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Central bank power: a matter of coordination rather than money supply

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Lund Economic Studies number 113

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To

Isabel and André

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Lund April 14, 2003

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1 Introduction: curiosity and frustration

This is not a puzzle-solving thesis. I am not trying to add another piece to the project of the normal science of economics.[1] Rather, I am trying to satisfy my curiosity about the mechanisms that surround a specific feature in society, and at the same time ease the frustration I feel about the traditional explanation of this feature. Specifically, I am curious about the nature of inflation; what factors determine the rate of inflation? As a trained economist, I am perhaps more curious, and frustrated, than a layman. This is because the traditional explanation of how inflation is determined is, to be honest, so peculiar that it in itself raises more questions than it solves. What I specifically aim at is the habit of coupling the question of price level[2] determination with the quantity of money. I will give two examples on problems that stem from this custom. Firstly, it obscures the link between individual prices and the price level. By discussing price level determination in an aggregate setting without individual prices, it becomes unclear how, in practice, determination is believed to come about – the operating mechanism is a black box. Secondly, the habit of coupling price level determination with money raises new questions, which may well be pseudo-questions. If we see the price level as determined by the relation depicted in the quantity equation, it becomes problematic to include a possibly ceasing demand for cash in our theory. If either the quantity of money is zero or the velocity of money is infinite, the price level is indeterminate in the quantity equation. This seems to suggest that a lot would be different, possibly chaotic, in a cashless society. If the price level were currently pinned downed by the quantity of money, it would be indeterminate in a cashless society. It is truly frustrating to imagine that such a minor change in our use of different transaction techniques – i.e.

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[1] Cf. Kuhn (1970) about the concept of *normal science*.

[2] In this work, the price level is an index of all individual prices. Thus, determination of the price level is in fact determination of individual prices. The reader should be aware of the metaphorical character of the phrase *price level determination*. Anyway, the phrase is established in the literature on matters of

to stop using cash entirely – would imply such a fundamental change to our society as an indeterminate price level.

What is really amazing is that intuitively, the question of how the inflation rate is determined and what factors influences it is not that complicated. It is only when we try to understand the nature of inflation within the quantity equation framework that it becomes puzzling.

Outline of thesis

The thesis is organized as follows. In chapter 2, the hypothesis about the coordination of nominal prices is introduced and briefly motivated. In chapter 3, I try to justify the need for a new hypothesis by discussing the shortcomings of existing theories about central bank power. From chapter 4 and onwards, I put forth a theory intended to support my hypothesis. Chapter 4 provides a framework for understanding transaction cost saving tools such as money and units of account. Chapter 5 discusses the role of money in theory and reality, with particular focus on the relationship between payment techniques and units of account. In chapter 6, I sketch a simple model of how a price level is determined, while in chapter 7, I focus on the function of a focal point, in the coordination game of expectations of inflation.

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nominal price coordination and determination, and it should be possible to employ without causing too much confusion.

2 Hypothesis: the central bank's impact on the inflation is that of a focal point

2.1 Outline

In this chapter I will introduce my hypothesis which consists of three interrelated suggestions, firstly that the determination of future price levels is a coordination game that might be determined by a focal point, secondly that the central bank might emerge to fill the role as focal point, and thirdly that central banks derive their influence over the inflation - if any - from their role as a focal point. To communicate my idea I will point out the similarities between the coordination game of future prices and those coordination situations that Thomas Schelling (1960) used to illustrate the concept of focal points. I will also relate to some recent discussions on the ultimate source of central bank power to influence the economy, and argue that the focal point explanation of this power is the more reasonable one.

2.2 Future prices as a coordination game

A price level is an index of individual prices and to predict future price levels is thus to predict future prices on individual items. At every moment, all prices are fixed and we are thus able to say unambiguously what the price level is right now; it is only a technical problem to construct and measure our index. As we consider an increasingly distant future, increasingly many prices become flexible and our predictions about the price level become increasingly dependent on our forecast of those flexible prices. To forecast those prices is to imagine how the people who set the prices think. They, in their turn, want a prediction of the future price level that is as correct as possible to use as basis for future prices. That is, they need to forecast how *other* price setters think. Now, we clearly see the picture of a coordination game, where I need to predict how you predict that I will act, and so on. David Lewis (1969: 27) has put it in the following way:

> I know that, just as I am trying to figure out what you will do by replicating your reasoning, so you may be trying to figure out what I will do by replicating my reasoning. This, like anything else you might do to figure out what I will do, is itself part of your reasoning. So to replicate your reasoning, I may have to replicate your attempt to replicate my reasoning.

In the short run and the moderately long run, it is perhaps not that difficult to figure out what others will do, because many prices are more or less fixed in running contracts and hence anchor the price level. However, for some contracts it must be true that they are the first to be written for a specific future period. The people who negotiate these contracts can only base their expectations of the future price level on predictions about how other price setters will forecast that future price level. To me, this situation looks very similar to the coordination problems, the solution of which Schelling named focal points.

The concept of a focal point, launched by Schelling (1960), appears in a variety of economic contexts. In short, it predicts that a particular equilibrium of a game is selected because it appears to be the 'natural' choice of the participants, that is, each agent sees it as a 'natural' choice for the others to make. Schelling (1960:54) provides the following example:

> When a man loses his wife in a department store without any prior understanding on where to meet if they get separated, the chances are good that they will find each other. It is likely that each will think of some obvious place to meet, so obvious that each will be sure that the other is sure that it is "obvious" to both of them. One does not simply predict where the other will go, since the other will go where he predicts the first will go, and so on ad infinitum. Not "What would I do if I were she?" but "What would I do if I were she wondering what she would do if she were I wondering what I would do if I were she . . . ?" What is necessary is to coordinate predictions, to read the same message in to the common situation, to identify the one course of action that their expectations on each other can converge on. They must "mutually recognize" some unique signal that coordinates their expectations of each other. We cannot be sure they will meet, nor would all couples read the same signal; but the chances are certainly a great deal better than if they pursued a random course of search.

Schelling (1960:57) further states that, although logic is insufficient to coordinate successfully, people often do coordinate successfully.

> People *can* often concert their intentions or expectations with each others if each knows that the other is trying to do the same. Most situations - perhaps every situation for people who are practiced to this kind of game - provide some clue for coordinating behavior, some focal point for each person's expectation of what the other expects him to expect to be expected to do. Finding the key, or rather finding *a* key - any key that is mutually recognized as the key becomes *the* key - may depend on imagination more than on logic; it may depend on analogy, precedent, accidental arrangement, symmetry, aesthetic or geometric configuration, casuistic reasoning, and who the parties are and what they know about each other.

If we interpret the determination of inflation as a coordination problem with a possible focal point, my hypothesis is that whatever influence the central bank exercises over inflation is based on its role as a focal point for inflation, and possible for other factors important to the inflation rate, for example the short-term interest rate.

Similar to e.g. Michael Woodford (2000: 256), I believe that the short-term interest rate, as well as the inflation rate, lacks an inherent general equilibrium. However, this does not mean that the market necessarily will coordinate on the central bank's target rate. The actors in the market may choose to do just that, but they may as well choose to coordinate on something else. Thus, rather than choosing to coordinate on the central bank point because nothing else would be rational, I think they coordinate on that point because they believe it to be the best available expectation, and therefore it is indeed more likely than any other to be just that. If financial actors did not believe that the market rate would adjust to the target rate, then each actor would lend/borrow on the market and borrow/lend at the central bank and thereby make a profit. The central bank would potentially face an infinite demand for either borrowing or lending.

Benjamin M. Friedman[3] believes that the central bank, at least in practice, controls interest rates through a coordinating function. He has recently (2000: 271) expressed concern that the market may cease to coordinate on the central bank:

> But what if the market loses its presumption that the central bank could, or would, be able to do the job if the market did not simply act on its signals? With nothing to back up the central bank's expressions of intent, I suspect that in time the market would cease to do the central bank's work for it. This prospect is ultimately what the threat posed to monetary policy by the electronic revolution is all about.

One might wonder, however, why *"the market would cease to do the central bank's work for it"*. The point is that as long as the central bank is successful, there is little reason for any financial actor to stop acting on its signals. Successful, in this context, would mean to be a reliable focal point. This in turn is determined by the faith individual agents has in it. There is no simple mechanism inducing people to coordinate on something else, simply because they realize that the central bank is just a focal point. The game played is of a cooperative nature. As an individual agent, there is nothing to gain from making a different forecast than the market in general: at best, you will miss out on profitable transactions and at worst, you will make non-profitable transactions. Consequently, one could envisage that the central bank may lose its coordinating function, it is not implausible. It is more likely, however, that it will continue to serve as a focal point in a near future, whatever that might be. To this matter, I agree with Charles A. E. Goodhart's (2000: 207) concluding sentence about the possibility that central banks may lose their influence over the economy because of changes in the financial markets that are induced by developments in information technology.

> Central banks may bring about their own demise by incompetence; they will be comparatively immune to technological innovation.

---

[3] In order not to confuse Benjamin Friedman with Milton Friedman, I will identify them by the initials of their first names.

A case for the central bank as focal point

Consider for a moment John M. Keynes' *beauty contest*, where the rules stipulate that you can only win if you vote for the person who receives the most votes in total.[4] In that case, you would have nothing to gain from making up your own criteria for beauty. You probably have a pretty good idea about which contestants stand a chance to win. Now, if you are playing to win, you would vote for someone who you reckon is a likely winner, regardless of your own preferences. What is "true beauty" is an irrelevant question, the only relevant measure of beauty in this case is the others' subjective opinion, or rather, how they think that others will vote. Nevertheless, even without an objective beauty standard, most players will do better than purely random choice. Similarly, I can not argue in the abstract that the central bank is a better point of coordination than any other, but I can argue that if the central bank has previously been right about short-term interest rates, or inflation rates, it would make sense to use the central bank prediction as focal point. Furthermore, in the same sense as one can list particular reasons why the lost and found desk is a reasonable focal point for couples who have lost each other in a store, we can suggest particular reasons why the central bank would be a reasonable focal point for short-term interest rates, or inflation. Since agents have to base their expectations on historical events, a long success record (or at least a long presence in the business) should be important. In this respect, the central bank has an obvious advantage over the vast majority of other forecast agencies. An additional fact that may give the central bank an advantage is that before the removal of strong currency and credit regulations, it had actual power to affect nominal and real variables in the economy. This factor however, should decrease in importance over time. Furthermore, the central bank works hard to stand out from the crowd. It surrounds itself with an air of power and eternity, manifested in impressive buildings in marble and granite, accommodating serious men in

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[4] Cf. Keynes (1936).

dark suits.[5] Moreover, the central bank presents inflation forecasts in an almost ceremonial manner, sometimes manifested by changes in the operative interest rate. In recent years, the Swedish central bank has regularly gone on promotion tours in order to increase its media exposure and enhance the public's recognition of its endeavor to maintain a low and stable inflation rate. Lastly, and perhaps most importantly, the central bank is associated with power and the nation itself, for example the *Bank of England* or *Sveriges Riksbank* in Sweden – the latter directly calling for an association with the concept of *national standard*.[6] What forecast could be a more natural choice than The National Standard forecast?

2.3 Conclusions

In many situations in the real world people need to be able to coordinate their actions, sometimes without the possibility to communicate with each other. Surprisingly often, people do succeed to coordinate in situations where there is no choice that is the obviously right one. In the terminology of game theory, there are many Nash-equilibria but no dominant equilibrium. Schelling introduced the concept of focal points to explain how people manage to coordinate in similar situations. The determination of future price levels has many traits in common with the situations Schelling referred to. The price level is an index of individual prices and since some prices are set in *sequential*[7] contracts, future price levels is partly determined by today's

---

[5] I am indebted to Ingemar Ståhl for recognizing the purpose of the almost sacred image of the central bank as pursued by bank officials. See also Werin (1993:44) about the nimbus that central bankers like to surround their business with.

[6] The, somewhat archaic, Swedish word for a national standard is "rikslikare".

[7] Regarding sequentiality - which is an important aspect to us -, we are interested in two types of contracts: (a) *simultaneous* contracts, in which deliverance and payment are completed instantly, at the moment of transaction as in a supermarket purchase, and (b) *sequential* contracts, in which the terms - in particular the price - of the contract are determined instantly while either deliverance, payment or both are completed at a future point. When considering the issue of price level determination, we confine our use of the term *sequential contract* for such contracts with a *predetermined price*, though in reality other kinds of sequential contracts are possible. The important feature of the sequential

expectations about future price levels. That is, you need to predict what prediction others will make, knowing that they will take into consideration their prediction about your prediction, and so on.

In cases when we are experiencing a stable inflation rate, it is reasonable to believe that price-setting agents have found a focal point to coordinate their expectations about future price levels. The question is then; what is the focal point? I have suggested that the central bank is a suitable candidate; it fills the demands of both conspicuousness and uniqueness. Moreover, interpreting the central bank as a focal point for inflation helps us understand the attention that the market pays to central bank announcements of changes in its interest rates. It would for example explain why the short interest rate tends to adjust to the central bank's target rate.

To suggest that central banks are currently serving as focal points for inflation is of course not to argue that they will continue to do so. They might or they might not, other producers of predictions on inflation rates are potential alternatives as focal points.

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contract is that it fixes a nominal price for some time, which makes it useful as a guide to future prices - typical examples are wage contracts and utility contracts. Those contracts will necessarily influence inflation, both directly and indirectly as they will be used by others as coordination points of inflation. (The reader should be aware that a fixed price only means that a predetermined price is agreed upon in a contract; obviously, all contracts are possible to renegotiate or breach, if only at a cost.) In chapter four and five, when we consider different techniques of payment and value measuring, we employ the term *sequential transactions* to cover all kind of transactions that are not wholly concluded at the moment of transaction.

3 The puzzle of contemporary central banking

3.1 Outline

In this chapter, I will explain what is wrong with the existing hypothesis of the sources of central bank power. It concerns three issues: the growing gap between descriptions about actual central banking and the ultimate reasons why central banking at all is possible; the problems that traditional monetary theory is facing in its attempt to derive a determinate price level in a cashless society; and the absence of a discussion about central banks' apparent coordinating role.

3.2 Theory and practice in central banking

There is an apparent gap between how the ultimate source of central bank power is described and how actual central bank operations are carried out. This is true both for academic accounts and for central banks' own accounts. Let us first look at examples of central banks' own accounts, starting with the Swedish central bank, *Sveriges Riksbank*. The quotation is from the bank's web site[8] and I have indicated *keywords* using italics.

