The Effect of Internet Value Transfer Systems on Monetary Policy

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Abstract: The arisal of experimental systems to transfer value (digital cash) over the Internet is of interest to monetary policy circles. These systems claim to turn the International Financial System back to the days of free banking, with uncontrolled and rampant issue of currency by private banks. This paper argues that, in actuality, Internet cash issuance will not be a strong force, neither against the tools of monetary policy, nor for its own mercantile purposes.

Three models are used to develop an understanding of how digital cash systems will fit in the financial system. Fractional banking describes the effect of such cash on the money supply. The Baumol-Tobin model provides insights into how digital cash will function in terms of balances, and thus how it effects the rest of the financial system. Finally, a look at potential participancy reveals the scale of effect on monetary policy.

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1. Introduction top

It has been argued in the media [e.g., [1]] that the introduction of Internet value transfer systems will weaken or destroy the ability of governments to conduct monetary policy. This arises from the apparent ability of digital money systems to return the financial system back to the days of free banking.

This paper will initially lay down some basic architectures, arguing that existing systems can be viewed in one of three forms. Then, various current observations based on recent history will be brought out.

Then, three approaches, or models, are used to examine the nature of the Internet financial system. Each of these draws out findings on how the system might work, and how it might relate to real world monetary policy activity.

Finally, the conclusion attempts to sum the findings with respect to monetary policy, and suggests some future directions.

The Internet financial system is a new world, and is necessarily the conjunction of diverse sciences. Few participants, including the author, are expected to be conversant with all of them, but many participants are expert in one. Therefore, the key background issues of cryptography, the Internet, and money are discussed briefly in the appendices.

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2. Models of Internet Value Systems top

This paper primarily concentrates on the notion of token money emulation systems (or, more simply, digital cash). However, there are many groups around the world working on diverse systems to allow transfer of value over the Internet. As far as the author can see, these efforts can be described as emulations of cash, or of IOU money (or cheques), or a hybrid approach.

It is assumed that there are at least two participants. The first participant is the system provider, and the second is the system user. The system provider takes on a role of financial intermediary, and is generally referred to as the *bank*. However, it should be clear that this is not be confused with any definition of banking based on local licensing laws, the term is used for convenience only. In general, as far as this author knows, no existing system provider is operating as a bank, as no fractional lending is occurring on the basis of the deposits held against issued digital cash.

There is a further assumption that the bank has a connection to the non-Internet world in order to allow value flows between the two systems. Specifically, it is envisaged that, in the first instance, participants must provide existing monetary instruments to the financial intermediaries (cheques or credit cards predominate) in exchange for new monetary instruments.

The second participant, the system user, is normally divided into two. On the one hand, the *customer* maintains balances with the bank, withdraws value from the bank, and sends value to make purchases.

The *shop*, on the other hand, receives value from the customer and deposits that value with the bank. Once deposited, they can either maintain balances or they can withdraw non-Internet monies. They also complete purchases in some way, but here, we are only interested in the passage of value, and not of goods.

It is not completely clear, at least to this author, why there is a distinction made between the shop and the customer, but such a distinction has been made (see, for example, the charging policies and software sets of each participant). One plausible motive would to attempt to segment the users for marketing purposes.

Cash

The idea of emulating cash was first achieved by DigiCash, and to date, they remain the most technologically advanced in their experiments.

In this model [1.b], the customer withdraws digital *coins* from the bank in a blinding protocol that ensures that whilst the bank has debited the account of the customer, it has no knowledge of the specific coins in circulation. That is, whilst it knows that a customer withdrew a set of coins, it cannot identify them.

These coins are held by the user until needed. Then, on transacting, the coins are passed to the merchant. Here, the merchant can inspect them and verify their signature, or the merchant can simply pass them straight to the bank for deposit.

On receipt of the coins, the bank verifies their authenticity by examination of the signature. It can then indicate to the merchant that the coins are valid, and increase the value of the merchant's account.

DigiCash also propose a protocol for *off-line* transactions, that is, for the merchant to authenticate the coin without contacting the bank. Whilst technically interesting, it does not bear on a discussion of monetary policy.

IOU Money

In the IOU model, the customer is empowered by the bank to write credit notes, or cheques. These can be authenticated by a variety of means, for example, by including in the cheque a copy of the user's public key, signed by the bank. Hence, by signing a statement that the customer (as identified by their particular key) is empowered to make certain transactions, the merchant can be assured that the bank has backed up this particular user.

On presentation of the cheque, the bank will simply transfer funds between accounts. Verification is based on the cheque being correctly signed by the customer, and that the customer is empowered to write that cheque.

Detail issues remain that are handled in different ways. For example, holders of bank authorisations might turn rogue and start writing bad cheques. These are not discussed further here, although they are of intense interest to the developers of the systems.

Hybrids

In contrast to the above philosophies, other developers argue that existing physical systems are dependent on physical constraints and historical baggage. New systems are constrained by neither of these, and hence should be designed around basic principles.

