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Monetary transmission in a new economic environment

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Summary

Proponents of the so-called New Economy claim that it entails a structural change of the economy. **Such** a change, in turn, would require the central bank to rethink its monetary policy to the extent that traditional relationships between inflation and **economic growth** are no **longer** valid. But **such** a rethinking presupposes that **prospective advances** in information technology and other **factors** associated with the new economy do not threaten the capacity of central banks to stabilise the general level of **prices**. It is the aim of this paper to shed some light on the **latter**, by analysing the monetary transmission **mechanism** in a 'new economy' environment. We argue that, although the form of **central bank instruments** and current methods for implementing monetary policy **may** change, the goals that the policy makers try to **achieve** by employing these instruments remain valid, and achievable.

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1. Introduction

Within the euro area, electronic money currently is relatively intensely used in the Netherlands. The advent of software-based electronic money instruments has spurred research (see, among others, Boeschoten and Hebbink, 1996; Visser, 1996; Groeneveld and Visser, 1997) investigating the monetary policy implications of these technological innovations on the **retail side** of the payments system. This research points to a **gradual** substitution of currency by its electronic counterpart (currently mostly multi-purpose prepaid **cards**). As currency by itself is neither a useful operational **or** intermediate target nor a relevant Channel of transmission of monetary policy, this type of financial innovation is unlikely to inhibit, in **any** substantial way, the formulation of monetary policy (Henckel et al., 1999). **Indeed**, recent work by the European **Central Bank** (ECB, 2000b) seems to take the same position.

However, innovations influencing the wholesale **side** of the payments system, both in **gross** and in net clearing systems, suggest the possibility of a **less** benign outlook for the monetary policy maker. The **main** reason for this is that these innovations affect the **demand** for reserves by financial intermediaries, which is at the **core** of the monetary transmission **mechanism** in modern **economies**. This manifestation of the development of e-money **may** diminish the need for bank reserves at the **central bank**. It thus has (in the **absence** of regulatory measures) the potential of eliminating the monopoly position of central banks as suppliers of the **means** of payment (Woodford, 2000), with negative consequences for the ability of **central banks** to conduct monetary policy.

The evolution of electronic **means** of payment is but one of the manifestations of 'New Economy'-type of developments directly impacting on the central bank and monetary policy in particular. **Advances** in information technology **also** influence the **structure** of (financial) **markets**, the (financial) behaviour of **economic** agents and the types of (financial) **products** traded; that is the entire monetary transmission **mechanism**. For example, **advances** in data processing and the easier **access** to information **erode** the **comparative** advantage of banks as intermediaries in an environment characterised by information asymmetries. New financial **products such** as securitised **assets** are a proliferation of non-bank credit. Households and **firms** increasingly turn directly to financial **markets when making** spending decisions. Moreover, the IT revolution enables the creation of new clearing **mechanisms** which **can compete** with the central **banking** settlement systems (King, 1999).

This paper is one of the first attempts to put together all these developments and **provide** a coherent discussion of the probable **effects** of the new **economy** on the monetary transmission mechanism. To this end we **first discuss**, in the next **section**, the concept of 'new **economy**'. A similar conceptual discussion, related to the transmission **mechanism**, is the subject of **section 3**. We **dissect** the transmission **process** in a number of stages, which are dealt with, respectively, in sections 4 to 6. **Section 7** concludes.

2 New Economy-conceptual issues

Defining the concept 'New **Economy**' is a daunting task; in **fact**, nobody has yet provided a **precise** definition. Most of the macroeconomic discussions to date seem to **relate** the new economy to a permanent rise in either the **level** or the growth **rate** of potential output, with an increase in the growth **rate** of trend productivity being the **main** component of this increase in growth (see, for example, Bullard and **Schaling**, 2000). The new economy would **also** seem to be characterised by a reduction in structural and frictional unemployment. What therefore appears to be meant by the new economy is that the speed limits of the economy have been increased, that is the new economy **can operate** at **higher rates** of growth than in the past without generating an acceleration in inflation (Jorgenson and Stiroh, 2000). Most of the current literature (see, for example, Oliner and **Sichel**, 2000, OECD, 2000 and European **Union**, 2000) then proceeds by examining whether the **existence** of a new economy **can** be detected empirically. The **latter** is not clear-cut, especially in Europe (ECB, 2000a).

The task we set ourselves to **achieve** in this paper is somewhat different, **however**.

Specifically, we seek to analyse the possible **effects** of the new economy on the monetary transmission **mechanism**, a concept which we **will define** shortly. In doing so, we take as a starting point the **existence** of a new economy. The description of the new economy as given above is not **very** useful for our purposes, since we need to **relate** the new economy to the entire **process** of monetary transmission, instead of just to the **final** part in the chain, that is inflation and growth. We therefore **proceed** by identifying the **main** variables which theory would suggest are plausible **candidates** as driving **forces** of the new economy, see, e.g. **Buiter** (2000). In this respect, most attention has tended to be focused on the **effects** of an acceleration in the diffusion of the **dramatic advances** in information and communication **technologies**, or ICT. Meijers (2000) for example shows analytically **how** the diffusion of ICT **across** the economy **can** account for some of the recently observed empirical phenomena, see **also** **Gordon** (2000). **However**, despite its unquestionable **importance**, the driving **forces** of the new economy go beyond just the ICT revolution (Cecchetti, 2000; Wadhvani. 2000). In this respect, the following indicators are **also** relevant, as they are **usually** seen as catalysts for the **effects** on inflation and output which are relevant in a new economy context. They include innovations in the field of the development and use of **financial products**, including risk management techniques; domestic financial market liberalisation and the globalisation of these **markets**; the globalisation of trade in goods and services; increasing labour market flexibility; increased product market competition, and improved macro-economic management (ie a credible **preference** for **price** stability and reduction of budget deficits).

By focusing on these phenomena, it becomes clear that the new economy is in **fact** not something **new**¹. Some of these **factors**, **such** as financial market liberalisation and globalisation, **already** have a fairly long history, see, for example. **Bordo**, Eichengreen and Kim (1998). and **Bordo**,

¹ For similar views, see for instance **Bartelsman** and **Hinlopen** (2000). **Hessius** (2000). **Plosser** (2000). Every time an economy has undergone significant structural changes, it has been regarded as a new economy. As early as in the

Eichengreen and Irwin (1999). We view the new economy as a dynamic process which results from an interaction ² of **all** these factors, the end **result** of which could be that the speed limits of the economy are raised. We are interested in analysing the consequences of this process for the monetary transmission mechanism. It is to a description of the **latter** to which we now turn.

3 Monetary transmission mechanism

The monetary transmission mechanism consists of several channels, **all** of them interlinked and **each** of them comprising of several stages, see Berk (2001). Central to these different views are alternative conceptions regarding important structural and institutional factors, more **specifically** the functioning of credit, labour and product **markets**. As **will** be discussed in detail below, the above-mentioned factors associated with the new economy **will** impact on the channels of the monetary transmission mechanism by affecting the functioning of **markets**. We should note at the outset, **however**, that no **attempt** is made to rank (the strength of the) different transmission channels, as our primary focus **will** be on analysing the impact of the new economy on **each** Channel.

To illustrate the working of the monetary transmission mechanism and the **role** of these factors it is useful, for presentational purposes, to highlight the following **elements**.³ First, the influence of **changes** in the instrument variables on the **cost** of finance. **Second**, the influence of **changes** in the **cost** of finance on expenditure decisions of private-sector agents, i.e. on non-financial activity. The **latter** is **defined** to include inflation and **real economic** activity. Third, the pass-through of **changes** in non-financial activity to output and inflation. Underlying this division of the transmission mechanism into separate stages is the conception that **markets** do not necessarily **clear** instantaneously. If, on the other hand, **all markets** did always **clear**, the transmission mechanism would be fairly trivial. A change in the instrument variable would immediately lead to a compensating change in the **price level**, without **having** consequences for output. The classical dichotomy would be **maintained**.⁴ This is not to say that the new economy could not, by increasing the availability of information and reducing transaction **costs**, be interpreted as a move towards the textbook model of perfect competition (McTeer, 2000). As **will** be further discussed in **section 6** below, it could be argued that, if one were to extrapolate the factors mentioned in the previous **section ad injunctum**, the **result** would **closely** resemble the perfect competition paradigm. **However**, while conceivable enough from a theoretical point of view, the **prospects** for this paradigm of coming

1960's, Kahn and Wiener (1967) discussed the emergence of a new economy in the context of the spread of ICT.

