Economic Analysis of Wireless Point of Sale Payment in China

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China is an extremely fast-growing economy where the standard of living in the major urban centers has improved even faster than the overall growth rate. The financial sector of the economy is also evolving rapidly. However, China is at a very different position than many other economies in terms of its payment systems in the economy. In China personal checks are not used. The use of cash is extremely high in China. Although debit cards are widespread and credit cards are beginning to be introduced, cash continues to be the payment method of choice when consumers pay their monthly bills and pay for their purchases.

When paying monthly bills for utilities and rent consumers typically have two choices: (1) pay in cash or with a debit card, which often means standing in line or (2) establish an “automatic payment” arrangement with a bank where the utility bills are debited against the account each month or use electronic banking. 2 According to an executive at one of the four largest Chinese banks, about 2/3 of its customers have chosen to use option (1).

China has a single debit and credit card network, Moneylink. 3 Moneylink’s rates are regulated by People’ Bank of China—the Central Bank of China, although complaints regarding the level of fees are widespread. Many medium and smaller merchants do not offer debit card payment because of the interchange fee and the cost of acquiring the point of sale (POS) terminals for debit card (and credit card) payment. Thus, cash is the primary payment method when consumers pay for their purchases.

China also differs from many other developed countries in term of its high penetration ratio of mobile telephone along with its relatively low penetration ratio of

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1 MIT Department of Economics, MIT Sloan School, and Chinese Academy of Social Sciences. We thank the MIT Center for E-business for financial support.
2 Electronic banking is also possible but the penetration of PCs at the household level is quite low. This alternative is used very little to pay bills according to interviews with Chinese banking officials.
3 Moneylink is also referred to as China Unionpay. In the US Visa and MasterCard are two major credit card networks and also offer signature debit. Three major debit networks, not associated with the credit card networks offer online (or PIN) debit. However, Visa offers both the largest credit card network and will be the largest (online) debit network beginning in about 2005.
fixed-line telephone. Two mobile telephone companies provide service nationwide with about 305 million subscribers. The penetration ratio is especially high in cities and among young people. The mobile telephone penetration ratio is about 25% with mobile exceeding fixed-line for the first time last year. Mobile telephone is also growing much faster than fixed-line telephone with mobile growing at around 60% on average per year from 1998-2003 while fixed-line growing at about 25% per year in the same period. An important economic factor in China is that a large proportion of mobile telephone subscribers, especially among young people, do not subscribe to fixed-line telephone. In contrast, in most countries that have high mobile penetration ratio, the vast majority (usually over 95%) of mobile subscribers also subscribe to fixed-line.

This project considers a proposal to develop a payment system that provides secure access to mobile subscribers’ bank accounts through the Chinese inter-bank settlement network. This system would take advantage of the rapidly growing mobile telephone subscriber base to substitute for the use of debit cards in a lower cost manner. If successful, it would lead to increased use of electronic payment and decreased amount of waiting in line to pay bills. The proposal would also allow for increased electronic transactions from businesses to consumers (B2C) and increased electronic transactions between people (P2P). While our research did not find any regulatory or institutional barriers to offering the proposed mobile-based payment system, which we describe, we found that the high rates set by the central bank for use of the inter-bank settlement network make the approach currently economically infeasible. Changes in the rates charged would be needed to make the proposed payment system economically feasible.

Possible Use of the Inter-Bank Settlement Network

Most countries, including the US and China, have inter-bank settlement (IBS) networks. In both countries the network is operated by the Central Bank. IBS networks allow one bank to send money to another bank, typically done once or more times per day in a batch mode in the U.S. In the U.S. the cost of a transaction is about $US0.07 per transaction. The IBS network can also be used as a substitute for debit and credit card transactions.
Debit card networks typically cause the debit card-issuing bank to pay an interchange fee of approximate 0.50% of the transaction amount with special rates for supermarket, in the range of about $0.15 per transaction. Credit card interchange fees are significantly higher by about a factor of 3 or more. Thus, on an approximately $40 average debit transaction, the merchant would pay about $0.20 fee of somewhat lower for a supermarket transaction.