The system being built by Systemics follows these principals and is described here, although there are others which are equally interesting (see for example [2]). This sytem postulates a monetary device called a box, which has the characteristics of a variable sized coin, or a temporary account, depending on the user's viewpoint. A box is uniquely identified by a public key, and the holder of the corresponding private key is the owner.

The bank provides two basic operations. Firstly, it allows registration of new boxes, on being given the public key. Secondly, an IOU signed by the owner of the box will cause a funds transfer out of the box into another.

A third basic primitive is available in that one user can pass the entire box over to a second user. As that second user may now be concerned that the public key is shared, he simply creates a new box and writes an IOU for the entire contents from the old to the new. Once the bank has cleared the IOU, the old box falls into disuse.

Hence, this system encompasses the notion of cash and IOU money, although that was not an original design intention [3].

Old Uses for New Money

We have talked about the usage of value transfer systems over the Internet in terms of monetary balances. However, this is a convenience only, as the technology is relatively versatile, at least in its theoretical form. It is possible to envisage its use emulating the following holders of value:

- casino chips
- financial instruments
- book tokens (i.e., special purpose money)
- loyalty systems

The author has seen no announced plans to pursue these avenues, but it is assumed here that they will exist at some stage in the future [3.b].

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3. Early Observations top

DigiCash experiment

The DigiCash trial electronic bank was launched in October 1984, with a capitalisation of one million *cyberbucks*. This notional currency was unbacked, and indeed, DigiCash made no secret of the fact that they did not intend to back the currency, nor expand the experiment beyond the initial capitalisation.

It is fair to say that the experiment was successful. Over the space of a year, around half of the currency was issued, at 100 cyberbucks per user, (although interest did tend to shift to other backed payment schemes as they came on line). Some 100 shops were attracted, being mostly trivial informational services.

Some shops did however deliver real services and goods. A casino was popular, and there were some efforts to sell politically-motivated T-shirts. Hence, there was a semblance of a real supply of desirable goods, and in mid 1995 a primitive market opened on the Internet to trade cyberbucks for dollars. After a brief flurry of trading, the price settled at 100 cyberbucks per 5 US$.

This was reportedly of some surprise to DigiCash. However, given a popular service such as gambling, a backing for the currency arose based on the desire for that service. And given that there was rationing and little else to do with the currency, it became an acceptable means of payment. Further, whilst the future value of the currency was uncertain in terms of any other currency, the future value in terms of the gamblers penchant for "having a flutter on the gee-gees" was relatively certain. In short, the experimental bank showed that there was a significant desire to trade on the Internet, and that it was entirely possible for a non-fiduciary token money to exist.

The IOU Captures the High Ground

Over the next year there was a flurry of developments, perhaps sparked by the success of the bank. By mid-1995, there were some 26 systems either in advanced development or in early prototype operation, all by start-ups or semi-academic groups. Already, some of the systems had caught up with DigiCash's experimental bank, and could boast 100 or more shops [e.g., see FirstVirtual]. There were also many smart card trials such as Mondex, although smart cards are not a subject of this paper.

What was evident then was that the method of choice was the IOU. By developing a cheque based system, little complexity was needed, and some of the systems even avoided the use of cryptography completely - that is, they were essentially insecure. From a marketing point of view, they had chosen to capture the high ground with a weakly armoured, but fast vanguard, intending to bolster up their capabilities on the ground. In contrast, digital cash companies found themselves with the necessity of building up a large main body before being able to advance out of the barracks.

Over the next year, to the current date (April 1996), major companies also took an interest. Visa and Mastercard, Microsoft, Citibank, were all actively involved, but none to date has achieved a major system delivery onto the Internet.

In summary, the industry of Internet payment systems is divided along two axes. A few sophisticated digital cash systems, with little market share, vie with simple, quick-and-dirty IOU systems that currently dominate. Also, the large, highly capitalised companies have yet to muster their forces to be able to bring in the more complete systems that are necessary for their brand strength, whilst the small, versatile start-ups are gradually proving and selling their services.

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4. Fractional Banking top

Is Monetary Policy Weak Anyway?

There has been a lot academic discussion about the weakening of monetary policy, in fact ever since its inception in the 1970s. The Bank of International Settlements, for example, recently looked at the effect of derivatives [4], and came to the view that monetary policy was "weakened but not dead." Derivatives achieve the effect of spreading risk across the economy, but not of insulating the economy from the effect of change in interest rates. Fundamentally, they argue, hedging is a short term tool - you cannot hedge forever, and all new investment decisions must be made with current rates and perceptions in mind. Whilst derivatives may slow the impact, they have not changed the fundamental linkages of monetary tools. Hence there is a case for using these tools more strongly, but not necessarily for abandoning them.

