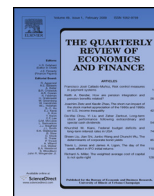




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# The Quarterly Review of Economics and Finance

journal homepage: [www.elsevier.com/locate/qref](http://www.elsevier.com/locate/qref)



## Monetary policy and alternative means of payment

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### ARTICLE INFO

#### Article history:

Received 28 October 2015  
Received in revised form  
29 September 2016  
Accepted 3 November 2016  
Available online xxx

#### JEL classification:

E4  
E5

#### Keywords:

Cash–credit choice  
Means of payment  
Monetary policy  
Risk of loss  
Welfare

### ABSTRACT

This paper captures the trade-offs between alternative payment instruments where each is associated with costs and benefits. Most models of cash–credit choice assume cash is a safe non-interest-bearing asset and credit is interest-bearing but costly. Here, I consider the risk of loss from using cash resulting from theft and foregone interest earnings. I use a cash-in-advance model to analyze the channel through which monetary policy could have a positive impact on the economy by altering the incentives for cash–credit choice. The model indicates that although expansionary monetary policy increases total consumption, the resulting substitution toward credit might increase transactions cost, which may not result in improving welfare. The net effect depends on the change in transactions cost of using credit relative to the responsiveness of theft to inflation. The assumption of fixed cost of credit is crucial to these results. Calibration of the model to the US and Polish economy confirms the results.

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### 1. Introduction

Money finds its role essentially as a “medium of exchange”, thus facilitating transaction of goods and assets. Cash, as a means of exchange, does not involve usage fee, interest fee, etc. and keeps the identity of the user intact. Participants can concentrate their attention on the qualities and prices of the goods they want to exchange; and do not have to memorize account numbers, personal identification (PIN) numbers, etc., again reducing transactions costs. In models of money and monetary policy, the need for cash is often motivated by a Clower-type cash-in-advance (CIA) constraint, which requires that the purchase of goods must necessarily be paid for by cash held over from the preceding period. However, cash is not the only means of payment; in any economy – cash and credit co-exist as means of payment (Lucas & Stokey, 1987).

This paper captures the trade-offs between alternative payment instruments with different properties. Despite cash being the most easy-to-use method of payment, it's characteristic of anonymity makes it susceptible to theft and renders it risky. Assuming there is no identity theft, using credit as a means of payment does not involve such risk; although, it might incur transactions cost. Hence, individuals use a combination of cash and credit to purchase goods and/or assets. With money being risky, the theft rate will influence

individual's cash–credit choice. The paper aims to study the distortionary impact, if any, that the risk of loss of cash (e.g., theft rate) could have on the effect of monetary policy in an economy with cash and credit transactions. The cost associated with credit is a fixed transactions fee. The main contribution of this paper is that it shows, theoretically, the condition under which monetary policy can have a positive impact on welfare of the economy by altering the incentives for cash–credit choice.

A study by Bolt and Chakravorti (2008) shows, empirically, that consumers participate in payment card networks to insure themselves against a theft shock as well as an income shock. Consumers and merchants benefit from greater consumption and sales that arise from transactions that would not occur in a cash-only economy. Hence, this motivates the importance of alternative means of payments when there are costs and benefits associated with both forms of payment. The current paper develops a theoretical model to study how monetary policy influences this cash–credit choice (and consequently, welfare) when the cost of holding cash, besides the forgone interest earnings, is the probability of cash being stolen. However, there are some economies in which non-cash payment system is not well-developed and majority of the transactions are carried out using cash. According to reports issued by the Bank for International Settlements (BIS),<sup>1</sup> a majority of transactions are

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<sup>1</sup> <http://www.unodc.org/documents/data-and-analysis/Crime-statistics/International-Statistics-on-Crime-and-Justice.pdf>.

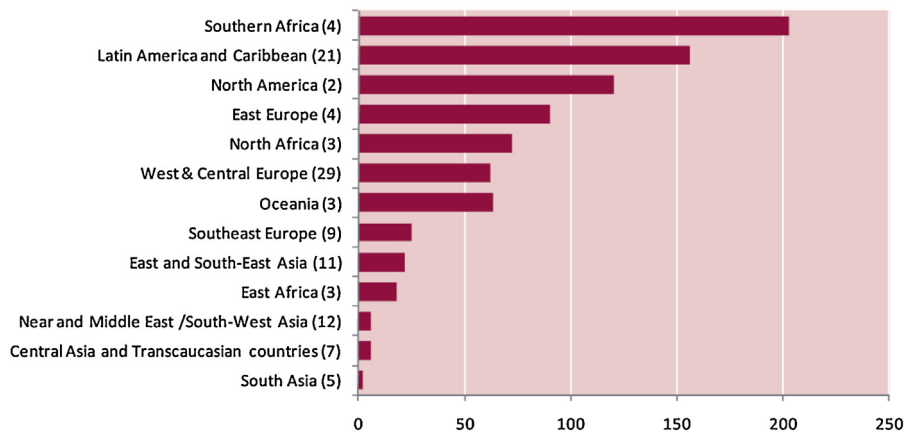


Fig. 1. Incidence of robberies per 100,000 population.

carried out in cash in Southern, Middle and West African countries; a large volume of low value transactions are carried out in cash in East European and Latin American countries. In most of these countries where cash is the dominant system of payment due to underdeveloped credit markets, the theft rate is relatively high. This paper demonstrates the possibility of welfare improving impact of expansionary monetary policy through substitution of cash and credit. Hence, it makes a case for the development of credit markets in economies with higher incidence of theft and underdeveloped credit markets.

