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ABSTRACT

Monetary Policy in a Cashless Society

In this Paper we analyse how monetary policies will be affected in a cashless society. Our main conclusions are that the central bank will lose its traditional instruments of monetary policy. Open market operations and advances to banks will become ineffective as instruments to control the interest rate and the money stock. We argue that this leads to two possible avenues for the future role of the central bank. In the first one the central bank becomes dependent on the treasury, both as a means to obtain revenues and as a way of maintaining some effectiveness of its traditional monetary policy instruments. Another avenue consists of strengthening the supervisory role of the monetary authority. This strengthening would include the quality control of the loan portfolios of the money issuing institutions as a way of ensuring market stability and to avoid bank runs. Simultaneously, supervision would allow the central bank to impose reserve requirements and to influence the money supply.

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NON-TECHNICAL SUMMARY

Innovations in information technologies have improved the prospects for the advent of a cashless society. Although it remains unclear whether the new information technologies will drive out cash completely from the payments system in the foreseeable future, the prospect of such an outcome cannot be excluded.

In this Paper we study the implications of a cashless society for the conduct of monetary policies. We define a cashless society as having the following characteristics: one is that there are no notes and coins in circulation issued by a central bank. All the money used is issued by private financial institutions (banks, and possibly other firms). It is conceivable that the central bank continues to operate like other banks issuing its own deposits that could be used as money in the same way as other bank deposits are. In that case, however, the central bank has no monopoly on the issue of money. We assume that in a cashless society the unit of account (e.g. one dollar, one euro) remains a national affair and is provided by the state. Thus banks in the same country issue deposits, or other means of payment, in the same national unit of account.

We analyse monetary policies in a cashless society in two steps. In a first step we study the following problem: is it possible that the private issue of money will lead to an unstable price level? In other words will there be a mechanism that ties down the price level and prevents systematic inflation? This problem has been called the *price indeterminacy problem*. We briefly survey the classical literature on this issue, and we use a simple model that allows us to conclude that in a monetary system where all money is provided by private institutions there is potential for price indeterminacy and inflation. In other words a monetary system without an outside 'guardian' who cares about nominal variables will find it difficult to avoid the problem of price indeterminacy. In the second step we study what the role of the central bank will be (if any) in a cashless society. In particular, we analyse whether and how the central bank can be transformed so that it can maintain price stability in a cashless society.

Our main conclusions are that the central bank will lose its traditional instruments of monetary policy in a cashless society. Open market operations and advances to banks will become ineffective as instruments to control the interest rate and the money stock. This is problematic because in a cashless society where all the money is privately supplied, there is no clear and reliable mechanism that ties down the price level.

We also argue that this leads to two possible avenues for the future role of the central bank. In the first one the central bank becomes dependent on the treasury, both as a means to obtain revenues and as a way to maintain some

effectiveness for its traditional instruments on monetary policies. This road is not without danger, because it would imply a return to a system of political dependence for the central banks.

Another avenue consists of redefining the role of the central bank. This consists of strengthening the supervisory role of the monetary authority. This strengthening would include the quality control of the loan portfolios of the money issuing institutions as a way of ensuring market stability and to avoid bank runs. Simultaneously, supervision would allow the central bank to impose reserve requirements and to influence the money supply. In particular, when the need arises, it would allow the central bank (supervisor) to design its supervision policy in a counter-cyclical way.

1. Introduction

Innovations in information technologies have improved the prospects for the advent of a cashless society. Although it remains unclear whether the new information technologies will drive out cash completely from the payments system in the foreseeable future, the prospects for such an outcome cannot be excluded either¹.

In this paper we study the implications of a cashless society for the conduct of monetary policies. We define a cashless society to have the following characteristics. One is that there are no notes and coins in circulation issued by a central bank. All the money used is issued by private financial institutions (banks, and possibly other firms). It is conceivable that the central bank continues to operate like other banks issuing its own deposits that could be used as money in the same way as other bank deposits are. However, in that case the central bank has no monopoly in the issue of money. We will continue to assume that in a cashless society the unit of account (e.g. one dollar, one euro) remains a national affair and is provided by the state. Thus banks in the same country issue deposits, or other means of payments, in the same national unit of account². As we will argue, this will require the state to exert some prudential supervision over the institutions that issue money.

We will analyse monetary policies in a cashless society in two steps. In a first step we study the following problem: is it possible that the private issue of money will lead to an unstable price level? In other words will there be a mechanism that ties down the price level and prevents systematic inflation? This problem has been called *the price indeterminacy problem*. We analyse it in section 2.

In the second step we study what the role will be of the central bank (if any) in a cashless society. In particular, we will analyse whether and how the central bank can be transformed so that it can maintain price stability in a cashless society.

¹ Recently, strong doubts about the speedy disappearance of cash have been formulated by Goodhart(2000) and Woodford(2000). In this paper we do not go into this problem. We take the view that since the advent of a cashless society in the foreseeable future cannot be excluded it is interesting to analyse its implications for monetary policies.

² This definition makes our cashless society very different from the free banking system that has been analysed by, among others Hayek(1978) and Klein(1974). In the free banking system each bank issues its own currency and/or deposits with different units of account. In such a system there is a free floating exchange rate between the different moneys even within the same country. It is conceivable that e-money would be of the same kind, i.e. each issuer uses a different unit of account. We do not go into this analysis here.

2. The problem of price indeterminacy

The problem of price indeterminacy has been analysed extensively by economists. One of the earliest writers on this issue was Irvin Fisher(1896). Later Patinkin(1965), Fama(1980) added important insights.

The classical view of the indeterminacy of the price level can be formulated in a simplified way as follows³. We start from the demand and the supply of money.

The *demand for money* can be specified as

$$P L(Y,r) \tag{1}$$

where P is the price level, L is the real demand for money, which itself is a function of output, Y, and the nominal interest rate, r. Note that we assume that the demand for money is homogeneous of degree one. This also implies that agents are free of money illusion.

The *supply of money* is M. The mechanism by which the supply of money is generated will turn out to be of crucial importance.

