Money and risk of loss in an asset market segmentation model

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A R T I C L E   I N F O

A B S T R A C T

A simple asset market segmentation model is constructed to study the relationship between inflation and theft when money is the only medium of exchange. In equilibrium, money is nonneutral and monetary policy has asymmetric effects on theft, real money holding, and consumption. The distributional effects persist over periods and the liquidity effect may arise. Next, given the asymmetric effects of monetary policy, the crime rates differ across economic individuals in order to smooth out consumption fluctuations. Given the conditions of stealing technology, monetary equilibrium would not be always sustainable. Finally, the optimal money growth rate is to minimize theft and the Friedman rule is suboptimal.

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1. Introduction

In this paper, a simple asset market segmentation model is constructed to present an analysis of the relationship between inflation and theft[1] when money is the only medium of exchange. Due to anonymity, money has been one of the most prevailed payment instruments although alternative payment instruments such as credit and debit cards thrive recently. According to Kosse (2010), in Netherland, cash is still the most used payment instrument for small amount transactions at points of sale. In particular, in poor regions or countries with low accessibility to financial intermediaries or underdeveloped financial markets, less people are involved into the financial activities and the use of money outweighs that of other payment instruments even more. In Humphrey (2010) and Schuh and Stavins (2010), in the US cash is more preferred as income decreases.

However, anonymity makes money an easy target for pickpocketing, purse snatching, or robbery in a place near ATMs, banks, markets, and tourist attractions, which increases the carrying costs of money. Humphrey, Lawrence, and Vesala (1996) find that as the crime rate increases the use of noncash payment instrument increases across countries according to the Bank for International Settlements. In Kosse (2010), the safety perception plays a crucial role for the consumer's choice of payment instruments in 2008 consumer survey data of Netherland. Humphrey (2010) and Schuh and Stavins (2010) argue that in the US, consumers still rate cash as the most unsafe payment instrument. Furthermore, Williamson and Wright (2010) address that theft along with counterfeiting would be potentially important for monetary policy analysis because it may cause costs of managing payment system.

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[1] In this paper, theft represents losing cash only.

The idea of theft has been formally introduced by He, Huang, and Wright (2005, 2008), Bolt and Chakravorti (2008), Alvarez and Lippi (2009), Sanches and Williamson (2010), and Choi (2011a). Most of these studies focus on the effect of theft on the choice of multiple means of payments, for example, cash, check, credit card, and debit card. For example, He et al. (2005, 2008) adopt a search framework and show that economic individuals may deposit cash in the bank and use checks to avoid theft. Choi (2011a) studies an endogenous choice of means of payments with theft in a cash-in-advance model. In both He et al. (2005, 2008) and Choi (2011a), in the existence of theft, the Friedman rule is suboptimal. In other words, inflation is negatively related to theft and inflation would suppress theft.[2]

The contribution of this paper is to analyze the persistent distributional effects of monetary policy on theft, the dynamics of money demand, and consumption across economic individuals. Unlike He et al. (2005, 2008) and Choi (2011a), money that is nonneutral is the sole medium of exchange as in Choi (2011b) which discusses the distributional effects of monetary policy when there are multiple means of payments in an asset market segmentation model. Unlike Choi (2011b), without alternative payment instruments, economic individuals do not have a device to avoid theft or to insure themselves against monetary policy shocks. Thus, this paper would deliver distinctively persistent distributional effects on theft and the dynamics of demand for money compared to earlier studies.

Understanding the real effects of monetary policy, i.e., the nonneutrality of money, and its persistency are long standing issues in macroeconomics. In order to explain the persistent real effects, much work including Grossman and Weiss (1983), Rotemberg (1984), Alvarez, Lucas, and Weber (2001), Alvarez, Atkeson, and Kehoe (2002), and Williamson (2008) has been developed and extended in an asset market segmentation framework.[3] For example, Alvarez et al. (2002) show the persistent effects when economic individuals receive idiosyncratic endowments and the asset market is endogenously segmented. In Williamson (2008), exogenous segmentation in both asset and goods markets results in the persistent effects.

This paper extends Alvarez et al. (2001) by adding an element of Choi (2011a). There are two types of households: traders who participate in the asset market and nontraders who do not participate in the asset market. The government conducts monetary policy through open market operations. Before the goods market opens, traders (nontraders) face the risk of loss of cash by traders (nontraders). Theft creates two distortions. It decreases output and distorts the intertemporal marginal rate of substitution between current and future consumption.

In equilibrium, when the government injects money, only traders receive it in the asset market. Given a perfectly flexible price, the money injection increases traders' real money holdings, but decreases nontraders'. Thus, the money injection increases theft among traders, but decreases that among nontraders in order to smooth out consumption fluctuations arising from the money injection. Consumption for traders and nontraders may increase or decrease. Next, the distributional effects persist over periods and the liquidity effect may arise. Finally, depending on the conditions of stealing technology, monetary equilibrium would not be always sustainable. The optimal money growth rate is to minimize theft and the Friedman rule is suboptimal.

The remainder of the paper is organized as follows. Sections 2 and 3 describe the model and the equilibrium dynamics. Sections 4 and 5 discuss monetary policy implications and a couple of examples. Section 6 concludes.

2. The environment and timing

Time is discrete and indexed by $t = 0, 1, 2, \ldots$. There is a continuum of infinitely-lived households with a unit mass. A fraction α of the households are traders who participate in the asset market every period and the rest, $1-$, are nontraders who never participate in the asset market. Traders and nontraders live in two different islands which are spatially separated.

Each household consists of a shopper and a worker. The household has preferences given by

$$E_0 \sum_{t=0}^{\infty} \beta^t ln(c_t),$$

where E_0 is the expectation operator conditional on information in period 0, $\beta \in (0,1)$ is a household's discount factor, and c_t represents perishable consumption goods.

At the beginning of period t, traders enter the period with $M_{r,t}$ units of currency and B_t units of one-period nominal bonds. Nontraders enter the period with $M_{n,t}$ units of currency. At period 0, traders start with $M_{r,0}$ and B_0 and nontraders with $M_{n,0}$.

Then, traders go to the asset market and acquire government nominal bonds with money. Each bond sells for q_t units of money in period t and is a claim to one unit of money in period $t+1$. The government injects the money stock, $\mu_t M_t^s$, through open market operations and its budget constraint is

$$\begin{aligned} B_t^s - q_t B_{t+1}^s &= M_{t+1}^s - M_t^s \\ M_{t+1}^s &= (1 + \mu_t) M_t^s \end{aligned} \tag{1}$$

where B_t^s denotes nominal bonds that mature in period t; B_{t+1}^s is newly issued nominal bonds with price q_t that mature in period $t+1$; $\mu_t > -1$ is the net money growth rate.