Comments on
"A Theory of Credit Cards"
Sujit Chakravorti, *Federal Reserve Bank of Chicago*
Ted To, *Bureau of Labor Statistics*

"Network Externalities and Technology Adoption:
Lessons from Electronic Payments"
Gautam Gowrisankaran, *Federal Reserve Bank of San Francisco*
Joanna Stavins, *Federal Reserve Bank of Boston*

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I want to thank the conference organizers and the authors for putting together a great conference, and allowing me the opportunity to discuss two fine papers.

Network effects are believed by many to be an important element of the economics of payments. In this session we see some of the best examples of papers that examine network effects, from both empirical and theoretical points of view. A central question of markets in which network effects are featured is whether they are internalized by the market institutions, or whether some network effects are external to the market agents, and therefore left unexploited. In the first paper today, network effects are present, and are reflected in the price in the model—the interchange fee. However, the interchange fee simply transfers rents in the model, so it doesn't play a role in internalizing network externalities. The second paper suggests that network effects are not fully exploited in an important U.S. payment system. This is troubling, especially if

one were to believe, as I'll argue, that the network effects estimated by the authors represents a lower bound on the network effects present in that payment system.

The paper by Bob Chakravorti and Ted To is a real addition to the literature. Let me summarize what I believe to be the key assumptions, and then discuss the findings of the paper. The paper models a charge card market: customers are advanced funds to make purchases at no interest. Issuers get income from merchants via a merchant discount. Merchants must decide to accept or reject the terms of the offer by the monopoly issuer of cards. Merchants are price-takers vis-à-vis the card issuer. Merchants have no repeat business from consumers. Consumers face random consumption requirements. Consumers prefer the charge card to cash as they can invest unused balances in the first period of the model. Under these assumptions, there is a network effect embedded in the interchange fee, in that the more that the card allows consumers to purchase in the first period, the more can the issuer charge to the merchant.

Second, there is a potential prisoners' dilemma in acceptance for merchants. They accept the cards, but at the expense of second-period sales. But no individual merchant can affect their own second-period sales. The recognition of this effect is an important contribution to the literature. Baxter's classic treatise on the determination of interchange fees identifies merchant willingness to accept interchange fees with social welfare gains. Rochet and Tirole point out a flaw in Baxter's argument by acknowledging competition. Competition between merchants means the acceptance of a card by one merchant may lead to other merchants accepting the card to maintain their competitive positions. By doing so, they steal business from the original acceptor. As a result, social welfare is much lower than would be the case in the absence of competition.

Chakravarti and To assume away the static business stealing effect of competition, but point out that such a device is still at work if we consider the dynamic effect of the presence of cards, combined with either competition in the second period, or just random assignment of consumers to businesses in the second period. So they have identified another limitation to Baxter's approach of estimation the welfare properties of the interchange fee.

Retailers' prices are fixed. The retailers cannot post a surcharge of offer a discount for cash. Finally there is no repeat business for the producers. These assumptions are defensible. Consider airport duty free shops. They have a monopolistic license, they don't interact with customers repeatedly, and their price may be fixed by prices in otherwise unrelated home markets. Such businesses might be good candidates for the type of assumptions the authors use in this paper.

The issuers and consumers' assumptions are simpler. The consumer enjoys a fixed boost to utility upon consumption if she needs to consume. As the price is fixed, and there is a positive discount rate, the consumers would preferred to consume earlier rather than later. Furthermore, under the assumptions of the model, consumers receive free credit from the credit card issuer, and so benefit in two ways from the use of credit cards: credit cards ease a credit constraint, and allow first period purchases when otherwise the consumer would be credit constrained, and credit cards allow wealthier consumers to invest more first period income than they would were credit cards not available.

The issuer is a profit-maximizing monopoly who extracts rent from the merchants through the interchange fee. The authors derive the results that first, as the number of

consumers whose wealth is sufficient to have been extended credit cards rises, the merchant discount rises--in effect, a network effect. Second, the merchants, because of the lack of repeat business, may accept credit cards even though it is not in their interests to do so, as a result of stealing business from the future.

These results add to the literature. Prior literature has shown that the interchange fee can in some circumstances correct for issuer monopoly pricing, or what is known as double marginalization of prices by both the issuer and acquirer, and therefore potentiall offset a market inefficiency. But in prior literature the interchange fee rarely reflects the value of a network effect in card usage.

One way the authors could usefully extend the paper is by adding bankruptcy or default costs to the model. In the model, when a customer defaults, the card issuer claims all the income of the customer. In reality, with no lien on assets, card companies find it difficult to collect from defaulting customers. The question arises whether, with a modest cost of default, the monopoly issuer would overissue cards, relative to the social optimum, to take advantage of the network-enhanced interchange revenues it can expect to earn. This is an extension in the spirit of the model, maintaining most of the assumptions, but allowing the authors to answer a challenging welfare question within the model.

How robust are the results of the model, and do the capture something that other papers haven't? First, perhaps they do capture something, especially in the business stealing from future sales effect. The transition from store credit to general-purpose cards reduced store loyalty, serving to enhance the incentives explored in this paper to accept

cards to make short-term sales, knowing that others are doing so as well. Future sales are a commons, with everyone else poaching my future customers today.

The paper does not address the role of surcharges, an important current policy issue, where the Reserve Bank of Australia is requiring credit card companies to lift no-surcharge rules. It does address the role of the interchange fee and suggests that attempting to create a cost basis for the interchange fee might be problematic, as in the paper there is no cost justification for the fee.

The paper sidesteps an important issue, but one that has been dealt with extensively in the literature—the potential for double marginalization of prices in markets in which there is market power in both issuer and retail segments. The effect of the interchange fee in this context is complicated.