Money market equilibrium is achieved when the demand equals the supply, i.e.

$$M = P L(Y,r) \tag{2}$$

or

$$\frac{M}{P} = L(Y,r) \tag{3}$$

This very simple equation describing monetary equilibrium can be used to illustrate the potential for price indeterminacy. The right hand side of the equation represents the real demand for money. It is the result of what happens in the “real” economy, i.e. transactions in the markets for goods and services lead to a demand for money balances. Note the importance of the absence of money illusion: agents do not care whether additional money desires are realised by increases in the money stock or declines in the price level.

The left-hand side of (3) is the real supply of money. We can immediately establish the following basic result: for any given real demand for money there are infinitely

³ For a more rigorous treatment see Patinkin(1965).

many combinations of money stock and price levels that will do the job of bringing about money market equilibrium.

The root of the indeterminacy problem can also be formulated more generally⁴. Private agents that do not suffer money illusion, care only about relative prices. They do not care about nominal variables such as the price level, or the nominal money stock. If there is nobody else in the system who cares about nominal variables, the latter will not be determinate. They can take any value. It is important, therefore, that some institution exists that will take the responsibility to fix nominal variables. In a cash society this responsibility is assumed by the central bank. We analyse how modern central banks do this in the next section.

2.1 The money supply in a cash society

In present-day economies money consists of both currency and bank deposits. There is a consensus today that central banks have the capacity to control the price level in two ways⁵. One approach consists in controlling the money supply. This approach has been advocated by the monetarist school and has led a number of central banks to implement money supply targeting procedures. The best known example was the German Bundesbank⁶. This approach has encountered a number of practical problems, however, that have led some central banks to drop it (e.g. the US Federal Reserve, the Bank of England)⁷. Today few central banks rely on this. The only noteworthy exception is the ECB (although it does not like to use the term ‘money supply targeting’).

A second approach has found increasing reliance among central bankers. This consists in following a Taylor-type rule whereby the central bank adjusts the short term interest rate in response to movements in expected inflation and the state of economic activity (most often measured by the output gap). This rule typically implies that when expected inflation increases, the central bank raises the nominal interest rate

⁴ See Patinkin(1965) for a generalisation. Patinkin’s generalisation is based on dichotomising the economy. In equilibrium, demand and supply in the real sector of the economy depend on relative prices only. This equilibrium is unaffected by the aggregate price level and the money stock. The latter only matter for the equilibrium in the money market.

⁵ The fact that they have the capacity to do so does not mean that they always do. The twentieth century is replete with histories of spectacular failures that have led to hyperinflation.

⁶ For an analysis see von Hagen(1999), Neumann(1999).

sufficiently to generate an increase in the real interest rate. This in turn helps to reduce inflationary pressures. There is now increasing evidence that this is what most central banks do in one way or the other (see Taylor(1993), Clarida, Galli and Gertler(1997))⁸. The empirical evidence also indicates that most central banks following this procedure have been quite successful in keeping inflation low.

From the preceding discussion one can conclude the following. Central banks in a cash society have the tools to solve the price indeterminacy problem. They can either control the money stock, which will then tie down the price level, or they can try to control the rate of change of the price level, thereby avoiding the indeterminacy problem. In a cash society there is a “guardian” who cares about nominal variables and who has the tools to control these nominal variables.

2.2 The money supply in a *pure* cashless economy

We now analyse the issue of whether in a cashless society there exists a similar mechanism that makes it possible to fix the price level. As will be remembered, we define a cashless society to be a regime in which currency issued by the central bank has ceased to exist. All the money is private money issued by banks in the form of deposits, or some fancier e-money issued by institutions that are not necessarily banks. We call the cashless regime *pure* because we will assume here that the central bank does not impose reserve requirements. In such a *pure* cashless society, banks and other institutions issuing money do not hold reserves at the central bank (we will come back to this issue and ask the question what difference it makes when the central bank would impose minimum reserve requirements on issuers).

The problem of the indeterminacy of the price level was analysed by classical economists. They analysed the issue of whether a monetary regime based on private bank money (deposits) would be capable of stabilising the price level. The consensus view was that this was not the case⁹.

⁷ For an analysis of some of these problems see De Grauwe(2000).

⁸ The latter authors find that this is what the Bundesbank was doing de facto. See also Bernanke and Mihov(1997) and Clarida and Gertler(1996).

⁹ There are dissenting views, however. The most notorious one was formulated by Hayek(1978). See also Klein(1974). These authors analysed the problem in the context of free banking, i.e. a system in which each deposit issuing institution creates its own unit of account. Here we consider a system in which the unit of account is a collective good supplied by the state.

Let us analyse the situation of a country where the only form of money is demand deposits issued by private banks. Currency has disappeared from circulation and there is no central bank issuing money. In order to analyse such a monetary regime it is useful to start from the banks' balance sheet:

$$A_t = M_t \quad (4)$$

where A_t is the value of the portfolio of financial assets held by the banks in period t and M_t is the value of the deposits issued by the banks in period t . It is assumed that deposits are the only means of payments in the economy. This balance sheet makes very clear that the process by which money is created is linked to the process by which credit is created. We can now develop the fundamental theorem of indeterminacy of the price level in a cashless economy. First divide (4) by the price level P_t and combine with (3)

$$\frac{A_t}{P_t} = \frac{M_t}{P_t} = L(Y_t, r_t) \quad (5)$$

It follows that the price indeterminacy can be eliminated if A_t , the portfolio of assets, can be pinned down. But can it? The answer is that in a cashless economy it cannot. In order to see this, let us take the easy case first, i.e. the banks' portfolio of assets consists of shares.

$$A_t = S_t Q_t \quad (6)$$

where Q_t is the number of shares held in the banks' portfolio at time t and S_t is the market price of shares at time t . We now can use the standard theory about how the price of shares is determined. This theory says that the price of a share today is equal to the present value of the future dividend stream, i.e.

$$S_t = \sum_{i=1}^{\infty} \left(\frac{1}{1+r} \right)^i E_t d_{t+i} \quad (7)$$

where E_t is the expected value operator and d_{t+i} is the dividend in period $t+i$.