The Internet and the Money Multiplier

Can this argument be applied to the Internet? Yes, to some extent. All existing Internet cash emulation systems use (and current planning envisages) a one-to-one dollar-backed fiduciary system. That is, the digital dollar (sometimes symbolised as e$) floating around the net is backed by a physical dollar held at a bank (although note the DigiCash experiment, above). Clearly there is a strong relationship between the two systems under this limitation -- a shortage of dollars will inevitably filter through to a withdrawal of

e$ from the Internet financial system.

Is the relationship one of perfect integration or unity? Let us a assume a new dollar of currency, created without previous history in any financial system (this is the dollar printed by a government expressly for paying a claim not met by, for example, taxes). When placed into the Internet financial system, the dollar results in two dollars, one deposited back into the physical banking system as reserves and one e$. Whilst the former then becomes subject to fractional banking and increases the sum of dollars in the total system according to the money multiplier, the latter enjoys no such power; it results in simply one dollar of value. Hence, the new Internet system results in an incremental addition to the size of the money supply, always whilst the Internet financial system does not engage in fractional banking. Therefore, there might be a small but manageable weakening of the monetary tool from this front. The size of the weakening is also dependent on the demand for digital cash, discussed below.

Can Electronic Banks Lend?

Thus, attention turns to the issue of fractional banking. As Michael Kuscyinksi has pointed out [5], if Internet financial intermediaries are operating under the self-imposed constraint of dollar backing, they are just operating as clearing systems and are not banks in the strict sense. (And hence, it could be argued, as clearing houses, they are not really of interest to banking regulators except on competitive grounds.)

Is the Internet financial intermediary likely to enter the fractional banking arena? The intermediaries have imposed the fiduciary constraint on themselves in order to win the trust of their users. However, in so doing, they are foregoing the opportunity to earn more lucrative profits by lending out deposits to a better class of borrower than other financial intermediaries: private firms. Hence, from the very start of the system's life, there will be pressure to lend out deposits as long term loans, and to use their depository base to expand their lending activities. Indeed, the Internet provides a ready supply of suitable investments: start-ups and new ventures attempting to operate commercial activities in the "new world" of the net. The very fact that Internet financial intermediaries are part of the system makes this a natural home market: they (should) already understand the technological implications of the net, and should be more capable of rationally judging and monitoring Internet business proposals than, say, the traditional banking sector.

Risky Loans Require Capital

Entering into the risky non-tradeable loans business requires capital to balance the risk [6]. If we could assume the existence of capital to cover this sort of risk, then there would be little problem. However, capital is not likely to be freely available on the Internet: those companies with capital tend to be either uninterested in lending or uninterested in the Internet. Those who are faster tend to have less capital. Let us examine some potential models of capital injection, in order to see how the Internet might escape from this difficulty.

A Brief History of the Euromarkets

In London, around 1955, S. G. Warburg started offering offshore US$ intermediation, in an environment of currency controls and capital barriers. High currency exposure and lack of central bank facilities made this a rather risky business, but Warburg and its competitors stuck at it and managed to build up cash in the system. This allowed them to take on bank liabilities, which further developed into non-bank

liabilities. From there, securities holding allow the interbank liability market to develop (mitigating the need for central banks) and also allowed the development of derivatives markets to handle risk.

Initially, this unofficial and unregulated market was extremely prudent, maintaining high reserves (low multiplier) to protect itself. It managed to grow slowly, and survive a shock or two (in 1963, the Governor of Banca d'Italia, Guido Carli, pulled Italian sovereign debt out of the market). Then, by a process more akin to a nod and a wink than anything repeatable in court, the US Federal Reserve accepted the legitimacy of the market and indicated the availability of central banking facilities. Shortly after, the oil shock of 1973 caused the kick-starting of the interbank money market, as oil producers lent out huge sums, whilst oil consumers borrowed huge sums. (We conveniently avoid the controversial issue of Eurodebt to the third world in this paper.)

The Internet as an Isolated Financial System

From the example of the Euromarkets, it is possible to see how a financial system can develop without the institutional support considered necessary. If we treat the Internet financial system in isolation, the requirement is therefore to build up capital under its own steam. This likely to be a long process. In the event of success of the system in providing basic services to the net, it is more likely that the existing non-Internet banking system will pile into the new market and thus integrate it by proxy: large banks that operate digital cash facilities will find their Internet activities fall slowly but surely under the wing of their central banks. Also, large banks operating in new markets do not (often) forget that they are, first and foremost, self-regulating - monetary imprudence with digital cash will simply mean reducing liabilities in some other part of the balance sheet.

Further, the Euromarkets could not engage in powerful fractional banking until a stable relationship with lenders of last resort was attained, even though they had developed a sophisticated interbank liabilities backstop. By analogy, only banks with a relationship with a lender of last resort will be able to engage in significant fractional banking on the Internet, thus leaving them as symbiotic partners in monetary policy with the central bank. If the Euromarkets are a guide, then the desire to fractionally lend is fundamentally limited by the credibility of the banks assets, and especially including the backstop of the central bank. This needn't, however, be as slow a process as it was with the International banks. Whilst it took some 30 years for the regulators to develop a policy towards the International banks [7], it should be expected that this experience will give them the tools to craft a more speedy response to a successful Internet financial system.