> **The role of the Riksbank**
> Inflation is *ultimately* a consequence of the money supply rising faster than demand. As the Riksbank has the exclusive right to issue banknotes, it can control the supply of money. When costs rise and prices move up, the demand for banknotes and coins will grow because a larger amount of money is needed to execute the payments.
>
> If the Riksbank refrains from supplying more money, prices will *ultimately* fall back. Thus it is the Riksbank's construction of monetary policy that *ultimately* determines whether rising costs lead to inflation in the longer run. This is the background to the Riksbank's central role in ensuring that prices remain stable.
>
> In *practice* the Riksbank no longer manages inflation by varying the supply of money. The demand for money is met and

[8] Full address: http://www.riksbank.se/frameset.ASP?ID=3562

> it is this demand which the Riksbank influences by adjusting the level of interest rates. High interest rates subdue the demand for money and vice versa. [www.riksbank.se]

One would like to know in what way the discussion about what is *ultimately* true supports the discussion about how central banking is conducted in *practice*. While it is understandable that changes in interest rates may influence the demand for money through some sort of monetary transmission mechanism, it is not as easy to see why the central bank should be able to change market interest rates in the first place. Is it because of its control over the supply of banknotes – a control, which it does not exercise – that the central bank controls interest rates? In that case, how does it happen? In short, I find it difficult to understand in which way the central bank's actual operations are linked to the underlying so-called ultimate reasons.

In a report by The Monetary Policy Committee of the Bank of England available on their web site[9], the committee outlines the transmission mechanism of monetary policy in a similar way. First stating, without further discussion, that the bank's power ultimately depends on the monopoly of supplying base money.

> A central bank derives the power to determine a specific interest rate in the wholesale money markets from the fact that it is the monopoly supplier of 'high-powered' money, which is also known as 'base money'. [www.bankofengland.co.uk]

Then, in the description of how this is done in practice, the Committee simply presumes that changes in the rate that the central bank charges for lending out base money will lead to changes in other short interest rates. This is, however, not at all self-evident. Considering how little a typical change in a central bank's operative rate influences the profitability of a typical bank, one would rather expect the impact of such changes to disappear among the bank's other operations.

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[9] Full address: http://www.bankofengland.co.uk/montrans.pdf

The standard academic explanation suffers from similar problems. The theoretical discussion always involves the central bank in controlling the *quantity of money*. Simply expressed, the idea is that with, say, less money, prices must go down for all goods to be sold, or that with more money, prices must go up for all money to be used. Those discussions are seldom accompanied by examples of how the quantity of money could be increased or decreased. In case they are, the examples are tellingly unrealistic, as the infamous suggestion that we should imagine a *helicopter drop* of money.[10] The wish to speculate about the consequences of a helicopter drop of money must stem from a total absence of realistic examples. In other instances, we are simply asked to *"suppose that the quantity of money suddenly rises"* [M. Friedman (1992:248)].

The proposition that central bank power is ultimately derived from the control over base money, is intimately associated with the idea that the general level of prices is pinned down by money, as in the quantity equation MV=PT, or MV=PQ, where T (real transactions) or Q (real production) and V (velocity of money) is exogenously determined. According to this belief, the pattern of real activity in an economy involves a certain demand of real money balances. The nominal money supply is generally supposed to be determined more or less directly by the central bank's monetary policy. This implies that the price level is determined as the unique level of prices that will make the purchasing power of the money supply equal to the desired level of real balances. Such an account leads quickly to the conclusion that it is important to formulate a monetary policy in order to control the quantity of money in circulation. It is argued that a central bank policy of passively supplying as much money as is demanded, i.e. an endogenous money supply, would mean a nominal money supply that varies in proportion to whatever the level of prices may be, since the demand for real balances is determined by factors on the real side of the economy. If the price level is determined by nothing else

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[10] Cf. M. Friedman (1969: 1-50] about the concept of helicopter drops of money.

than the money supply and this supply is adapted to the price level, it would imply that both the money supply and the level of prices are completely indeterminate because there are too many unknown variables, and all pairs of money and price level would be equally possible.

I would like to argue that this reasoning has serious flaws. In particular, the concept of a *determinate price level* is misleading in itself, due to its aggregate perspective. If we study the determination issue from the viewpoint of a Walrasian auctioneer, it is plausible to claim that it is impossible to say that one price level is more consistent with the underlying relative price structure than another. However, since the auctioneer is a poor representative of the market, one would rather like to study price level determination from the viewpoint of those individual persons and organizations that actually offer and accept prices, i.e. the price makers. This would bring us to a very different conclusion: to each individual price maker the nominal price is not an arbitrary choice but rather the opposite, since only one nominal price can be consistent with the product's equilibrium relative price. The perceived problem of an indeterminate price level in a cashless society is a consequence of the attempt to determine the price level without reference to individual prices.

The presumption that base money is necessary for a determinate price level has formerly been challenged by a number of writers belonging more or less to the New Monetary Economics (NME)[11] school of thoughts, most thoroughly in Tyler Cowen and Randall Kroszner (1994), where they analyze what they call a *ghost medium of account*. Their ghost unit is a currency unit, which has survived as a unit of account, although the currency denominated in the same unit has disappeared as a medium of exchange. They state that the ghost unit does not provide a determinate price level when no liquid

---

[11] Also known as the BFH school of thoughts. The label BFH refers to the three original contributors to the school that later also has been called the new monetary economics. They are Black (1970,1987,1995), Fama (1980, 1982, 1983) and Hall (1982). Later contributions are made by e.g. Greenfield and Yeager (1983), Cowen and Kroszner (1987,1994) and Woolsey (1992).

claims of any sort are denominated in terms of the ghost unit. Prices might be 100 units as well as 10,000 units, and price level determination would become an arbitrary game of coordination. They go on commenting the criticism often proposed against different kinds of *free banking* and *real bills doctrine*.

> Critics who levy the charge of nominal indeterminacy against the real bills doctrine or versions of free banking focus upon the special case in which the nominal value of all securities can be changed simultaneously at zero cost. [Cowen and Kroszner (1994:64-65)]

They conclude that in the real world, exchange media issuers can not choose an arbitrary number of zeros to place on their issues. This is apparently true because all financial intermediaries are decentralized and therefore not seated around the same table to decide whether one or two zeros should be placed on their issues. Cowen and Kroszner (1994:65) provide the following example to illustrate the non-zero cost:

> A single issuer, acting on its own behalf, can attempt to increase the real value of its liabilities by writing additional zeros on its nominal issues. Unless the additional zeros are backed with real assets, however, the securities issue cannot be marketed. If IBM stocks are currently priced at $100, IBM cannot simply market new issues for $1000.

Cowen and Kroszner make it very clear that price level indeterminacy is not present even in a pure credit economy if price setting is decentralized. Although their arguments are both clear and forceful, they have not had enough impact on the literature on monetary theory. For what it is worth, at least their arguments are fully appreciated by the author of this thesis.

3.3 Inflation in a cashless society

The theoretical problem of determining the price level by means of the quantity equation in a cashless state has also forced some economists to simply denying the possibility of a world where liquidity is freely available. More or less fantastic arguments have been put forward in order to claim the

impossibility of a cashless society, thereby avoiding the challenge of deriving nominal prices without ultimate reference to base money. One line of arguments focuses on the demand side, claiming that the demand for cash will always be positive. Accordingly, some economists argue that a total disappearance of base money is impossible referring to the need for *an ultimate medium of conversion*, or an *ultimate medium of settlement*. This particular issue has been addressed in a few articles, e.g. in Kevin D. Hoover (1988), the criticism of which centers on Eugene Fama (1980).[12] Hoover (1988:152) criticizes Fama's conclusion that the essential real service provided by cash is that of an efficient surrogate for a bookkeeping system. Hoover thinks that Fama ignores the role of cash *as a preferred good of settling outstanding* debts:

> Whenever we purchase a real good – except in direct barter – we create an incipient debt. Cash settles such a debt. In Fama's spaceship economy these debts are settled by transfers of assets of equal value. Unfortunately this ignores the fact that we usually have preferences over what sort of assets we wish to accept in exchange. [Hoover (1988:152)]

Hoover commits the mistake of treating cash as an ultimate medium of settlement. This is probably a consequence of seeing cash as a commodity while perceiving deposits as debt. However, we should think of cash as a liability of the central bank (or in the end, the State) to deliver real resources. If we consider the problem in this particular aspect, what is the difference between cash and a bookkeeping system as payment technique? Furthermore, it is just as easy to choose assets to settle a bookkeeping debt as a cash debt. The holder of the debt chooses whatever asset or service he wants to consume, just as he does when he uses cash. Consequently, I am not convinced by Hoover's objections to the feasibility of a cashless society. All debts eventually have to be settled in real resources. The use of base money is just one way of intermediate clearing as is clearing in a bookkeeping system.

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[12]A similar debate has been held between Greenfield and Yeager (1983,1986) and White (1984,1986).

A more speculative argument is the allegation that fiat money, due to its irredeemable character, can not disappear. This is the implicit assumption underlying thought experiments beginning with *a suddenly increased quantity of money*.[13] This argument possesses some insidious appeal since you can not legally demand to have your notes redeemed in anything else but notes of the same kind. Still, it is nonsensical, because you can always pay taxes with your notes and coins.[14] Any excess cash held by the public will almost instantaneously disappear from it through tax payments to the State. In Sweden for instance, monthly tax payments are larger than the entire stock of notes and coins. It underscores the fact that the State/central bank can only offer the public to hold more money, but it could never force the public to hold them. Below, a simplistic story is told to show what it could look like. The State wants to boost the economy by granting state employees increased salaries. They finance the pay raise with freshly printed money. My point is that this is not possible in a Western society. The story is told by showing the balance sheets for each agent in the process, the state, the central bank, the banking system and the public. Those balance sheets only include entries that would be different compared to the situation immediately before the money-financed wage increase. These are the steps in the story:

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[13] I am thankful to Ingemar Ståhl for recognizing this line of argument.
[14] Cf. Kraay (1964) and Hicks (1969) about the argument that paper money is accepted by the public because it could be used as tax payments. See also discussion in Chapter 5.

A. The State buys cash from the central bank in exchange for government bonds.

Balance sheets

The State		The central bank	
assets	liabilities	assets	liabilities
100	100	100	100
(cbn)	(gb)	(gb)	(cbn)

gb = government bonds, cbn = central bank notes, bd = bank deposits

B. Instead of paying the state employees directly into their bank accounts, the State pays their new salaries in cash.

Balance sheets

The State		The public	
assets	liabilities	assets	liabilities
	100	100	
	(gb)	(cbn)	

C. The employees now recognize that they have too much cash and walk straight to their banks to exchange their cash for bank deposits.

Balance sheets

The banking system		The public	
assets	liabilities	assets	liabilities
100	100	100	
(cbn)	(bd)	(bd)	

D. The banks recognize that they in turn have too much cash since their holdings of cash are a function of the public's demand for cash. Thus, they deliver the excess cash to the State as tax payments, instead of increasing the State's holdings in the banking system, as they otherwise would have done.

The State will therefore receive more notes and less bank deposits in taxes compared to what previously would have been the case.

Balance sheets

The State		The banking system[15]	
assets	liabilities	assets	liabilities
100			100 (to the public)
(cbn)			(bd)
x-100			x-100 (to the State)
(bd)			(bd)

x = Deposit holdings in the banking system, which the State previously has had after receiving tax payments.

E. We end up with the same stock of outstanding cash as before. However, the public now holds more bank deposits and the State less, in an amount equal to the amount of newly printed money that the State first tried to put into circulation.

Balance sheets

The State		The central bank		The public		Banks	
assets	liab.	assets	liab.	assets	liab.	assets	liab.
100	100	100	100	100	0	0	100 (public)
(cbn)	(gb)	(gb)	(cbn)	(bd)			(bd)
x-100							x-100 (State)
(bd)							(bd)

The State then has two alternatives: *(a)* it could use the notes again to cover for the lack of bank deposits. If the State is able to keep the cash in continuous circulation, it can cover its expenses minus the salary raise. To maintain the raised salaries, the State has to acquire new money from the

central bank for each period, and the economy would rapidly move towards chaos. Partly for this reason, it does not make sense to think of cash as playing any significant role as payment technique for public expenses in developed countries. This is obviously the reason why we never observe this kind of action other than in conjectures by economists.[16] Moreover, one may well expect the pace of the above process to speed up, since it is very inconvenient to the employees to receive their salaries in cash. *(b)* the other alternative for the State is to sell additional bonds to the banking system in exchange for bank deposits. Then we would end up in precisely the same situation as if the State had borrowed the additional amount needed for salaries directly by selling bonds to the public and cash would be indifferent to the matter. We conclude that the State or the central bank can only *offe*r the public notes and coins. They can not force the public to keep them, unless some very peculiar legislation is introduced, which in itself would change society in much more important aspects than the monetary aspects discussed here.

Although neglected by mainstream monetary economics, the state of frictionless financial markets has been seriously considered in the NME school of thoughts, and long before them by, e.g. Knut Wicksell (1935[1906], 1936[1898]) and Erik Lindahl (1929, 1930), who analyzed price level determination in a cashless society. Lindahl (1930: 11), for instance, explicitly argues that it is a weakness with the quantity theory that it breaks down under the condition of zero cash holdings. Novel theories about money are also found in free banking literature, e.g. by Friedrich A. Hayek (1986) and Dowd (1988). More mainstream, Woodford (1997), in a paper with the misleading title, *Doing Without Money: Controlling Inflation in a Post-Monetary World*, takes the challenge of a total disappearance of base money seriously and proposes an alternative approach in order to determine the price level

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[15]The 100 extra owed by the banking system to the public cancels out by the 100 less owed to the State.

[16] See Persson, Persson and Svensson (1995) for an example of such a conjecture.

without reference to any monetary aggregate.[17] He suggests a *Wicksellian approach* that allegedly produces well-behaved equilibrium conditions also at the cashless limit, something which an ordinary approach featuring an exogenous money supply does not.[18] The key to the alternative approach in Woodford's paper is that equilibrium money prices are determined by the way in which government policy depends on the absolute price level; the monetary and/or fiscal policy rules depend on the general level of prices, in such a way as to make only a certain price level consistent with the equilibrium.[19] In the Wicksellian policy regime, it is the monetary policy rule that makes real quantities depend on the level of money prices – the rule being that one must adjust the short-term nominal interest that is controlled by the central bank as a function of the price level. To my understanding, the Woodford model describes a class of monetary policy regimes that appears to picture a possible way for monetary authorities to control inflation in a cashless world. However, it is not perfect since it provides no explanation regarding how the pictured policy regime could be implemented in such a world. It turns out that the possibility of implementing a Wicksellian policy depends mainly on the subtle difference between a world *at the cashless limit* and an *actually cashless world*. The problem is that to implement the policy, the model needs to assume that the central bank exercises some control over interest rates, and this is supposedly true, because of its monopoly right to issue cash. Thus, while it would be possible to control inflation by applying the suggested monetary policy in a cashless world as well as in a world at the cashless limit, it is only in the latter that the policy can be implemented. Woodford ends up arguing that he would have a model for controlling inflation in a cashless

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[17] Woodford's refined arguments (2000) will be discussed later in the chapter. The particular criticism put forward here only concerns the 1995 and 1997 papers.
[18] The approach is named *Wicksellian* because Wicksell was first to claim that price stability could be achieved under a fiat money regime by a policy that lowered nominal interest rates when prices were getting low and raised them when prices were getting high. The central bank did not have to control the quantity of banknotes in circulation and the approach was thus well suited for a *pure credit economy*.
[19] Cf. also Woodford (1995)

world, if only the demand for cash balances were strictly larger than zero! Despite this inconsistency, I still find the Woodford model interesting, since it suggests that the central bank in a cashless society may still exert crucial influence on the inflation rate, in case it is able to control nominal interest rates. That is, he shows that the link between short nominal interest rates and inflation does not depend on cash, which makes his model seemingly more relevant to actual central bank operations than the traditional discussion about the control of the money supply.