These future dividends are influenced by many variables. One prominent variable is the money stock. The higher the money stock the higher will be the value of these future dividends. The reason is that with a higher money stock nominal values (prices) increase, including the nominal value of dividends. Thus we can write

$$d_t = f(M_t) \quad (8)$$

i.e. the nominal value of dividends is a (positive) function of the money stock. When the money stock increases the nominal value of dividends also increases. Substituting (8) into (7) and (7) into (6) yields

$$A_t = \left[\sum_{i=1}^{\infty} \left(\frac{1}{1+r} \right)^i E_t f(M_{t+i}) \right] Q_t \quad (9)$$

We conclude that the value of the banks' assets depends on the expected future deposits (money stock). Since the bank balance sheet constraint implies $A_t = M_t$, we have that

$$M_t = \left[\sum_{i=1}^{\infty} \left(\frac{1}{1+r} \right)^i E_t f(M_{t+i}) \right] Q_t \quad (10)$$

It follows that the stock of deposits (money) today depends on the expected future stock of deposits (money). Any expectation about the future level of deposits (money) is validated.

The mechanism underlying this self-fulfilling expectations process can be described as follows. If agents expect higher dividends in the future, this raises share prices today and thus the value of the banks' assets today. This in turn increases the value of the banks' deposits. Since deposits perform the role of money, the higher money stock validates a higher future dividend stream. The money stock can take on any value depending on the agents' expectations about future dividend streams. Nothing will tie down the money stock in this system. Using equation (5) we can also conclude that the price level is indeterminate.

This feature of the banking system creates a potential for inflation both in share prices and in the general price level. Because of their self-fulfilling character expectations

can also lead to speculative bubbles in the stock prices. This is also the reason why in many countries banks have been forbidden to hold shares in their portfolio.

Restricting the types of assets that banks can hold in their portfolio to fixed interest securities (e.g. bonds, mortgages) eliminates an important source of price indeterminacy. Assume that banks would only hold bonds in their portfolio. We now redefine S_t in equation (6) to be the price of bonds and Q_t the quantity of bonds held by the banks. The price of bonds to be repaid in period T can be written as

$$S_t = \sum_{i=1}^T \left(\frac{c}{1+r} \right)^i + \frac{K}{(1+r)^T} \quad (11)$$

where c is the fixed coupon of the bond and K is the face value of the bond. Since c and K are fixed numbers the only uncertainty arises from changes in the interest rate used in computing the present value and the default risk. In contrast to the pricing of stocks, there is no expectations mechanism that can lead to self-fulfilling behaviour of the price of bonds. Instead there is a strong mean reversion process underlying the bond prices, i.e. as we come closer to time T when the bond matures, the bond price must return to its face value. Thus in this case, S_t is tied down, and so is A_t . Does this mean that the price indeterminacy problem can be eliminated by imposing a condition that banks can only hold fixed interest securities in their portfolio? The answer is negative. To see why we also have to analyse the link between the money stock and Q_t (the number of securities in the banks' portfolio).

There are other mechanisms linking the money stock to the banks' assets. One such mechanism goes from money to Q_t , the amount of bank assets (loans). It can be described as follows. When the money stock increases this stimulates economic activity. As a result firms will want to borrow more and issue more bonds (or other fixed return securities). There will also be a higher (transactions) demand for money. It follows that the balance sheet of the banks will increase, i.e. banks will accumulate more bonds and issue more deposits. Q_t increases.

A second mechanism recognises that bank loans are often extended based on adequate collateral. The example is mortgage loans. This provides a link between the money stock and the value of the collateral, in this case the value of real estate. When the money stock increases this will lead to higher asset prices, including higher real estate

prices. These higher real estate prices then increase the value of the collateral, which in turn increases the value of new loans. Again a higher money stock leads to an increase in the value of the banks' assets.

We conclude that although the prices of fixed interest securities (including mortgage loans) are tied down there exist other mechanisms that lead to an indeterminacy of the value of the banks assets and thus of the price level. This mechanism is especially relevant with respect to mortgage loans. Time and again, banks have been willing to increase their portfolio of mortgage loans in response to higher real estate prices. These higher real estate prices, however, have often been caused by excessive money creation. This has often led to bank crises and collapses. In the absence of a central bank this feature of private banking could go on unchecked.

2.3 Conclusion

We have shown that in a monetary system where all money is provided by private institutions there is a potential for price indeterminacy and inflation. In other words a monetary system without an outside “guardian” who cares about nominal variables will find it difficult to avoid the problem of price indeterminacy. The question, therefore, becomes the following. Can the central bank in a future cashless society (assuming that central banks will continue to exist) assume its present role of stabilising the price level? And if so, how?

We analyse these questions in the next sections. In section 3 we assume that the central bank does not impose legal reserve requirements. As will be remembered, we call such a system a *pure* cashless society. In section 4, we allow for the possibility that the central bank would impose legal reserve requirements on private banks issuing deposits, and on all other institutions that provide new forms of money (e-money, internet money, etc.). Many central banks do this today, although for reasons that are not always related to monetary control¹⁰. It is conceivable, even probable, that central banks will want to continue to use reserve requirements.

¹⁰ The ECB's minimum reserve system has as two main functions: “[...] [stabilization of money market interest rates]...[“ and ”]...[creation or enlargement of a structural liquidity shortage]...[“ , according to “The Single Monetary Policy in Stage Three – General Documentation on ESCB monetary policy instruments and procedures”, ECB, September 1998.

A final point should be stressed here. We mentioned earlier that in a cashless society the central bank or another official institution is likely to exert powers of supervision on those institutions that issue private money. In section 4 we will also study the issue of how this supervisory function can be strengthened so as to maintain monetary and price stability in a cashless society.

3. The Central Bank in a *pure* Cashless Society

In the previous section we came to the conclusion that a private system of money supply faces the problem that the price level cannot easily be controlled. This raises the issue of how the price level and the rate of inflation can be controlled in a cashless society. In order to analyse this question we study the role of the central bank in such a system.

