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New monetarism with endogenous product variety and monopolistic competition



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ABSTRACT

I examine the role played by endogenous variety and monopolistic competition in the long-run transmission of monetary policy. I integrate free entry, product variety and monopolistic competition into a New Monetarist framework, considering preferences that give rise to either constant or variable markups. I find that inflation generally reduces variety. Under CES preferences, firms are inefficiently small, with the inefficiency increasing with product differentiation and the extent of search frictions. The Friedman rule is the best policy under CES preferences. In contrast, with variable elasticity of demand, inflation can increase firm size, reduce markups, and raise welfare, even though output is lower. Under CES preferences, the welfare cost of inflation is high; moreover, this cost increases monotonically with the markup and is higher with endogenous variety than with a fixed product space.

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1. Introduction

The Lagos–Wright environment renders monetary equilibria tractable across a wide variety of market structures. In doing so, it facilitates the integration of models that explicitly describe the frictions which make money useful and the rest of macroeconomics. I argue that introducing endogenous variety and monopolistic competition matter for the long-run transmission of monetary policy. First, taste for variety determines the substitutability of goods, which in turn pins down the markup. A higher markup reduces buyers' gains from trade and hence the marginal benefit of holding money. Consumers thereby underinvest in money holdings, which magnifies the welfare costs of inflation. Second, inflation affects firms' incentives to enter the market, which in turn impacts the size of the product space. I label these respective channels the rent-sharing effect and entry effect.

Endogenizing variety via monopolistic competition enables me to study how inflation impacts the amount of a good exchanged (the intensive margin); the size of the product space (the extensive margin); and, depending on preferences, markups. I refer to the last effect as the markup channel. [Syverson \(2007\)](#) provides evidence that markups are lower in larger markets, which motivates the study of how inflation can affect markups.

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There are three main contributions. First, I derive optimal measures of firm size, which generally depend on production costs, taste for variety, search frictions, and preference shocks in the goods market. With constant-elasticity-of-substitution (CES) preferences, firms are inefficiently small. Intuitively, firm entry creates congestion on existing firms and reduces equilibrium production. From here on, I refer to “size” synonymously with production.

Second, under variable elasticity of demand the Friedman rule – which is optimal under CES preferences – can be suboptimal. This happens because with variable elasticity of demand, inflation can reduce buyers' desire to diversify their consumption basket, thereby diminishing sellers' market power and increasing their production. Lower markups increase buyers' surplus, which mitigates the cost of higher inflation. Provided that the reduction in average cost is large enough, welfare increases. Firms can either be smaller or larger than the optimal size.¹

Third, I show that love for variety and the extensive margin matter for the welfare cost of inflation. At 30% markups under CES preferences, the welfare cost of 10% inflation is 5.71% of output without firm entry and 7.97% with entry. With no taste for variety, these figures are 1.23% without entry and 1.48% with entry. This study thus obtains welfare costs of inflation comparable to those that arise under bargaining.² Nevertheless, some important differences with bargaining emerge. In contrast to the solutions of [Rocheteau and Wright \(2009\)](#) and [Dong \(2010\)](#), which endogenize the frequency of trade, the welfare cost of inflation rises monotonically with price markups. This monotonicity arises from the fact that higher markups imply a more important entry effect.

This paper draws on the extensive literature on monopolistic competition and the New Monetarist framework. [Dixit and Stiglitz \(1977\)](#) formalized monopolistic competition with product variety in a tractable way.³ Monopolistic competition is used even more broadly and has realistic features: firms set prices and goods are imperfect substitutes. It also provides a natural setting for studying economies of scale, and hence for exploring the tradeoff between increasing variety and lowering average production cost.

New Monetarist theory, in turn, emphasizes frictions (e.g. limited commitment and anonymity) that render money essential. The use of matching frictions facilitates this purpose. The latest generation of models adopts the structure of [Lagos and Wright \(2005\)](#), which renders divisible money tractable. While many market structures have been studied (e.g. [Rocheteau and Wright, 2005](#)), relatively little attention has been paid to endogenous variety and monopolistic competition.