A revival of interest in the cashless society

Particularly since 1999, we have witnessed a revival of interest in the question of what consequences innovations in information technology may bring to central banking. Will e-money or network money perhaps end the use of currencies or even banks, as we know them? An article by B. Friedman (1999) contributed substantially to make these issues hot again. Subsequently, the journal *International Finance*, *The World Bank* and *IMF* jointly arranged a conference called Future of Monetary and Banking Conference, which was held 11 July 2000. The papers were subsequently published in the journal. At least five of the papers were concerned with our subject and this paper will follow up the discussion in those papers. Roughly speaking, B. Friedman refined his arguments from the 1999 paper and Charles Freedman, Goodhart, Bennet T. McCallum and Woodford, in distinctly different ways, opposed the view that the IT revolution will bring dramatic change to the financial world.

By and large, Freedman (2000), Goodhart (2000), McCallum (2000) and Woodford (2000) all appear to argue that *(a)* the demand for base money is not likely to disappear and thus business as usual, and *(b)* if it were, the central bank would still be perfectly able to carry out a monetary policy. Goodhart (2000:190) was the most specific:

> Indeed, while it is true that such control appears to rest on the central bank's ability to vary its monopsonistically supplied monetary base by open-market operations, I shall argue that this is, in fact, a superficial epi-phenomenon.

All above authors have one thing in common: they pursue the *(b)* analysis, more or less, for the sake of the argument. Nevertheless, we will focus on this part of the debate since it is very relevant to my hypothesis that central bank power does not rest on the monopoly of printing money. Apparently, B. Friedman also felt the need to shift the focus away from the issues of e-money replacing cash, which are eye-catching but less interesting.

> It is therefore useful to begin by noting, in a few particulars, what is *not* the plausible source of concern: it is not the possibility that nobody will use currency for ordinary economic transactions; nor that no one will use bank checks to execute transactions. It is not that no bank will hold balances at the central bank. It is not that the central bank will be unable to control the size of its own balance sheet. It is not that the central bank will be unable to influence the price - the interest rate - at which its own liabilities exchange for other claims that private transactors regard as assets. Finally, the issue is not that the central bank will be unable to influence some short-term nominal interest rate. [B. Friedman (2000: 261-262)]

I agree with Goodhart that *"as a practical proposition, the IT revolution is not going to remove the demand for currency"* [Goodhart (2000: 190)], or for that matter a demand for settlement balances.[20] Both cash and the clearing service of central banks are demanded because of their superior convenience for some purposes. However, on the other hand, I would like to stress that one of the reasons, and a crucial one, for this superior convenience is that the central bank, in fact, does not use currency for purposes of monetary policy.[21] Why do central banks restrain, in fact, from actively using the supply of currency as a way to control inflation? This issue brings us back to the question of the possibility of cash being superseded by other kinds of

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[20] It is one thing to argue that cash would probably continue to be demanded because of its convenience. It is quite a different thing to claim that the demand for cash could not possibly disappear because of e.g. the public's need for an ultimate means of settlement. While the first line of arguments is an honest attempt to answer the question of whether money will continue to be demanded, the second line of arguments constitutes a way to avoid answering the question.

[21] Pointed out by Freedman (2000) and further emphasized by B. Friedman (2000).

payment techniques. As already noted, most of the above writers conclude that cash is uniquely convenient in certain situations and therefore not likely to disappear. However, would it still be convenient to use cash if the central bank actually tried to use it for policy purposes? What would happen if you had to queue for days rather than minutes to get your cash: would it still be a convenient means for small, everyday purchases?[22] While the central bank has monopoly on issuing cash, it does not have monopoly on supplying small-purchase payment techniques – which is all cash is – in general. The point is that the central bank will continue to face a demand for its notes and coins as long as it does not try too hard to use it for policy purposes. Indeed, central banks seem more aware of this than monetary theorists. In practice, central banks use open market operations to control desired variables, as the short-term interest rate, and open market operations do not involve cash.

What about the alleged monopoly of the other part of base money – settlement balances at the central bank held by banks? The case seems to be the same here: clearing could be handled without a central bank.[23] However, as long as the central bank provides an efficient settlement service, there is no reason not to use it. Central banks may occasionally make minor changes to the price charged for the use of its services, but they are restricted by the fact that their monopoly is only illusory, the *potential* threat of competition puts serious limitations on their maneuvering space. This implies that central banks may use settlement balances for some fine-tuning, when, *for some other reason*, the market is already prepared to adhere to the bank's intentions. However, it also suggests that it would be impossible to use settlement balances to *force* the market to follow the bank's intentions if the market for some reason is not willing to do so in the first place. Therefore,

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[22] McCallum (2000) makes a related point when stating that the "pace of technological innovations that serve to reduce the demand for money, is significantly endogenous and can be expected to be slower in an era in which inflation is lower than over (say) 1965-1985." Accordingly, the pace of substitution should be expected to speed up if the central bank were to use cash for policy matters.

[23] See Black (1970) and Fama (1980)

although it is true that cash and settlement balances probably will continue to be demanded, it is nevertheless fundamentally irrelevant to policy matters.[24]

I am encouraged by the fact that B. Friedman (2000: 262) has come to a related conclusion, suggesting that the markets which the central bank can control may become isolated "corner solutions".

> The threat to monetary policy from the electronic revolution in banking is the possibility of a "decoupling" of the operations of the central bank from the markets in which financial claims are created and transacted in ways that, *at some operative margin*, affect the decisions of households and firms on such matters as how much to spend (and on what), how much (and what) to produce, and what to pay or charge for ordinary goods or services.

By "decoupling", B. Friedman suggests that the coupling mechanism between the central bank's financial operations and the non-financial decisions by households and firms, i.e. the foundation of all stories on how monetary policy works, will vanish. I think my point bears some similarities with B. Friedman's decoupling. B. Friedman suggests that the markets controlled by the central bank may be corner solutions and that they are not connected in a meaningful way to the rest of the financial world. B. Friedman (2000: 263) points to the widening spread:

> Within the past year, in the USA, an unusually wide spread has opened up between the interest rate on long-term US Treasury securities and interest rates on similar instruments like high-grade corporate bonds and securities collateralized by insured mortgages. The apparent reason is the projected scarcity of long-term Treasury bonds.

Indeed, this example seems to underline my own suggestion that any monopoly power on behalf of the central bank is restricted to its particular products and has at most a marginal impact on general market rates. A vast majority of economists would agree that *in practice* the central bank affects

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[24] Fundamentally I say, because in practice they may have a signaling function,

interest rates and inflation in an economy. There are also many good accounts on how e.g. changes in the short-term interest rate may influence long- and medium-term interest rates and inflation rates through an intertemporal substitution of consumption or through the expectation hypothesis. Rather, the question is why the central bank's open market operations – limited in scale as they are – should move rates in markets of other instruments, such as e.g. interbank markets for short-term loans. The need for a plausible explanation regarding how the central bank gets involved in the non-financial economy attracted the attention of B. Friedman (1999: 322), who aptly described the traditional accounts of the sources of central bank power as fictions.

> In truth, the ability of central banks to affect the evolution of prices and output in the non-financial economy has always been something of a mystery. It is not that there are no good accounts of how this influence might arise. There are many. The problem is rather that each such story, while plausible enough at first or even second thought, turns out to depend on one or another of a series of by now familiar fictions: households and firms need currency to purchase goods and services; banks can issue only reserve-bearing liabilities; no non-bank financial institution create credit; and so on.

These fictions suggest a link between the monopoly of producing cash and the central bank power that would explain why open market operations work. One might wonder why these fictions have not been more vigorously challenged after it became apparent that they, as a description of reality, are counterfactual. Part of the answer probably stems from the fact that far from all monetary economists has perceived it as a mystery at all. B. Friedman (1999: 322) provides another part of the answer soon after on the same page.

> The central mystery notwithstanding, at the practical level there is today little doubt that a country's monetary policy not only can but does largely determine the evolution of its general price level (…) The assumptions necessary to explain in simple terms how this happens are fictions, but they are useful fictions.

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which could be of considerable importance.

That is, these fictions are not at all the reason *why* economists believe *"that a country's monetary policy not only can but does largely determine the evolution of its general price level"*. The other way around is just as true: economists have those beliefs in the first place and the fictions are part of the rhetoric necessary to rationalize them. Actually, it is futile to discuss these fictions and beliefs in terms of which came first, they are both parts of the same *paradigm*.[25] Through training, students of monetary economics become used to thinking about the quantity equation as a relation, meaning that the price level is a function of money.

Thus, when B. Friedman says that the fictions help explain in simple terms how a monetary policy influences the evolution of prices, he uses the word 'explain' in a rather special way, only relevant within this particular paradigm. The fictions explain nothing in the ordinary meaning of the word. Within the paradigm, however, they help construct a logical system of its different propositions/fictions, and thus 'explains' other parts of the system. The main spirit of B. Friedman's paper is that the IT revolution has or will reshape the financial arena and hence make these familiar fictions no more 'useful' neither as descriptions of reality nor as 'as-if' descriptions.

My own approach to the issue is not primarily to examine whether the IT revolution may deprive the central bank of its control over the evolution of the general price level. It must first be questioned whether the traditional story about the source of central bank power has ever been justified. I clearly believe that the proper way to proceed – once some of the fictions have been declared fictitious – is to start questioning the whole paradigm, rather than just some of its minor elements.

3.4 Explaining the coordinative role of central banks

An alternative to the aggregate perspective of quantity thinking would be to recognize the fact that the price level is not an object in the real world, and

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[25] Cf. Kuhn (1970) about paradigms in science.

move on from there. The price level is, of course, not a variable in its own right but a convenient way to talk, in one word, about prices on many different items. The possibility to do so is important when we try to extract true information from encountered price changes. However, although the price level is a very useful concept, it is nonetheless inaccurate to treat it like a variable.

If asked, not many economists would disagree with the claim that the price level is nothing but an index of individual prices. Nevertheless, much analysis is carried out as if it were in fact possible to talk about inflation with no regard to actual prices. Consider for example the view that: *"The conclusion is that substantial changes in prices or nominal income are almost always the result of changes in the nominal supply of money."* [M. Friedman (1992:249) This statement asserts that the quantity of money will determine the level of prices. We must therefore conclude that the quantity of money also determines individual prices. Assertions such as this are, however, rarely accompanied by an account of *(a)* how the quantity of money has increased or *(b)* how individual price setters take this into account when they negotiate or quote prices. Rather, both *(a)* and *(b)* are assumed to happen, as in the case of M. Friedman (1992:248).

> Starting from a situation in which the nominal quantity that people hold at a particular moment of time happens to correspond at current prices to the real quantity that they wish to hold, suppose that the quantity of money unexpectedly increases.

Why should we *"suppose that the quantity of money unexpectedly increases"*, perhaps because there has been a *helicopter drop of money*? The lack of realistic suggestions regarding how changes in the supply of money affect price setters suggests in itself that economists who use this jargon are not themselves fully aware of the meaning of their proposition on an individual level. This is of course the accepted risk when you decide to take the shortcut of discussing in terms of aggregate concepts without reference to objects in reality, i.e. you may lose sight of where action in fact is taken and

accept aggregate postulations as laws, something which they obviously can not be. You *could* of course claim that changes in the quantity of money leads to changes in the price level, but you *could not* back up your claim by referring to some propositions (e.g. stable velocity) about the quantity equation. While the quantity equation can be used to illustrate striking statistics, it can never be used to justify claims about causation, simply because it has the character of a *black box* when it comes to the operational mechanisms.

So, let us try to *understand* what actually happens, i.e. how individual agents make decisions about prices and on what grounds. For example, let us ask the following question: do central banks in fact influence decisions in households or firms on what to buy or sell, by controlling the quantity of outstanding currency? As Freedman (2000) points out, as B. Friedman (2000) further emphasizes, and as we already have mentioned here, the answer is clearly negative. Central banks do in fact passively supply as much currency as the public wants. Thus, when someone states that central banks control interest rates, or the price level, by controlling the supply of currency, it should be clear that it could not be a statement about actual events.[26] Rather, the statement is a metaphor, which everybody familiar with the paradigm knows how to interpret.

B. Friedman (1999:323) acknowledges the irrelevance of these traditional stories of central bank power and explains why central bank power is a bit of a mystery.

> The easiest way to see why the influence of central banks over non-financial economic activity is such a puzzle is to consider their small size, and the even smaller size of their monetary policy operations, in relation to the economies that they supposedly influence.

Indeed, why should tiny open market operations move much larger markets? You could of course argue that "Yes, they are tiny, but they could be much larger if necessary". That is, rather than moving the market through a

pure supply/demand effect, open market operations move the market by signaling potentially very large supply/demand effects.

To illustrate this issue further, let us look at a monetary policy that does not involve base money in practice (although it can be argued that control over base money is the reason why it works). Woodford (2000) provides a comprehensive account of how New Zealand and Canada pursue their monetary policies – *the channel approach* – by paying interest on bank reserves rather than by conducting open market operations on the monetary base. Standing facilities for lending and depositing at rates slightly above or below the central bank's target rate guarantees both that the market rate will be close to the target rate and that commercial banks will have incentives to clear as much as possible on the interbank market before using the central bank's standing facilities.