Some merchants now offer payment options that attempt to lower the transaction fee from debit or credit cards by using the IBS network. For example, Safeway supermarkets in California issue an individual shopper card that allows Safeway to issue a debit against the individual’s bank account. The individual’s bank then sends the money over the IBS network to Safeway’s bank for payment. Safeway achieves approximately a 50% reduction in fees.

Our proposal for China has features in common with this arrangement, although we propose to use the mobile phone network to send messages to the customer’s bank.

A small increase in risk does occur using the IBS network rather than debit or credit cards. The customer’s bank account typically has the money removed at the time of the debit transaction and the credit card networks guarantee merchant payment (absent fraud). In an IBS network transaction, the customer’s account may have the money at the time of the transaction, but at the end of the day when the IBS network transaction is made the account may no longer have the funds. However, this risk is typically not very large.

Moneylink: the Debit and Credit Card Network in China

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Footnotes:

4 This interchange fee is then passed on to the merchant. Both banks and merchants also pay processing fees, which we do not consider here, since they should be relatively invariant to the approach used.
5 In the US Visa and Mastercard also offer signature debit at rates higher than PIN debit, but lower than credit card fees. PIN debit prices have decreased since the settlement of the Wal-Mart litigation.
6 While a 0.25% reduction may not seem large, supermarkets work on extremely low margins in terms of sales so the amount is significant. Safeway provides incentives for shoppers to use these cards. Similarly, “electronic checks” have begun to be used in the US where a customer presents the check and the electronic coding on the check is used for a transaction over the IBS network. No special card is required for the shopper in this situation.
7 However, another cost to the merchant can arise from credit card transactions when the customer claims not to have made the purchase or decides to return the goods.
Moneylink (ML), also called China Unionpay, was formed in 1992 as a non-dividend paying for-profit joint stock company with 80 banking and financial institutions as members. The top ten largest banks in China all belong. ML was set up to provide ATM and POS (debit) card network services, as credit cards were not in use in China in 1992. ML proposes the interchange fee, but the actual fee is set by the Central Bank. The transaction fee varies by type of merchant from 0.8% to 2.0%.  

Debit card usage is not regulated in China. All debit is online (PIN) debit. Credit card transactions are now sent over the same network as debit card transactions. Credit card issuance is still tightly controlled in China so that credit card usage is much smaller than debit card usage. Most bank customers have debit cards while few have credit cards. However, credit card usage is growing rapidly in the past year. The Central bank sets the interchange rate for credit cards and the network fee is currently the same as for debit cards. 

E-commerce in China

E-commerce has begun in China, but it is not widespread. Here we consider only individual e-commerce, not B2B e-commerce. Since individual computer ownership in China is not high, fixed-line Internet e-commerce by individuals is quite low. Banks have offered electronic banking services, but the usage has been low to date. We concentrate, instead, on mobile e-commerce because of the relatively high penetration of mobile telephones service, which now exceeds 300 million users in China.

China Unicom, the smaller of the two mobile telephone operators in China, recently began a mobile-ecommerce initiative in July 2004. China Unicom operates

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8 Merchants are classified into three categories by profitability. The total rates paid by each merchant are approved by the central bank. The government also sets the so called “8:1:1” rule that determinates the division of the total rate which consists of the interchange fee, the fee paid to China Unionpay, and the fee paid to the acquiring bank. In other words, the transaction fee depends on the profit margin of merchants. For instance, hotels and restaurants etc. are classified as merchants with high margins. The total rate these merchants paid is 2%, in which the interchange fee is 1.6%, the free paid to China Unionpay is 0.2%. Note that in China, there is no difference among the fees for POS transactions using either credit card or debit card.