In this environment, each period is subdivided into a decentralized market (DM) with Dixit–Stiglitz preferences, monopolistic competition, and search frictions, followed by a centralized market (CM). In the DM, a continuum of goods is produced by monopolistically competitive firms and sold to consumers. In the CM, a general good is consumed and produced. With one variety per seller, the extensive margin directly measures the amount of variety available in the economy.

The paper is organized as follows: [Section 2](#) reviews the related literature. [Section 3](#) presents the CES model with entry, following [Dixit and Stiglitz \(1977\)](#). In contrast to the findings of [Shi \(1997\)](#) and [Rocheteau and Wright \(2005\)](#), the Friedman rule maximizes equilibrium welfare. [Section 4](#) examines equilibrium under additively separable preferences, which give rise to variable markups. Here the Friedman rule is not generally optimal; rather, inflation can increase firm size, reduce markups, and raise welfare. [Section 5](#) analyzes the welfare costs of inflation using a compensated measure. [Section 6](#) concludes. The appendices provide proofs, variations of the model, additional derivations, numerical checks, and a summary of the optimality of the Friedman rule for a number of models.

2. Related literature

The Lagos–Wright environment has been a fertile setting for studying the role of different market structures.⁴ [Rocheteau and Wright \(2005\)](#) examine bargaining, Walrasian price taking, and competitive search in such a framework. Under competitive equilibrium, which is closest to the environment here, the Friedman rule implies efficiency along the intensive margin but not the extensive margin. The latter holds only under a Hosios-like condition in which the congestion externality balances out the thick market externality.

¹ However, if optimal firm size is smaller than equilibrium firm size, then the number of firms (and varieties) at the optimum exceeds the equilibrium level.

² In competitive search equilibrium, which combines price posting and directed search, welfare costs of inflation tend to be much lower. For instance, [Rocheteau and Wright \(2009\)](#) find that 10% inflation costs about 1.1% of output. These low welfare costs arise from the fact that competitive search ensures competitive pricing in equilibrium. In contrast, [Ennis \(2008\)](#), who features price posting but with undirected search, finds that welfare costs of inflation are high, but this result relies on providing all the bargaining power to sellers. With monopolistic competition, instead, the division of surplus depends endogenously on the taste for variety and quantity of trade.

³ Thereafter, product variety has been incorporated into business cycle theory (e.g. [Shleifer, 1986](#); [Caballero et al., 1996](#); [Bilbiie et al., 2012](#)); growth theory (e.g. [Romer, 1990](#); [Grossman and Helpman, 1991](#); [Aghion and Howitt, 1998](#)); and international trade (e.g. [Krugman, 1979](#) and [Melitz, 2003](#)). Monopolistic competition is used even more broadly, encompassing the fields above as well as the New Keynesian literature. On the empirical front, [Broda and Weinstein \(2010\)](#) use the AC Nielsen Homescan Database (1994–2003) to show that net product creation and growth in total sales closely correlate. The AC Nielsen Homescan Database is constructed by providing scanners to 55,000 households who scan in purchases of every good with a barcode. The sample is demographically balanced and includes 23 cities in the U.S. The sectors primarily include grocery, drugstore, and mass merchandise. The expenditure on these sectors amounts to 40% of expenditure in the Consumer Price Index. Furthermore, since the novelty of a product is measured at the household rather than the store level, the inclusion of a new good in the sample genuinely represents an increase in variety at the household level.

⁴ It is compatible with different types of bargaining, such as proportional bargaining ([Aruoba et al., 2007](#)); mechanism design ([Hu et al., 2009](#)) for the purposes of normative analysis; competitive search ([Rocheteau and Wright, 2005, 2009](#)); auctions; and Walrasian price taking.

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