> The lending rate on the one hand and the deposit rate on the other define a "channel" within which overnight interest rates should be contained. Because these are both standing facilities (unlike the Fed's discount window in the U.S.), no bank has any reason to pay another bank a higher rate for overnight cash than the rate at which it could borrow from the central bank; similarly, no bank has any reason to lend overnight cash at a rate lower than the rate at which it can deposit with the central bank. Furthermore, the spread between the lending rate and the deposit rate give banks an incentive to trade with one another (with banks that find themselves with excess settlement cash lending it to those that find themselves short) rather than depositing excess funds with the central bank when long and borrowing from the lending facility when short. [Woodford (2000:245-246)]

This would seem to explain why the central bank in practice does not have to engage in large transactions, since the banks have incentives to clear as much as possible on the interbank market. According to Woodford (2000), and Graeme Guthrie and Julian Wright (2000), the channel approach to a pursuit of monetary policies indeed seems to work in New Zealand without the central bank having to engage in particularly large transactions. Guthrie

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[26] Cf. e.g. Holmberg (1996) for an example of such a statement.

and Wright also show that *open mouth operations* are the actual sources of changes in market interest rates. The expression - *open mouth operations* - is used to describe the phenomenon when market interest rates adjust immediately as soon as the central bank announces changes in interest rates. Another common way to describe the same phenomenon is to say that *the market is doing the central bank's job*. This means that the market adjusts to the target rate of the central bank without the central bank having to carry out actual operations.

The question is now why it works. There are two possible explanations. It could be that the central bank is always right about the market's expectations and adjusts the channel accordingly, or else that financial actors believe that the market rate will adjust to the central bank's target rate – otherwise they would have tried to make a profit from the difference between the market rate and the rates in the channel. Although the first possibility holds some truth, it can not give a reasonable explanation regarding the fine-tuning of the overnight interest rate, as noted by Woodford (2000) and B. Friedman (2000). We are thus left with the fact that financial actors seem to expect the market rate to be equal to the central bank's target rate. The question to be answered is then why they expect this. We will consider three possible explanations as to why market participators expect the central bank to control, in fact, overnight interest rates. All three interpretations have one thing in common: in practice, the central bank only needs to signal its preferred interest rate, or inflation rate, in order to induce the market to coordinate on that figure. The differences are found in the explanation of why the market participators choose to coordinate on that particular figure.

Central bank liabilities define the value of the unit of account

Although the sheer magnitude of central bank operations does not really explain why central banks should be able to control market rates, Woodford (2000:256) suggests that size at first sight would seem to matter in a situation where the central bank has no monopoly power at all (i.e. in the hypothetical case of a zero demand for base money).

> (…) it might be thought that any remaining ability of central banks to affect market rates should depend upon a capacity to adjust their balance sheets by amounts that are large relative to the overall size of financial markets.

Nevertheless, Woodford (2000:256-257), claims the opposite, i.e. that central bank power does *not* rely upon size.

> The key to an answer is to note that there is no inherent 'equilibrium' level of interest rates to which the market would tend in the absence of central-bank intervention, and against which the central bank must exert a significant countervailing force in order to achieve a given operating target. This is because there is no inherent value (in terms of real goods and services) for a fiat unit of account such as the 'dollar', except insofar as a particular exchange value results from the monetary policy commitments of the central bank. Alternative price-level paths are thus equally consistent with market equilibrium in the absence of intervention, and associated with these alternative paths for the general level of prices are alternative paths for short-term nominal interest rates.

Although Woodford (2000:257) recognizes Black's (1970) and my own (2000) suggestions about self-fulfilling expectations, where the central bank plays *no* role at all or the *soft* role of serving as a focal point for coordination of expectations, he argues that the central bank still would have a *hard* role in price level determination.

> The answer is that the unit of account in a purely fiat system is *defined* in terms of the liabilities of the central bank.[27] A financial contract that promises to deliver a certain number of 'dollars' at a specified future date is promising payment in terms of settlement balances at the central bank- the Federal Reserve in the case of the US dollar, the Reserve Bank in the case of the NZ dollar, and so on - or in terms of some kind of payment that the payee is willing to accept as a suitable equivalent.

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[27] See Hall (1999) for a similar view.[28] The quotation is from the book Social Evolution, see also Triver's seminal contribution on reciprocity, Trivers (1971).

By unit of account Woodford refers to the unit in which prices are stated and contracts written. Woodford (2000:258) further emphasizes the central bank's distinguishing feature.

> The special feature of central banks, then, is that they are entities the liabilities of which happen to be used to define the unit of account in a wide range of contracts that other people exchange with one another.

Let us now consider the validity of these claims, starting with the question: do the liabilities of the central bank actually define the unit of account which people normally use in contracts? Nobody would argue that a *one-dollar central bank note* is not worth one dollar, and that is clearly not the issue. The issue is not the value of a fixed-dollar liability of the central bank. It is certainly worth its face value (as long as the central bank is not severely distrusted); the issue is rather the value of a *dollar-unit of account*. The unit of account and the payment technique bear the same name and have hence been mixed up. This confusion is central to the myth we are examining. McCallum (2000:282) provides another example of the fallacy when discussing Woodford's cashless limit.

> The 'price level' in such a system <u>cannot</u> be the inverse of the purchasing power of money, *as it is* in a monetary economy with only a small fraction of transactions conducted by money, since there is no such thing as money in such a system.

Although some may argue that it is only a matter of definition, I believe it is dangerous to define *the price level as the inverse of money's purchasing power*, since this may lead to confusion about causality. The problem is that the concept of the purchasing power of money presupposes the concept of a price level, while the opposite is not true; we can understand the concept of a price level without a concept of the purchasing power of money. The purchasing power of money is determined by individual prices, which we can represent by constructing an appropriate index - the price level. Hence, it is better to define money's purchasing power (or the unit of account) as the inverse of the price level. This would e.g. make more sense when we analyze

changes. Imagine for instance that the oil price has risen. Most people would then say that this decreases money's purchasing power. Consider McCallum's definition in a similar manner, i.e. starting with the statement that money's purchasing power has decreased, how would that affect the price level? I seriously doubt that anyone would find it sensible to suggest that the price level *must* rise *because* money's purchasing power has decreased.

To definitely settle the question of definition of the unit of account, we first have to understand what it may imply. We will interpret it on two levels, first as a hypothetical possibility and then as a historical fact.

The statement that the central bank's liabilities define the value of the unit of account appears to say that *one dollar is worth one dollar*, or perhaps, that any claim to one dollar is worth a one-dollar central bank claim. Without exaggerating, we can conclude that something seems to be missing here. It becomes even clearer if we consider the following example. Let us assume that the new manager of the FED, *Mr Greenbuck*, decides to make a fresh start and abandon the dollar since it is too heavily associated with the drug trade. The new unit of account is named the *newbuck*. The FED starts issuing notes of the newbuck in different denominations and declares them legal tender. Since it is a fiat currency, there is of course no fixed rate of convertibility into anything else – and according to monetary theory, the newbuck liabilities of the FED define the value of the newbuck. The public is urged to write contracts in this new unit and to exchange their old dollar notes for new ones. The question is now: *how many one-newbucks would an individual demand in exchange for each one-dollar?*

I think that this little story, although admittedly naive, makes it clear that a central bank could not launch a new unit of account by simply defining its value in central bank liabilities. So, what reasons do we have to believe that this is the way our current units of account obtain their value?

If we leave the abstract interpretation aside, does the definition story have any support in history? The answer appears to be negative in this case also; I can not think of any unit of account that has been introduced in this manner. All fiat currencies seem to have inherited, in some way, their value from

earlier units of account, either commodity standards or fiat standards. The euro is a recent example; it is illuminating that the value of the euro was in fact not established in accordance with Woodford's definition story. Instead, its value was explicitly inherited from old units.

The point is that a unit of account can not obtain its value exclusively from financial contracts – ultimately, there must be some connection to a non-financial economy. *No financial claim whatsoever could be issued in a (fiat) unit of account if there were no prices of non-financial products stated in the same unit of account.* That is why the little story about Mr Greenbuck looks so strange: how can we know the purchasing power of a one-newbuck note if no prices are stated in newbucks?

We do not know the value of the dollar, krona, euro or whatever from the value of central bank liabilities, but from prices of real goods and services. Again, a central bank liability with a fixed nominal value of, say, one US dollar is defined to be worth precisely one US dollar. The purchasing power of this liability, however, can only be understood if there are real goods or services offered at reasonably stable prices stated in US dollars.

The Woodford solution to the 'B. Friedman puzzle' – tiny central bank operations that control huge markets – is that the unit of account has no inherent equilibrium value and thus can be determined by a, however small, amount of central bank liabilities. This line of reasoning is a little bit too abstract to convince me. In any case, Woodford's account on *how* open mouth operations work, in e.g. New Zealand, is a different matter; it is just the story regarding *why* it would still work in a cashless society that I find exceedingly speculative.

The central bank is strong enough to absorb any losses

In comparison with the definition story, Goodhart's size argument seems less fanciful. It claims that the solution to this problem is that the central bank can always change market rates in line with its wishes, since it basically could, and would, punish anybody betting against it. Goodhart (2000:190) puts forward the size argument.

> What the ability of the central bank ultimately depends upon is the fact that it is the governments' bank, and thus has the power to intervene in (financial) markets without concern for profitability (let alone profit maximization). It can, consequently, force its profit-seeking commercial confreres, in the last resort, always to dance to its tune.

This is a very clear statement about the fundamentals of central banking power and quite far from the naive views of macroeconomic textbooks. Not only is Goodhart's claim more down to earth, it is also potentially more interesting than the definition arguments we have just discussed, since Goodhart sees his size argument as the actual source of central banking power also under the current circumstances. Thus, although Goodhart (2000:205) argues persuasively that currency will not disappear, he states on several occasions that currency, or the entire monetary base, is superfluous to the power of central banks.

> Because it is not profit-maximizing the central bank is always in a position to dictate the finest terms on either the bid, or ask, side of the money market. It can, therefore, set the nominal interest rate for 'e' whether, or not, the system also includes currency and/or banks. Because the other players in the money market, whether banks or not, know that the central bank has the power of the government behind it, it is actually unlikely that the central bank will normally have to undertake a large volume of open market operations to get the market to adjust interest rates in line with its wishes. Open mouth operations will normally suffice.

If we use B. Friedman's words instead, Goodhart's coupling between central bank operations and market interest rates consists of the possibility that the central bank stands ready to buy or sell as much as it takes to achieve its desired interest rates, and that it can do so because it can absorb whatever losses necessary.

If the threat of using force is taken seriously by financial actors, it makes perfect sense that the central bank normally only has to engage in quite small operations. As B. Friedman (2000) notes, it is obvious that a large enough player can set market rates if he is willing to enter transactions of potentially

infinite volume. We just then ask ourselves the following central question: is the central bank large enough? This question is difficult to answer, since we never observe central banks engaged in very large operations. This is consistent with both Goodhart's view and with my view that the central bank is a focal point without the means to force its will on the market. However, the fact that it now seems impossible for central banks to keep managed fixed exchange rates seems to speak in favor of my interpretation. The EMS crisis in the early nineties and the turmoil in Asia a few years later underscore this opinion. If we bear in mind that the operative means to defend a fixed exchange rate are the same as those used to defend a target for some interest rate, we can perhaps conclude that if a central bank can not defend a preferred exchange rate, it is also unable to defend an interest rate target.

3.5 Conclusions

The descriptions of the ultimate sources of central bank power to influence the economy that you find in textbooks, or in statements of the central banks themselves, lack a conceivable link to actual central bank practices. On the one hand, the monopoly right to issue notes and coins is claimed to be the ultimate source of power while on the other hand, notes and coins play no part of actual central bank practices. The quantity identity is supposed to supply the missing link. However, the identity in itself is not sufficient to establish the needed link, it has to be complemented by assumptions about the relations between the variables. In the traditional story the identity becomes the quantity equation when assumptions about three of its variables are added; that money and real production is exogenously determined and that the velocity of money is stable. This leaves the price level as the only endogenous variable, which should make it possible to determine. However, the assumption of a stable velocity is crucially problematic. In a world where there exists other payment techniques than cash payment, the velocity of money is a meaningless concept other than as a residual in the quantity identity. In the hypothetical world where all payments are made with cash, it would be possible to interpret the velocity as a measure on how many times

an average note is used during a certain period of time. On the other hand, in the real world where payments are made also by the use of other means, this is no longer true and the only way to interpret the concept of velocity is to define it as PQ/M. With the velocity being the residual that makes the quantity identity hold, the identity is impossible to use to justify claims about a link between money and prices. Although the quantity equation is thus flawed, you could of course still claim that money cause prices in some way, but then you would have to come up with some good arguments. Such arguments are however, utterly absent in textbook expositions.

In this chapter, I have also discussed recent and more promising attempts to explain why the central bank should be supposed to be able to influence the economy through its operations. In brief, I find the attempt to explain central bank power as a consequence of central bank notes defining the value of the unit of account unconvincing. As a historical matter, fiat money has never been introduced without borrowing its meaning from an already existing unit of account. Neither is it possible to imagine how it could be; an established habit of using a unit of account must logically precede any fiat medium of exchange.

We then consider an attempt to explain central bank power as stemming from its link to the government's taxing power. That argument says that central bank could, in the end, force the market to adjust to its target rate of interest since it is ultimately backed by the government. Although this claim is harder to dismiss I hold it doubtful, considering the international character of the financial markets and the huge amounts it involves.

4 Changing the game: technological solutions to problems of trust

4.1 Outline

From here on, the thesis will be concerned with the establishment of a theory around the hypothesis that central banks derive their power from a focal point role for expectations on inflation (and short interest rates). To accomplish this, we need to understand the role of *money* and *nominal prices* from the perspective of an individual agent. This is because inflation is changes in a price level, which in turn is an index of individual prices, which in turn are set by individual agents. That is, we need to understand the particular decision situation that price setters face. We interpret the use of money and nominal prices as transaction costs saving customs, much like Douglass North (1990:121) interpret them as ways to overcome transaction costs associated with long-distance trade:

> The development of standardized weights and measures, units of account, a medium of exchange, notaries, consuls, merchant law courts, and enclaves of foreign merchants protected by foreign princes in return for revenue were all part and parcel of the organizations, institutions, and instruments that made possible transacting and engaging in long-distance trade.

To build our theory, we will start with the present chapter and consider market institutions in general and use its non-market equivalents as reference. We hence need to consider how problems, similar to problems solved by market institutions, are solved in other parts of society which chronologically and logically precedes the market, as e.g. the family. In particular, we will see that one way to overcome prohibitively high transaction costs is to apply technological solutions that change the nature of the game. We will also see that the use of payment techniques and units of account

could be interpreted as such technological solutions to problems of transaction costs that involve a high degree of trust.

