Electronic finance and monetary policy

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1. Introduction

The rapid spread of the internet and some aspects of e-finance[2] are changing the financial system in ways that are hard to predict. This has potential ramifications for monetary policy all through the process of its operation.[3] Effects may be felt on the central bank's ability to operate monetary policy, the connection between interest rates it controls and key market rates, how these rates affect the real economy and inflation, and the feedback from real economy data to policy setting. This paper discusses these effects in turn. Many of them will probably only be manifest in the medium- to long-term but given the rapid development of the internet some could occur surprisingly soon. While e-finance also has important implications for financial stability, bank supervision, consumer protection, security and law enforcement, these are outside the scope of this note.[4]

2. Monetary policy operating procedures

Implementing monetary policy involves the central bank's role as operator of the inter-bank settlement market and the monopoly supplier of liquidity to it. Other entities could affect financial markets by operating on a sufficiently large scale, but only the central bank can do so by operating on a small scale. The central bank can generally determine the interest rate prevailing in the inter-bank market to an adequate degree of precision; for example, the average deviation between the federal funds overnight rate and its target over the past year has been only 7 basis points. Monetary policy will be effective to the extent that this interest rate affects other interest rates and so ultimately output and inflation.[5]

Often the central bank does not even need to operate in the market; it can merely announce its desired rate ('open mouth operations') and the rate in the market will move there. It is able to do this only because the market knows that the central bank has the *ability* to act to move the rate to its desired level. The danger posed by e-finance is that, in Friedman's (1999) analogy, the central bank may become "an army with only a signal corps" lacking the means to impose its will. The relevant questions are therefore whether either the central bank's settlement market ceases to operate and/or whether the link between interest rates in it and those pertinent to the rest of the economy are severed.

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[1] This paper has benefited from discussions with numerous colleagues at the Bank for International Settlements and Professors Benjamin Friedman and Charles Goodhart. Opinions expressed are those of the author and not necessarily shared by the the BIS.

[2] 'E-finance' has been defined in different ways. Here it is used rather broadly to mean the provision of financial services over the internet or other electronic media. This includes money, banking, payments, trading, broking, insurance etc.

[3] Useful references on this topic include Freedman (2000), Friedman (1999, 2000), Goodhart (2000), King (1999) and Woodford (2000).

[4] Some of these issues are discussed in Sato et al (2001) and Turner (2001).

[5] This contrasts with the textbook idea of the 'money multiplier', which posits that the central bank can control its liabilities, the 'money base' and this has a stable relationship to the money supply and hence nominal spending and inflation. The money base predominantly consists of banknotes issued by the central bank (it also includes deposits of banks with the central bank, and possibly coins and other items). In this view the effect of e-money replacing banknotes would be very serious; the money base and so the money supply would contract, triggering a recession.

2.1 What if e-finance causes central bank balance sheets to shrink?

There are two main types of e-money. Firstly, there is 'e-cash', which includes electronic purses and multi-purpose stored value (smart) cards[6], such as Mondex and Proton. Secondly, there is 'cybermoney' (sometimes called 'network money'), prepaid software products that can be used for payments or transfers on the internet, such as the failed Digicash. It is worth noting, however, that payments for most internet purchases - and these are still less than 1% of retail sales in most countries - are made using the conventional credit card network. E-cash is more likely to substitute for notes and coin (and so is discussed in this section), while cybermoney is more likely to substitute for bank deposits (and so is discussed in the subsequent section).