² For example, information technology, financial innovation and globalisation are intimately linked. By reducing the cost of communications, ICT has helped to globalise product and capital markets. In turn, globalisation spurs competition and therefore innovation, and speeds up the diffusion of new technology through trade and investment. For details on the various interactions, see, for example, Buiter (2000) and Sijben (2000).

³ The transmission mechanism is a dynamic process, in that it represents a sequence of events taking place at successive moments in time. The ordering below reflects the timing of this sequence.

⁴ This line of reasoning implicitly follows traditional real business cycle theory (Kydland and Prescott, 1982). However, the assumption of market clearing does not necessarily imply a trivial transmission mechanism. Counterexamples are the stochastic general equilibrium models which incorporate money, for example within the cash-in-advance framework (Cooley and Hansen, 1995). For a critical analysis of the latter framework, see Bengtsson (2000a). Even more interesting from the point of view of the new economy, Woodford (1998) shows analytically that it is possible to analyse equilibrium inflation determination without any reference to money.

into reality in the foreseeable future **can** be put into question. The **main** part of our analysis **will** therefore be devoted to an investigation not of the end **result** of the new economy, but on the **process** towards it and of the most likely implications for the various transmission **channels** of monetary policy.

4 The influence of **changes** in the instrument variable on the **cost** of finance

The presumption underlying this stage is that there exists a **mechanism** that links the purely financial operations of the central bank to the non-financial decisions made by **economic** agents. More specifically, it is assumed that the monetary authority exercises power over **economic** behaviour of private-sector agents by influencing the financial (opportunity) **cost** relevant to the spending decisions of these agents. The typical operational target used by central banks is the overnight **rate**, which it broadly determines through its monopoly **control**, notably by open market operations, of the monetary base, ie the currency outstanding and the deposits held with central **banks** by commercial banks (Crockett, 1994; Mishkin, 1996). According to BIS (1994), the pass-through from these overnight **rates** to short-term market interest **rates** is fairly complete in most industrialised countries. The central bank therefore is able to **control** the short-term market interest **rate**. Although this position is currently relatively unchallenged (see also Bermanke and Blinder, 1992; Mauskopf, 1990), the question arises **how** the new economy impacts on this central bank **control** of the overnight **rate**. Put differently, what are the consequences of the new economy for the influence the central bank currently has on the monetary base. Moreover, if that influence would disappear, is the central bank **still** able to **control** short-term interest **rates**? We **will discuss** these issues in turn.

*Central bank **influence** on the monetary base*

The most visible **advance** in **ICT** with a possible impact on (the **relevance** of) **central** bank influence on the monetary base pertains to the development of **convenient** ways of executing payments electronically that might in the past have required the use of central bank issued currency. These **electronic** innovations **often** have been loosely labelled by the term **electronic** money, or e-money. Although the **medium-of-exchange** function probably is the most important in a discussion of **electronic** currency substitutes (Ely, 1997; England, 1997; Berentsen, 1998; ECB, 2000b), it is important for what **follows** to note that money performs more **roles** than facilitating transactions. **Indeed**, defining the concept of money is by no means an easy task (see Dalziel, 2000, for a comprehensive survey and Bengtsson, 2000a, 2000b for a theoretical analysis), and the same **holds** for its **electronic** variant. Standard **economic** textbooks attribute to it three characteristic functions: medium of exchange, a store of value and unit of account. The **legal** definition of **electronic** money as currently prevailing in Europe for **instance** reflects most of these functions.⁵

⁵ According to article 1 of the European Parliament and Council Directive 2000/46/EC, 'electronic money shall mean monetary value as represented by a claim on the issuer which is (i) stored on an electronic device; (ii) issued on receipt of funds of an amount not less in value than the monetary value issued, (iii) accepted as means of payment by undertakings other than the user'.

It is **convenient** for what follows to distinguish between three classes of electronic **means** of payment, ie e-transfers, e-purses and e-money proper (White, 1997; Lelieveldt et al., 2000). E-transfers are **defined** as transfers which are not based on paper as a source document (an example of the latter would be checks). A **subset** of e-transfers is e-purses, the most prominent example of which are **multi-purpose** stored value cards or smart cards which **figure** prominently in European countries and Japan.⁶ Value transferred from payer to payee via e-purses **can** not, in **general**, be used again, but has to be forwarded to the issuer for redemption. E-purses that **allow** for the direct transfer of credit balances from purse to purse, without the immediate involvement of the issuing (financial) institution, **fall** into the category of e-money proper.

While **all** of these **concepts** initiate an electronic transfer of value between two transaction **accounts**, only balances of e-money proper are circulating bearer media. **When** issued by private parties, they **can** be considered to **fullfill** a full-fledged medium of exchange role which has the potential to evolve to a substitute for central bank **currency**.⁷ A balance of e-money proper represents a floating claim on the issuer that is not **linked** to **any** particular account (White, 1997). To the extent that the issuer is not a central bank, there **will** be a transfer of seigniorage from the central bank to the private (**financial**) institution issuing e-money (Groeneveld and Visser, 1997; Berentsen, 1998).⁸ If e-money proper becomes so entrenched in the preferences of **economic** agents (for example, **when** it completely dominates alternatives in terms of convenience and low **cost**; Rahn, 2000), it could replace not only central bank currency but **also** traditional bank **demand** deposits and other types of highly **liquid deposits**.⁹ If this leads to a situation in which the claims that people exchange in order to **execute** transactions are no **longer** claims on the books of banks (or are no **longer** backed one for one by bank deposits), problems for the efficacy of monetary policy could arise as the connection between the change in reservable bank deposits and the change in non-financial activity **will** be weakened (Gilbert, 1997). There are, **however**, (regulatory or institutional) ways to get around this problem. Examples include extending the reserve requirements to **all** entities in the business of issuing these claims or requiring tax payments to be made using claims backed by bank deposits (Jordan and Stevens, 1997; Goodhart, 2000). The regulatory path seems to be favoured in Europe, see ECB (2000b), whereas the US seems to follow a more **liberal** attitude in this respect (Greenspan, 1997).

⁶ Examples of e-transfers not belonging to e-purses include access products, such as debit cards, credit cards, ATM's, and home banking, in which payments are settled by way of transfers between bank accounts, and payment instruments as pre-paid telephone cards, which are accepted as payment only by their issuer.

⁷ In addition, if ICT were to significantly **reduce** the **demand** for currency by the general public, the depository institutions' derived demand for vault cash would also diminish. For an analysis of vault cash, see Bennett and Peristiani (2001).

⁸ Today, almost all proposed e-money schemes are developed by private institutions. The issuer, however, could also be a central bank.

⁹ E-money is characterised by relatively high fixed costs, due to the need to rely on new technologies, but low marginal costs, as the cost of processing a single transaction is very small. This makes e-money especially suitable for making frequent and small payments. Moreover, it is likely that there will be a network effect. That is, once a critical mass is reached, a new payment instrument develops more quickly because its usefulness is an increasing function of the number of individuals who use it in executing transactions. Finally, the likelihood of e-money becoming a substitute for bank deposits would increase were e-money to be remunerated.