4.2 Selfish genes, reciprocity and rules

There can be little doubt that Adam Smith used vivid language rather than expressed an opinion about the biological nature of man, when he suggested that man has a propensity to exchange one thing for another. Nevertheless, I take the position that man is biologically hardwired with the emotional capacities needed to *learn* or *acquire* an exchanging *social* nature. I also embrace the view that the way we are behaviorally hardwired says much about the way we come to shape our social institutions and I therefore devote some space to this subject. The purpose is to gain some insight into the kind of behavior we could expect from humans, i.e. a model of man. Since there is not necessarily a one-to-one correspondence between self-interest for genes and self-interest for humans, we are able to sketch a more complex man than the so-called Economic Man. According to the biologist Robert Trivers (1985:386): [28]

> It seems likely that during our recent evolutionary history (at least the last 5 million years) there has been strong selection on our ancestors to develop a variety of reciprocal interactions. I base this conclusion in part on the strong emotional system that underlies our relationships with friends, colleagues, acquaintances, and so on. Humans routinely help each other in times of danger (for example, accidents, predation, and attacks from other human beings). We routinely share food, we help the sick, the wounded, and the very young. We routinely share our tools, and we share our knowledge in a very complex way. Often these ways of behavior meet the criterion of small costs to the giver and great benefit to the recipient. Although kinship often mediates many of these acts, it never appears to be a prerequisite. Such aid is often extended in full knowledge that the recipient is only distantly related.

The evolution of *reciprocity* is a matter of social evolution, although based on the biologically hardwired set of emotional capacities. William D. Hamilton's (1964) notions of *kin selection* and *inclusive fitness* are keystones

to the study of how the concepts of evolution and family are coupled. Blood relatives share the same genes. Inclusive fitness refers to the fact that a specific gene that modifies behavior in some way will be replicated more often if it takes into account not only the host's reproductive success but also the reproductive success of those among the host's relatives who also carry this particular gene. Hamilton's famous rule says that an altruistic behavior should be anticipated when the benefit to the recipient multiplied by a factor *r* is larger than the costs of the act, where *r* is the measure of the relatedness between the beneficiary and the benefactor.[29] The rule is an attempt to measure the extent to which kinship considerations should be expected to result in a human being making sacrifices on behalf of a relative.

K. Binmore has worked comprehensively on the subject of social evolution and has formulated his thoughts of what is learned and instinctive behavior, respectively. He writes (1998:193):

> Many of our personal preferences are doubtless genetically determined, like hunger, thirst and the sexual urge. Perhaps some of our beliefs are also hardwired [...] But some preferences and most beliefs must surely be acquired. That is to say, our genes do not always insist that we prefer or believe specific things; in some contexts they insist only that we organize our cognitive processes in terms of preferences and beliefs. On this view, we come equipped with algorithms that not only interpret the behavior patterns that we observe in ourselves and others in

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[29] Obviously, it is doubtful whether these acts really could count as altruistic in the ordinary interpretation of the word. To the particular gene that triggers the modified behavior, the act is in line with its self-interest and the sacrifice only illusory. To the host, however, the act could very well have a truly altruistic character. In the discussion of *reciprocal altruism* outside kinship relations, the use of the term altruism is clearly misleading. In these cases, the benefactor always expects to receive at least as much as he sacrifices. In line with Binmore (1998: 185), I therefore prefer to use the term reciprocity in those cases. Another term that is potentially misleading but so commonly used it could hardly be avoided is 'self-interest'. It should be clear that genes have no interest in survival. However, genes better equipped for survival will nevertheless exist in greater numbers in the species' next generation, relatively speaking. One should keep in mind that it is a matter of adoption rather than adaptation. On this last issue and its application to economics, cf. Alchian (1950). See also Dawkins (1976) who popularized the concept of "the selfish gene".

> terms of preference-belief models, but actively build such models into our own operating systems.

Binmore (1998:194) concretizes his idea by stating that humans are natural imitators.

> It is probably uncontroversial to suggest that we are natural imitators. Like proverbial monkeys, we tend to copy what we see others doing, whether the behavior makes much sense or not. But neither humans nor monkeys are totally uncritical. We test our newly acquired behaviors against our preferences, as expressed through our emotional responses. In short, we ask ourselves whether we like the consequences of our new behavior.

To me, and to Binmore as I read him, this would imply that we, i.e. humans, from a very young age observe and imitate the behavior of those closest to us. We then recursively develop a preference-belief model based on responses to our acts from the environment. Once equipped with a preference-belief model, i.e. deep psychological mechanisms as well as more or less conscious views about the world around us, we use it to pre-test new patterns of behavior that we are confronted with. That is, we do not have to apply the behavior ourselves and observe the response, but can intuitively judge whether we should imitate or not.

What then, are the interesting consequences, if any, to economics? One point is that we *learn* to understand who our relatives are, rather than know it instinctively. That is, we do not judge our degree of kinship with another person by his biological features as smell or looks, but by his relation to us. According to Binmore (1998:200):

> Some species can apparently sort out their siblings from strangers in some such way. Perhaps they can taste or smell the necessary genetic differences. However, is seems unlikely that humans operate in this manner. The evidence from the sexual preferences of unrelated children brought up together seems rather suggest that we identify as relatives whomever we happen encounter within the family circle.

To a species that usually lives in families, I think that the costs from the loss in precision associated with this behavior are quite small. Within the family circle, the social relationship is most often an accurate prediction of biological relationship, something which means that most reciprocal acts based on social relations will be directed at biological relatives. Moreover, this way to maximize inclusive fitness, i.e. to regard social relatives as biological relatives, has also made it possible for humans to build friendships and kinship-like relationships with biological strangers and to thereby further increase their inclusive fitness by benefiting from the vast advantages from cooperation (recall the quote from Trivers about the development of reciprocity). The advantages of cooperation during food crises probably favored survival of those of our ancestors who were most apt at cooperating outside the family and who could thereby increase the insurance effect through reciprocal actions.

To relate this discussion back to Adam Smith's talk about a *propensity to exchange*, we might talk about man's *propensity to exchange beneficial acts* guided by reciprocity. A certain version of this behavior is known as playing *tit-for-tat* in repeated games, which was popularized by Robert Axelrod (1980a, 1980b, and 1984). Axelrod shows how a cooperative strategy could evolve and thrive, even in a hostile environment. Once established, a cooperative strategy would be quite robust and resist invasion from hostile strategies. The missing piece concerned the issue of how a cooperative strategy could be developed initially if the environment was so hostile. The suggested answer is the same as we have discussed, that is, that cooperative behavior first evolves because of kinship considerations.[30] North (1990:34) suggests that kinship was one of the constraints that made impersonalized exchange possible, which in turn made increased specialization possible.

> As the size and scope of exchange have increased, the parties have attempted to clientize or personalize exchange. But the greater the variety and numbers of exchange, the more complex the kinds of agreements that have to be made, and so the more

[30] Axelrod and Hamilton (1981), Axelrod (1984)

> difficult it is to do. Therefore a second general pattern of exchange has evolved, that is impersonal exchange, in which the parties are constrained by kinship ties, bonding, exchanging hostages, or merchant codes of conduct.

Having said that we on evolutionary grounds could assume that man has a propensity to just behavior, *why do we need contracts, law or money.* The answer is "We don't", as long as we stay within the family circle or a community similarly close. An interesting question is then whether we can tell how far the family circle can be stretched out. Binmore refers to Robin I. M. Dunbar (1992, 1993), who offers evidence to suggest that the maximum size of such circles is about one hundred individuals or so. Dunbar bases his view on the assumption that further growth of the circle is prevented by our neocortex' ability to handle the information needed to organize all relationships.[31] Dunbar proposes that language has evolved as a more efficient method for social bonding, making it possible for humans to maintain the stability of much larger groups than would be possible through grooming alone. Nevertheless, humans do interact, at least implicitly, with many more people than is predicted by the neocortex size, even considering language. My view is that we have invented tools such as contracts, law and money, which help us interact with people in a reliable way without the need to build and maintain a social relationship to each of them. [32]

The theory of collective action[33] is a related, but still different, approach to explaining why small groups can function efficiently together although they are guided only by rational self-interest. A central feature of this theory is that each individual always bears the full cost of actions taken to help establish a peaceful order. He only receives a part of the benefits, however. At first sight, these two explanations seem to explore the same phenomenon, i.e. that

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[31] The neocortex is the part of the brain where conscious thought takes place. Its proportion to the total brain volume is significantly larger among primates than other mammals. Dunbar (1996:62).

[32] Evidently, language is a prerequisite for the development of these institutionalized relationships.

[33] Olson (1965) is the classical reference, but see also Olson (1993) for an intriguing application on the collective good of a peaceful order.

humans are able to exchange reciprocal acts in small gatherings without necessarily being related. However, based on what we know about the human brain, the Dunbar/Binmore theory helps us understand how humans actually behave in relation to relatives and strangers. On the other hand, the theory of collective action helps us understand why such a behavior should be expected to survive the test of evolution. Now, from this perspective, we can see market institutions as correspondents to reciprocity-guided norms. The latter ensure a fruitful exchange of goods and services within the family circle and thereby an efficient division of labor.

We may perhaps further enhance our understanding of these matters by bringing in Hayek (1973:45) and the concept closely associated with him – spontaneous order.[34]

> The question, which is of central importance as much for social theory as for social policy is thus what properties the rules, must possess so that the separate actions of the individuals will produce an overall order. Some such rules all individuals of a society will obey because of the similar manner in which their environment represents itself to their minds. Others they will follow spontaneously because they will be part of their common cultural tradition. But there will be still others which they have to be made to obey, since, although it would be in the interest of each to disregard them, the overall order on which the success of their actions depends will arise only if these rules are generally followed.

In my interpretation, the first kind of rules Hayek refers to is those guided by self-interest, such as the desire to eat when hungry, drink when thirsty, rest when tired or to prefer more to less (see quotation below). The second kind of rules corresponds roughly to those guided by reciprocity and concerns our behavior in family-like situations. The third kind of rules govern how we behave with strangers and is perhaps most clearly exemplified by the law, although we could say that all kind of rules that we consciously follow are of this third kind. In other words, this kind of rules constitutes all rules, which

we know that we can choose to violate.[35] Needless to say, the line between the different classes is somewhat vague and also different to different individuals (as demonstrated by criminals and psychopaths…). Hayek goes on to stress the importance of this third kind of rules (Hayek 1973:45):

> In a modern society based on exchange, one of the chief regularities in individual behaviour will result from the similarity of situations in which most individuals find themselves in working to earn an income; which means that they will normally prefer a larger return from their efforts to a smaller one, and often that they will increase their efforts in a particular direction if the prospects of return improve. This is a rule that will be followed at least with sufficient frequency to impress upon such a society an order of a certain kind. But the fact that most people will follow this rule will still leave the character of the resulting order very indeterminate, and by itself certainly would not be sufficient to give it a beneficial character. For the resulting order to be beneficial people must also observe some conventional rules, that is, rules which do not simply follow from their desires and their insight into relations of cause and effect, but which are normative and tell them what they ought to or ought not to do.

This is quite important. Hayek says that if people were guided only by rational self-interest, i.e. *"rules which follow from their desires and their insight into relations of cause and effect"*, we would not experience an order with the beneficial nature that we usually ascribe to the market order. For example, to make trade viable, we must honor contracts. This can not always be done through rules of the first or second kind. Instead, we need the third kind of rules, such as laws.

We are now ready to explore the correspondence between market institutions on the one hand and social and biological rules on the other. *That*

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[34] It is only Hayek's third kind of rules that are rules in the meaning of *formal rules*; the first kind of 'rules' are perhaps better understood as *natural instincts*; the second kind of 'rules' are likewise better understood as *norms of behavior*.

[35] A similar threefold division of rules is the one put forward by Smith (2001), best known for his work in the field of experimental economics: "The deep structure of human behavior falls into three interdependent categories: the internal order of mind; the external order of social exchange; and the extended order of markets.

is, market institutions restrict our behavior in voluntary exchange relations with strangers, in a way similar to how restrictions asking for reciprocity, which we habitually obey, restrict our behavior in relations with perceived relatives. These restrictions allow us to organize a division of labor on a much broader scale than could be done through reciprocity and kinship considerations alone.

4.3 Market transactions

In his pursuit of catallaxy[36], man develops institutions, in a broad sense of the word, such as law, bookkeeping, marketplaces, payment techniques, units of account and different organizational forms. These institutions are the cornerstones of the market economy, and we refer to them as market institutions. They enable us to take the division of labor further, beyond the narrow circles of kinship and reciprocity considerations.

One consequence of taking voluntary exchanges with strangers, i.e. a transaction in the vocabulary of this text, as our primary event, is that some institutions are implicitly assumed to be already in place. To make any sense, the concept of voluntary exchange must presuppose that property rights are established and generally respected, since without recognized property rights we can not define what a voluntary exchange would be. One could of course argue that property rights also are parts of the market economy and that they therefore should be explained rather than assumed within the framework. However, I am reluctant to do that, because property rights have a more crucial function than mitigating transaction costs; without recognized property rights even autarchy would not be possible. It is very doubtful that the organization of production within an autarchy unit could be properly described in terms of transactions without stretching the meaning of

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Each forms a complex self ordering system governed by endogenous rules reflecting individual and species experience, and biological/cultural evolution"

[36] Hayek (1976) argued that we should reserve "economy" to describe the deliberate arrangement of resources, and that "catallaxy" be used to describe the market, the complex web of relations that connect economies. The term is applied by economists who hold that economics should aim at the *act of exchange* rather

transaction very far away, from how it is commonly understood. Thus, if the market economy is understood as a way to organize transactions, what goes on under autarchy could not be described as a market activity.

When we move from a state of autarchy to an exchanging (market) economy, small *uniform societies* start trading with each other. We say uniform societies because it is not exactly individuals that employ autarchy, but small groups of individuals, which already have developed a division of labor within the group. In these groups – usually families or tribes – cooperative solutions are secured by reciprocity or kinship considerations, i.e. Hayek's first and second rules.

Transaction costs

Now that we have discussed how *transactions* are understood here, we ought to discuss also the concept of *transaction costs*. It is firmly associated with Ronald Coase, who describes it as *"…cost to using the price mechanism"* (1937:390). From Coase's discussion, Carl Dahlman (1979:148) has elaborated a functional taxonomy in which three categories of transaction costs can be distinguished: search and information costs, bargaining and decision costs, policing and enforcement costs. I would like to add that the words themselves imply a distinction too: "transaction" refers to certain situations of human interaction. That is, while a purchase at a supermarket is a transaction, this is normally not the case when you exchange benefits with your parents or children. Just a little bit of introspection is required to see this. You do exchange benefits with your children: on the one hand, you provide them with housing and meals, while on the other hand, you have the pleasure of watching them grow up and in time, they may even grant you grandchildren. However, I seriously doubt that you would call such an exchange of benefits transactions. In short, we ought not to stretch the meaning of the word transaction too far from how it is commonly understood, at least we will not do that here.

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than the *act of individual optimization*; Buchanan (1964) contains a widely

To sum up this discussion, we can say that transaction costs are costs associated with voluntary exchanges in situations where neither inclusive self-interest nor reciprocity is necessarily enough to induce the transaction participants to commit themselves to honest behavior. We could also call this transactions between *strangers*, or people who perceive themselves as strangers.