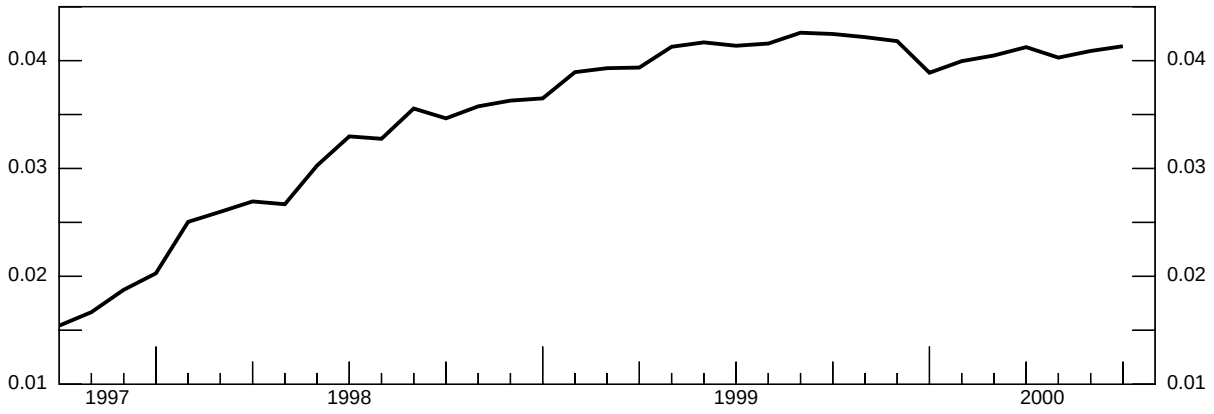
Any displacement of notes and coins is happening very slowly. Indeed the ratio of notes and coin to GDP has actually risen in some countries. It is possible that this overall stability disguises two offsetting trends: a very gradual displacement of low-denomination notes and coins by e-cash, but a greater use of high-denomination notes for various forms of bad behaviour or as a store of value offshore. E-cash is typically used only for small-value transactions. If it only displaces coins and low-value notes, this would not have much effect on the total *value* of notes and coin outstanding, as this is dominated by large denomination notes.

The ECB's data for the euro area show e-cash outstanding is only €140 million, less than 0.1% of notes and coin on issue, and its spread has been slowing. (Graph 1) This is consistent with anecdotal reports that many 'electronic purse' projects have been disappointing and have not progressed beyond the trial stage.[7]

Graph 1

Electronic money in the euro area

As a percentage of notes and coins



[6] As distinct from credit cards, debit cards, ATM cards etc, which do not have any intrinsic value themselves but allow customers to transfer funds between bank accounts, and single-purpose payment cards which are essentially an acknowledgement of a pre-payment.

[7] The most successful ventures have been those based on a popular single-use stored-value card. The majority government-owned Octopus card in Hong Kong is a contactless reloadable card used to pay for trips on the underground railway and bus networks. There are now more cards on issue than residents in Hong Kong and the card's use has gradually been extended to kiosks within rail stations and drink vending machines. It is now used for 1-2% of household expenditures. Another possible manner in which a card could quickly achieve a large market share would be if governments that require their citizens to hold identity cards had electronic chips in these cards which could be given an additional payment function.

It is now generally thought that the spread of e-cash will continue to be quite gradual, although some new forms seem better designed, such as being contactless.[8] There are good reasons why notes and coins may continue to be preferred. They are familiar and simple to use, and clearly anonymous. They are legal tender, ensuring widespread acceptability, and government-guaranteed. They can be readily respent by the recipient. The resource costs of their use are generally not borne by the user. Furthermore, the attractiveness of the present raft of e-cash schemes is limited by their lack of interoperability. It would be technically possible for e-cash to pay interest, which would obviously increase its attractiveness, but so far no forms do. The period between the introduction of the euro and its manifestation in notes and coins represents a missed opportunity for e-cash issuers. In the same way that currently various payments instruments (coins, notes, cheques, giros, credit cards, direct debits etc) co-exist, specialising in different uses, it is likely that e-cash and banknotes will co-exist for a long period.