However, the development of e-money proper is as yet mainly a theoretical concept” and not a practical reality (BIS, 1996a). Moreover, it is unlikely that ICT will have the potential to completely eliminate the demand for central bank issued currency, owing, among other things, to the uniquely convenient features as a means of payment¹¹ of central bank currency as well as its status of being legal tender (Goodhart, 2000). But even a significant reduction in the demand for central bank issued currency might not necessarily pose a problem for the central bank. First, it is well known that it is not the size of the central bank balance sheet that matters in this respect, see Tobin and Brainard (1963). What matters is that changes in the size of the central bank balance sheet, or the interest rate the central bank can set, are at the margin related to changes in the volume and price of assets and liabilities that the public needs to engage in economic activity (Friedman, 2000a). Since central bank issued currency by convention (but not by necessity, see Goodhart, 1993) earns no interest, the issue thus is how closely the expansion or contraction of the remaining activities requiring central bank currency matches the expansion or contraction of the overall economy that the central bank seeks to influence.¹² Second, central banks usually passively accommodate currency demand, instead of trying to fix its supply (Ely, 1997; Freedman, 2000). That is, as central bank issued currency is probably not very relevant in monetary policy implementation, its demise, if this ever happens, is also unlikely to be important.

Currency is but one of the components of base money. We therefore now turn to a discussion of the effect of the new economy on the demand for central bank deposits by depository institutions. These institutions hold an account balance with the central bank mainly to satisfy reserve requirements and for use as settlement balances. Consider first reserve requirements. The introduction of the so-called sweep accounts in the US illustrates the relevance of the new economy, via the introduction of faster information processing, for central banks. It gives an impetus to innovations that facilitate the transfer of funds by depository institutions between their accounts not subject to reserve requirements and the balances that are, thereby allowing payments to be made while maintaining low average balances subject to the reserve requirements (White, 2000). This type of behaviour can of course be countered by new regulation. However, the long-term success of the regulator in the ensuing regulatory rat race can be called into question when the regulations are not sufficiently market-oriented (Browne and Cronin, 1997). For statutory reserve requirements that compel a depository institution to hold reserves it can not use or that pay subcompetitive interest rates act as an implicit tax, which innovators will always have an

¹⁰ The proliferation of various privately issued e-monies implies multiple media of exchange, stores of value, and, in principle, units of account (on the latter, see however Bengtsson, 2000a). Regulation can preserve the current uniqueness of the unit of account function performed by central bank issued money, for example by imposing a redeemability requirement on issuers of e-money (ECB, 2000b). For a theoretical rationale, see Issing (1999). The cost structure of e-money, characterised by high fixed and low marginal cost, however deters such a proliferation. In fact, as indicated by Shapiro and Varian (1999), it introduces a tendency towards a natural monopoly ('winner takes all').

¹¹ Currency is, for example, completely anonymous, and is less prone to loss, theft and counterfeiting than electronic transfers (Ely, 1997; Kabelac, 1999). It moreover provides finality in settlement.

¹² Note that, since central bank-issued currency earns no interest, it is at a competitive disadvantage to private issuers of e-money who do offer remuneration for holding e-money balances. This of course touches on the free banking issue, see, for example, Black (1970); Hayek (1976, 1978); White (1984, 1989). Goodhart (1986, 1989) and Issing (1999) provide a

incentive to circumvent. The notion that regulators **can** permanently swim against the **tide** of innovation is criticised by Friedman (1999).¹³ The worldwide trend towards the elimination of reserve requirements is **also indicative** in this **respect**.¹⁴

In addition to satisfying regulatory requirements, depository institutions **also** hold reserves at the central bank in order to **pay** one another. That is, reserves function as a **means** of settling interbank transactions through the central bank's clearing **mechanism**. This **demand** for central-bank settlement balances is mainly precautionary. Without uncertainty about payment transactions, a depository institution could plan perfectly ahead and always have the exact amount of reserves necessary. **However**, with uncertainty, a depository institution **needs** to **minimise** the risk of incurring a penalty over the market **rate when** unable to meet settlement obligations by the end of the day. This generally results in a positive **demand** for intraday reserves (Poole, 1968; Baltensperger, 1974). By reducing this uncertainty, **advances** in information technology usually associated with new **economy** impact on the **demand** for settlement balances. More specifically, payments system innovations, both in gross and net clearing systems, have increased the efficiency and safety with which banks **clear** and settle interbank transactions, thereby potentially reducing the **demand** for intraday reserves (Henckel et al., 1999).¹⁵ Moreover, another important factor related to the new **economy**, financial market liberalisation and deregulation, increases the liquidity of securities (BIS, 1998) providing depository institutions with an important substitute for central bank reserves. Instead of holding settlement balances, banks hold liquid securities which they **can** use at **any time** to borrow the settlement balances that they exactly need to avoid end-of-day overdrafts in their current account at the central bank.

Although these new **economy factors** work towards a reduction of the **demand** for settlement balances, it is likely that some **residual demand will** continue to exist, due to, for example, **strategic** bank behaviour or other market **imperfections**.¹⁶ Debtor banks **may**, for example, be unable to **locate** a potential lender in **time** or lenders **may** not offer loans at suitable conditions for **strategic** reasons. **When** the marginal creditor bank in the market must negotiate a **price** at which to lend resources to the marginal debtor bank, a game situation **arises** in which the creditor bank **may** be tempted to 'corner' the debtor bank (ie adopt non-cooperative behaviour). These arguments point to a reduced, but nonetheless positive,

critical analysis.

¹³ Gilbert (1997) however seems to reach a different conclusion.

¹⁴ In most of the countries still using them, the requirements no longer function as an instrument for monetary control. Their residual role instead is their use as liquidity buffer. Note that in countries which completely abolished requirements, monetary policy still remains effective (although operating procedures for policy implementation have changed). See Sellon and Weiner (1996, 1997). and Woodford (2000).

¹⁵ Gross settlement systems have the advantage of ensuring finality, whereas netting systems limit the need for settlement balances, for which a 'price' is paid in terms of settlement risk. Observance of the Lamfalussy standards (BIS, 1990), however, has considerably reduced this risk. On the other hand, sophisticated queueing algorithms, the provision of collateralised intraday liquidity by central banks and an efficient interbank market for central bank money have reduced the need for intraday liquidity in gross settlement systems. Thus, differences between gross and net systems tend to diminish over time.

¹⁶ It can be seen from economic history that, even before the nationalisation of clearing and the advent of reserve requirements, banks held positive reserves (White, 1989)

demand for settlement balances, which are currently **almost** exclusively provided by the central bank.” As in note issue, central banks have taken on this role largely because private providers have been legally restricted or nationalised (White, 2000). From an **economic** point of view, the **main comparative** advantage that central banks currently hold over (potential) private competitors pertains to the **fact** that they **provide** settlement **finality** as a payment service (Issing, 2000). That is, **final** settlement represents an ultimate, official guarantee of values **exchanged** by depository institutions and their customers (Jordan and Stevens, 1997).¹⁸ **However**, there are no intrinsic reasons why **final** settlements could not be **carried out** by the private sector without the need for clearing through the central bank.” The practical implementation of **such** a system (a description of which is provided by, for example, Browne and Fell, 1994 and Browne and Cronin, 1997) would possibly require computers that **communicate** in **real time** to permit the instantaneous verification of the creditworthiness of counterparties, which presumably is beyond the computer power that is currently available (King, 1999). Moreover, the **real-time** transfer of wealth between **electronic accounts** needed to settle a transaction of goods or services would probably involve financial **assets**. Eligible **assets** would include **any financial assets** for which there are market-clearing **prices** in **real time**. This **also** requires formidable computing power (in addition to well-functioning and **liberalised financial markets**). **However**, the **factors identified** in section 2 work into the direction of **making all** this available to more private parties at progressively lower **cost**. So, new **economy** induced competition **can erode** the central bank monopoly in the market for settlement balances.