From the outset it should be stressed that in a cashless society the central bank will have lost the largest part of its seigniorage revenue because it has lost its monopoly position in the creation of cash, including settlement balances (i.e. bank deposits held with the central bank to be used for the settlement of payments)¹¹. Boeschoten and Hebbink (1996) have calculated that the effect of this loss on central bank balance sheets is likely to be large, depending upon the capacity of e-money to substitute for traditional money.

According to these authors, seigniorage revenues largely exceed central bank operating expenses, being an important source of profit for central banks (see table 1). Considering only that prepaid cards would eliminate all banknotes denominations up to US\$ 25, seigniorage revenue would diminish between 0.05% and 0.16 % of GDP, in different G-10 countries. If all seigniorage revenue would be abolished, as we are assuming here, an important source of revenue would disappear and central banks would certainly have to find alternative financing sources.

¹¹ This does not preclude that the central bank issues its own deposits that are used as money. The central bank could then make money like any other private bank.

Table 1– Comparison of seigniorage and central bank expenses (1994) - % of GDP¹

Country	Seigniorage ²	Central bank operating expenses	Seigniorage reduction
			Eliminate all banknotes denominations up to US\$25 ³
Belgium	0.44	0.17	0.05
Canada	0.31	0.03	0.15
France	0.28	0.13	0.08
Germany	0.52	0.07	0.06
Italy	0.65	0.06	0.05
Japan	0.42	0.06	0.01
Netherlands	0.46	0.06	0.06
Sweden	0.48	0.04	0.10
Switzerland	0.45	0.05	0.05
UK	0.28	0.03	0.14
United States	0.43	0.03	0.14

¹ Source: Boeschoten W.C. and Hebbin G.E. (May 1996). ² Seigniorage is roughly estimated by multiplying notes and coin outstanding by the long-term rate of interest on government securities. ³ Or the equivalent amount in domestic currency.

This immediately raises the issue what the relation of the central bank will be with the government. In a first step we will assume that the central bank is completely independent from the government and will not be subsidised by that government. This also implies that the central bank, like any other bank, cannot make losses in a sustained way. In this context we analyse whether the central bank can use its traditional instruments of monetary policy in a cashless society. We will first study the question of whether the central bank can use open market policies (section 3.1). In the following section we analyse the issue of whether the central bank can control the short-term interest rate in a cashless society (section 3.2).

In a second step we will analyse the question of whether the central bank can maintain its status of political independence once it has lost its seigniorage. We will study the new relations between the central bank and the treasury in a cashless society that arises from this loss of seigniorage. As will be seen, the need to redefine the relation between the central bank and the government in a cashless society follows not only because of the loss of seigniorage but also because the central bank cannot use its

traditional instruments of monetary policy without some government support. We will analyse the nature of this support.

3.1. Can the central bank perform open market operations in a cashless society without government support?

Let us start from an analysis of the present situation of a cash society. Suppose the central bank purchases financial assets (treasury bills) from the commercial banks and credits their accounts by an equivalent amount. As a result, banks have excess reserves. Assuming that the country is closed (or has a flexible exchange rate system) these additional bank reserves are here to stay. They are the result of a liquidity creation by the central bank, and cannot be reduced except if the central bank engages in a reverse operation (an open market sale). It follows that collectively the banks can only “get rid” of the excess reserves by engaging in a process of credit expansion, which will have the effect of expanding deposits. This will ultimately lead to higher prices. All this is well-known from the textbooks.

Things are radically different in a cashless society. In such a world the central bank cannot “force the banks to swallow” the reserves it creates. Instead, the central bank is a bank like any other one facing reserve withdrawals, if too much credit is created. Let us go through the mechanics of an open market purchase in a cashless society.

In a cashless society the liabilities of the central bank are deposits like the deposits of any other bank. Consider then an open market purchase by the central bank. This means that the latter offers to buy treasury securities held by commercial banks at a price above the market price, so that these are willing to sell the securities to the central bank. We have the same movements in the balance sheets as in the case of a cash society. However, the central bank deposits acquired by the commercial banks are just regular bank deposits. The commercial banks are unlikely to be willing to hold the full amount of these deposits in their asset portfolio. The largest part will be presented for conversion at the central bank, through the private payments system. The central bank will have to liquidate an equivalent amount of assets (treasury securities). As a result, the initial increase in the assets and liabilities of the central bank is eliminated. The central bank cannot expand the amount of liquidity in the system, except to the extent that other banks are willing to hold the liabilities of the

central bank. Since the central bank's liabilities have lost their unique character of constituting the cash reserves of the banks, it is unlikely that commercial banks (nor any other agent) will be willing to hold these liabilities in significant amounts. This will only happen if they are forced to do so¹². We return to this issue when we discuss the role of legal reserve requirements.

It is worth noting that the situation of the central bank in a cashless society is very much comparable to the situation of a central bank of a small country on a fixed exchange rate and perfect capital mobility. Any attempt by this central bank to independently raise the domestic money stock by open market operations would lead to an outflow of reserves, which forces the central bank to bring the money base back to its initial level.