9 The opposite situation exists in the US.

10 The fixed-line companies also offer a mobile PHS service, but we do not consider it further here because of its lack of data capability.
two networks, a GSM 2G network and a CDMA 1-X 2.5G network.\textsuperscript{11} China Unicom foresees that many possible banking services may be provided: transfer of money between individuals (P2P) and perhaps some firms such as airlines or supermarket will use the system. However, no bill payment service is currently offered.

We see three possible problems with China Unicom’s success. (1) China Unicom only receives money for the telecommunications services so insufficient economic incentives may exist to invest in expanding the service, (2) only 20-30\% of its CDMA subscribers have Internet enable phones and the services offered demand this feature, and (3) China Unicom does not offer the service on its GSM network.

China Mobile, the larger of the two mobile networks in China, has not announced plans for mobile e-commerce. China Mobile operates a 2G GSM network and has not yet adopted a higher speed 2.5G EDGE network for faster data transmission. However, China Mobile is planning to deploy EDGE very soon.

Moneylink (ML) plans to offer one form of mobile bill payment over GSM mobile phones\textsuperscript{12}. It is a SIM card based service that allows utility bill payment without standing in line. After registration, the customer sends a message using her mobile phone and her bank account is debited for payment to the utility.

\textbf{Our Proposal}

We propose to use mobile phone for both bill payment and for POS transactions payments, as a lower cost alternative to debit cards and credit cards. Customer bill presentation would be done in one of two ways. Either SMS would be used to send the bill or if the subscriber’s phone were Internet enabled, the lower cost option of using a data message would be used. The customer would be contacted through the cellular phone and could decide to pay the bill, if correct, by pushing a single key. If the customer had questions regarding the bill, she could ask for further information by pushing another

\textsuperscript{11} G stands for generation. The second-generation networks have data speeds of about 20 kbs, while CDMA 1X has a data speed of 40-50 KBS, about the same as the fixed-line network. China Unicom uses BREW technology from Qualcomm. CDMA 3G EVDO networks in use in Japan, Korea, and in parts of the US have data speeds in the range of 200 kbs to 2.4 mbs, which is equivalent to a high speed broadband service. China Unicom does not yet have plans to deploy a EVDO network, as the Chinese government has not yet finalized plans over 3G deployment.

\textsuperscript{12} This service is a joint project between ML’s subsidiary ChinaPay and China Mobile. A trial of this service will start in October 2004 in Guangdong Province.
button, which would contact a customer service representative or look at more detail, if she had an Internet enabled mobile telephone. All of these options are significantly lower in cost than printing and sending a mail by mail. Also, the customer could establish a time to be contacted each month, if desired. This approach would likely lead to more prompt bill payment. The customer need not stand in line, which would also lead to an incentive for customer use. Thus, the firm has a lower cost, the customer need not stand in line, and the mobile telephone operator receives service revenue. Lastly, the banks require fewer counter personnel to collect bill payments so they receive a cost savings as well.

For POS transactions we propose the following platform. So far as we are aware this approach has not yet been adopted in any country.\textsuperscript{13} Almost all “cash registers” are now computers. Further, almost all mobile telephones are now sold with “Bluetooth” capability, which allows for short-range communications. Cash registers equipped with a Bluetooth device would transmit the transactions amount and the retail store’s bank code to the mobile telephone, which would then send a data message to the subscriber’s bank. The bank would verify that sufficient funds were present and would initiate a transaction to the firm’s bank over the IBS network. A message would be returned to the mobile phone, which would use Bluetooth to signal the cash register that the transaction had been completed.\textsuperscript{14} Thus, the firms would substitute the mobile data network and the IBS settlement network for use of ML’s debit card or credit card network.

**Could this Approach Work in China?**

Many fewer stores in China allow for POS use of debit and credit cards, mostly because of cost. Further, a number of retail merchants are currently complaining that ML’s interchange fees are too high.