Central bank control of short-term rates with substitutes for base money

The new **economy** thus could, in the limit, lead to a situation in which the **demand** for settlement balances is severely reduced, and the position of the central bank in the market for settlement balances is next to completely marginalised. In combination with a diminished **demand** for central bank currency, this **could** lead to a situation in which central bank liabilities approach zero. Woodford (1998) has shown that in this ‘cashless limit’ (ie a situation in which there is some, possibly infinite small, **demand** for central bank reserves), the **price level** is **still** determined, and the central bank is **still** able to influence overnight interest **rates** by changing its operational target. What is different, **however**, is that in **such** a world the use of quantity-targeting techniques (ie rationing bank reserves) to **control** interest **rates** (such as currently applied in the US) **may** become **ineffective**, especially **when** the **residual demand** becomes highly inelastic or unstable. It **may** have to be replaced by a more price-oriented system, see **also**

¹⁷ This central bank monopoly is complete in Europe, whereas in the US private clearing mechanisms exist, such as the CHIPS system of the New York Clearing House Association.

¹⁸ Note the rather paradoxical fact that the advent of privately issued electronic purses (which threaten central bank issued currency) for the time being strengthens the central bank position in the market for settlement balances, as final net settlement of imbalances between these monies will be in the form of central bank liabilities.

¹⁹ Freedman (2000). however, doubts whether the special role of central banks in providing settlement balances could ever be replaced, even in the absence of legal requirements for depository institutions to settle with the central bank. His argument hinges on a privileged relation between the central bank and the government. Whether this has consequences for central bank independence is an interesting topic for subsequent research.

Friedman (2000a). Under **such** a system the central bank operates a borrowing facility at which an arbitrary quantity of reserves **may** be borrowed (subject to suitable **collateral**) at an announced **rate**. Variations in this **rate** then is the tool by which desired variations in the operational target are achieved.

Beyond this limit lies a true ‘moneyless’ world²⁰ in which e-money properly perfectly substitutes central bank issued currency, in which **final** settlement could be made without recourse to the central bank, and in which there are no **cost** advantages for depository institutions to using central-bank settlement balances. Even in this economy, sometimes **labelled** as ‘fully frictionless’ (Woodford, 2000; McCallum, 2000; Bengtsson, 2000b), the central bank **still** has the ability to influence the **level** of the overnight **rate**, as long as it is **willing** to change the interest **rate** that it pays on reserves.” Although currently base money is not remunerated in the US, the remuneration of settlement balances is certainly not without precedent. In **fact**, a number of countries currently **pay** interest on balances that depository institutions hold at the central bank, eg. Canada, New Zealand, **Australia** and the Eurosystem. **Indeed**, some of these countries **already control** short-term interest **rates** by varying the interest **rate** paid on balances held with the central bank, **rather** than by injecting or absorbing liquidity in **such** an amount as to **induce** a desired differential between that interest **rate** and the overnight **rate**. In a world in which there exist (perfect) substitutes for bank reserves, only a zero differential is compatible with a positive **demand** for base money, and conducting a monetary tightening by trying to increase the spread **would result** in a complete substitution away from reserves towards the higher-yielding privately issued **liquid assets** (Woodford, 2000). Instead, the central bank **can** steer **short-term** market **rates** in a direction it desires by bringing about **changes** in the interest **rate** paid on base money. That is, for a tightening the central bank raises the nominal return on base money, which by virtue of arbitrage and the perfect substitutability characteristic **also** raises the nominal return on non-monetary **assets** to an extent that is consistent with **price** stability (Woodford, 2000; Hall, 1999). As the choice of the nominal **rate** of interest on central bank liabilities is an arbitrary choice of the **central** bank, this instrument is always available. The only requirement is that the liabilities of the central bank are always **accepted**. Goodhart (2000) **however** makes the **qualification** that the **changes** in the **rates** paid on base money must be brought about by **selling** or buying existing central bank **assets**, which **will** imply a reduction of **central** bank **profits** (or an increase in **losses**). Effectively, **central** banks tighten by the selling of **assets** out of their portfolio at a lower **price** (**higher** return) than their competitors. and **loosen** by buying **assets** in exchange for base money at a **higher asset price**. He does not **find** this a major problem, because of the **non-profit-maximising** behaviour of the **central** bank as a public institution (see **also** Goodhart, 1985, 1988). **However**, this could have consequences for the (financial) **independence** of the central bank.

²⁰ In ‘conventional’ monetary exchange systems the basis medium of exchange (commodity money or fiat money) invariably has served as the unit of account. In a moneyless world, there is no longer a tangible medium of exchange, and so the choice (and even the number) of the unit of account becomes less obvious, see Fama (1980, 1983).

²¹ In such an economy, the demand for base money would, in the absence of remuneration of reserves, equal zero (Woodford, 2000). Clearly, in the absence of demand, varying the supply (either by announcing a quantity or a willingness to supply at a certain interest rate) will be ineffective in influencing the overnight rate.

So, even in an economy in which ‘high-powered money’ has lost its power, the central bank **will** be able to steer the overnight **rate**. There remains **however** the question of the role to be played by central banks in **such** a world described by, for example, Black (1970), as the traditional functions of money **will** be performed by an **infinite** number of alternative instruments, which **can all** be expressed in terms of **each** other (Fama, 1980; Goodhart, 1989). In that world, monetary policy, that is the maintenance of a constant purchasing power of the unit of account, has no meaning because there **will** be a number of units of account (Issing, 2000). **However**, if society were to express a **preference** for a particular unit of account, in which **all** alternative instruments would be priced, then it would still be possible for the central bank to regulate the value of this unit of account, as was **discussed above**.²² Note that in **such** a world the need to limit **excessive** money creation is replaced by a concern to ensure the integrity of the computer systems used for settlement. Central banks could be seen as a natural **candidate** for **such** a supervisory activity.

It is **very** unlikely that this utopian world **will** ever become reality. In **any** case, **such** a world would probably be preceded by an economy **where** central banks face a reduced **demand** for settlement balances and competitors challenge the position of the central bank in this market. It follows from the discussion above that in this situation, a central bank **can** continue to influence the **cost of finance**. It **can** do so by changing its instrument variable, either by choice of **economic** agents (by offering to **lend/borrow** unlimited amounts of its liabilities at a (risk adjusted) **price** which is by definition the most **attractive**) or by regulation. The **latter** could be realised by requiring taxes to be paid in central bank liabilities (Friedman, 2000a,b). An alternative would be to ensure that the central bank remains the only entity which is allowed to corner the market for settlement balances by forcing **participants** to lend or borrow from its facilities at the **rates** it chooses to impose on the market. For a description of **such** a system, see Henckel et al. (1999). By being the uncontested **broker** in the case of settlement **difficulties**, a central bank acquires an unique disciplining capacity which bolsters the credibility of its interest **rate** announcements and ensures that no private **broker** takes its **place**.

The functioning of credit markets and the new economy

The level of **short-term** market interest **rates** affects only a proportion of the financing of expenditure of households and **firms**. The private sector **also finances** part of its spending at longer-term **rates** on the capital market as **well** as through **financial** intermediaries (and through other **means** like retentions and equity issues). The **cost** of borrowing from these sources is only indirectly influenced by the current level of money market **rates**. Important determinants of the impact of **changes** in the instrument variable (the overnight **rate**) on the **cost** of finance thus include the substitutability between different forms of **finance**, the pass-through of **changes** in market interest **rates** to bank lending and deposit **rates** and the impact of

²² Such a preference is likely, since an unique numeraire is an efficient solution to the co-ordination problems involved in negotiating **contracts** and performing economic calculations, see White (1984) and Issing (1999).

changes in **short-term** interest **rates** on long-term interest **rates**. These determinants **will** likely be **affected** by the **factors** associated with the new economy.