The Internet as the New World

If we treat the Internet financial system as a new country, then we could envisage banks being conduits for lending from the "old world" into the "new world." Thus, deposits can be taken off the street, as always, and invested into the Internet. However, whilst entirely plausible, this is uninteresting, for several reasons. Firstly, there is little effect on monetary policy. Secondly, banks don't like lending into an area they don't understand, and understanding the Internet would imply having a substantial presence or resources devoted. Hence, and thirdly, in the absence of banks, the major lenders are likely to be (and currently are) venture capital firms that have invested the knowledge.

Slow Bankers versus Fast Cheque Writers

It also needs to be recognised that there are a number of non-banks that have already realised the potential of the Internet and are working furiously to put systems into place. These institutions (e.g., Mastercard with a secure credit card protocol and Quicken with a dialup clearing system tied to PC financial packages) are financially innovative firms that can recognise the changing map and developing opportunities (examples of these might be General Motors in credit cards, Direct Line in insurance and Quicken in software). It's also fair to say that they have been given a pretty big hint by the small start-up IOU companies that have enjoyed explosive growth, and that IOU systems are fundamentally much easier to implement.

Hence, it is likely that by the time the non-Internet banks wake up, there will be little left for them to do, as the competitive advantage of widely recognised payment standards will be in place. Secondly, if it took 30 years for the Asian economies and the Euromarkets to develop enough depth to call themselves systems, then that is probably 29 years too much. If Internet banks have no advantage in offering payment services, then they will suffer a major disadvantage in raising deposits.

Prediction 1: Internet Banking will be Comparatively Weak

I would predict from the above that banking, as we know it, may not be able to establish itself as a major force on the Internet. Indeed, the question arises whether the domination of the Internet financial system by IOU clearing house systems is of net social benefit, as there is some possibility that their presence will slow down the development of other forms of intermediaries.

There will always be the smaller participants in any market, those that seek to secure niche markets based on, for example, technical sophistication or regulatory arbitrage[8], and it is to be hoped that electronic banking services can fill this area. This has the effect of keeping the large players (including regulators) honest, which in this context should be read as being effective and efficient. It might also be argued from the point of view of Goodhart's Law[9]: if there is going to be leakage in the system, it is probably better that it is a small, strong, useful and understandable sector, rather than trying to eliminate it all together and thus causing a new Pandora's box to be opened.

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5. The Demand for Electronic Money top

The Baumol-Tobin Model

Designers of cash emulating systems such as DigiCash consider that users will hold digital cash on their local PCs, ready for purchases, as postulated in the Baumol-Tobin model [10]. With this model, it is possible to predict the total supply of cash, by inputing the transaction cost of going to the bank and the cost of interest forgone on cash holdings. Hence, we can determine a total supply of money, according to this model, once we know these two variables.

A Transaction over Internet Cost

Firstly, however, we need to postulate a basic unit, being the cost to the user or customer of a transaction conducted over the Internet. For sake of brevity, we refer to this as a TIC (for Transaction over Internet Cost). This is the cost of the smallest atom of useful work that can be done, where here, useful implies the initiation and completion of some self contained task. For example,

- download a WWW page,
- do a keyword search (here, using the web term),
- withdraw some digital cash,
- send an electronic IOU.

A TIC does not include any fixed costs, such as hardware or setting up the atom of work, which in themselves may dwarf the cost. These are considered to be sunk costs, in that the user has already decided on incurring these costs, regardless of the decision to trade. Neither does it include any charges that are dependent on the nature of the atom of work. The essential idea here is to deal in a basic unit that can apply generally to the variable costs of using the Internet. Once agreed, we can predict several things about this cost:

- it approaches zero as technology improves,
- it is much less than search costs (here, using the economist's term),
- in terms of time, it is between 1 second and one minute. This is the authors guess based on personal experience.
- in direct monetary terms, it is probably of the order of 1 to 3 US cent. That is, much less than 10 cents and probably not zero, with the major components being the cost of a telephone call and the on-line time charge of a provider. However this is currently difficult to measure, due to the predominantly fixed cost nature of Internet charging, and the lack of any statistics or extensive surveys.

We can also predict some comparative transactional costs. Especially, the transactional cost incurred at the merchant's shop will be more than that of the banker, as the former is concerned about maximising the effectiveness of search costs, whilst the latter is concerned with extracting economies of scale.

Internet Bank Transaction Cost

To go to the electronic bank (as required by Baumol-Tobin) is a fairly low cost operation, considering that the task is automated by software, and the withdrawer is already "there" in the sense that to purchase, they must be connected to the network. Being connected to a potential recipient of funds therefore implies likely connection to the supplier of funds. Therefore, we can work with the notion that the indirect cost of going to bank is equal to a TIC, as the bank is concerned to extract economies of scale.