We met with officials of the Central Bank who are attempting to encourage the growth of e-banking. However, most of the activity and growth to date has been B2B activity. The Central Bank is currently planning to draft regulations for e-banking. The

\textsuperscript{13} MobileBest has proposed to use a card-swiper that is connected to a mobile telephone to serve as a POS machine for medium and small merchants.

\textsuperscript{14} The subscriber could be informed by the bank of the amount transferred at that time so no question about fraud would occur.
Central Bank would expect to encourage the type of cost saving and time saving approach that we have outlined.

The IBS network in China requires all companies involved in payments to be banks, with the exception of the Post Office. Our approach abides by this requirement since it sends payments from the mobile subscriber’s bank to the retail store’s bank. Further, the IBS network is national and electronic so all of China would be covered so long as a mobile network existed in the given geographic location. The Chinese IBS network is transaction based with clearance in real time, rather than batch as in the U.S. Thus, the bill presenter or retail store would have no risk of non-payment because the transfer would take place at the time of the transaction.\(^{15}\)

The primary potential obstacle we see is one of cost and the structure of IBS network fees. The Central Bank fee for an IBS network transaction is 5.5 Yuan for banks in different cities, or about US$0.66.\(^{16}\) For a 100 Yuan transaction this amounts to approximately 5.5%. In comparison, for a ML debit card transaction the transaction fee is 0.8% for typical merchants with low margins. Thus, the cost savings are unlikely to be sufficient for a retail merchant with relatively small transactions to adopt the system. The merchant would save the cost of purchasing POS equipment, but the necessity of purchasing Bluetooth enabled cash registers would likely offset much (or most) of these savings. For merchants with higher margins whose debit card transaction fee is higher up to 2% and with higher transactions amounts than 100 Yuan, the cost savings would be more. However, many of these merchants already accept debit cards so that replacement by the IBS network might be difficult.

The Central Bank fee for an IBS network transaction is zero for banks in the same city. For transactions where both the mobile subscriber’s bank and the retail merchant bank is in the same city, the economics of our approach would be very attractive since the merchant would only need to have the equipment to interact with the mobile phone. Also, for bill payment where often both the mobile subscriber’s bank and the bill

\(^{15}\) In the US where batch clearance is used, a small risk of non-payment arises as we discussed above. This approach could also be used for money transfer between individuals (P2P). A mobile subscriber would enter the recipient’s bank code and account number together with the amount to be transferred. The IBS network would be used to transfer the payment.

\(^{16}\) Approximately 8.3 Yuan equal US$1.00. This amount is significantly higher than the fee for an IBS network transaction in the US, which is about $0.08.
presenter’s bank are in the same city, no charge would arise. Whether the Central Bank would keep a zero fee for IBS network transactions within the same city if the number of transactions were to increase greatly is an open question.

Thus, the major requirement to our approach of using mobile phones as an e-commerce payment system would be “rebalancing” of the Central Bank fee structure. The cost of an IBS network is mainly a fixed cost, as with most telecommunications networks. The marginal cost of a single network message between banks is close to zero. Currently the Central Bank fee structure is quite high for inter-city transactions and zero for intra-city transactions. However, the costs of the inter-city and intra-city transactions are likely to be very similar since marginal cost is largely distance insensitive given the economics of modern fiber optic networks.17 A rebalancing of IBS network fees by the Central Bank to make inter-city and intra-city fees the same or very similar would move prices (fees) more in line with costs and would provide the correct economic incentives for an e-commerce approach that we have discussed in this paper. We see the question of IBS network fees as the primary obstacle to the adoption of the plan as outlined in our proposal. However, these network fees need not be a problem if the Central Bank sets an IBS network fee structure that could cover the network costs while giving the correct economic signals for the use of the IBS network.

17 The largely distance insensitive nature of telecommunications costs has been studied and remarked on over the past 10 years in great detail.