The substitutability between different forms of finance and the responses to market **rates** of lending charges applied by financial institutions is to an important extent dependent on the functioning of credit **markets**. The new economy is believed to bring **closer** a neo-classical financial environment without frictions and **asymmetric** information, that is, a world in which the **Modigliani-Miller** (1958) theorem **holds**. In this world, agents in the private sector **can**, at market interest **rates**, borrow and lend whatever amounts are necessary to **achieve** their desired spending patterns. The **absence** of information imperfections between suppliers and users of funds implies that the substitutability between internal and external financing sources and between different forms of external finance, **such** as intermediated and non-intermediated credit, is perfect (BIS, 1994). If bank **assets** and liabilities have identical characteristics to other borrowing and saving **instruments**, **such** as **bonds**, then bank and non-bank instruments **will** trade at the same **price** (assuming risk neutrality). The pass-through from market interest **rates** to bank **rates** is immediate and complete (Dale and Haldane, 1993). Financial **prices** in this perfect capital market **allocate** financial quantities optimally. Interactions between financial variables and **non-financial** activity **can** be reduced and simplified to interactions between interest **rates** and non-financial activity.²³ The **main** implication would therefore be that, to the extent that information asymmetries and the **crucial** role of financial intermediaries **will** be diminished by the new economy, there **will** be an enhanced role for direct finance with a **larger** role of private debt securities and equity **markets**.²⁴ In **such** an environment, interest **rate** changes **may** impact on the corporate sector more quickly as **financial** market **prices** tend to **react** more quickly to changes in official **rates** than retail deposit and lending **rates**. **Thus**, monetary policy actions **may** **almost** instantaneously affect corporate bond yields and equity **prices**, affecting the cost of direct borrowing, while the impact of official **rates** on lending **rates** is currently less immediate. **Also**, the more **competitive financial markets**, the greater the inclination of **financial** intermediaries to adjust their interest **rate** spreads more promptly and significantly in response to changes in official **rates** (Mojon, 2000).

Non-price component of cost of finance

However, since the **seminal** paper by **Akerlof** (1970) it is **well-known** that the **efficient** functioning of the market for credit is hindered by asymmetries in information between borrowers and lenders, resulting in principal-agent problems (Oliner and Rudebusch, 1996). These problems lead to endogenous and varying credit conditions which help to shape the transmission of monetary policy decisions through the economy, see Stiglitz and Weiss (1981), Bemanke (1983), Bemanke and Blinder (1988). As recognised by, *inter alia*, Kashyap, Stein and Wilcox (1993). Kashyap and Stein (1994) and Hubbard (1994) this

²³ As emphasized by Meltzer (1995, 2001), this equilibrium determines not a single interest rate, but a vector of rates, representing the yields on bonds, equity and other **assets**.

²⁴ Allen and Santomero (2001) **argue** that financial intermediaries maintain their **crucial** role in the financial system despite the reduction in information asymmetries, by switching from their traditional business to free-producing

uncertainty generates a potential important role for financial intermediaries which **specialise** in gathering and distilling agent-specific information. The implication is that financial intermediaries, usually banks, play a unique role in the monetary transmission **process**, **acting** as an interface between the policy decisions of the central bank and non-financial activity. Decisions of financial institutions regarding the **size** of their balance sheets and the yields paid on their **assets** and liabilities play an **active** role in the transmission of monetary policies. Because financial institutions obtain a **portion** of their funds from instruments subject to reserve requirements, open market operations, which **alter** the quantity of reserves, **may** affect the opportunity **cost** of funds to those institutions beyond their impact on market interest **rates**. That is, **financial** quantities (the availability of credit) **play** an important **role** in this credit view of the transmission **mechanism**.²⁵

The new **economy**, and the revolution in ICT in particular, increases the amount of information which is available to a greater number of **economic** agents at an increasingly lower **cost**. If the increased availability of information reduces the **prevalence** of information asymmetries, it **also** implies a reduced role of depository intermediaries in advancing credit to the non-financial **economy**, as their traditional **comparative** advantage, information intermediation, **erodes**, see Allen and Santomero (1998). This disintermediation **will result** in a further proliferation of **nonbank** credit (Friedman, 1999). **However**, the extent to which the **importance** of the credit view of monetary transmission **will** be eroded by the new **economy** remains an open question. As a general **remark**, increased availability of information does not necessarily imply increased **access** to information.²⁶ And the theoretical basis for the credit Channel, the theory of **asymmetric** information (Akerlof, 1970), **stresses** that these asymmetries arise because there exist **economic** agents **who benefit** from not disclosing their information to others (and that other agents know this). **It** is not likely that this behaviour **will** change with new ICT (Browne and Cronin, 1997). **However**, even with a significant part of agents in the **economy** remaining 'bank dependent' because of continuing information asymmetries, the new **economy** could have an impact on the **role** played by financial intermediaries in the transmission **mechanism**.²⁷ To see this, note that innovations on financial markets have now advanced to the point **where** the bank that investigates the borrower's creditworthiness, originates the loan and services the credit relationship, no longer **needs** to hold the loan in its own portfolio. Instead, bank loans are **often** sold to (**nonfinancial**) **firms** that package them into aggregated portfolios of similar **credits**, which in turn stand as **collateral** behind securities owned and traded by market investors, as **well** as households **who** buy these securities directly on their own account. New financial **products** such as derivatives are used by these agents (either directly or indirectly, via

activities based on risk management skills using derivatives.

²⁵ Note that, in addition to the effects described in a previous section, a declining importance of reserve requirements and open market operations will also impact on the transmission mechanism by weakening the credit Channel.

²⁶ See Herings and Schinkel (2000) for a more general discussion of the limitations to the diffusion of ICT.

²⁷ Some also argue that the dominant mode of financial intermediation will change due to new economy-related developments (disintermediation and securitisation in particular). The traditional 'par-value' banking system, in which both the deposits and loans are redeemable at par, will in this view be replaced by a 'mutual fund banking' system. In the latter all assets and liabilities are traded on secondary markets and thereby carry varying values (Fama, 1980, 1983; Goodhart, 1988; Browne and Fell, 1994). For a critical review, see Goodhart (1986, 1993).

financial intermediaries) to manage the risks incurred by these investments. Securitisation weakens the influence of central banks on the transmission **process** to the extent that it severs the bank-oriented component of the credit expansion from **any** direct relation to the central bank's system of required reserves, see Thornton (1994). Mishkin (1996), Friedman (1999) and Estrella (2001). The transformation of non-marketed bank loans into marketable securities thus reduces the role of the credit view even **when** bank dependency continues, see Chami et al. (1999) and Fender (2000a, b).²⁸ Edwards and Mishkin (1995) **provide** some empirical **evidence** of this weakening.

Term structure

The responses of longer-term interest **rates** to movements in short-term **rates** are easiest explained under the paradigm of perfect capital **markets**, as **discussed** above. If **all** financial assets (monetary or non-monetary) are perfect substitutes, there exists only one relative **asset price**, 'the' interest **rate**. The **difference** between the short-term interest **rate** and the long-term interest **rate**, or, more generally, **changes** in market interest **rates** along the maturity spectrum, **will** reflect **fully** the current level and expected future path of short-term interest **rates**. This is the so-called expectations theory of the term structure (Modigliani and Shiller, 1973), a theory that currently **receives little** empirical support (Berk, 2001). This should not **come** as a surprise, as capital **markets** are not perfect, financial market **participants** are not risk-neutral and consequently the differences between interest **rates** of different maturity **will** not only reflect expectations of future **changes** in short-term **rates**, but **also** risk premia. But to the extent that the **factors** usually identified with a new **economy** (section 2 above) work in the direction of a move towards perfect capital **markets**, and the pervasive possibilities for insuring and sharing risk using new financial instruments diminish the **importance** of risk premia (Shiller, 1993), the expectations theory of the yield curve should **fare** better in a new **economy**. The **latter** should not be taken to imply that risk premia **will** disappear completely and immediately. **However**, the new **economy** will tend to **reduce** and in the limit eliminate imperfections **such** as transaction **costs**, brokerage margins between borrowing and lending **rates**, restrictions on **short** sales, differential tax considerations, etc. In addition, the use of securitised claims for payments might **also** ease credit risks, as those claims would be marked-to-market on an ongoing basis and would be transferable in **real time**. The ensuing increase in portfolio diversification possibilities reduces **price** discrepancies between **assets**. Finally, it **can** not be excluded that the advent of derivatives in the management of risk by **economic agents** **will** change their attitude towards risk, perhaps more into the direction of

²⁸ There seem however to be limits to the extent of securitisation, to the extent that certain assets, notably those which do not have a sufficient amount or quality of collateral, remain uncertain. This uncertainty in turn is a cause of the preference for convertibility into 'safe' base money. Proponents of the narrow banking movement (Fama, 1980) try to remedy this uncertainty, see Goodhart (1989, 1993) for details. Note that the advent of corporate risk management strategies, making use of new financial products such as derivatives, tend to reduce the limits that are traditionally placed on the process of securitisation. See Goodhart (1989, p. 120-121). For a further, and interesting, generalisation of implications of risk sharing, see Shiller (1993).

risk neutrality, see Cape1 and Jansen (2001). This **all** points towards an increased substitutability of **assets across** the maturity spectrum (Vrolijk, 1997). The **result** would be a **faster** transmission of monetary policy signals along the yield curve. Moreover, by the **leverage** inherent in the use of derivatives this transmission would **also** be stronger.

