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Home production and sticky price models: Implications for monetary policy



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ABSTRACT

I analyze the consequences of including home production in a New Keynesian model with staggered price setting. Home production amplifies responses to technology and monetary policy shocks. Compared to a model without home production, the model generates close to twice the output response to a monetary policy shock. I consider the implications of several nominal interest rate rules and show that a traditional Taylor rule lacks its usual attractive properties. Alternatively, strict inflation targeting implements the constrained efficient allocation.

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1. Introduction

A substantial amount of individuals' time endowments are allocated to neither work on the market nor leisure, but to work at home. Home work includes activities such as meal preparation, laundry, and grocery shopping. The amount of hours devoted to home work has remained large over time. [Aguiar and Hurst \(2007\)](#), using evidence from time use surveys spanning five decades, show that adults spend approximately 20 hours per week working at home ([Table 1](#)). This compares to an average of 34 hours per week working in the labor market. Goods and services produced at home are, at least in principle, substitutable for market produced goods and services. This suggests that the relative price between home and market consumption influences the allocation of time between market activities and home production. Consequently, to the degree that market prices are sticky, the allocation of labor between the home and market may be distorted. What are the consequences of including home production in an economy with sticky prices? Does home production alter monetary policy tradeoffs? If not, economists studying monetary policy can safely abstract from it. However, if home production changes the consequences of various monetary policies, it becomes an empirical question whether these effects can be safely neglected.

This paper investigates the dynamic properties of an economy with nominal rigidities and home production. More specifically, I incorporate household production into a New Keynesian Dynamic Stochastic General Equilibrium (DSGE) model with staggered price setting and analyze the responses of the endogenous variables to technology and money supply shocks. Allowing households to substitute between market and home production provides an amplification mechanism to changes in the money supply. In particular, including home production in a calibrated model generates a market output response to a monetary policy shock that is roughly twice as large as in a model without it.

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Table 1

Home versus market hours over time.

Year	1965	1975	1985	1993	2003
Market hours	34.24	32.13	32.13	34.02	33.01
Home hours	23.52	20.30	20.64	17.94	18.00
Sample size	1862	1712	3283	5465	15,244

The table above is taken from [Aguiar and Hurst \(2007\)](#): “Measuring Trends in Leisure: The Allocation of Time Over Five Decades”.

The intuition for the amplified response to a monetary policy shock runs as follows. When the central bank increases the money supply or lowers the nominal interest rate, firms want to raise prices. Because of staggered price setting some firms are stuck at their old prices, which makes the market produced good relatively cheap. Households respond by substituting out of leisure and into consumption. This mechanism is the same in the model with home production as in the model without it. However, in the model with home production, households not only substitute away from leisure, but also away from producing at home. The expansion of market labor supply partially offsets the increase in marginal costs associated with the increase in production. Consequently, output expands by more in the model with home production than without it. Similarly, when there is an increase in market technology, both the model with and without home production exhibit humped shaped output dynamics since price stickiness prevents immediate price reductions to the increase in technology. The output response in the model with home production, however, is bigger because labor is flowing from the home sector to the market sector.

Next, I ask what are the consequences of following different nominal interest rate rules in an economy with home production. The attractive properties of a conventionally defined Taylor rule, which include minimizing the output gap and inflation, no longer hold in an economy with home production. Intuitively, if there is a reallocation of labor away from the market sector, due to say a favorable technology shock in the home sector, a central bank following the Taylor rule would cut interest rates, which would stimulate market output and hinder the efficient allocation of resources. In contrast, strict inflation targeting implements the constrained first best allocations.

This paper contributes to the work incorporating home production in DSGE models of business cycles, which started with [Greenwood and Hercowitz \(1991\)](#) and [Benhabib et al. \(1991\)](#) and continues with more recent contributions such as [Fisher \(2007\)](#). Additionally, [Arouba et al. \(2014\)](#), given in the context of a deterministic money search DGE model, analyze how the level of inflation affects home prices.

Another strand of related literature studies multiple sector New Keynesian models like [Kilian et al. \(1995\)](#), and more recently, [Barsky et al. \(2007\)](#). The latter paper shows that in an economy where only some prices are sticky, namely those of durable goods, monetary shocks generate large effects. In this paper, the market sector has sticky prices and the home sector, at least implicitly, has flexible prices.

Closest to this paper is [Ngouana \(2012\)](#), who includes home production for services in a model with staggered price setting. Ngouana’s model captures the fact that consumption of services is more sensitive to monetary policy shocks than non-durable consumption. This paper is complimentary to Ngouana’s because I consider shocks to technology in addition to monetary policy, derive the optimal monetary policy, and explore the quantitative and qualitative implications of suboptimal policy. In contrast to [Ngouana \(2012\)](#), my model economy has one sector, whereas his has two. In the textbook one sector New Keynesian model, there are well studied welfare results of optimal policy, which makes the results found here easily relatable to optimal policy in the textbook model.¹ Moreover, adding another sector means keeping track of hours transitions across sectors, in addition to transitions between the home and market. To preserve the most clarity in the mechanism, I maintain the one sector model. I speculate on how this simplifying assumption may alter the main result in the conclusion.

2. The model

The baseline model has a textbook New Keynesian structure, but is augmented with home production.² To keep the mechanism as straightforward as possible, there is no capital accumulation. The model includes an infinitely lived representative household, intermediate good firms, final good firms, and a central bank. The firms are owned by the household, the final goods firm operates in a perfectly competitive market, and the intermediate good firms are monopolistic competitors. As is standard, staggered price setting is introduced as in [Calvo \(1983\)](#).

2.1. Households

A representative household has preferences over total consumption, leisure, and real money balances. Total consumption is an aggregate of market produced goods and home produced goods. Lifetime expected utility is given by

$$E_0 \sum_{t=0}^{\infty} \beta^t U \left(C_t, l_t, \frac{M_{t+1}}{p_t} \right) \quad (1)$$

$$C_t = g(C_{m,t}, C_{h,t})$$

¹ See [Walsh \(2010\)](#) or [Galí \(2008\)](#).

² See [Walsh \(2010\)](#) or [Galí \(2008\)](#).

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