Fig. 1 shows the incidence of robberies per 100,000 population in different regions. Robbery, here, includes muggings, bag-snatching and theft with violence. South Africa, Latin America and East Europe, which have a very high incidence of robbery are also the regions in which, according to the BIS reports, cash is the dominant method of payment. Again, robbery is high in areas which have a high usage of cash. Crime, which includes theft and robbery, imposes a cost on society (Becker, 1974). This paper analyzes how monetary policy can alleviate the cost on society by altering the incentives for cash–credit choice.

The co-existence of multiple means of payment has been studied by several authors including Lucas and Stokey (1987), Prescott (1987), Ireland (1997) and Lacker and Schreft (1996). However, to my knowledge, the genre of monetary models with theft dates back only to He, Huang, and Wright (2005) banking models, where the safe-keeping role of banks is generated by the risk of theft that accompanies use of cash. Sanches and Williamson (2010) determines the set of frictions, including imperfect memory, limited commitment and theft, under which money and credit are both robust means of payment. Teles (2004), using a money-in-utility framework and Jones and Kutan (2004) have shown, empirically, that monetary policy can influence the rate of economically-motivated crimes like theft and robberies. The current paper provides a theoretical foundation, using a cash-in-advance framework, for the analysis of the channel through which monetary policy could have a positive impact on the economy where cash and credit co-exist, and each method of payment is associated with costs and benefits.

Choi's (2011), cash-in-advance model analyzes monetary policy implications in an economy with multiple means of payment, where holding money is risky. He shows that in a steady-state equilibrium, the marginal rate of substitution of cash goods for credit goods depends on the interest rate, as well as crime rate. Further, in the event of a positive monetary shock, there would be substitution towards using credit in less number of markets (which reduces fixed transactions cost of credit). Consumption with both cash and credit would increase in each market. Thus, there would be

a welfare-enhancing impact of monetary policy. The present paper finds that an expansionary monetary policy might not always be welfare improving. Essentially, the effect of monetary policy on welfare depends on the responsiveness of theft and the transactions cost of credit to monetary policy. In other words, it depends on the relative change of the net benefit of alternative payment methods in the economy. Two crucial assumptions driving these results are a fixed transactions fee of credit per market and diminishing marginal returns to theft – unlike the linear theft function of Choi (2011).

The rest of the paper is organized as follows: the environment is set up in Section 2; Sections 3 and 4 demonstrate equilibrium and the steady state, respectively; Section 5 explores the dynamics around the steady state; and Section 6 analyzes the welfare implications of monetary policy.

## 2. The environment

There exists a unit mass of infinitely lived households on the continuum  $[0, 1]$ . A household comprises of a worker–shopper pair. Each worker,  $j$ , produces and sells all non-storable consumption goods,  $i$ , in the continuum  $[0, 1]$  in the goods market. Each household's objective is to choose a path of real consumption,  $c_t$ , and asset holdings to maximize:

$$U(\{c_{t,j}\}_{t=0}^{\infty}) = E_0 \sum_{t=0}^{\infty} \beta^t \{\ln c_{t,j} - x_{t,j}\}$$

where  $\beta$  is the discount factor,  $c_{t,j} = \int_0^1 c_{t,j}(i) di$  represents consumption of goods purchased from all markets  $i$  in period  $t$  by household  $j$ , and  $x_{t,j}$  is the transactions cost of using credit, which is further defined later in the paper. Price of each consumption good,  $i$ , is  $p_t(i)$  and  $P_t$  is the aggregate price level ( $P_t = \int_0^1 p_t(i) di$ ). The transactions cost of credit could include record-keeping costs and the effort exerted to keep such records affects utility.

Each household enters period  $t$  with  $M_{t-1}$  units of currency. The monetary authority makes a nominal lump sum transfer,  $T_t$  to each household. Hence, the growth rate of money,  $\theta_t$ , which is a stochastic variable, is revealed to the households at the beginning of each period. Each household has:

$$M_t = (1 + \theta_t)M_{t-1} \tag{1}$$

where the per capita transfer,  $T_t$  equals  $\theta_t M_{t-1}$ .

Let  $u_t = \theta_t - \theta$  be the deviation of money growth rate from its steady-state average rate and assume:

$$u_t = \rho_u u_{t-1} + \varphi_t \tag{2}$$

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