3.2. Can the central bank control the short-term interest rate in a cashless society without government support?

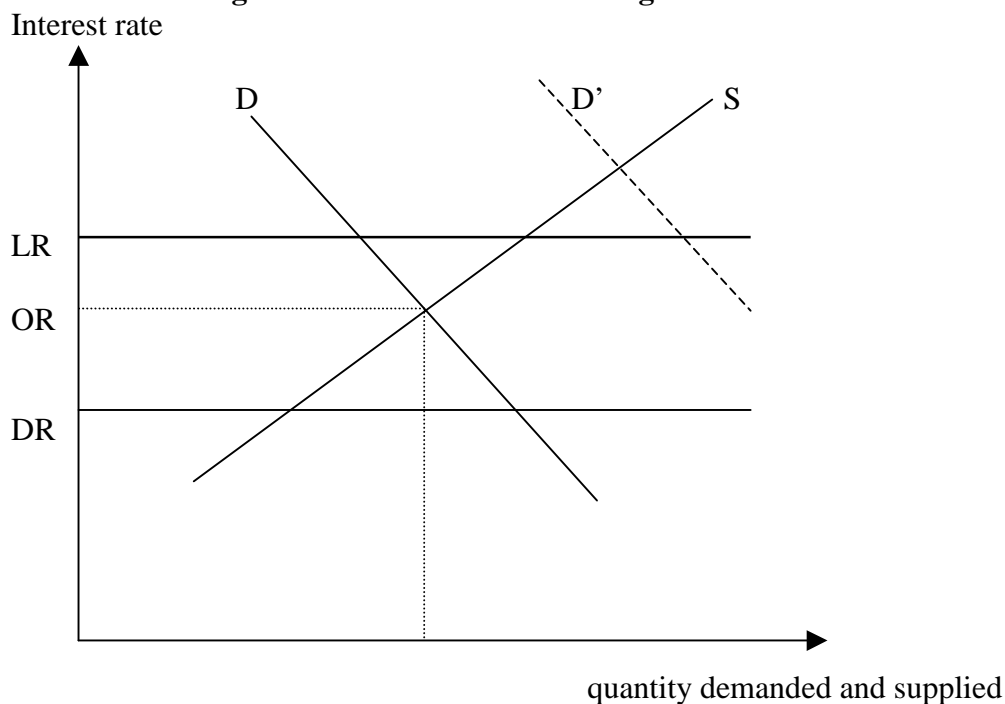
The control over the short-term interest rate is crucial in the monetary policies of modern central banks. Even if the latter aims at targeting the money stock, the operational way to achieve the target consists in changing the interest rate that is applied in open market operations and in bank advances. The central bank can also be guided by the new approach to monetary policy, which stresses that the central bank should aim at the inflation rate directly (e.g. in the context of a Taylor-type rule). In this approach the central bank uses the short term interest rate in response to increases (decreases) in expected inflation rates. Thus, whatever the approach taken by the central bank, the capacity to control the short-term interest rate is of overriding importance. The question then is whether the central bank will be able to control the nominal interest rate in a cashless society. In this section we analyse how the central bank can influence the short-term interest rate using the system of standing facilities. This system is used by many central banks, including the Eurosystem. We first analyse its working in the present cash system, and then go into the question of whether this system can continue to function in a cashless society.

¹² The BIS (1996) points out that cash is one of the largest components of central bank liabilities in many of the 43 countries analysed. Consequently, the e-money impact will depend upon its substitution power as compared to the traditional money. It also calls our attention for the fact that open market operations have a relatively small size on normal days. However, they are a powerful instrument in special circumstances, whose impact might be cancelled out if e-money takes gains importance.

The basic functioning of a system of standing facilities is represented in figure 1. This shows the demand (D) and supply (S) of liquid funds (overnight funds) by commercial banks. The central bank sets its deposit rate at DR and its lending rate at LR. These official rates work as floors and ceilings within which the overnight rate (OR) will be located. A shift in the demand curve, say to D', forces the central bank to intervene and to supply liquidity. The supply curve becomes perfectly elastic when the overnight rate reaches LR. At that point the central bank is willing to supply unlimited amounts of overnight funds.

To make this point clearer, consider the mechanics of borrowing at the central bank. When today a bank borrows at the central bank at the announced rate LR, the central bank has no limit in the amount it can lend, for the simple reason that it creates bank reserves “by a stroke of the pen”. That is, the ultimate means of payments are the liabilities of the central bank. As a result, there is in principle no constraint on the amount the central bank can provide in a lending operation¹³. Surely, when the central banks lends to commercial banks, it will demand collateral, but all this means is that the constraint is on the borrowing institution. The central banker, however, can face any demand of liquidity originating from the banking sector.

Figure 1. The market for overnight balances



¹³ This is also the basis of the capacity of the central bank to be a lender of last resort.

The central bank can raise (or lower) LR and DR. This shifts the band upwards (or downwards) forcing the overnight rate to increase. In principle, very little actual intervention in the market will be necessary, because market participants know the commitment and the unlimited capacity of the central bank to intervene at the margin. As a result, when the central bank shifts the band the overnight rate will typically settle within the new band, without the need to intervene in the market¹⁴.

Can this system continue to function in a cashless society? In order to answer this question we continue to assume that the central bank in the future cashless society is independent from the government and that it cannot draw on the state's resources.

Two things that are important for the operation of the standing facility will have changed in a cashless society. First, as stressed earlier, the central bank's liabilities will not be used as cash and as settlement balances anymore. Second, the relative size of the central bank balance sheet in a cashless society will have shrunk considerably. Let us develop this last point further. When we will have moved to the point where currency and bank reserves have disappeared, the size of the central bank's balance sheet in comparison with the size of the balance sheets of commercial banks will have declined sharply. To give some perspective, table 2 presents the size of the balance sheet of the Eurosystem (ECB + national central banks in Euroland) and compares this with the size of the balance sheets of the financial institutions (MFIs). It can be seen that today (May 2000) the balance sheet of the Eurosystem represents 8.9% of the consolidated balance sheets of the banking sector in Euroland. This is still a respectable size. When compared to the balance sheet of individual MFIs, the central bank is in most countries still the largest player in the market.

Table 2: Consolidated balance sheets of the Eurosystem and of the MFIs in Euroland (May 2000) in billion euros.

Eurosystem	MFIs	Eurosystem/MFIs
1,082.2	12,135.1	8.9%

Source: ECB, Monthly Bulletin, July 2000.

¹⁴ See Guthrie and Wright(2000), who analyse a model in which the announcement of a particular target rate is sufficient to stabilise the interest rate without any need for intervention. The key for this result is the knowledge that the central bank has the capacity for unlimited intervention.

However, it is to be expected that the relative size of the Eurosystem will continue to decline as the use of currency and bank reserves declines. Today these two items represent more than 70% of the total balance sheet of the Eurosystem. There is thus a huge potential for further shrinking of the Eurosystem as a result of the gradual decline in the use of currency and bank reserves. At the same time the financial sector is likely to continue its strong expansion. The last few years it has expanded at rates close to 10% a year. Thus, when we reach the cashless society, the central bank is likely to be much smaller than today. It could become significantly smaller than the big players in the financial markets.