I think that adding credit can significantly enrich (and complicate models). Credit cards attract two types of consumers, credit constrained and convenience users. Convenience users use them as charge cards, for convenience of record keeping, and for the grace period. Credit constrained users use them for the credit they offer. Merchants may not gain sales from the convenience users, but may gain significant sales (at least in the first period) from the credit-constrained card holders. That is one direction in which to go, and another is to bring to bear methods of general equilibrium, which would require simplifying some of the market structure issues as we see in Chakravarti and To's paper.

Gautam Gowrisankaran and Joanna Stavins have presented an excellent paper, that seeks to estimate network effects in the use of the automated clearing house (ACH) over the period from 1995 to 1997. They find that the recent adoption of ACH by other

banks in the geographical area significantly increases the likelihood that a bank will use ACH itself. This result is shown in three different ways-each one more clever than the last. Perhaps surprisingly, the result doesn't extend to the extent of ACH usage by other banks, but instead is restricted to the whether or not other banks originated ACH transactions at all. Their paper is very impressive. They develop a useful and clear static model of adoption of ACH, and employ very well thought out statistical methods while using firm-specific data. By employing panel data they avoid many of the problems of many plausible outcomes being consistent with the data. It is a paper that will be cited in the literature for years to come.

Nonetheless, one can question whether the paper indicates the presence of network externalities at all, or, if it does, whether is presents a lower bound on the network effects in ACH. To begin with, it is in some ways surprising that the authors find evidence of network effects. The reason is that some would argue that they aren't testing for direct network externalities.

The economic literature has identified two types of network externalities, direct and indirect. A direct externality is usually the result of different agents employing complementary components of a technology to perform a trade. For example, to make a credit card transaction, a merchant must have developed a relationship with an acquiring bank and, for electronic transactions, installed a card reader. A consumer must have developed a relationship with a card-issuing bank and obtained a card. Put the two together, and one has a card transaction. As a result, the typical story of direct network externalities in card payments is that as more merchants offer terminals, the consumer has

a greater demand for cards (and vice versa). That is an example of a direct network externality.

An indirect externality is one in which users of a particular computer game system learn more about it, and share their knowledge, leading others to find it more convenient to use the full features of the program, thereby increasing the value of the game to them. But the users don't exchange files—that would be a direct externality.

The authors of this paper are arguably testing only for an indirect externality because the data they use to measure adoption and usage is data on ACH originations. That is, they say a bank has "adopted" ACH if it makes a number of ACH payments, credits or debits, in a given month. The number of recipient banks is held fixed. Testing whether one bank originates ACH transactions as others begin to do so is not testing the amount of sharing or exchanging of files between banks. It is not testing whether, as more banks are able to receive ACH transactions, more banks originate ACH transctions. It is instead similar to testing if the number of credit card holders or transactions are clustered in time and space for a fixed number of merchants. If the transactions are clustered, the result is ascribed to network effects. These must be indirect effects, of learning or effects that operate through the labor market, in increased expertise being shared, for example. But banks do not employ complementary components of a technology when "adopting" ACH according to the G and S definition—the complementary components lie in the originating and receiving of payments.

Arguably, network effects could be completely absent. One story that is consistent with the results, but for which there are no network effects is that a consulting firm (such as Paychex in NY, PayDay in California, etc.) moves to an area at a given time

and offers to process payroll for a local company, which confers some slight technological advantages on its customers. Alternatively, the consulting company sells cash management software to a local bank. The company's bank agrees to act as ACH agent, and begins to process the company's payroll, or it promotes its cash management services to local firms. The consulting firm sells its services to other companies in the region, and other banks begin to offer services as a competitive response to the first bank. The model of the paper does not admit this possibility as the customers do not choose banks. Even the three-stage game the authors discuss would not be consistent with this natural alternative, in that the demand would not be lower for bank k, absent network externalities.

Such a story is consistent with the results of the paper, but does not rely on network effects. Network effects could be present, via learning by bank employees, or by firms in the area. But the authors' results on volume of transactions, which do not indicate strong clustering, suggest that the network effect is in the adoption decision itself. This suggests to me, that rather than indirect externalities, this competitive story may be at least equally likely in explaining the results. This story is compatible with all tests of the authors. In their most stringent test, the large bank branches may import fancy technology, and then the local yokels have to catch up. Again, this is consistent with competitive pressures being brought to bear on local banks as regionals begin to offer cash management products to local firms.

This test of indirect network effects through originations raises a concern: perhaps all banks adopt in an area at the same time because one bank sends many payments, many of which are wrong, and other banks have to send those payments back! I was very

relieved to see in the version of the paper I received last week that in model 4, the authors defined adoption as consisting of at least 20 payments, which goes a long way toward alleviating this concern. Still I wonder how the results would change if the authors limited themselves to those banks that adopt ACH and don't exit. Surely these banks are ones that have made a stronger business commitment to ACH.

Suppose we accept the authors' estimates of the significance of network effects. What implications do they have for policy? They have important implications. First, the use of specific payment instruments might be significantly underutilized given the presence of indirect network effects alone. This suggests that direct network effects, which are presumably larger might be quite explanatory in determining the extent of use and growth of alternative instruments. Such judgements are difficult to make however, as the magnitude of the externalities is difficult to assess.

Where should one look to test direct network effects? Perhaps the recent experience of PayPal would offer a good test. As more sellers offered to accept payment by PayPal, the number of people establishing PayPal accounts would grow, and vice versa. Different types of sellers would mimic the geographical areas of the paper. Here again, though, the competitive effect of offering the same options as those offered by rivals, makes inferring the presence of network effects difficult.

I would like to applaud both sets of authors for providing very fine papers to discuss.