Looking a long way ahead, there are possible concerns about the widespread issue of e-cash by private non-banks. It might erode the benefits of a currency as a single unit of account. If over time some types of e-cash were thought more creditworthy or acceptable than others, they may then trade at different values. Then a good might be priced at 100 BankA e-dollars but 105 BankB e-dollars. This might be avoided by requiring all e-cash to be redeemable in conventional money[9] and/or requiring issuers to be licensed and supervised.

Some writers fear that excessive issue (or worse still counterfeiting) of e-cash could give rise to inflationary pressures. Another risk is that were a prominent e-cash system to fail, it could shatter consumer confidence in many other electronic schemes. If by this time such schemes dominate the payments system, this could be highly disruptive to the economy. In this way, a prominent e-cash scheme could become too big to be allowed to fail and so implicitly government-guaranteed.

For central banks, wider usage of e-cash could eventually reduce seigniorage (ie issuing an interest-free liability to buy interest-earning assets). Seigniorage is currently a multiple of central banks' operating expenses but, in the very long run, it may be less. This may force central banks to rely on government grants to fund their operations, with implications for (perceived) central bank independence.

There are three possible responses central banks could make to this challenge.

- persuade governments to impose taxes or reserve requirements on private issuers of e-cash to generate revenue for the central bank.
- become issuers of e-cash themselves.[10]
- increase other revenue such as charges for services rendered or build up their capital to the point where the yield on it was sufficient to fund their expenses.

As well as the effect on seigniorage, if displacement by e-cash means the issue of banknotes is much reduced, the central bank's balance sheet will be much smaller. Circumstances might then arise where the central bank finds it more difficult to implement operations on a sufficiently large scale. (The other major central bank liability in many countries is banks' required reserves. If e-money displaces banks' current deposits to a large extent, this could also reduce the central bank's balance sheet.) From time to time, the central bank needs to sell a large amount of assets to sterilise the effects of large purchases in the foreign exchange markets or to offset the effect of large-scale emergency liquidity assistance to a bank. It may be difficult to do this if it lacked sufficient assets on its balance sheet to sell. Possible solutions to this problem are the central bank expanding its balance sheet by issuing

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[8] Even in a survey of issuers of e-cash, only a third expected it would totally replace notes and coins (and most of these thought it would take over ten years) and a fifth thought it would not replace it at all. Credit cards have been available for over a quarter of a century but have still not replaced cash or cheques.

[9] This may be necessary for e-cash to become widely acceptable. Paper money initially gained acceptance by promising convertibility into precious metals. In Europe redeemability is required by legislation.

[10] The authorities in Singapore plan to issue e-cash with legal tender status by 2008. Given that central bank e-cash would presumably be more trusted and accepted by government agencies it could well become the dominant form. On the other hand, the central bank might be a less technologically innovative issuer. It might also put the central bank in the position of being both the supervisor and a competitor to banks.

central bank bills or inducing the government to deposit with it, or conducting operations using repos or forex swaps. Another alternative in the emergency liquidity assistance case would be for the central bank to guarantee loans made to the troubled bank by other banks rather than make the loan itself.

It is possible that developments in information technology will allow banks to manage their operations in the inter-bank market more efficiently. This could mean that they need to hold smaller amounts on average in their accounts with the central bank. Similarly, some countries require banks to hold on average a set proportion of their deposits in their accounts with the central bank and e-finance could reduce the magnitude of bank deposits to which such ratios apply. However, as illustrated by the fact that a number of central banks (Australia, Belgium, Canada, Hong Kong, Mexico, New Zealand, Sweden, UK), operate monetary policy with no required reserves, it is *marginal changes* in the settlement balances than are relevant for monetary policy operating procedures rather than the levels.

2.2 What if banks no longer settle at the central bank?

Another possible risk to current monetary policy operating procedures is the possibility of banks switching to their own electronic settlement system not involving the central bank. This is technologically feasible. There have been cases where one private bank has provided settlement services for other private banks (eg HSBC in Hong Kong prior to December 1996). In some countries only the larger banks settle directly using central bank funds and smaller banks settle across accounts at one of the larger banks. There are already a number of large private sector bank networks which conceivably could develop in this direction. One possibility is that global banks might decide to settle all transactions between each other in just one place rather than using national central banks.