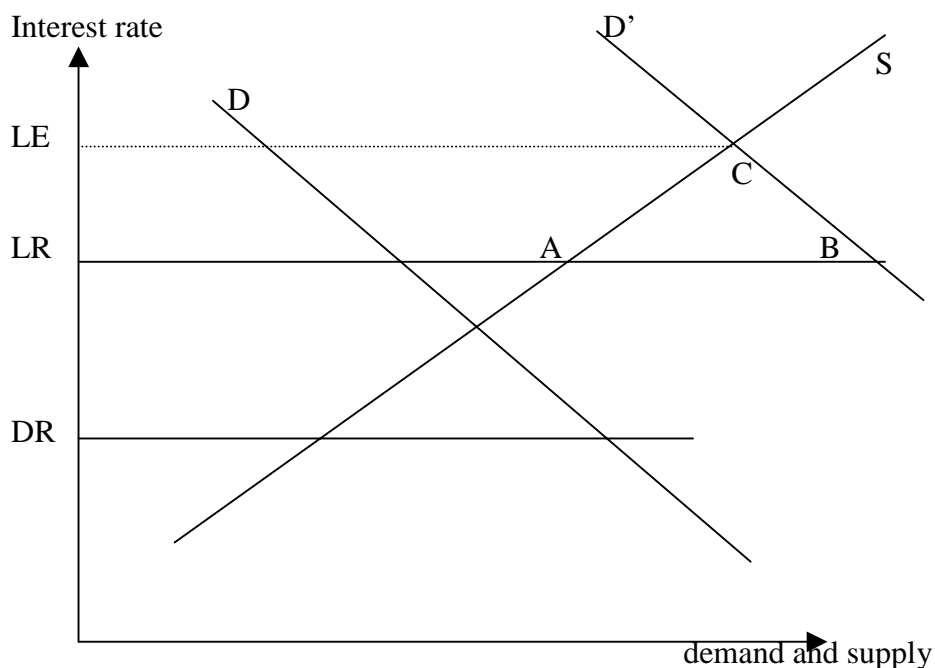
The small size of the central bank in a future cashless society together with the loss of its monopoly position in the supply of cash and of settlement balances has important implications for the operation of standing facilities in a cashless society. Consider again a borrowing operation by a commercial bank. The central bank will not be able then to provide the demanded liquidity by “a stroke of the pen”, because its liabilities will not be the ultimate means of payments anymore (cash and settlement balances). Instead, the central bank will have to go to the market and borrow liquid funds itself, which it will then lend out to the commercial bank. This also implies that the central bank will have to provide collateral. If the borrowing banks are large relative to the central bank, the latter will not have sufficient collateral to make the operation possible. Instead of being an institution that does not face a constraint on its capacity to create liquidity, the central bank in a cashless society will face the rigours of the market. As a small player in that market it will have great difficulties to lend the amount of liquidity that big players will occasionally demand. Thus, the loss of monopoly power in the provision of liquidity combined with the small size will make it hard for the central bank to control the short term interest rates.

The previous analysis can be made more precise by referring to figure 1. The horizontal lines (floors and ceilings) can be interpreted as infinitely elastic supply of deposits and loans by the central bank. Take the perfectly elasticity supply of loans (the ceiling). This perfect elasticity arises from the fact that the central bank today can supply the loans at the given loan rate LR in unlimited amounts because its liabilities are the ultimate means of payments. In a cashless society where the central bank will have “to go to the market “ in order to raise the liquidity it wants to lend, the supply of loans curve will not be horizontal anymore. We show this in figure 2.

Suppose as before that there is a shift in the demand for liquid funds. As a result at the rate LR there is excess demand equal to AB. The central bank wishing to prevent the short term interest rate from exceeding LR would have to borrow at market conditions (given by LE the equilibrium rate corresponding to the intersection of the D'- and S-lines) and lend the funds to the commercial banks at the rate LR. This would lead to losses for the central bank and profits for the commercial banks. In addition, and more importantly, it would create arbitrage opportunities for the commercial banks who would have a strong incentive to borrow cheaply from the central bank and to lend the funds back to the same central bank. This would lead to unsustainable large losses for the central bank. Without an external support the central bank cannot credibly set up a standing facility in a cashless society. This conclusion is reinforced by the fact that the central bank will have relatively small size. It will, therefore, be impossible for the central bank to keep the short-term interest rate between a horizontal band as in figure 1. All this leads to the conclusion that in a cashless society where the central bank's liabilities are not the ultimate means of payment anymore, the central bank will have lost its capacity to regulate the short-term interest rate. Since agents know this the commitment of the central bank to intervene in the overnight market and to be the residual supplier and demander at fixed rates will have no credibility¹⁵.

¹⁵ The reader will recognise that the problem of the central bank in a cashless society is comparable to the problem of the central bank pegging a fixed exchange rate. In the absence of sufficient reserves this commitment has low credibility and will be fragile. It will often lead to speculative crises. We came to the same conclusion when we discussed the use of open market operations in a cashless society.

Figure 2. The market for overnight balances in a cashless society



3.3. The central bank and the treasury in a cashless society.

In the previous sections we argued that the central bank in a cashless society will have few instruments available to fulfil its mandate of maintaining price stability. In deriving this conclusion we assumed that the central bank stands alone and cannot draw on the resources of the government. In this section we relax this assumption. We ask the question of how the relationship between the central bank and the treasury will have to be redefined to allow the central bank to fulfil its mandate for price stability.

Let us consider the case in which the central bank can draw on the resources of the state in a cashless society, i.e. the losses that the central bank incurs are borne by the treasury. Will this be sufficient to allow the central bank to regain its control over the short-term interest rate? In recent contributions Goodhart(2000) and Woodford(2000) have claimed that this would be the case.

Goodhart(2000) has made the point that the central bank will maintain its capacity to control the short-term interest rate because it is not a profit maximising institution, and it is capable of drawing on the resources of the State. As a result it can set the interest rate at a different level than the market rate, knowing that the ensuing losses it

incurs will be covered by the Treasury. This gives the central bank the power to move the interest rate in the market.