5 The influence of changes in the **cost** of finance on non-financial activity

The impact of changes in the **cost** of finance (which includes quantity as **well** as price-related variables) on non-financial activity depends on various **factors** (Bank of **England**, 1990). First, changes in the **cost** of finance **induce** a substitution between saving and borrowing, as **economic** agents intertemporally smooth expenditure. Moreover, investment decisions are re-assessed in the light of **changed costs** of **capital**, as the **latter** affect the opportunity **cost** of **real** expenditure decisions. This substitution effect mainly influences new borrowing decisions. The direction of this effect is always negative, ie a rise in the **cost** of finance decreases non-financial activity, and the extent of the impact **will depend** on the ability of agents to substitute intertemporally. Deregulation and globalisation of financial **markets**, improvements in ICT as **well** as **advances** in risk management techniques and related instruments (derivatives), increasingly enable risks to be traded on financial **markets** and **provide** insurance. The new **economy** therefore improves the intertemporal substitution of **income** streams (Shiller, 1993). This should work against the substitution effect of monetary transmission. It is, for example, possible to hedge against the **adverse** impact of the substitution effect: by using **structured** derivatives **such** as options on futures, a hedger **can lock** in the current interest **rate** for potential future funding **needs**. The new **economy** thereby **pushes economies** towards a more classical-looking world, in which expenditure decisions are determined to a larger extent by expected wealth and relative **prices**. In this frictionless world it is the **real** interest **rate** that matters, because **economic** agents **will** typically base their decisions on a comparison between what they consume today and what they hope to consume in the **future**.²⁹ Moreover, current **income** (ie the **fraction** of wealth which is generated in the current period) should become **less** important a determinant of current consumption. Net worth would gradually replace cash flow as the primary influence on investment expenditures. There is some empirical **evidence** to support this position (see Browne and **Fell**, 1994, for an overview), but it is still far from **conclusive** whether the substitution effect of monetary transmission **will** become **weaker**. This is mainly because there will remain uncertainties which are not hedgeable. Moreover, hedging **comes** at a **cost** (through the option premium for example), which **may** prove to be prohibitive for some (especially **small**) **economic** agents.

Second, changes in the **cost** of finance lead to changes in **average rates** on outstanding contracts, modifying incomes and cash flows and hence constraints on spending. This **income** effect mainly impacts on outstanding borrowing. Its **main** influence is on agents' liquidity, and its direction depends on the net holdings of **assets** and liabilities. A net saver **receives** a positive **income** effect following an

²⁹ If the new **economy** increases **profitable** investment opportunities, then the **real** interest **rate** must increase in order to **encourage** households to save more to finance the **higher** level of investment.

increase in the **cost of finance**, whereas a net borrower has a negative income effect. The rise thus redistributes income from borrowers to lenders. In **practice**, the standard life-cycle pattern of employment followed by retirement **will** lead those obtaining income from labour to be, on balance, net savers. In contrast, the **productive** investing sector is by **nature** a net borrower, since it has to issue financial liabilities on itself to purchase the **real assets** which **will** subsequently **provide** the returns to meet the debt obligations. If borrowers have a **higher** marginal propensity to consume than lenders, then the aggregate income effect is negative. As **discussed** above, the new economy **provides** increased insurance possibilities. This is particularly relevant for the income effect of monetary transmission, as derivatives **significantly** increase the ability of **economic** agents to hedge the income effect associated with fluctuations in the **cost of finance**. Hedged agents are either more sensitive to the **cost of finance**, or more risk averse than agents **who** end up holding risk. Hedgers could be willing to carry the **cost** of hedging because they have a **higher** marginal propensity to consume, and therefore wish to maintain their high consumption (Vrolijk, 1997). Derivatives allow these agents to hedge their exposure to payments and receipts which are sensitive to the **cost of finance**. It **can** be argued that the **size** of the income effect **will** be reduced due to new-economy induced increased insurance possibilities. Consider that for the duration of the hedge, the complete income effect has been shifted from the hedged agents to the risk holding agents. The hedged agents are not prone to an income effect, whereas the risk holders **receive** a double income effect. But since it is **likely** that the risk holders' propensity to consume is lower than that of the hedgers, the income effect is not as negative as if the hedgers had not been hedged. This line of reasoning demonstrates that, for **every** hedged unit, a risk **holder** must have acquired the risk, that is, hedging is (in a **closed** economy) a macroeconomic zero-sum **game**.³⁰ There are thus always some **economic** agents which are confronted with an income effect. The actual change in the income effect element of the transmission **mechanism** lies in the **difference** between the marginal propensities to consume of the hedger and the risk **holder**.³¹ Moreover, and this **also** applies to the preceding analysis of the substitution effect, the new economy related **factors** **also** work in the direction of a **faster** transmission of monetary policy to **asset prices** (as their substitutability increases). This implies that (hedged as well as unhedged) **economic** agents are impacted by a substitution and income effect sooner. That is, both effects **may** impact earlier, but are smaller in magnitude.

Third. **changes** in the **cost of finance** affect the value of certain **assets, such** as housing, equities or government **bonds**. These values, in turn, have an impact on wealth perceptions, which influence spending (Bank of **England**, 1999). Moreover, this so-called wealth effect influences the ability to borrow and the willingness to lend. As wealth is equal to discounted future net income, its effect in the chain of monetary transmission in **principle** is **closely** related to the income effect. There are two ways through which wealth **can** vary: through **changes** in income flows and through **changes** in the discount

³⁰ However, to the extent that the new economy influences risk trading in such a way that risk ends up with economic agents and institutions most willing and able to bear risk, it improves efficiency. On the other hand, it **also** has the potential to shift the non-diversifiable risk in the economy to the imprudent (Buiter, 2000).

³¹ Hedgers remove the need for precautionary saving, thereby increasing their propensity to consume. There is some.

factor. As the former effect is **discussed** above, we **will** focus here on a change in net worth due to a change in prices, see **also** Mishkin (1996). A reduction in prices of, for example, **bonds**, equity and **real** estate, **causes** a decline in wealth, which, according to the life cycle consumption model (Modigliani, 1971), **induces** a reduction in non-financial activity. Again, hedging techniques **similar** to those used for hedging an **adverse** income effect, tend to **reduce** the **size** of the wealth effect. **However**, since hedging in order to maintain market **value** of **assets** currently is **less** common than using derivatives for earnings or cash flow management (**Bodnar** and **Marston**, 1996), its **size** is probably **small** relative to hedging against **adverse** income **effects**. This is in **particular** the case for **changes** in the **price** of **real** estate, for which the hedging possibilities are fairly limited, due to the relatively **illiquid** character of the market for **real** estate. **Finally**, to the extent that households and **firms** are likely to increase the share of securitised **financial** assets in their portfolios, the wealth effect **may** gain in **importance**.