Even in trade between strangers, exchange may still be possible without applying Hayek's third kind of rules, i.e. what we call market institutions. In some very simple cases such as direct barter, where two goods with immediately recognizable quality and value are traded, exchange leaves no room for opportunistic behavior and is therefore straightforward.[37] Another way to put it is to say that if property rights could be perfectly *delineated*, there would be no transaction costs. Yoram Barzel (1989) has developed transaction costs economics along this line. If we are able to speak about particular rights instead of goods or services, which in fact are bundles of rights, a more precise analysis can be done. However, to our purposes, I do not find this higher degree of precision necessary, although it is perfectly consistent with the analysis carried out here. Markets where goods with immediately recognizable quality and value are traded have also been categorized as self-enforcing markets. These markets require nothing more than the potential gain from exchange and the physical possibility for exchange. Mancur Olson (2000:174):

> The argument here is that some types of markets regularly emerge whether or not the participants have anything in common, and sometimes even when participants have antipathy toward one another. These markets emerge spontaneously and some of the are literally irrepressible. I call them *self-enforcing* markets.

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recognized statement of this opinion.

[37] Williamson (1985). The term opportunistic behavior describes man's tendency, in contractual relations, to take advantage of a superior position concerning information, skills or whatever factor that is relevant to their relative strength.

These markets do not have to exclude transaction costs. On the contrary, the transaction costs can be quite high. Nevertheless, if there is enough to gain from an exchange, i.e. if there is a sufficiently high quasi-rent to appropriate, it will take place. Neither is it true that these markets are independent of institutional arrangements; they will be different under different sets of institutions. The point is that they need no supporting institutions to emerge; they do not need what we have labeled Hayek's third kind of rules.

We will use the time dimension to see why some transactions are possible in the absence of institutions that reduce transaction costs, while others are not. In our example above of pure barter, costs for enforcing the transaction are low due to the transaction's *double simultaneous* character. The label - double simultaneous character - refers to the fact that both *payment* and *value evaluation* is completed instantaneously. For a transaction of double simultaneous character, only property rights have to be recognized. However, transactions, in which payment is immediately secured and the value immediately recognized are very rare in modern society, both non-simultaneous payment and non-simultaneous quality evaluation is standard, both naturally following the division of labor. With the emergence of a developed division of labor, producers and consumers become increasingly separated both geographically and in their knowledge of the quality of a product.

If we see transactions in this way we infer that *transaction costs are coupled with the time dimension* – without any *sequentiality*, a transaction does not have any transaction costs. Payment becomes an issue first when there is sequentiality in the exchange of benefits, and the same holds for value evaluation. By *sequential transaction*, we refer to any transaction, or exchange, in which not all duties, by both parties, are fulfilled at the moment of transaction. The term *sequential transaction* is more general than the term *sequential contract*, since for the latter we demand that the nominal price is predetermined.

This suggests another way of logically distinguishing between two major groups of transaction costs: costs for securing payment and costs for finding out the value of the traded products. Finding out the value, in turn, involves both finding a 'proper' value of the products, given their quality, and finding out their quality.[38]

4.4 Payment in sequential transactions

Let us begin by considering the general nature of payment issues in a non-monetary economy. Consider two agents who are contemplating an exchange of services in a mutual attempt to increase their welfare. Let the agents be, say, a dentist and a barber, so that it is clear that they can not exchange their services simultaneously. If they were members of the same uniform society, they simply would have trusted each other to continue the interchange of services, and they would have experienced an increased welfare. Nevertheless, for each of them, it would have been better to receive the other's service without producing anything in return. Therefore, there is always an incentive for cheating, and as strangers to each other, they can not know for certain whether the other is reliable. There is always the possibility that the agent who is second in turn to *perform* his part of the exchange will *defect*. If we see the situation as a one-shot transaction, we can interpret it as a version of the prisoner's dilemma, in which a social optimum is reached when both cooperate, while the dominant strategy for each is to defect. It is a problem since they can not commit themselves to perform. We can discern four, more or less distinct, ways out of this payment problem. I will give a brief account of them here and in the following chapters, I will consider one of them in more detail since it is the one we need to analyze our chosen subject matter – money.

First, if the game is not of a one-shot character, rules of the third kind may be superfluous. In an enduring relationship, self-interest may be

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[38] In the absence of a better word, we use quality to refer to more features than it is normally considered to cover. Finding out the quality of the counterpart's goods

sufficient to motivate the agents to play tit-for-tat. The key is that the lasting character of the relationship provides the principal with the possibility to punish the agent if he fails to perform. Much has been written on this subject, both in game theory[39], political science[40] and in comparative-institutional analysis – in connection with incomplete contracts and hold-up problems.[41]

Secondly, the transaction could be incorporated into a hierarchical setting with its own system of punishments and rewards, the firm being an obvious example. This way to overcome transaction costs is associated with bilateral contracting and has been extensively examined within the comparative-institutional framework since Coase' seminal article 1937, "The Nature of the Firm", e.g. in Oliver E. Williamson (1985).

Thirdly, one could rely on a legal system to enforce the contract in case the counterpart would defect. In some cases, the parties could rely on the legal institutions to enforce payment in accordance with the contract. We said before that to be able to discuss the market economy in a meaningful way, we have to presuppose, at least, a minimal state, and in particular, that property rights are recognized. As Olson (1993:567) has forcefully argued, not even autarchy should be expected in the absence of peaceful order:

> …no society can work satisfactorily if it does not have a peaceful order and usually other public goods as well. Obviously, anarchic violence cannot be rational for a society: the victims of violence and theft lose not only what is taken from them but also the incentive to produce any goods that would be taken by others. There is accordingly little or no production in the absence of a peaceful order.

Accordingly, we can assume that before anything with the slightest resemblance to a market transaction is conducted, a power is already in place that secures at least some property rights. A voluntary exchange is of the character that both the promisor and the promisee ex ante prefer a situation

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involves e.g. finding out that the quantity is correct.

[39] See e.g. Fudenberg and Maskin (1986:533-554).

[40] Cf. Axelrod (1984).

[41] See e.g. Hart (1995).

where the promise is enforceable ex post, to the case of not being able to carry out the transaction at all. Obviously, one way to make the promise enforceable would be to ask the power that enforces property rights to enforce contracts about sequential transactions as well. Indeed, the efficient enforcement of promises/contracts seems to be an important factor in order to explain the main features of modern contract law. A whole branch of economics has evolved around this subject, now known as *Law and Economics* and it is by now a firmly established but still expansive field of economics with its own textbooks. For more on the specific subject of enforceability of contracts, see e.g. Robert Cooter and Thomas Ulen (2000:184–223).

Lastly*, the character of the transaction could be transformed from sequential to simultaneous.* Since the sequential character is the reason why the transaction is vulnerable to fraudulent behavior, an apparent way to avoid transaction costs would be to restrain from engaging in sequential transactions. It is obvious that it would be beneficial if one were able to obtain the advantages from potentially beneficial exchanges without having to expose oneself to cheating. Indeed, this is an important theme in a market economy; many middlemen could for example be viewed as devices for transforming sequential transactions to simultaneous. I think this way to overcome transaction costs is vastly important in reality, but at the same time perhaps the least explored by economists. Rather than finding a solution to a game where trust is needed to obtain all the benefits from an exchange, man has found ways to change the game into one where there is less possibility of cheating. In this category, we find, for example, all kinds of payment techniques. The fact that the use of payment techniques has this character is so elementary that it is easily overlooked. When you perform a service to a stranger, you do not have to worry about whether he will perform something for you in return (or do a service to a third party who in turn will do something for you); You only have to make sure that he will pay you, either immediately before or after your action. Still, there is a small possibility for cheating, but much smaller than if you had no access to a payment

technique. The principal difference between this way of solving incentive problems and the others is that it directly attacks the possibility of cheating rather than changes the expected value of cheating.

4.5 Costly value evaluation

There are two main problems concerning the evaluation of offered goods or services. The supplier often has an informational advantage concerning the quality of the product and therefore, there is a possibility that the supplier's testimony about the quality is false.

The other problem is that of finding a *proper price* of the product, given the quality. To know in a particular situation whether a price is proper or not is to know one's opportunity set, i.e. *both* the price of such a product if bought elsewhere and the price on other products one desires. Obviously, solving this problem is one of the more apparent accomplishments of the price mechanism; it provides market prices on all kinds of products that reveal all the necessary information about the product. However, it is just a metaphor for what is really going on. We will discuss what market institution makes market prices possible and how this is done.

Product quality

The problem of asymmetric information about the quality of a product is central in a market economy and comes as a direct consequence of the division of labor. We do not refer to uncertainties about the quality that are induced by nature, but to differences in knowledge about the product between the seller and the buyer. In this sense, in a state of autarchy there is no uncertainty about the quality of products. What we are looking for is the additional information, which the producer has compared to the retailer, and the retailer compared to the consumer. That is, we are looking for the kind of information about quality that can be used as an advantage. In the words of Barzel's more precise analysis, we would be talking about property rights that are too costly to fully delineate. *"Because rights to commodities are costly to*

delineate, some of the valued attributes of these transactions are subject to capture." Barzel (1989:114)

This intuitive idea of asymmetric information between buyer and seller has been explored in various fields of economics. In formalized microeconomics, it has been dealt with in the setting of the *'lemons problem'* (G. Akerlof (1970)). In institutional economics, it has been discussed in connection with *optimal financial contracts* and *capital structure.*[42] The *adverse selection* problem dealt with in connection with insurance is of a similar kind. In reality, society has dealt with the problem through the application of various methods, including standardization, the establishment of brand names and third-party monitoring.

To our purposes, a striking application of the idea is the one elaborated by Armen Alchian in his seminal article *Why Money* (1977). Alchian shows that asymmetric information about product quality is a necessary prerequisite for the use of money to emerge. In the next chapter, I will make use of Alchian's findings, but also expand it further in that I distinguish between money as a payment technique and as a unit of account.

Market price

As mentioned above, there is another problem that may hinder a mutually advantageous transaction, namely the question of what price is the *proper price*, given that quality issues have been settled. We must then start by asking ourselves what we mean by the term proper price. In the abstract, the proper price is the price that clears the market, i.e. the price at which all sellers and all buyers can carry out their transaction plans. In textbooks, rational self-interest, competitive markets and the absence of transaction costs are assumed, explicitly or implicitly, in order to arrive at such a price.

However, this does not answer our question, as we would like to know what the proper price is in a particular situation, i.e. how does one decide whether a price is proper? Individuals assess an offered price by comparing it

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[42] Cf. Dowd (1995) for an overview and discussion of this literature.

to their opportunity set. Obviously, the comparability between different transaction opportunities is of crucial importance to their possibility to get the most out of their resources. This is the perspective in which we should see the device of a unit of account. It would naturally be much easier to find out your opportunity set of transactions if prices were expressed in a common unit rather than as bilateral exchange relations. This aspect of 'money' will be used in the analysis of the role of money carried in the next chapter.

4.6 Conclusions

In this chapter, I have applied knowledge about other parts of society to shed light over some questions about the market. In particular, I have used the fact that many of the contractual problems in the market have their correspondents elsewhere in the society. Since people that act in the market are the same people that act in for example families, it is reasonable to believe that they apply conducts that has worked within the family also in market situations. More important, though, than the similarities, between family and market relations, are the differences. In the market you have to deal with strangers and this makes, especially, sequential transactions more vulnerable to fraud. A wide range of institutions has evolved in society to deal with similar problems. Of special interest to us are solutions that means that the situation is changed in such a way that the amount of trust you need to have in your counterpart is reduced. We see that payment techniques in general are efficient means to reduce the need for trust. By using a payment technique, you are able to transform a sequential transaction to a simultaneous one, which is much less exposed to fraud. The simultaneous use of both a payment technique and a common unit of account brings the additional gain of reducing the costs for evaluating the value of the traded goods.

5 Payment techniques and value measurement techniques

5.1 Outline

In this chapter, we will analyze the use of payment techniques and nominal prices/units of account as techniques to reduce the need to engage in sequential transactions during attempts to exploit the advantages of a division of labor. We will look at different kinds of payment techniques that have been used throughout history and pay special attention to the interdependence between the use of payment techniques and units of account. This will help us understand how these entities are related and perhaps more importantly how they are not. Our findings here will be important when we in subsequent chapters start sketching our theory of how a nominal price level is determined.

5.2 Money in economic theory

From Coase (1937), we know that the neo-classical general equilibrium model in the tradition of Walras-Arrow-Debreu (WAD) involves no firms. In this thesis, we will follow Coase and analyze another absent friend, namely money. There is nothing strange about the non-existence of money in the WAD model; It is a description of a static world, where all exchanges take place once-for-all. Money has no function in such a world, since the primary function of money is to solve problems of sequential transactions. The use of money is a way to solve the problem of making credible payment commitments in transactions where simultaneous exchange is impossible.

The inconsistency between mainstream microeconomics and the actual use of money in the observable world has forced economists to make some peculiar conjectures about the nature of money. Some have built models in which agents enjoy happiness from the sound of rustling notes and jingling

coins.[43] Others hold that there are certain goods or services that can only be paid for in cash, perhaps inspired by the market for illegal drugs.[44] The peculiar conjectures underlying the *money-in-the-utility-function* model and the *cash-in-advance* model illustrate how inappropriate it is to apply the WAD framework to an analysis of money. With the WAD framework, one can adequately analyze a world with a smoothly working *price mechanism*, or in other words, a market economy with zero transaction costs. The problem is that with zero transaction costs, money would have no purpose to fill. In the real world, on the other hand, the market economy consists of a wide range of institutions, which have as their sole purpose to bring down transaction costs. Hence, it should be clear that the WAD framework is not suitable for an analysis of market institutions such as e.g. money. Steven G. Medema and Richard O. Zerbe (1998:217) put it nicely: *"A blackboard theory that assumes away transaction costs will have predictive value, but only in those instances in which transaction costs are not determinative."* That is, while there are issues that can be adequately addressed within the WAD model, issues about money are certainly not among them.

Here, we will analyze money in a framework where the driving force behind economic evolution is the division of labor facilitated by a system of voluntary exchanges, which are associated with certain transaction costs. Although the analysis is not intended to describe the actual history of the evolution of money, it relies on particular facts from history during the discussion of the characteristics of different payment techniques. Thus, by acknowledging actual circumstances, we attempt to avoid the risk of analyzing only an approximation of a society. Geoff M. Hodgson (1998:33) refers to this in the following passage:

> By confining itself to allegedly universal and ahistorical concepts, mainstream economics fails to become rooted in any specific socio-economic system. Its very generality provides limited means for an understanding of capitalism or other

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[43] Cf. e.g. Sidrauski (1967).
[44] Cf. e.g. Clower (1967)

> specific systems. Instead of attempting to confront a particular economy, or *real* object, it becomes confined to a remotely abstract and artificial *idea* of an economy, the economy in general.