Direct Bank Transaction Cost

It is difficult to predict the direct cost of a bank transaction that a user will have to bear. This is partly due to the lack of experience, and partly due to the fact that what experience exists is perverted by marketing concerns. For example, digital cash systems charge nothing for internal transactions and 4 to 5% for

withdrawal of physical funds (e.g., Mark Twain Bank)

Even if we look at credit cards, there are difficulties. With credit cards, the cost will be higher depending on the competitive advantage of the card issuers user base. Also, it will need to incorporate the cost of the old paperwork systems and newer networking systems. It results in costs of some 1-5% (depending on retailer size), although there is something like a 0.5% risk premium built in.

Cheques, on the other hand, are generally cheaper, as they are subsidised by deposit balances. Even where they are not subsidised, their costs tend not to be above 0.5%.

We assume here that the direct charging cost is zero for cash emulating systems. This has the merit that it makes calculations easier, it is what relates to cash, and that at least one system uses this calculation. For IOU systems we could use 1%, but they are not concerned with cash balances away from the bank.

Prediction 2: Baumol-Tobin Cash Demand Prediction

Meanwhile, the other costs of making the purchase are the transactional cost of the purchase and the searching costs. The former is not less than the cost of going to the bank (as the merchant is less concerned, in general, with economies of scale), whilst the latter, by our model, above, is much greater than a TIC.

Hence, we can assume that the cost of going to bank, for the average Internet shopper, is equivalent to the direct transaction cost. In the cash emulating methods, this is zero, when taking into account the entire cost of the purchase.

With a total bank cost of zero, the Baumol-Tobin model predicts zero cash away from the bank. Is this surprising? If the cost of going to the bank is dwarfed by the total purchase costs, then it will be incorporated into the activity. Thus, each time cash is needed, a trip to the bank occurs, for the exact amount of the purchase. As the merchant will deposit the monies received immediately (for authentication) no cash balances are kept away from the bank.

This matches the observed effect of financial innovations such as credit cards and direct withdrawal cards. Where there is no trip to the bank at all for some proportion of purchases, households can economise by holding less cash. There is some empirical evidence of households reducing their cash holdings due to the advent of credit cards, although it is not universally accepted [11].

In fact, the recognition of the extremely low cost of going to the bank probably underpins the notion of *micropayments*. This form envisages paying for extremely low cost items such as a newspaper article on a per-access basis. As the cost of a single article is likely to be of the order of a cent, and a delay anything more than a second would be unacceptable, alternative mechanisms are allowed to make the system more efficient. In this context, a micropayment is one of such low value that the cost of going to the bank bears significantly upon the economics of the transaction. We do not take it further here, other than to say that with non-trivial costs, Baumol-Tobin can now predict an optimal level of digital cash balances (but it will be a trivial amount).

Prediction 3: Cash Emulation is like IOU systems

If we take the assumption that there are no cash balances, then we can conclude that the cash emulation systems will have the same impact on monetary balances, and hence, demand, as an IOU system. Indeed, there is not even a change to the money multiplier, as an IOU account with an Internet payment service is logically the same as that of any account manager. It is unimportant how the IOUs are written, although we do assume that IOUs are instantly deposited, and do not get turned into money.

In fact, the accounting of an issuing bank has to treat it this way regardless. As the dollar issued by an electronic bank is a liability that will be redeemed, a withdrawal is simply an accounting move from a user liability to a cash liability. In contrast, physical money withdrawals cause a decrease in customer liabilities and a corresponding decrease in bank assets. This will be true unless the bank is handling the cash (i.e., liabilities) of other banks, which of course, is taking the system back to the current central banking model.

A corollary to the above is that the amount of digital cash in existence is known as the sum of the issued cash liabilities of the respective banks. As there is an expectation of rolling over all currency within, say, a year of issue (and expiring it thereafter), and, as systems are designed to be secure, it is thought by many that the size of the cash supply should be strongly quantifiable, at least at the bank level.

Prediction 4: Cash Emulating Systems Will Not Earn Seignorage

If there are no cash holdings, there will be no benefit accruing to the bank for free time use of money. Whilst less important for monetary policy, it does imply that there is less concern from the point of view of existing cash issuers. If central banks were to see significant seignorage accruing to the new electronic banks, they would be more tempted to argue for control over the industry and recuperation of the benefit.

This is not to say that there is no net change to the existing cash issuers position[12]. End usage of balances by any given entity is, at the local level, a zero sum game, and thus balances switched into the Internet cause balances to diminish elsewhere. As the Internet becomes more capable of supplanting cash transactions, then the demand for cash balances will gradually be supplanted by demand for Internet balances. As the former earns significant seignorage for the central banks, and the latter does not, then there will be a loss of revenue from this source.