A **final** factor through which **changes** in monetary policy instruments influence non-financial activity operates through the exchange **rate** (**Menon**, 1995). Under flexible exchange **rates**, a **higher** cost of **finance** due to an interest **rate** increase attracts foreign **capital**, thereby appreciating the exchange **rate**. The **higher** exchange **rate** **makes** domestic goods relatively more expensive than foreign goods, decreasing net **exports** and (domestic) non-financial activity. Derivatives have the potential to **significantly** **reduce** the impact of this transmission Channel, to the extent that both **wholesale** **importers** and exporters use currency derivatives to hedge **nominal** exchange **rate** fluctuations in the short run. **Indeed**, currency derivatives **figure** prominently in **surveys** of derivatives **markets** (**Bodnar** and **Marston**, 1996; BIS, 1996b). **However**, **changes** in the **cost** of **finance** **also** **induce** **changes** in the **real** exchange **rate**, and these are more **difficult** to hedge, especially **when** the driving force behind the fluctuations are **changes** in the relative **price** level. In this case there is a substitution effect which is not insurable; agents are **faced** with the situation in which one country is relatively more reasonable for future investment or consumption flows. An alternative aspect of the exchange **rate** **channel** is that of interest **rate** parity, which transmits domestic policy abroad, and foreign policy home. It **can** be argued that the **arrival** of large-scale over-the-counter currency **markets** increases the strength of the **covered** interest **rate** parity relationship. Moreover, through the link from derivative **markets** to spot **markets**, it **will** ultimately strengthen the uncovered interest **rate** parity relationship (see in this respect Berk and Knot. 2001). The implication is an increased international interdependency of interest **rates**, and greater international **capital** flows following policy **changes** that change interest **rates**. Or, to put it differently, derivatives **allow** zero-risk arbitrage portfolios to be set up, forcing harmonisation of the relationship between exchange **rates**, foreign and domestic interest **rates**. Monetary policy inconsistent with domestic fundamentals or with foreign interest **rates** (or with the pegged exchange **rate**) **will** **cause** strong capital flows. Some of the counterparts of exchange **rate** derivative **contracts**, that is the agents **who** take over the risk from exporters or importers **who** want to insure themselves against exchange **rate** fluctuations, **will** be abroad. The total impact on domestic non-financial activity of a change in the exchange **rate**

albeit limited, empirical evidence supporting this (McCarthy, 1995)

induced by a change in the **cost** of finance **will** therefore be reduced, but the **reverse also holds**. That is, foreign monetary policy **can** affect the domestic economy through foreign risk held domestically.

To the extent that the new economy, via globalisation of trade, **leads** to an increased openness of an economy to trade in goods and services, the exchange **rate channel** of monetary transmission **will** increase in **importance**. This exchange **rate channel** touches **upon** the broader aspect of the effect of the new economy on international interdependence of monetary transmission **mechanisms**. Rapid advances in **ICT** not only have brought **many** more investors into the international **markets**, but **also** have created a **much** greater degree of **coherence** in the attitudes and portfolio behaviour of investors **who** remain physically dispersed (Friedman, 1999). As financial globalisation advances, more and more central banks **will find** that attempts to **control** their short-term interest **rates** in a policy **vacuum**, that is, without regard for international **economic** developments, **will** not **generate** the desired domestic **effects**.

In sum, it is likely that in a new **economic** environment **changes** in the **cost** of finance **will** affect non-financial activity sooner, but the total impact **will** be **less** as more **economic** agents **will** be **able** to isolate themselves from these **changes**. Moreover, the **mechanism** of monetary transmission **will** be increasingly international.

6 The split between inflation and economic growth

Our previous discussion showed that, because of **real** rigidities in the form of credit market imperfections, monetary policy **can** influence non-financial activity not (only) through interest **rates** but (**also**) through the availability of credit. In addition, the extent to which **changes** in non-financial activity generated by **changes** in the instrument variables translates into **changes** in **prices** and output, respectively, depends largely on the behaviour of wage and **price** setters. In **general**, the greater the degree of nominal wage and **price** flexibility, the more **changes** in non-financial activity affect **prices** and not output. Wage and **price** behaviour, in turn, is influenced by inflation expectations as **well** as by institutional **factors**. The introduction of the rational expectations hypothesis (Muth, 1961), to macroeconomics by Lucas (1972). **Sargent** (1976) and **Sargent and Wallace** (1975), led to expectational **effects** being explained in terms of **concepts** such as credibility and reputation of the policy maker. The institutional framework in which this interaction between the policy maker and the private sector takes **place stresses factors** which inhibit the continuous clearing of **markets**. Rational expectations are thus compatible with non-market clearing due to various (institutional) barriers to rapid adjustment of **prices** and wages (Fischer, 1977; Blinder, 1991; **Ball** and Mankiw, 1994). The most notable explanations as regards the **causes** of these rigidities include **legal** and institutional **barriers** to **price** adjustments (**such** as rent **controls**) and monopolistic or oligopolistic competition in product **markets** (Gordon, 1990; Mankiw and Romer, 1991). But **also** in a **competitive** environment, **price inertia** may result from the **existence** of menu **costs** in changing **prices** or from a **desire** by firms not to damage long-term relationships with clients by frequent variations in **prices**. As regards wage rigidities, explanations **also** focus on **factors** hindering competition, **such** as regulatory impediments to

wage adjustments (e.g. minimum wages), the influence of **unions** and generous unemployment **benefit schemes**.³² On the other hand, even **where** competition is **fierce** but information is distributed asymmetrically, there **may** be a **desire** of both **firms** and workers to have longer-term working relationships entailing an **implicit** insurance against **excessive** wage volatility, or firms **may** refrain from downward wage adjustments in order not to jeopardise employee motivation and labour productivity. Moreover, from the hysteresis literature (Cross, 1988), wage rigidities causing unemployment **persistence** are explained with insider-outsider and duration theories of the wage bargaining **process**.

It follows that the behaviour of **markets** will be an important factor in determining **how** and with what speed a change in the **cost** of finance is spilled over into **economic** growth (ie quantities) or inflation (**prices**), see in this respect **also** Cavelaars (2001). In discussing the **effects** of the new **economy** on the functioning of **markets**, we **will** mainly restrict ourselves to the availability and **access** to **information**.³³ In that respect, a useful distinction **can** be made between goods information and information goods, see Hirschleifer and Riley (1995). The former have no intrinsic value; they **relate** to information about **products**, and aim at (and derive their value from) improving the decisions made by **economic agents**.³⁴ The conclusion that the more widespread use of ICT brings the **economy** more to the textbook model of perfect competition is mainly due to the likelihood of a more comprehensive and cheaper exchange of goods information, to **such** a extent that **all** the goods information ultimately becomes incorporated in the **prices** of goods. In **general**, the diffusion of ICT allows for a more **efficient** processing of information which (by reducing search **costs**) lowers transaction **costs**. Moreover, by further enhancing an integrated approach in which information systems of various **participants** within the supply chain are interlinked (so-called connectivity), productivity growth is increased, see for example Meijers (2000), Sijben (2000).³⁵ This improves the functioning of **markets** in that agents are in a better position to **find** a solution to the 'signal processing problem' (Lucas, 1977). The **latter** relates to the issue of determining whether observed movements in **prices** reflect a shift in the general **price level** or in relative **prices**, and are permanent or **transitory**.³⁶ The solution to this problem **will** determine whether **economic agents** change their spending decisions, which **will** in

³² For recent discussions of rigidities in the labour market, see Akerlof, Dickens and Perry (1996, 2000).

³³ Other factors that are likely to play a role in this respect, partly touched upon in previous sections, include financial market liberalisation and globalisation, and trade liberalisation, which can increase the degree of competition, productivity growth, and (by de-materialising output) reduce transportation costs. Moreover, more prudent fiscal policy has the potential to significantly reduce market distortions by containing crowding-out effects, and the successful pursuit of price stability improves the working of the relative price mechanism, leading to more efficient resource allocation.

³⁴ This of course does not imply that goods information cannot be traded in markets, as the real-life example of real estate agents shows.

³⁵ More and cheaper access to information also improves the functioning of the labour market, by making the matching process more efficient and reducing frictional unemployment.

