetary policy where relatively more weight is put on output gap stabilization than previously found in the literature.

1. Introduction

Survey evidence consistently ranks implicit contracts and other forms of customer relations as important factors that firms consider when setting prices. For instance, price raises are often refrained from for fear of adverse customer reactions that may damage long-term relations. The importance of these factors for pricing has been documented in numerous studies for different countries; for recent studies, see Apel et al. (2005), Amirault et al. (2005), and Fabiani et al. (2007). In recent years, narrative evidence that documents the importance of implicit contracts has also emerged. Young and Levy (2006) provide evidence for implicit contracts in the marketing of Coca-Cola, while Nakamura and Steinsson (in press) survey the media and find numerous examples of firms communicating their intentions not to raise their prices.

The customer market model, first proposed by Phelps and Winter (1970), formalizes the idea that firms and customers form long-term relations. In their model, a firm's customer base is a valuable asset that only gradually adjusts to price changes. It is now well established in the literature that the dynamic interaction between prices and demand arising in the customer market model has important implications for price-setting behavior. Early contributions include Bils (1989) and Gottfries (1991), who use customer market models to explain why short-run variations in demand have weak effects on prices. In order to expand their customer base, firms refrain from increasing their prices in times of high demand. More recent examples on this theme are Ravn et al. (2006) and Kleshchelski and Vincent (2009), who construct general equilibrium customer market models that predict countercyclical markups, providing a source of real rigidity. The idea that firms fear adverse customer reactions is formalized in the customer anger model in Rotemberg (2005), where it is assumed that consumers react negatively to prices they perceive as unfair. This fear of antagonizing consumers makes firms scrupulous about price changes, which has the potential of generating nominal price rigidity. Nakamura and Steinsson (in press) analyze a model with forward-looking customer markets and find that nominal price rigidity is sustainable as an equilibrium outcome.

This paper investigates how customer markets affect inflation dynamics and the optimal conduct of monetary policy in the context of the New Keynesian framework. The economic environment I have in mind is one where there are costs associated with the acquisition and processing of information about prices, so that households only occasionally

* Tel.: +46 18 471 11 00.
E-mail address: johan.soderberg@nek.uu.se

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reoptimize their allocation of consumption among different goods. For instance, if different goods are sold at different physical locations, households may choose to only infrequently compare price quotes across stores. This means that information about better shopping opportunities diffuses slowly through the economy. This interpretation is in the spirit of the original customer market model proposed by Phelps and Winter (1970). But even if households are fully informed about prices, there may be costs associated with the time and cognitive effort required to optimally allocate consumption between goods. Such frictions, as well as uncertainty about other product attributes, are factors known to give rise to repeat purchase behavior; see Solomon et al. (2006, Chapter 8) and references therein.

Explicit modeling of information frictions is technically complicated, and I therefore resort to a variant of the signaling mechanism proposed by Calvo (1983). It is assumed that a household allocates consumption among different goods by choosing the *relative* consumption of each good, i.e., the quantity consumed of the good relative to the total basket consumed. But in each period, the household is only allowed to reoptimize for a randomly chosen subset of all goods. By applying the restriction of infrequent reoptimization across goods, as opposed to across households, the representative household construct is preserved, which fundamentally simplifies aggregation and solution of the model.

The result is a model where a firm's market share depends on its lagged market share as well as on current and expected future prices. Because demand is a function of expected future prices, there is a problem of time inconsistency in price setting. Firms would like to promise low future prices, but renege on these promises when the future arrives. The time inconsistency problem is resolved by assuming that firms commit to state contingent price plans. This assumption is unrealistic if taken literately, but it captures the idea that firms can, to a considerable extent, make promises to their customers. The ability of firms to commit should be interpreted as a stylized way of modeling implicit contracts between firms and their customers.

Nakamura and Steinsson (in press) obtain a similar demand formulation by assuming internal deep habits, i.e., households form habits in the consumption of individual goods. They analyze a partial equilibrium model where firms are unable to commit to price policies and show that nominal price rigidity is sustainable in a reputational equilibrium under imperfect information. In their model, a firm compensates for the lack of commitment by setting a price cap above which it will not raise its price. In this paper, in contrast, it is assumed that firms can commit to a price policy. Taking price stickiness as given, the general equilibrium implications for aggregate dynamics and monetary policy are analyzed.

A central difference compared to Ravn et al. (2006) and Nakamura and Steinsson (in press) is that customer markets in this paper are the result of frictions that do not alter households' preferences for different goods. As a consequence, the consumption Euler equation is unaffected by the introduction of customer markets. This has the advantage of allowing me to study the implications of customer markets without having to account for simultaneous changes in preferences and aggregate demand.

The customer market framework is integrated in an otherwise standard New Keynesian staggered price-setting model. The resulting model differs from the standard one in two important respects. First, the Phillips curve is no longer purely forward-looking but also depends on lagged inflation, leading to endogenous inflation persistence. This is a consequence of the forward-looking nature of demand. A firm that desires a higher price, but is constrained by price-setting frictions, will, as a second best option, commit to raising the price in the future. This results in firms continuing to raise their prices even after the factor that initially led them to desire higher prices has dissipated.

Second, the welfare criterion places a much lower weight on inflation stabilization. The main lesson emerging from the utility-based analysis in the canonical New Keynesian model is the importance of inflation stabilization over output gap stabilization. Inflation leads to price dispersion, which distorts the allocation of consumption among the different goods in the economy. Customer markets reduce this distortion by slowing down the reallocation of consumption when relative prices are dispersed. This makes price dispersion less distortionary, which reduces the welfare cost of inflation and leads to an optimal monetary policy that involves a substantially higher volatility of inflation and a lower volatility of the output gap.

The remainder of this paper is organized as follows. Section 2 describes the model and Section 3 presents the welfare criterion. Section 4 describes the calibration and Section 5 shows the results from the numerical simulations. Section 6 concludes.

2. The model

In this section, the decisions of households and firms are analyzed, and a log-linear approximation to the model is derived.

2.1. Households

The economy is populated by a large number of households, indexed by $h \in [0,1]$. A household h derives utility from the consumption of a large number of different goods, indexed $i \in [0,1]$, according to the aggregator:

$$C_t^h = \left[\int_0^1 (C_{it}^h)^{(\eta-1)/\eta} di\right]^{\eta/(\eta-1)}, \tag{1}$$