The risk of ending up with a theory that can not be applied to reality when an ahistorical approach is used, is exemplified in some of the more recent attempts to incorporate money into the WAD framework. We will discuss this briefly below. Many traditional discussions on money have emphasized its function as a *medium of exchange* and especially its role in overcoming the *double coincidence of wants* problem associated with pure barter exchanges (William S. Jevons, 1875). The focus is often on the intrinsic properties of objects that make them more or less a natural medium of exchange, including properties such as relatively low storage or exchange costs (Carl Menger, (1892)). In recent years, steps have been taken to incorporate money into mainstream microeconomics along this line, and some of these intuitively appealing ideas have been formalized by the use of search-theoretic equilibrium models of the exchange process. Nobuhiro Kiyotaki and Randall Wright (1989) show how an indirect exchange with a few commodities used as money may evolve because of the usual transaction costs associated with pure barter.[45] In later papers (1991,1993), Kiyotaki and Wright attempt to explain also the holding of fiat money. In these models, fiat money arises endogenously as a medium of exchange, leading to reductions in the search and transaction costs associated with pure barter. However, since neither the possibility of money with intrinsic value nor convertible paper debt are considered, these models does not explain why fiat money is accepted in the actual world. Besides, a common problem with this class of models is the interpretation of fiat money. In Kiyotaki and Wright (1993:64), for example, fiat money is described as *"a collection of pieces of paper or certain types of seashells, for example, with no intrinsic value."* This is a troublesome interpretation of fiat money, since this kind of money has never been used in

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[45] Cf. Ostroy and Starr, 1990, for a survey of earlier work in the tradition of incorporating monetary theory into the general equilibrium theory of value.

the kind of transactions the authors are studying, i.e. transactions between strangers. In cases when seashells have been used as a medium of exchange between strangers, it has been in cultures where seashells had a consumption value and they are therefore principally not different from gold coins. To my knowledge, pure token money has only been used within non-stranger environments as a simple bookkeeping device. Fiat paper money, in practice, has never been entirely inconvertible; as a last resort, one can always pay taxes with them (as we will argue later). Consequently, since the authors define fiat money as something different to the objects in reality that we normally call fiat money, the predictions of these models have uncertain value outside the rather special economy they describe.

The absence of a double coincidence can also be interpreted as a problem of asymmetric information about trading histories. Robert M. Townsend (1989) describes a model with private information, spatial separation and limited communication, where a currency-like object – a token – and other forms of credits can be distinguished. Credits can be used among agents in a persisting relationship, i.e. among agents with known trading histories, whereas tokens are needed among relative strangers. Tokens play the role of a bookkeeping device among strangers. Townsend shows that under certain conditions, tokens will exist alongside normal credits. In his analysis, however, it is unclear why indirect exchange would not be used. Put in a historical context, it appears that his paper compares a situation of autarchy with a situation of a modern market economy with fiat money. Historically, there are in fact thousands of years between the two, and indirect exchange as well as intrinsically valuable money and convertible money have been commonly used as money in the meantime. Thus, it is not at all clear from the model if the fiat money would be held in equilibrium were the possibility of other payment techniques considered. Hence, although the model makes valuable contributions to our understanding of the record-keeping function of money (in an abstract sense), it does not explain the use of token money. Again, since the situation depicted in the model has no actual counterpart, we can not say for certain what it teaches us about reality. Richard N. Langlois

(1984:34) has claimed, in a different context, that the neoclassical logic of explanation is generally inapplicable to issues about market institutions:

> Admittedly, this is an odd sort of explanatory mechanism: rather than literally proposing a process by which the efficient result is achieved, it relies simply on showing that the efficient result is logically possible given the assumptions.

These examples of attempts to incorporate money into the WAD framework illustrate what Hodgson and Langlois warn against: ahistorical discussions about allegedly universal concepts without reference to the actual institutional settings are prone to lead our thoughts in the wrong direction.

5.3 Money - a payment technique

Money is used to settle debts incurred by e.g. purchases or a liability to pay damages; i.e. to use money is to apply a kind of payment technique. I prefer to talk about the more general term, *payment technique*, rather than money. The reason is, of course, that the term money is far from clear-cut; The nature of money has been subject to many different interpretations: *numeraire, medium of exchange, store of value, medium of account, unit of account, standard of deferred payment, standard of value* and so on. However, to avoid confusion, one should be more precise about what exactly is referred to with the term money. Although I would prefer to dispose with the messy concept of money, it is probably wise to clarify what money is, and is not, before I start my analysis.

The different roles of money?

In this section, we will consider in some depth the concept *unit of account* and its relation to the concept of a *medium of exchange*. Money is often supposed to be not only the medium of exchange but also the unit of account. However, is that actually true? The fact that it has been difficult to define money unambiguously is explained in the following way by Robert Clower (1995:525):

> Few writers seem able to avoid references to "money" that are metaphorical: comments that seem on the surface to refer to money "objects" but refer in truth to an unspecified complex of institutions associated with monetary economies.

In his account of what money has been thought to be, Clower (1995:526) states that: *"from Aristotle in the 4th century B.C., to John Hicks in 1967, no evident progress was made towards rational understanding of the nature of the 'thing' called 'money'."* Clower then quotes Hicks[46], who sums up the conventional view of money as being defined by its functions. It is a functional definition, since it defines money from its perceived functions, which Hicks refers to as threefold: *"to act as a unit of account, as a medium of exchange, and as a store of value."* One way or another, most definitions resemble the idea that money does perform these functions, most importantly the unit of account and the medium of exchange functions. It is obvious that if money in fact does not perform both these functions, then any attempt to define money under the presumption that it does fulfil both functions would be purposeless. I think this lies at the heart of the question why definitions of money have been widely unsuccessful; economists have been unwilling to reconsider in an unprejudiced fashion the idea of money as a unit of account. As the analysis proceeds, we will see that the unit of account is quite a different institution than what can reasonably be called money.

First, we need to decide what the unit of account is. Cash, for example, is undoubtedly money, but it is the unit of account no more than a measuring stick is the standard of measurement of length. I think that an analogy with physics is helpful in this case. The unit of account, e.g. the Swedish krona, performs a function similar to that of, for example, the meter, i.e. it is a standard of measurement of value, in the same sense as the meter is a standard of measurement of length. That is, we choose to define something as our unit of measurement as we defined the standard meter bar, and since 1983 the length traveled by light in vacuum during 1/299 792 458 of a second, as our unit of measurement of length. The purpose of such a

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[46] Hicks, J, (1967) "Critical Essays".

standard of measurement is that it simplifies comparisons of the length, or value, of different objects. In neither case is it possible to measure in an absolute way. To say that something is x meters long is just a statement about its length in relation to other objects. Royall Brandis (1966:120) has explored the analogy in some detail:

> We could do without a standard of length measurement although it would be very inconvenient to do so for the length of any particular distance would then have to be expressed as ratios of the lengths of all the other distances in the physical universe. This is analogous to the measure of relative values in a pure barter economy without a numeraire which is an equally inconvenient arrangement for the same reason. Thus we establish a standard of length measurement which serves the same function as a numeraire in an economic system. Our length standard does not measure absolute length but only relative length and its own length is unmeasurable. The question - how long is the standard meter bar? - is a meaningless question. Our monetary unit does not measure absolute value but only relative value and its own value is similarly unmeasurable.

That is, it is meaningless to ask what the krona's value is, since krona is the unit we have created in order to be able to measure the value of other things. Nevertheless, I would like to add that although we can not measure the standard of measurement with the things that it is intended to measure, we *understand* it in some way like that. Most people will never be able to observe the length traveled by light in vacuum during 1/299 792 458 of a second, so how do they know the (relative) length of the meter? Obviously, if you have a measuring stick that is one meter, it helps you understand how long a meter is. Otherwise, if you know that you are 1.70 meters tall, that would also be helpful to understand the length of a meter. Therefore, we should not be surprised to find that early standards of measurement were connected to objects everybody was reasonably familiar with, such as an inch or foot. The definition in itself, no matter how impeccable, is not enough to make the concept useful; we must also be able to relate it to the reality we know.

Although the analogy to measurements in physics is useful, it is not perfect. The unit of account krona is not explicitly defined in the same sense as e.g. the meter, and thus it is not quite obvious how it is defined. We do not have a formal definition of a standard of measurement for value, but that does not prevent us from finding a functional definition. We should look for our definition among all those relations that couple the unit of account with values. Such coupling is present in every contract stating a price on an item, and thus, we should expect to find our definition among them. In analogy with the case of length measurement, it would be logical to focus on the one price that does not change, i.e. the price of the medium of exchange. That is, if a tree that used to be one meter now has grown to 1.10 meters, we would say that it is now 1.10 meters, not that the meter is now longer. If, on the other hand, the length traveled by light in vacuum during 1/299 792 458 of a second has become shorter, we would, perhaps, say that the meter now represents a shorter distance than before and that this distance still is one meter. Similarly, if the value of the medium of exchange decreases in relation to the value of all other things, the price of the medium of exchange would still be one. Thus, we could state that the unit of account krona is implicitly defined as having the same value as the medium of exchange krona. As for the meter, the krona becomes meaningful first when we have measured some familiar phenomena with it. It makes sense to treat our unit of account krona as defined by its relation to our medium of exchange krona, because a contractual obligation to make a certain payment that is specified in the unit of account could always be fulfilled by paying with the medium of exchange. Although not perfect, the essence of the analogy still holds; we choose the value (length) of some phenomenon in reality to be our standard of measurement of value (length). Every distance that is just as long as the 1ength traveled by light in vacuum during 1/299 792 458 of a second is said to be one meter long and everything that is possible to buy with a one-krona coin is said to have the value one krona.

To explore the full significance of our analogy, we will consider its implications under the different regimes of gold-convertible money and fiat

money respectively. From our definition of the unit of account, it is trivially true that a one-krona coin is worth one krona, in the same sense as it is trivially true that the length traveled by light in vacuum during 1/299 792 458 of a second is one meter. Furthermore, if it is also stated that a one-krona coin always will be worth x gram of gold of a certain grade, it would also be true in practice that the unit of account krona is equal to the value of that quantity of gold. Although not formally correct, we could for all practical matters say that the standard of measurement of value, the krona, is x gram of gold. This implies that if the value of gold decreases in relation to a basket of goods, the measured value of this basket becomes higher. We can now notice a difference of major practical importance between measurements in physics and economics: while we are quite accustomed to a standard of value that changes in relation to everything else, we do not expect our standard of length to change from one day to the next. While the law of physics changes very slowly, our appreciation of goods changes more or less continually. This difference is also the main reason why we no longer have a standard of value defined in the same way as our standard of length. If the length of particular distances fluctuated as much as the value of particular items, we would perhaps define our standard of measurement of length differently too.

Let us now consider how the definition of the standard of value works under a fiat money regime. In this case, we do not have a permanent link between the medium of exchange and a certain commodity corresponding to the link between the medium of exchange and gold under a convertible money regime. As long as we have not measured any goods with our standard of value, the definition of the standard is meaningless. This is an important difference to the case of length measurement: While it may be difficult to observe the length traveled by light in vacuum during 1/299 792 458 of a second, it is still just a technical problem. In the case of a fiat standard of the measurement of value, the definition is entirely empty until we have measured some values with it. That is, if no prices were quoted in our unit of account, we could not measure any value with it. The definition alone is not sufficient for the fiat unit of account to be a usable standard of measurement,

we need to measure at least one value first. It seems that we are stuck in a circle: How can we possibly make our necessary first measurement? The point is that we can not, and indeed, have not. How, then, is it possible that the fiat type of the unit of account is completely dominant today? The answer is that these units have all inherited their meaning from previous, already established, standards of measurement. In practice it means that all items are immediately given an initial value measured in the new unit of account, proportional to their value measured in the old unit of account. The introduction of the euro is a good example. Thus, the problem of the first measurement is overcome. The primary benefit with the fiat unit of account is that it does not fluctuate with the relative value of a single good.

In accordance with what has been said, we will use the term "money" to refer to a subset of all media of exchange, namely those that are deliberately designed to be a payment technique, i.e. paper notes and gold coins are money, but not gold as such. The broader class of media of exchange, in turn, is a subset of all payment techniques, namely those that have a physical representation. The last category of payment techniques includes those that can be characterized as services and they will be treated under the heading of middlemen. While other classifications are possible, I think this provides a suitable basis for a sound understanding of the role of different payment techniques in different societies and subsets of societies.

5.4 Payment techniques as a substitute for trust

The division of labor, understood as the specialization in production associated with extensive trade, is one of the most fundamental factors behind economic progress, and it is a decisive factor behind the rise of the market economy. To harvest the advantages of specialized production, it is necessary to trade different goods and services for each other. To carry out trade one must, among a host of other things, be able to make reliable payments. In the rare situations where an immediate exchange of goods with immediately recognizable quality is possible, payment is no issue. However, these situations are very rare indeed, and thus, reliable payment is a crucial

issue to the growth of a market economy. Man will try to organize a division of labor in order to obtain potential benefits from it. The complex of institutions - e.g. bookkeeping techniques, payment techniques, measuring techniques and firms - that we refer to as the market economy has emerged as one way to organize the division of labor.

Let us return to the two kinds of relationships that were mentioned before, *strangers* and *non-strangers*. In non-stranger relationships, there is no scope for opportunism, either because fraud is observable and would be punished[47], or because the agents belong to the same social unit as e.g. a family or a tribe and therefore are quite willing to exchange beneficial acts. A functional definition of a transaction follows naturally from this division of relationships: *a transaction is an exchange between strangers*. Exchanges between strangers are associated with transaction costs because of potentially opportunistic behavior. Recall Hayek's third kind of rules, rules that we do not necessarily obey spontaneously. These rules only come with a cost, for example the cost of drawing up enforceable contracts, and if required, maintain one's rights with the help of the power. The costs come partly from efforts spent on activities to secure a payment and partly from efforts spent on an evaluation of the value of traded goods. Transaction costs, thus comprehended, come with the division of labor, since they are costs that exist in a catallactic economy but not in an autarchy. Now we can interpret the market as the complex of institutions that has emerged as a way to economize on transaction costs. All transaction costs are not directly related to the problem of trusting a stranger. There are also considerable transaction costs of a purely practical nature. With the specialization of production comes an increased need for transportation of both information about goods and the goods themselves.