However, there are a number of reasons why banks may continue to settle on the books of the national central bank. The first is that it may be compulsory, as in Australia and Canada. The second is that the central bank is almost universally regarded as the safest counterparty. The third is that banks may not want a rival organisation to gain more information about their operations. Fourthly, staying with the current system avoids adjustment costs. Finally, the provision by the central bank of routine intra-day or overnight credit and the possibility of providing emergency liquidity assistance provide a further attraction. Even if these reasons did not prove enough, governments could require that transactions with them (tax payments, pensions, government employees' salaries, purchases etc) are settled on the central bank's books.

3. Central bank operations and the broader financial market

But even if the inter-bank settlement market continues to exist, it may become less relevant to the broader economy.[11] If the bulk of citizens hold their wealth, borrow funds and effect payments through other types of institutions, then influencing the inter-bank market may not give much leverage over broader macroeconomic conditions. Could e-money not just erode the demand for notes and coin but also erode the demand for bank products?

If, as had been the case in many countries in the 1960s and 1970s (due to heavy regulation of banks), the banks lose business to domestic non-bank, but bank-like, financial intermediaries such as building societies, thrifts, finance companies, merchant banks etc, then the central bank can try to bring these intermediaries within its purview. It could then require them to settle with the central bank. Similarly, the central bank could try to ensure that all new institutions based in the domestic economy offering banking services through the internet are licensed as a bank and meet prudential rules. However, this may lead to further new institutions being established outside the regulatory net. This risks what Friedman (1999) calls "a regulatory race … the central banks might well lose." Moreover, this response would be much more difficult if domestic residents are banking with e-banks (or using the internet to bank with traditional banks) in a foreign jurisdiction.

[11] The comment that banking is necessary but not necessarily banks has been attributed to Bill Gates.

3.1 What if alternative currencies are used for payments?

Another possibility, albeit probably much further in the future, is that some non-banks may set up rival currencies with their own payment and settlement systems. King (1999) has argued that "the key to any such developments is the ability of computers to communicate in real time to permit instantaneous verification of the creditworthiness of counterparties, thereby enabling private sector real time gross settlement to occur with finality." Then "the successors to Bill Gates would have put the successors to Alan Greenspan out of business". Such a development would resemble historic periods of "free banking".

One way such a rival network may emerge is the growth of cybermoney, which might be issued by telecommunication or IT companies. While early attempts at marketing cybermoney have not been very successful, there are reasons why demand for it may grow. Many internet content providers expected to fund themselves by selling advertising space on their sites. This has proved much harder to do than expected, as the market becomes saturated and consumers increasingly ignore such advertisments. These content providers are likely to switch to charging users a small amount to access some information, read an article or listen to a song. These micropayments are uneconomic if the credit card network has to be used but could be well-suited to cybermoney.

The potential demand for cybermoney has also been increased by the greater number of person-to-person payments induced by online auctions, such as those conducted using eBay. Payments mechanisms such as PayPal have been established to facilitate these payments, but so far they are not interoperable and rely on the credit card system for settlement. In principle, a "money" can be issued by any kind of entity that can convince people to hold it. The difference with cybermoney is that it has a ready use which might encourage people to hold it, and well-known companies such as telecoms and information technology firms with both the technical capacity to develop it and sufficient public trust to encourage customers to hold it. Eventually cybermoney could be used to pay for transactions that did not originate on the internet. Generally, cybermoney is initially purchased in exchange for conventional money. However, this is not necessary; some accrue as 'rewards' for purchases from a particular company but can be spent on the web. A private cybermoney may not be able to claim a lower default-risk than the national currency but it could market itself as less vulnerable to inflation. However it will be hard for a private currency to be convertible into a widely useful commodity (like salt, wheat or cattle used to be).