It is important not to confuse this loss with an apparent seignorage earning ability by the digital cash issuers. Rather, the benefit enjoyed by central bank's use of an inefficient system (cash) is being eroded by newer, more efficient, systems (digital cash, and before, credit cards) that return the benefit back to the system (and hopefully, the user) in interest payments earned by better enjoyment of the time-value of money.

From society's point of view, central banks' concerns that their seignorage is being eroded by the arisal of digital cash can be viewed as a desire to maintain revenue. This was reasonable given the historically high efficiency of token money issued by governments, however these concerns are likely to be received less sympathetically by a technically aware and public spirited Internet community. Further, the arisal of account balances in all their forms are just society's way of implementing Goodhart's Law[13] in the face of a now inefficient structure maintained to protect that revenue.

Prediction 5: Bank Pays Risk Free Rate

If we can show that the cost of going to the bank is close enough to zero to be ignored, then what is the cost of going to the securities market? In a full Internet financial system, with disintermediation allowing direct access to markets, then the cost should be the same as going to the bank: a few TICs (withdrawing cash, sending the order plus cash, receiving the security), the all-important search costs, and the market transaction charge.

If we assume that there is a range of securities, and especially include a risk free security such as a US treasury bill, then a user could cut search costs to zero by just holding T-bills. Further, if we accept the argument that a few TICs are so small as to be negligible, the interest foregone in the market must then be equalised by the charge made by the securities market, under cost minimising behavior by the user.

Hence, in order to attract deposits, banks will have to offer the risk free rate of return, minus the transaction charges of the market. This is simply expressing the dominance of risk free instruments over money, where there are no barriers to holding either. Potential barriers still remain, however: it is unlikely that a liquid market for a risk free security will be available for some time, and thus the bank will be able to appropriate the difference in spread.

Prediction 6: Zero Transaction Costs are Not Sustainable

Consider these points on bank money holdings:

- There is no revenue earned from seignorage,
- emulating cash implies that a transaction should not be charged directly, and
- low switching costs imply market rate of interest needs to be offered.

Under these conditions, bank revenue earning ability may be a problem, leading banks to charge for physical money deposits and withdrawals, and fixed charges based on some measure such as balances held.

However, this might not be workable in the long term. In the short term, there is probably sufficient flow between the existing system and the digital system to cover the revenue requirement. In the longer term, the intention is to generate substantial balances within the system. Once that state is obtained, there will be a need to secure revenue from the activity generated, assuming a competitive state to the industry. See especially [14].

Charging on the basis of balances or on a per account basis is unlikely to prove accurately related to costs, in that cheap transactions will generate frequent usage by heavy users, e.g., churning. It is highly likely that the most appropriate charge is on a transaction basis, requiring a re-think of the Baumol-Tobin approach above. Once there is a charge per transaction, Baumol-Tobin predicts an increase in cash holdings and higher switching costs. Therefore, the adding of a transaction cost has the further benefit of adding seignorage.

However, this may still result in an effective cost of close to zero, when considering the low cost base of the Internet bank, especially if search costs are maintained at a reasonable level (searches tend to get more powerful before they become cheaper). It also has the pleasing effect of increasing switching costs

between various forms of value holdings, which immediately gets enjoyed by the bank again as a better differential between the offered rate of interest and the market rate.

Indeed, this may be the motive for the significant exit costs of 2 to 5% that Mark Twain Bank are charging (as of June 1996). If we assume that a merchant has 100% of costs in the real world, he must therefore withdraw all earned digital revenues in physical cash. If this incurs a charge of, say, 3%, then that is passed directly into the pricing structure. As merchant transactions are the dominating type, this implies that this is indeed a transaction cost, albeit one that does not quite fit the Baumol-Tobin model (i.e., switching costs and bank trips are still free).

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6. Participation in the Internet Financial System top

It is important to understand the size of the constituency in the "new world", in order to understand the effect in the existing financial system. For this purpose, I divide the market into two groups, being institutions and individuals, and discuss each in turn.

Institutions

Institutions are capable of leaving the closed system already. For example, they generally have access to the Euromarkets for both lending and borrowing, and thus can operate outside the control of the imposed monetary policy. Likewise, their earning and spending power can be manipulated to the extent permitted by the economic structure in their industry: whilst food manufacturers might be limited to transfer pricing, services can manipulate the production of their wares to leave only the endpoints under the control of the applicable monetary policies. E.g. attractive regulatory approaches have enhanced the City of London's status as a lending market, but the ultimate sources and destinations of the 'product' is not primarily in that country.

Indeed, the Euromarkets and offshore techniques exist because of the institutional desire to escape local restrictions. There is therefore likely to be little essential need for them to transfer any activity over to Internet value transfer systems, although they may find cost and convenience incentives. Further, institutions already have access to low-transaction-cost networks of the nature of the Internet, and have had for some time.