³⁶ The ensuing improvement in the co-ordinating capabilities of modern decentralised market economies is illustrated by the more optimal use of inventories. This, in turn, may help to dampen business cycle fluctuations, see McConnell et al. (2000)

turn determine whether **real** variables **will change**.³⁷ In an utopian new economy world with goods and goods information **all** information asymmetries **will** be eliminated, and the Walrasian auctioneer **will** determine equilibrium relative **prices**.³⁸ In **general**, though, before this world becomes reality, fluctuations in the **cost** of finance **will** elicit relatively **quicker** price adjustments, with less effect on **quantities**.³⁹

Information goods (goods that **can** be represented in digital form) on the other hand are an end in themselves, ie they directly enter into production or utility functions. Examples of information goods used in production include word processors and databases, whereas consumers derive utility from information goods mainly from their entertainment value. The production and distribution of information goods are characterised by the public good properties of non-rivalness and **non-excludability** (Arrow, 1962). This implies that the advent of information goods in the economy is not a move towards the classical textbook model of perfect competition, in which an **infinite** number of **small** price-taking entities **compete**. Instead, competition in this world is more akin to the Schumpeterian **concept**.⁴⁰ Increased returns to **scale** on the supply **side** on the market for information goods tend to interact with network **effects** on the **demand side** to **create** powerful incentives for **natural** monopolies. This results in a market **structure** characterised by a **small** number of large price-setting entities. **Profit** maximisation by a traditional monopolist implies restricting supply and rising the price, leading to **higher prices** than in the conventional **competitive** paradigm. Monopolies in the market for information goods **may however** prove less harmful, as the pressure of technological change elicits a dynamism which **will** ensure that there exists a rivalry between alternating or succeeding monopolies, ie contestability is always **possible**.⁴¹ The **result will** be that **firms** operating in the market for information goods **will compete** by lowering the price and increase output (Shapiro and Varian, 1999).

If the weight of information goods in a new **economic** environment is relatively **small**, chances are that the economy **will** move towards the traditional classical paradigm, with the concomitant behaviour of **markets** and the consequences for the passthrough of **changes** in the **cost** of finance to **prices** and quantities (that is **prices** adjust quickly, with limited **effects** on quantities). If, on the other hand, this new economy **will** be dominated by information goods, this **will** imply a change in relative **prices** as resources are re-allocated towards these information goods. The **general price level** should be

³⁷ A purely transitory change in the relative price will not elicit a change in behaviour, and nor will a change in the general price level. See Lucas (1977) for a formal exposition.

³⁸ Supplemented by a fully frictionless financial world the general price level would be meaningless, as would be monetary policy. However, if society were to express a preference for a single unit of account, its value could be regulated by a central bank, and there will exist an equilibrium level of money prices (Woodford, 1998). See section 4.

³⁹ This will lead to permanent effects on equilibrium price and output levels, with transitory effects on economic growth and inflation. For similar arguments, see for example Herings and Schinkel (2000).

⁴⁰ Note the interaction of the various forces associated with the new economy. In particular, the deepening and development of financial markets discussed above tends to improve especially the growth prospects of young, dynamic and innovative firms, that is the type of firms that contribute mostly to the waves of creative destruction.

⁴¹ In addition, the durable character of information goods will act as a catalyst for competition, see Herings and Schinkel (2000). The key issue for competition policy in the new economy therefore is not market share, but the abuse of market power by a dominant firm to discourage innovation by others.

less **affected**, and **will** continue to be determined by monetary **factors**, especially in the long run (Lucas, 1977). The macro-economic effect of the advent of the new economy in terms of functioning of **markets** is therefore not clear-cut. The same applies for its effect on inflation and growth (Buiter, 2000). Investigating the implications of phenomena **often** associated with the new economy, **such** as lower **profit** margins, a lower NAIRU, a **higher** trend productivity growth, on inflation and output, in the short as **well** as in the **longer** run, requires the **specification** of a model. The theoretical basis for **such** a model is available, even for an economy dominated by information goods (see, for example, Meijers, 2000). So, just as the new economy is, in **fact**, not new, its effects **can** and should be discussed using readily available, that is existing, **economic** theory.

7 Concluding remarks

The new economy is generally interpreted as a **supply-side** phenomenon, driven by technological **advances** and structural **changes**, which, partly via more flexible and **efficient** labour, product and **capital markets** and increased competition, over **time** lead to a **higher level** and growth **rate** of potential output. Regarding the financial system, the new economy might **also be** associated with a tendency towards disintermediation, securitisation, the emergence of new **financial** instruments and increased financial wealth.

We have discussed **how** monetary policy transmission would look **like** in this new **economic** environment. Our most general conclusion is that monetary policy **will** be possible. It seems unlikely that new economy-induced developments would ever **severely** limit the possibility of central banks **steering** the overnight **rate**. Of course, methods for exercising this influence **will** have to be adapted to the new **economic** environment, but that is nothing new for central banks. As long as there remains some **residual demand** for base money, and there is **every** reason to **expect** that this will be the case, these **changes** **will** not have significant consequences. Even in the unlikely event that there are perfect substitutes for base money, the central bank **will still** be able to steer interest **rates**. **However**, it **will** probably require government backing, in the form of regulation that **changes** the **structure** of the financial system, or to **financially** support the central bank. By **steering** its 'nucleus', the overnight **rate**, the **central** bank is **still** able to anchor the term **structure**, and this interest **rate channel** of monetary transmission **will** gain in **importance** in a new economy. The speed by which this anchoring occurs increases, as **will** the speed at which **changes** in the **cost** of finance **will** affect non-financial activity. The impact of the **latter** **will**, **however**, be less.

Although not directly addressed previously, we **would also** like to argue that there remains a need for monetary policy in a new economy. Stories about the 'death of inflation' (Browne and Fell, 1994) are not firmly based on **economic** arguments. Even in the unlikely case in which the new economy would closely resemble the perfect competition paradigm, this would **mean** a better functioning of the **price mechanism**, that is of relative **prices**. This suggests that monetary policy actions **will** elicit primarily reactions in **prices**, with relatively less effects on quantities. Movements in

the general price level **will** still occur, and there **will** remain a need for an authority entrusted with maintaining the stability of this price level. Monetary policy as we currently understand **will** be meaningless only in a utopian, **fully** frictionless, world because the **latter** has no general price level. **However**, it seems likely that even in this world there would be a single unit of account, the value of which **can** be regulated by a central bank.

Our discussion points to a number of policy relevant questions that warrant future research. The **first** is to **provide** the qualitative analysis presented here with quantitative underpinnings, investigating the relative **importance** of the effects of the new economy on the various transmission **channels**. Secondly, **having discussed** how the new economy **changes** the way monetary policy **affects** the economy, the policy maker is confronted with the natural follow-up question, that is **how** to conduct monetary policy in a new economy. This touches on issues as the permanent **or** transitory character of accelerations in productivity **or** real output growth, and whether this is accompanied by a permanent **or** transitory decline in the inflation **rate**. Providing answers to these questions would require a **rigorous** modelling effort (see in this respect **Buiter**, 2000) and lies beyond the scope of this paper. **However**, our analysis suggests that caution is warranted in interpreting new economy effects on inflation **rates** and **economic** growth as permanent. The new economy will, in the end, imply a shift in and better signalling properties of relative **prices**. **After** completing this relative price adjustment, the equilibrium price level **will** probably be lower, but the **persistence** of the effects on the inflation **rate** are murky, at best. Confronted with the uncertainty that prevails surrounding these issues, another relevant question for policy makers would be whether to conduct policy in a gradual **or** more aggressive fashion, that is should the **central** bank follow a policy of interest **rate** smoothing **or** stepping?

In the end, the new economy is not new. and the same **holds** for the toolkit needed for analysing its implications, as **well** as for the questions that confront the monetary policy maker operating in a new **economic** environment. The ‘old’ **central** banks therefore seem to have lost nothing of their **relevance**.

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