At present the size of cybermoney is believed to be tiny. Berentsen (1998) suggests that cybermoney balances will never be very large as the same improvements in technology that facilitate its use for payments also facilitate transfers from interest-bearing accounts to it. Rather than hold large amounts of cybermoney, customers will buy some online only when they want to make a large payment.

Perhaps the more likely rival to the domestic currency and settlement with the domestic central bank is not a new private cybermoney but rather existing national currencies of other countries which e-finance may make easier to use for domestic transactions. In a sense, the dollar, euro, yen, sterling and Swiss franc may become competing brands, not just in the third world but within their own territory. There are already instances of 'xenocurrencies' playing a large role in economies; the dollar in Latin America, the euro in eastern Europe, the Hong Kong dollar in Macao and southern China, and the baht in Cambodia. There may be lessons from their experience if e-finance brings this phenomenon into advanced economies as well.

There has been a recent surge of interest in the question of whether monetary policy could operate even in this brave new world. Goodhart (2000) has argued that the monetary authorities could still influence monetary conditions, as being backed by the government's power to levy taxes, they are uniquely able to intervene in financial markets (if necessary, buying or selling some private e-money) regardless of concerns about its profitability. In this way the central bank could still move interest rates up and down.

The question that then arises though is how large such purchases might need to be. If the central bank demonstrates a few times that it able and willing to make sufficiently large purchases and sales to affect the market interest rate, in future its announcements may move interest rates, much as is currently the case. However, this argument still requires the central bank to make these interventions a few times to establish its credibility. Given the size of financial markets, the size of such purchases could be very large relative to the balance sheets of central banks or the size of transactions they have typically made in the past to influence financial conditions.

4. Effects on the transmission mechanism

The growing use of internet technology will affect the transmission mechanism in a myriad of ways, through influences on financial institutions, trading in financial markets and changes in the behaviour of the real economy. Assessing how quickly these changes will occur and the size (or even sign) of the net impact is very difficult. But this problem should not be overstated. Central bankers have been coping with significant and hard-to-predict changes in the nature of the transmission mechanism (whether induced by technological change, financial deregulation, currency unification or division, or even the move from a planned to market economy) for the last three decades and will continue to do so.

In general, the application of internet technology to the real economy could be thought most likely to accelerate the impact of monetary policy. For example, the use of information technology to economise on inventories ("just-in-time" procedures) and track sales more closely means that a reduction in sales will reflect more quickly in changes in output and prices. The more rapid spread of information via the internet should enable agents to react more promptly.

By contrast, it is possible that some e-finance developments will attenuate, or at least slow, the impact of a monetary policy tightening. The development of e-finance is completing markets, and removing frictions. Monetary policy will therefore have to operate more by changing relative rates of return rather than quantities and this process may be weaker and slower. For example, previously constrained firms may be able to access a wider range of potential lenders, which could weaken the credit channel of monetary policy. If hedging against exchange rate and interest rate fluctuations becomes easier and cheaper, this could reduce the responsiveness of activity and prices to changes in interest rates.

On the other hand, the spread of e-broking in retail markets may increase the importance of wealth effects in the monetary transmission mechanism. It has markedly reduced transactions costs, which has been a factor in encouraging more small investors to invest directly in equity markets. This may mean that reductions in equity prices resulting from a tightening in monetary policy would have much larger effects than were observed after the 1987 stock market crash.

The transmission mechanism may also be influenced by the impact of e-finance on competition between financial institutions. For example, it had been suggested that virtual banks operating without physical branches would make such large savings on operating costs that they would be able to offer more attractive interest rates than established banks. However, it now appears that savings on branch operating costs are offset by the much higher marketing expenses they incur (see the paper by DeYoung in this volume). More importance is now being accorded to network effects and economies of scale which may in time lead to increased consolidation in the finance industry, possibly making the market in the longer term less competitive and responsive.