Individuals

Individuals, in contrast, face a bewildering range of barriers in attempting to leave the financial system of the state. These might be categorised as:

- Banking capture: difficulty in extracting themselves from their current bank.
- Trust: perception of shadiness of foreign banks, and of "offshore" banking.
- Regulatory: bans on foreign advertising, requirement to provide details to authorities, outright illegality in participation.
- Retail access: difficulty in accessing the services of non-local financial intermediaries.

The Internet weakens these barriers, but adds in a few of its own: such as sophisticated computing knowledge, Internet access complexity, and poor ability to consummate deals.

Trust issues tend to be better understood on the Internet because of the culture of caveat emptor and equality that has developed, at least in the viewpoint of this author. Regulatory restrictions may technically be bypassed by the access effects of the Internet and the privacy afforded by strong encryption. Finally, anything that works over the Internet will be accessible equally over the entire globe (however, there is a remaining barrier in language. The net *lingua franca*, English, is not universally accepted or adequate, especially in Asia).

From a technical point of view the advent of a parallel retail banking system is strongly indicated, based on the success of telephone banking (especially in the UK).

Prediction 7: Small Fish in a Big Pond

What proportion of the individual population is likely to avail themselves of these opportunities? The number will of course continue to grow, but in the near term, we can postulate less than 10% of the Internet population: telephone banking appears yet to have exceeded this number in the UK after some 6 years[15]. As the largest community is likely to be the United States, with approximately half of the entire Internet population, this group is something like 20 millions [16], or, say, 10% of US population. Hence, we can talk in terms of 1% of the population of the US taking advantage of the new facilities, and this is easily the largest clientele within any country. Further, it is unlikely to be more than 10% of their total expenditure, e.g. discretionary income only. Clearly, this amount is negligible in terms of monetary policy.

However, the reverse may not be true: as the source of the individual expenditure is likely to be weighted towards wealthy, technically-oriented young-to-middle-aged males, their discretionary expenditure is likely to be effected hardest and earliest by a monetary policy adjustment than the rest of the population (the yuppie of the 1980s is replaced by the nerd of the 1990s?). Hence, a contractionary policy could plausibly cause a dramatic flight out of Internet deposits, in response to the strong squeeze required by a weakened tool.

To offset this sensitivity, the Internet population is diversified across states, thus limiting the effect of any one squeeze. However, given that the OECD states tend to move more in line with each other these days than not, it would appear that the Internet financial system has more to fear from monetary policy than the reverse.

It is interesting to speculate why there is so much interest in the topic. Consider the above numbers. They indicate some 2 million banking facilities to be created in the Internet financial system, and in terms of the total system, this is indeed small. However, put in context of the perceived high switching costs facing users, then the issue of banking capture becomes all-important. Hence, the interest could be a reflection that those in the system first will have best chance of securing the bulk of the action.

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7. Conclusion top

Monetary Policy

We can now conclude some things about the future of the Internet financial system:

- technical complexity strongly effects the structural makeup of the system by heavily favouring the marketing success of IOU systems.
- Cash emulating systems can be substantially treated as demanding negligible cash balances, and are equivalent to IOU systems in these respects.
- without linkage into the existing financial system, powerful fractional banking is difficult to envisage.
- if linked into the existing financial system, digital cash issuance will be subject to self-regulation by the issuers, and to a lesser extent by monetary policy agents.
- The amount of money that is likely to flow into the system is minute in the short term, and not likely to be significant for some time to come, in comparison with the total system.

With no sign of a dominating demand for Internet financial intermediation, and with no special monetary cash demands, it would appear that the "threat" to monetary policy is somewhat overdone.

In contrast, with monetary policy having an amplified effect on the Internet financial system, and with a likely domination of simple IOU services, there should be more cause for concern as to whether developments will be of social benefit to the Internet community and society as a whole.

It has been assumed by many that the central banks' approach to the Internet financial system would be one of regulation and limitation [17]. However, where there is a concern that strong monetary policy might by at risk, there is nothing stopping a central bank from extending its usage of monetary policy tools to the net. For example, open market operations are not likely to be a technical problem, once there exist suitable instruments to buy and sell. Further, who better to stabilise the credibility and value of digital cash than a central bank with a strong history of financial prudence?

Future Work

The efforts above to define the demand for digital cash would benefit from rigorous application of Baumol-Tobin. There are also other useful models that could be applied: [18], [19]

It might be possible to research the cost structure of various Internet financial intermediaries, although at this stage of non-competitive growth, it is likely that charges will be subject to marketing strategy.

How much is a TIC? This topic is becoming more interesting as Internet service providers question the economics of fixed charges.

Efforts to define market size are not reliable. However, it should be possible to generate some viewpoints on likely IOU money demand based on projections.

The idea of no transaction costs is appealing and interesting. Is it a sustainable concept from an Internet financial system point of view, or is it in the interests of financial intermediaries to not become too efficient? I.e., if the bank and the market both had zero costs, what would happen? This is interesting from a theoretical point of view, but it also arguably represents a better model for the future Internet financial system than existing cost structures.

