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Who should bear the resource cost of electronic transaction?

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ABSTRACT

Using a search theoretic model of money, we examine an optimal allocation of the resource cost of electronic transaction. A transaction using cash incurs a buyer its carrying cost, while an electronic transaction incurs data-processing cost to the payment platform which then raises the resource cost from buyers or sellers using the electronic payment system. An equilibrium allocation of the resource cost implies the seller-take-all-burden scheme by which the payment platform can maximize the volume of electronic transactions by raising the resource cost only from sellers. However, the socially optimal allocation of the resource cost implies the buyer-take-all-burden scheme by which the resource cost should be raised only from buyers in order to maximize welfare.

1. Introduction

As the electronic means of payment such as credit card and debit card are used widely for in-store purchases, the cost of electronic transaction has called attention from retailers, consumers, payment networks, and policymakers. For those parties involved in electronic transactions (e.g., retailers, consumers, payment networks), this cost mainly consists of two parts: one is the resource cost incurred from record keeping and information processing on the transaction involved, and the other is the fees paid by one party to another. From the societal point of view, the latter is a zero-sum in the sense that the fees paid by one party are cancelled out by the fees received by another, whereas the former requires additional resources. Hence, policymakers who have an interest in an efficient allocation of resources have raised particular concerns about the resource cost of electronic transaction. (See, for instance, Hayashi and Keeton (2012);Schmiedel et al. (2012).)[1]

In this paper, we examine such a resource cost of electronic transaction due to information processing, which has the feature of a fixed per-transaction cost independent of the transaction amount. In order to do that, we consider a model economy in which debit-card transactions are available but unsecured credit-card transactions are ruled out. As pointed out properly by Lotz and Zhang (2013), there are vital distinctions between credit card and debit card. First of all, credit card is an unsecured "pay-later" card which involves the cost due to "payment guarantee services" other than the resource cost mentioned above. Partly due to this feature, credit-card fees are typically *ad valorem*. On the other hand, debit card is a "pay-now" card and there seems to be

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[1] There is a relatively large literature that has focused on the issues related to the surcharge and interchange fees (e.g., Rochet and Tirole (2002); Schmalensee (2002); Gans and King (2003); Wright (2004); Schwartz and Vincent (2006); Monnet and Roberds (2008); Prager et al. (2009); Bolt et al. (2010); Rochet and Wright (2010); Verdier (2011); Shy (2012), and Wright (2012)).

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a wide agreement that a debit-card transaction incurs a fixed processing cost (e.g., Wang (2010)). This suggests that the cost of debit-card transaction is mainly composed of the resource cost that we are interested in.

We also note that in the real world, a payment platform (e.g., debit network) typically raises the resource cost only from retailers. We first investigate whether this is indeed an optimal scheme of raising the resource cost on the part of a payment platform who maximizes the usages or volume of electronic transactions. This appears to be a plausible objective of a payment platform, considering that debit networks, for example, charge a flat processing markup called a PIN-debit fee. We then ask the efficiency or social optimality of the payment platform's raising scheme by looking into the problem of a social planner who maximizes welfare defined as a lifetime discounted utility of a representative agent.

More specifically, we construct a standard search theoretic model in which money is essential as a medium of exchange and agents can make debit-card transactions via electronic transfer of money as well as cash transactions. In a decentralized market, sellers (retailers) first post prices and then a submarket is formed according to the posted prices. Buyers (consumers) direct their search toward a most attractive submarket where each buyer is randomly matched with a seller. In all pairwise meetings, trades are *quid pro quo* and either cash or checking account deposits should be transferred from a buyer to a seller. A cash transaction incurs cash-carrying cost to a buyer, whereas an electronic transaction incurs data-processing cost to the payment platform which then raises the cost from a buyer and a seller involved in the trade.

The main results are as follows. The payment platform should raise the resource cost only from sellers (seller-take-all-burden scheme) in order to maximize the volume of electronic transactions. Buyers are then willing to make transactions using an electronic payment instrument regardless of the magnitude of its resource cost because using cash only incurs its carrying cost without any benefit compared to using an electronic payment instrument. This prediction is consistent with the aforementioned observation from the real world: i.e., debit networks in the U.S. charge fees only on retailers but the retailers are not typically allowed to impose a surcharge for purchases made using debit cards.

In contrast, however, it turns out that a buyer-take-all-burden scheme is socially efficient. That is, in order to maximize the welfare, the resource cost should be raised only from buyers. Intuitively, a scheme that raises (a fraction of) the cost from sellers is distortionary in the sense that it decreases consumption as sellers eventually pass on the resource cost to buyers by charging a higher price of consumption goods. On the other hand, under the buyer-take-all-burden scheme, there is no room for such a pass-through channel and each buyer chooses the means of payment by comparing the cost incurred from a cash transaction with that from an electronic transaction.

In a nutshell, we show that there exists a wedge between an equilibrium allocation of the resource cost of electronic transaction and its efficient or socially optimal allocation. This is analogous to a strand of industrial-organization literature which shows a wedge between the profit-maximizing interchange fee and the welfare-maximizing interchange fee in the two-sided markets. (See, for instance, Verdier (2011) for an extensive survey.) In particular, Wright (2012) shows that a profit-maximizing card platform sets the fee in favor of cardholders so that retailers end up paying too much. This implies that social welfare can be improved upon by increasing card fees and reducing merchant fees, which basically shares the same spirit with the implications of our key results. The main difference is that we focus on the fixed social resource cost of electronic transaction rather than its private costs in the context of a macroeconomic model where money is essential as a medium of exchange in the presence of search frictions.

The paper is organized as follows. Section 2 describes the model economy. Section 3 characterizes a stationary monetary equilibrium. Section 4 compares the welfare across different equilibria and discusses an optimal cost-raising scheme that maximizes welfare. Section 5 discusses the robustness of our main result under different pricing mechanisms such as the generalized Nash bargaining and the Walrasian price taking. Section 6 summarizes the paper with a few concluding remarks.

2. Model

The background environment comes from Lagos and Wright (2005). Time is discrete and in each period, there are 2 subperiods, morning and afternoon. A unit mass of infinitely-lived agents trade the "CM-good" in a centralized market (CM) which opens in the morning and the "DM-good" in a decentralized market (DM) which opens in the afternoon. Both goods are divisible and perishable. There is another object called money that is divisible, durable and intrinsically useless.

In the morning, all agents can produce and consume the CM-good. The utility from consuming g units of the CM-good is given by $v(g)$ where $v'' < 0 < v'$, $v(0) = 0$, $v'(0) = \infty$, and $v'(\infty) = 0$. The disutility from producing g units of the CM-good is given by g according to a linear production technology. Upon opening the CM, new money is injected by lump-sum transfers. That is, the money stock evolves according to $M_t = \mu M_{t-1}$ where M_t denotes the stock of money in the period-t CM and $\mu > \beta$ with $\beta \in (0, 1)$ denoting the discount factor between the morning and the afternoon.[2] Each agent then trade in the CM and chooses the money balance that is carried into the afternoon. Money can be kept in the form of either cash or checking-account deposits. The information on checking accounts is managed by a payment platform (i.e., a provider of electronic payment service) which has technology for record keeping of the accounts only from the current CM to the next morning before the new CM opens. This limited record-keeping technology, as we will see later, makes us avoid unnecessary complexity by allowing electronic transactions only in the DM.

[2] The discounting is not between the afternoon and the next morning. As in Rocheteau and Wright (2005), for instance, all that matters is the total discounting between one period and the next.