This reasoning can be criticised on the following grounds. In a society where central banks do not impose minimum reserve requirements, as we are assuming here¹⁶, deposits held at the central bank for operational reasons tend to be residual¹⁷. In a cashless society where central banks do not have any specific role in the monetary process anymore, there is no apparent reason for banks to hold reserves at the central bank.

Thus, when the central bank sets the loan rate LR (as in figure 2), this means that it will have to borrow the funds itself in the market at the rate LE in order to lend them back at the lower ceiling rate LR. As argued earlier, this will set in motion profitable arbitrage by banks whereby the latter borrow cheaply from the central bank and lend the same funds dearly in the market. The counterpart of this arbitrage are the losses of the central bank. The fact that the central bank now has at its disposal the resources of the state will only make the size of these arbitrage activities larger, without creating added liquidity. As a result, the equilibrium rate remains in LE¹⁸. If the willingness of the treasury to bear the losses of the central bank is unlimited, so will the profits of the banks be unlimited. This is clearly unsustainable. We conclude that the willingness of the treasury to bear the losses of the central bank does not increase infinitely the power of the central bank to set the interest rate. The crucial reason is that the central bank has lost its seigniorage and the power to create the ultimate means of payments (cash and settlement balances). As a result, it cannot affect the amount of liquidity in the system

A similar conclusion holds as far as the use of open market operations is concerned. Consider again an open market purchase by the central bank in a cashless society. In order to convince commercial banks to sell their treasury bills the central bank must offer favourable terms, i.e. a premium above the market price. This will be a source of

¹⁶ We drop this assumption in section 4.

¹⁷ According to C. Borio (1997), in countries such as the UK, where the reserve ratio was very small (below 0.5%), deposits tend to be very small (below 0.5% of the GDP), showing that even in a traditional money supply environment banks do not hold deposits with operational goals, namely if they are not remunerated.

¹⁸ Note that this is where the cashless society differs from the present monetary regime. In the latter the lending by the central bank adds liquidity, and thereby affects the equilibrium in the market.

losses for the central bank¹⁹. The government, however, will foot the bill, but this will not help the central bank to control the stock of liquidity in the system. As argued earlier, the commercial banks that, after the open market operation, have acquired a deposit issued by the central bank will mostly not want to keep these in their books. As a result, these deposits will be presented to the central bank for conversion forcing the latter to liquidate its stock of earning assets, i.e. the treasury securities it has bought in the first place. The fact that the central bank does not face a profit constraint is irrelevant. What is relevant here is that in a cashless society, the central bank faces the same constraints as the other banks, i.e. it cannot overextend its loans. If it does, it faces deposit withdrawals forcing it to liquidate assets.

In order for the central bank in a cashless society to be able to control the interest rate and the amount of liquidity, one needs more than a commitment by the treasury to cover the losses of the central bank. In addition, the treasury must be willing to supply potentially large amounts of risk free securities (bonds) to the central bank. There are two reasons why this is necessary. First, large holdings of treasury securities by the central bank would make the central bank a big player in the financial markets. Put differently, the shrinking balance sheet of the central bank on the road to a cashless society would be “blown up” by treasury securities.

Second, and most importantly, the capacity of the central bank to obtain treasury securities is essential to allow it to use its traditional instruments of monetary control in a cashless society. Take the standing facilities. We have seen that in a cashless society the central bank must borrow funds in the market when it faces a demand for loans at the loan rate LR . In order to do so, it has to provide collateral. This collateral can only come from treasury securities it is holding, or that it can obtain from the treasury. In addition, by supplying new treasury securities in the market, the central bank is increasing the amount of liquidity in the system, thereby affecting the interest rate.

In a similar way, the central banks will have to be able to draw on a pool of treasury securities to sustain an open market purchase. This allows the central bank to confront withdrawals after an open market purchase. Thus, in a sense in a cashless society,

¹⁹ Note that this is also the case today in a cash society. The central bank must also offer favourable terms. The losses it makes on open market operations are more than offset by the large profits resulting

treasury securities become the ultimate means of payments. By being able to draw on an automatic credit line with the treasury, the central bank can effectively control the total amount of liquidity.

There is a danger associated with this required transformation of the role of the central bank in a cashless society. The danger is that the central bank becomes an agent of the treasury (i.e. the government), so that it loses its independence. We have learned from the monetary history of the last centuries that central banks that are dependent on political institutions often fail in stabilising the price level. As a result, many countries in the world have transformed their central banks into institutions that are independent from the politicians. There is a large consensus today that this transformation is beneficial and that it is necessary to maintain price stability.

The paradox therefore is that the movement towards a cashless society may in fact increase the power of the state on monetary affairs again. Thus, the challenge becomes how to devise institutions that will give the means to the central bank to play its role in stabilising the price level, without increasing the intrusion of politicians²⁰. Certainly such institutional changes are possible. They will require some creative thinking, however.

4. A new role for the central bank in a cashless society.

In the previous section we argued that the central bank will lose both its traditional instruments of monetary policy and the largest part of its revenues in a cashless society. It therefore risks to become very much dependent on the treasury, both as a means to strengthen the use of its traditional instruments of policy and as a means to obtain revenue.

There is, however, another avenue for the central bank (or more broadly the monetary authorities). This consists in strengthening the supervisory role of the monetary authorities. (Note that we make abstraction here from the fact that in some countries

from the fact that most of the liabilities of the central banks do not pay interest (the seigniorage gain). The latter is absent in a cashless society.

²⁰ The prediction made by Goodhart(2000) that the central bank would be the same institution as today, but instead of making monopoly profits, would make (potentially) large losses that would be covered by the state, is not very comforting. It is difficult to see how an institution that year in year out must be subsidised by the government would remain independent from the latter.

the supervision is done by another institution than the central bank. In the present context we will assume that the central bank is also the supervisor).

At the centre of the central banks' responsibility in a cashless society will be supervision of the money issuing institutions. By supervision we mean the control of any activity which might interfere with monetary variables or with the sound functioning of the monetary system. In a cashless society this supervision should be strengthened in two directions.