Having concluded that there is no change to the money multiplier, due to negligible demand for digital cash, what is the effect on velocity, at least within the Internet financial system?

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8. References top

Notes. Ian Grigg wrote this paper for International Financial Systems, an elective taken as part of an MBA at London Business School. The elective was taught by Professor Michael Kuczynski of Cambridge University. The latter's course notes are used extensively. However, any errors or misquotes are the responsibility of the author. General permission to qoute this paper is given by the author (an email of intentions would be appreciated), as is permission to take one electronic or paper copy for study or research purposes.

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Version History (back):

- V1.4 Meta header
- V1.3 Added Chaum and Browne&Cronin references.
- V1.2 Incorrect use of trademarks.
- V1.1 Original.

1 *Business Week*, 12 June 1995, for example, quoted an eminent academic, Martin Mayer at the Brookings Institute, as saying that "he expects the Fed to lose control of a significant portion of the money supply." Back.

1.b David Chaum, *"Achieving Electronic Privacy,"*; Scientific American, v. 267, n. 2 Aug 1992. Back.

2 Markus Jakobsson and Moti Young, *"Revokable and Versatile Electronic Money,"* ____ Back.

3 To be fair, a digital cash payment system wasn't a design criteria. Systemics' applications needed a payment system and given the uncertainty of availability of an efficient system, it was easier to develop an in-house solution. Back.

3.b Since original publication of this paper, Systemics announced the usage of electronic financial instruments for trading purposes, and the issuance of a trial electronic bond for testing purposes. See *Systemics Announces First Internet Trading System* Back.

4 __, *"Macroeconomic and Monetary Policy Issues Raised by the Growth Derivatives Markets,"*; BIS Working Paper, November 1994 Back.

5 Private conversation with Michael Kuczynski, Feb 1996. Back.

6 International Financial Systems course notes, 2.appendix., 1996 Back.

7 *Capital Adequacy Guidelines*, BIS, 1987 Back.

8 A. Michael Froomkin, *"The Internet as a Source of Regulatory Arbitrage,"*; DRAFT 3 April 1996. Back.

9 According to Begg, et al, "Goodhart's law says that attempts by the [government] to regulate or tax one channel of banking business quickly lead to the same business being conducted through a different channel which is untaxed or unregulated." I do not have an original reference, see Begg, Fischer and Dornbush, *Economics*, 3rd Edition, McGraw-Hill, 1991 Back.

10 Jeffrey D Sachs and Felipe Larraine B., *"Money Demand"*, in `Macro Economics in the Global Economy`, 1995. Also, the original papers are W. Baumol, *"The Transactions Demand for Cash: An Inventory Approach,"* Quarterly Journal of Economics, November 1952, and J. Tobin, *"The Interest-Elasticity of the Transactions Demand for Cash,"* Review of Economics and Statistics, August 1956.

Also see Browne, F. X. and D. Cronin, *Payments technologies, financial innovation and laissez-faire banking,* Cato Journal, Vol. 15, Nr. 1, Spring/Summer 1995. Back.

11 John P. Judd and John L. Scadding, *"The Search for a Stable Money Demand Function: A Survey of the Post-1973 Literature,"* Journal of Economic Literature, v. xx, Sep 1982 Back.

12 This point was substantially developed in conversations with Gary Howland, and was prompted by discussions on Cypherpunks regarding the nature of seignorage, especially, the comments of James Gleick and Perry E. Metzger. Back.

13 See earlier reference to Goodhart's Law. Back.

14 Note taken from Michael Kuczynski 2.appendix.A, referenced above, : This is the essence of the 'new' view of Gurley and Shore [1960]. Taken to its extreme, the modern view sees banks as a transitory phase on the path to a full set of Arrow-Debreu markets. **Need refs.** Back.

15 First Direct, the leader in UK, had more than 500,000 clients after 5 years of operation, Steven I. Davies, *"Retail Lessons from Europe"*, Bank Management, Nov/Dec 1995. Back.

16 For example, Nielsen Media Research said 37 million people had access in the US and Canada in October 1995, being 17% of the adult population, although the methods used have been criticised. Also, it is widely thought that future growth will come predominantly from outside the US and Canada.**Need to check refs.** Back.

17 For example, "if cybercash becomes a significant phenomenon, the [Federal Reserve Board] might question whether reserve requirements should apply." Melanie L. Fein, *Regulating CyberSpace: What does it mean to Banking?,"* Bank Management, Sep/Oct 1995. Back.

18 David Laidler, *"The Buffer Stock Notion in Monetary Economics,"* The Economic Journal, supplement 1984. Back.

19 Merton H. Miller and Daniel Orr, *"A Model of the Demand for Money by Firms,"* Quarterly Journal of Economics, August 1966. Back.