Another institutional change arising from the development of e-finance is the emergence of new entities. These include vertical portals (which compare offers from rival banks), smart agents (which go one step further and automatically transfer funds to the bank offering the best deal) and aggregators (which consolidate information about a consumer's various bank accounts). These might all be expected to reduce information and transactions costs and so reduce lags in the monetary transmission mechanism.

The move from floor- or telephone-based trading to e-trading in financial markets allows fundamental changes to the market microstructure. Architectural features such as access, and the extent of transparency and anonymity, are now a matter of choice rather than being dictated by physical limitations. E-trading could have implications for the liquidity and volatility of financial markets. At least in the short term, a proliferation of new trading platforms in some currently centralised markets may be reducing the liquidity in each individual platform. However, in many formerly OTC markets such as for foreign exchange and bonds, e-trading is exerting a centralising effect. While e-trading may reduce the profitability of designated market-making, causing firms to scale back this activity, it is arguable how much designated market makers contribute to maintaining liquidity. As e-trading is reducing the cost of trading, it is likely to lead to increased market participation, which should increase liquidity.[12] A report

[12] The impact may depend on the nature of the additional participants. Markets are increasingly dominated by institutional investors seeking slightly better returns than their rivals. As the managers of these funds are often evaluated by a comparison of their short-term performance with their peers, they tend to behave like a herd, rushing in and out of markets

by the Committee on the Global Financial System (2001) found no firm evidence that liquidity had suffered from the introduction of electronic trading.

5. Effects on data used in setting monetary policy

As distinct from the technical ability to operate policy by moving instruments, e-finance may complicate the task of setting these instruments by affecting the data analysed by central banks. For example, if e-money eventually displaces a significant amount of banknotes, then monetary base and M1 growth rates will be misleadingly low if e-money is not included. Furthermore, offshore e-banks may attract a significant share of deposits and provide a significant share of loans, or e-finance may enable more financing to occur through securities markets rather than banks. In this case, broader monetary and credit aggregates may be similarly misleading. The entry of non-financial institutions outside current data collections into financial activity may cause further distortions.

Central banks who place weight on such indicators in their monetary policy deliberations may need to start planning data collections on e-money and incorporate it into their measures. Since 1998, the European Central Bank has included e-money issued by banks as overnight deposits and therefore as a component of the monetary aggregates. However, it is not clear that a monetary aggregate that included a sizeable component of e-money would bear the same relationship to economic activity as one based on current forms of money. For example, if e-money were to contribute to a more efficient payment system, it could boost the velocity of circulation of monetary aggregates. The analysis would be further complicated to the extent that e-money was interest-bearing or substituting for components of the money supply that pay interest.

The wider use of internet banking may mean that a significant proportion of liquidity available to domestic residents is held with banks physically located in foreign countries. If the domestic authorities are to know the extent of this, it may be necessary to ask foreign countries to request information from their banks on non-resident deposits and for central banks then to exchange such information, perhaps by building on the existing BIS international banking statistics.

Macroeconomic data used by but not compiled by the central bank will be affected by e-commerce more generally. Sales are increasingly being made over the internet (and in the case of software, music etc the product delivered over the internet). These are likely to be missed from the traditional surveys of retail stores by statisticians. This could lead to inflation being overstated if internet purchases are cheaper. Even if the prices are the same, the volume of private consumption may be understated. Policymakers could then set policy too loose if they mistakenly interpret the apparent fall in consumption as a drop in domestic demand.

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together. By reducing the costs of transacting, e-trading may just add to the number of investors jamming the exits. Herding investors may hit limits simultaneously, causing them all to sell at once, leading to further sharp price falls. In this way a vicious circle may arise, amplifying price volatility. However, encouraging more participants may also mean there are more contrarian investors able to buy at lows and sustain temporary losses if needs be, which will act to stabilise prices.

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