First, the central bank will have to expand its supervisory control of any money issuance, independently of its type or origin. It will then be possible to implement a system where the central bank certifies the quality of the issue of private money. This will apply to both traditional private money (such as bank deposits) as to new forms of money such as e-money. In such a system, if a firm has enough assets, which allow for money issuing, the central bank will "print" its "logo" on this money, assuring the underlying quality of the asset. The central bank will therefore perform a rating activity, which will give legal tender characteristics to private money, including e-money.

Second, the central bank as a supervisor should not only use microeconomic criteria to certify the quality of the money-issuing institution. In a cashless society it should also use macroeconomic criteria to guarantee the quality of the money issue, including e-money. The use of macroeconomic criteria will be crucial precisely because the central bank will have lost most of its traditional instruments to influence macroeconomic variables such as the money stock and the interest rate. Using macroeconomic criteria in the supervision will then substitute for the lack of direct control over macroeconomic conditions in a cashless society.

Let us give an example to make this point clear. Consider the quality of mortgage loans. In a traditional microeconomic approach to supervision, the central bank (or the institution responsible for supervision) evaluates the quality of the banks' loan portfolio by analysing the structure of the bank's balance sheet, the amount of equity issued, the value of the collateral, etc. The macroeconomic environment in which these loans are issued usually does not play an important role²¹. The use of macroeconomic indicators to evaluate the quality of the loan portfolio would include

an analysis of the degree of asset inflation in the housing market, the risk associated with interest rate movements, the state of the business cycle. When these macroeconomic indicators point towards overheating, and thus to a risk of asset inflation, the supervisor could strengthen the criteria for providing its positive rating. For example, during a boom in economic activity, the supervisor could raise the capital adequacy ratio, or alternatively it could increase the collateral banks are required to use in extending loans. During a recession the supervisor could then lower the capital adequacy ratio and/or lower the required collateral for extending bank loans. Used in such a way, supervision could in fact become an instrument to affect macroeconomic conditions in a counter-cyclical way. Such a counter-cyclical supervision would give the monetary authority an instrument to stabilise the price level in an environment where it has lost many of its traditional monetary policy instruments.

In this expanded role for supervision the use of legal reserve requirements will be of great importance. It will have to be applied to non-traditional types of money, such as e-money. In practice this means that a certain percentage of “high quality” e-money should be deposited at the central bank. This would not necessarily make supervised firms less competitive. It would depend upon the remuneration rate attached to these deposits. By remunerating deposits with an interest rate below but close to the market rate, the central banks can make sure that the losses of competitiveness of the money issuing institutions are limited. The price these institutions would have to pay in the form of a somewhat lower return on short-term assets than the market return could be considered to be the price to pay for a permanent and updated rating service.

Legal reserve requirements can also be used as an instrument of control of the supply of money, including e-money. One should be aware however that as an instrument of monetary control, legal reserve requirements have such a large impact, that it has to be used very carefully. Consequently, its flexibility is quite limited, especially in the absence of the other traditional instruments of monetary control.

It is useful to look at the present-day use of legal reserve requirements. Table 2 shows the recent use of reserve requirements in a number of industrial countries and in Euroland. It can be seen that reserves are very small.

²¹ We do not want to imply that present-day supervisors do not use macroeconomic analysis. Some undoubtedly do. We argue that in a cashless society this will have to be done more systematically.

In Germany, it used to be more important, but since the start of EMU, the importance of reserve requirements in that country has declined. In 1997, The Dutch central Bank used reserve requirements primarily for liquidity management functions. In order to maximise the flexibility of the requirements, authorities flexibly adjusted the level of the ratio and the length of the maintenance period in order to meet the changing profile of the autonomous creation of liquidity. However, subsequently, this policy was slowly substituted by more market-oriented instruments²².

In the Eurosystem, the reserve base includes “deposits”, “debt securities issued” and “money market paper with maturities inferior to 2 years”. The minimum reserve requirement ratio is only 2% of reserve base. Thus, the use of legal reserve requirement today is very limited. In order for reserve requirements to become an effective instrument of monetary control, it would have to be expanded significantly, so that it could be used both as an instrument of monetary contraction and of monetary expansion. With reserve requirements of 1 to 2% of the reserve base significant relaxation of monetary policies are impossible.

It is quite unlikely that in a cashless society that will also be characterised by fierce competition and internationalisation of the financial markets, the monetary authorities of individual countries can significantly increase legal reserve requirements. As a result, its use as an instrument of monetary control will remain limited.

²²) See Borio C. (1997).

Table 2 – Reserve Deposits Held at the Central Banks as a Share of**Total Bank Liabilities (*)** (Year average of End-Month Observations, in %)

	1980	1985	1988	1991
United States	1.6	0.8	1.0	0.6
Japan	1.6	1.1	1.0	1.0
Switzerland	4.0	3.1	1.7	0.7
UK	0.3	0.1	0.1	0.1
Germany	7.2	5.6	5.5	5.5

(*) Source: Kasman, B. (Summer 1992), in “A comparison of Monetary Policy Operating Procedures in Six Industrial Countries”, Federal Reserve of New York, Summer 1992, Volume 17, Number 2

5. Conclusion

In this paper we have analysed how monetary policies will be affected in a cashless society. Our main conclusions are that the central bank will lose its traditional instruments of monetary policy. Open market operations and advances to banks will become ineffective as instruments to control the interest rate and the money stock. This is problematic because in a cashless society where all the money is privately supplied, there is no clear and reliable mechanism that ties down the price level.

We also argued that this leads to two possible avenues for the future role of the central bank. In the first one the central bank becomes very dependent on the treasury, both as a means to obtain revenues and as a way to maintain some effectiveness for its traditional instruments on monetary policies. This road is not without dangers because it would imply a return to a system of political dependence of the central banks.

Another avenue consists in redefining the role of the central bank. This consists in strengthening the supervisory role of the monetary authority. This strengthening would include the use of macroeconomic indicators in the control of the quality of the loan portfolios of the money issuing institutions. It would lead the central bank (supervisor) to design its supervision in a counter-cyclical way. It also implies that the supervision should be expanded to the issuers of e-money.

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