As we have mentioned before, rules are not the only way to deal with the problem of transaction costs. Another way is to neutralize the problem by

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[47] Under such circumstances, trading life would be one long repeated game with an indefinite end. In such games, it is reasonable to believe that a co-operative strategy will emerge as norm.

technical means, e.g. by transforming sequential transactions to simultaneous transactions. We will now focus on one such technique, namely the method of settling debts with some kind of payment technique. The application of specialized payment techniques comes so natural to us today that it is hard to see the fundamental problem that it solves. Therefore, I think it is appropriate with a little repetition on this issue. One has to imagine what trade would have looked like if no method of payment were available, not even indirect exchange. In that case, one would either have to exchange goods directly in a pure barter deal or engage in a sequential transaction, possibly involving several persons.

Different payment techniques will be discussed under three headings: *pre-monetary exchange* including barter and indirect exchange, *money* including gold coins, convertible and inconvertible debt notes and cash cards, and lastly *middlemen*, including different kinds of bookkeeping records. The purpose of using the term middlemen is to emphasize its character of service rather than object. The state of pure barter will function as a frame of reference and the different payment techniques will be discussed in relation to it. Each payment technique will be analyzed according to three main issues: its relation to the *payment issue*, its relation to the *quality evaluation issue* and its relation to the *unit of account*. The interactive nature of the evolution of payment techniques on the one hand, and the unit of account on the other, will be highlighted. Finally, acknowledging that the evolution of society is history-dependent, the institutional prerequisites for each payment technique will also be discussed.

5.5 Pre-monetary exchange

There is a fundamental difference between societies using a deliberately designed medium of exchange and societies, which do not. As we will see, the use of a deliberately designed medium of exchange requires a higher level of trust in society. This may seem counterintuitive but is based on the fact that media of exchange not deliberately designed as such always trade at their consumption value, i.e. their value in their second-best use is almost the

same as their exchange value. This is not necessarily true for deliberately designed media of exchange, which trade for more than their value in their second-best use. Even gold coins often varied somewhat in gold content, and so an element of trust in the issuer is present, something which of course is ever more relevant when we consider paper money. Under this heading, we will treat payment techniques that do not involve deliberately designed media of exchange.

Barter

The basic form of exchange is pure barter, basic because it only involves goods, the features of which form the basis for the mutually beneficial exchange. Therefore, barter is potentially more utility-improving than any exchange involving an intermediary payment technique, since the use of a payment technique will always use up some of the advantages from the exchange. From this we can conclude that there must be some rather substantial costs involved in barter, since almost all exchanges are in fact conducted through the use of an intermediary payment technique. *Some* of these problems are often discussed under the label of *'a double coincidence of wants'* problem, roughly meaning that through barter, goods can not be allocated as efficiently as under a Walrasian auctioneer.[48] There are several reasons why this is the case, one being that goods can not be efficiently allocated since bilateral pure barter can not achieve all possible allocations. There are many other problems as well: how and where to find a potential trading partner is a substantial problem; limited divisibility is another; still another is the fundamental impossibility of immediate exchange of some services, something which we have discussed earlier – a barber can not cut the dentist's hair while simultaneously receiving dental care from him.

These are all *payment* problems following the division of labor. There is one more type of problems following the division of labor, namely problems

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[48] I say 'roughly', since the notion of the double coincidence of wants is much older than the concept of a Walrasian market.

concerning *quality evaluation*. During autarchy, each agent has a good idea of the quality of the goods he consumes, simply because he has produced them himself. When production gets specialized, this familiarity with the goods decreases, partly because new goods become available, but also because the familiarity with the 'old' goods gradually disappears. We see now that pure barter not only requires a double coincidence of wants in its broadest sense, but also *a double coincidence of familiarity with the goods*.

Indirect exchange

The custom of indirect exchange mitigates two of the problems associated with pure barter: Firstly, it increases trading opportunities, since the double coincidence of wants problem is reduced to a *single* coincidence of wants ditto. A single coincidence is to find someone who has the goods I am looking for; a double coincidence is to find someone who has the goods I am looking for *and* who desires the goods I have to offer. Secondly, in many cases, it also resolves the problem of securing a payment, since it enables simultaneous transactions instead of sequential transactions. Essentially, these are two sides of the same problem. The *double* coincidence of wants problem would be much less problematic if sequential transactions were not problematic. If sequential transactions were not costly to handle, you would be able to make a purchase only by finding someone who supplies the goods you desire, i.e. what I have called the single coincidence problem. You and your trading partner could set up a contract that says that you will pay him when you have sold your own production. However, in the real world, sequential transactions are costly to handle; you either have to trust your counterpart and thus face the risk of being cheated, or you have to spend resources on drawing up and enforcing a contract.

In more valuable transactions, some of the institutional devices mentioned earlier may solve the problem, such as writing detailed contracts or using the legal system to monitor the parties. One party could also offer some collateral

as hostage.[49] In many transactions, however, the cost of enforcing them would outweigh the gains from the exchange. In the case of pure barter, the mutual and simultaneous deliverance of goods solves the problem of securing a payment. However, it requires not only a double coincidence of wants but also a *double coincidence of exchange*, i.e. that the exchange in its entirety can be performed instantaneously. That is, most services can not be exchanged in a pure barter fashion, since they often take some time to fulfil. The impossibility of instantaneous exchange is most obvious in a transaction where two producers of different services are to exchange services. Recall our earlier discussion of a barber and a dentist, for them it is physically impossible to exchange services without creating a debt/debtor relation; one of them has to perform his side of the transaction first and then hope that the other will fulfil his part.

All kinds of payment technique have this one thing in common: they transform sequential transactions into simultaneous transactions. They make it possible for both sides of a transaction to perform simultaneously, and thus help reduce the number of transactions that give rise to debt/debtor relations. The practice of indirect exchange is one such payment technique. It means that the buying side of a transaction uses some intrinsically valuable and tolerably durable, divisible and portable good as payment. The selling side accepts the payment although he does not want to consume it at the moment. However, he decides that he will either consume it later or be able to use it as payment in another transaction. Hence, by transforming the sequential transaction to a simultaneous transaction where *trust* is not required, the agent solves the original problem of making credible commitment to comply with the, implicit or explicit, contract. The technique of indirect exchange can be seen as the simplest form of payment technique. Unlike all other payment techniques, it does not involve any, for payment purposes, deliberately designed goods or services.

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[49]Cf. Dowd (1996). See especially chapters 2, 3, 4 and p. 155.

Initially, the medium of exchange would most likely be goods that the seller already has a stock of and that the buyer accepts without having decided yet if he will use it as medium of exchange, or perhaps consume it himself. A good example is the Aztec' use of cacao beans as a medium of exchange. This particular example also illustrates a fact that seems partly forgotten today: What we call *money with intrinsic value* is only intrinsically valuable within a specific cultural context. In the case of cacao beans, it is illustrated by the reaction of the first European pirates who captured a ship carrying cacao beans: they thought the cargo was rabbit droppings and threw it overboard.[50] This should be kept in mind since it reminds us that the line of demarcation between intrinsically valuable money and intrinsically worthless money is less clear-cut than it may seem at first sight.

Over time, a few goods will be discerned as the most *salable*, as described by Menger (1892: 250-252), in a self-reinforcing process. A salable good should not only be appreciated as valuable in a society, but also divisible, durable and portable. Durable and salable in combination means that it is a suitable store of value. In addition, it should present a modest 'lemons' problem; i.e. its quality should be relatively easy to evaluate.[51]

The emergence of a unit of account can be told as a corollary to the story of how different payment techniques evolved. Before indirect exchange, in the pure barter state, no explicit unit of account is employed, relative prices are agreed upon in every transaction. When indirect exchange has become customary, a vast majority of transactions involve a medium of exchange, such as gold or silver. This implies that all other relative-price relations gradually will disappear from people's consciousness. Hence, relative prices become prices expressed in goods accepted as media of exchange, out of which the same number of a unit of account may be distinguished. The emergence of a unit of account stimulated by the emergence of indirect

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[50] Cf. Weatherford (1997) for a description of cacao beans as a medium of exchange in the Aztec culture and for further references on the matter.
[51] Cf. Akerlof (1979) about 'lemons', and Alchian (1977) about the significance of an asymmetric distribution of information about a good's quality.

exchange has in turn repercussions on the medium of exchange. The habit of expressing prices in the medium of exchange will provide incentives to further decrease the number of commonly used media of exchange, since traders would then need to know fewer prices. Thus, to reduce the problem of securing payment in an ideal way, there would be very few, maybe only one, medium of exchange, and the unit of account would be a specified amount of the medium of exchange, which hence would serve as the medium of account (MOA). We can see the final stage as a state where pieces of gold, silver and copper are employed as media of exchange and where there are units of account specified as a certain weight of each of these metals. However, even in this ideal state of indirect exchange, there would still be a considerable problem of evaluating the quality of the traded goods. It fact, it would be greater than in pure barter, as demonstrated by Alchian (1977). As long as one has to pay in order to evaluate the quality of the medium of exchange, the use of it would add to the total cost of evaluation. More on this will be said in the next section.

5.6 Money

The problem concerning the evaluation of the overall quality of the offered good or service is a problem of asymmetric information. The asymmetry in the distribution of information between the agents arises because of the fact that the seller is an expert at evaluating the value of his own goods, whereas the buyer is not. This asymmetry is an unavoidable consequence of the division of labor. Thus, there may be an incentive to sellers to produce low-quality goods and attempt to cheat uninformed buyers, assuming that low-quality goods are cheaper to produce. Therefore, the buyer has to take on value-consuming examinations of the seller's goods. This applies both to the primary goods *and* to the medium of exchange. The examination of the quality of a gold nugget, for instance, was associated with great effort and used up a great part of the profit from the trade.

The common feature of different kinds of *money,* i.e. deliberately designed media of exchange, is that they are denominated in integer numbers of the

already established unit of account and that the problem of evaluating the value of the medium of exchange itself is thereby reduced. A gold coin e.g. is struck with a number or symbol intended to indicate its gold content, with gold serving as MOA and a specific weight of gold serving as unit of account. In relation to the custom of indirect exchange, money brings no further benefits to the double coincidence of wants problem, i.e. what I have called the single coincidence of wants problem remains. Neither the problem of finding a prospective trading partner nor the problem of finding out the quality of the *primary* goods is resolved by the use of money *by itself.*

A standardized medium of exchange with intrinsic value, and convertible debt notes

Gold, silver and copper coins are examples of what we call standardized media of exchange with intrinsic value. The decisive characteristics of them are (a) that they contain a valuable metal and (b) that the content of that metal, regarding weight and pureness, is guaranteed through a stamp on them. Hence, it is clear that their purpose is to overcome the problem of evaluating the quality (and quantity) of the metal itself. In order for the trader to make full use if its benefits, however, the coin must be designed in such a way that it is hard to tamper with and its issuer must be trusted. To refer to our discussion above, the coin is intrinsically valuable at face value only within a certain social context. That is, only those who trust the issuer (or someone else who guarantees the coin's value) will accept it at face value.

Similar to the payment technique of indirect exchange, the use of intrinsically valuable money is associated with an opportunity cost because the metal has a consumption value. Payments with this technique are consummated when the buyer of the goods or services hands over coins to the seller. It is a very straightforward and simple payment system, but as trade grows, it becomes increasingly expensive. This is because gold coins are costly

to store and handle since they are heavy to carry around and exposed to theft.[52]

Convertible debt notes, or paper money, are similar to gold coins in many ways: the unit of account is the same, they solve the double coincidence of wants problem to the same degree and they do not, by themselves, settle the problem of finding out the quality of the traded goods. The difference between them lies on another level, i.e. in the way they obtain their value. Gold coins obtain their value from a trust in the issuer regarding the gold content, combined with the fact that gold itself is desirable. Convertible debt notes obtain their value from a trust in the issuer regarding the possibility of redeeming the notes in gold. This difference has to do with the institutional settings for each payment technique. Gold coins and other coins were minted by the State. The ancestors of King Croesus of Lydia are believed to have produced the first coins around 640–630 B.C.[53] According to Robert M. Cook (1958), these coins were introduced to pay mercenaries. Colin M. Kraay (1964) and Hicks (1969), propose that governments minted coins to pay mercenaries only in order to create a medium of exchange for taxes.[54] Without a convenient medium of exchange, a wide range of production would be difficult to tax. To accept tax payments in kind necessarily results in taxes floating in at irregular intervals – and some of them will be perishable goods.

I think these assessments come close to the core of the issue of coinage and we will find the answer by asking ourselves what is so special about States. The special feature we are looking for here is that *all members of a society are actually or potentially indebted to the State*, because of the State's possibility to levy taxes. Presumably, you are more likely to accept, at face value, coins minted by someone you owe money to, than coins minted by someone else. You do not have to worry about whether anyone else would accept them, because you presume that the issuer of the coins will accept them to settle your debt. This idea is reinforced by the fact that for many

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[52] See Dowd (1996:10).
[53] Cf. Weatherford (1997)

centuries, produced coins varied between five and ten per cent in weight, and nonetheless, they were accepted as of equivalent value.[55] This emphasizes that the stamp on the coin did not guarantee the actual content of gold but rather at which price the issuer was willing to accept it as a (tax) payment. Again, we can se that the line of demarcation between media of exchange with intrinsic value and those without is not that sharp.

While coinage was a governmental activity, the introduction of debt notes was a private sector enterprise. As trade grew, so did the possibility of basing commercial relationships on trust due to the hostage effect. With money came an early form of marketplaces where merchants settled down.[56] According to John Weatherford, marketplaces, with numerous small retailers, appeared for the first time in Sardes, Lydia at the end of the 6th century B.C.

Presumably, a merchant who works permanently in the same location could charge a higher price for goods, the quality of which it takes some time to assess, as compared to a traveling merchant. The point is the repeated nature of his transactions with the inhabitants in the region. The character of the relation between buyer and seller starts to change towards a no-stranger relation and thereby social norms based on reciprocity become increasingly relevant.[57] With time, by routinely assessing the trustworthiness of retailers in their daily life, the public will become accustomed to recognizing signs of trustworthiness. People will develop a *tacit knowledge* for judging trustworthiness, which in turn paves the way for trust-intensive money. We could say that the ever-growing experience of buyer/seller relations helps people develop what Donald (Deirdre) N. McCloskey (1994) has called bourgeois virtues. Now, in a society where people know how to distinguish between those who are trustworthy and those who are not, there is probably a fairly small cost for trusting a paper note issuer. Paper note issuers will use

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[54] Cf. also Goodhart (1998b) and Redish (1992).
[55] Cf. Melitz (1974).
[56] Cf. Weatherford (1997:61).
[57] By the way, we could observe that, in modern society, the alienation of buyer and seller has increased again and reciprocity-based trust is replaced by *sunk cost* investments in brand names and goodwill.

similar signs of trustworthiness as those used by successful merchants, for example investments in permanent facilities. They will also build personal relations, and, of course, earn a reputation of honesty by actually making honest business. Personal relations are very important since we as human beings have an intuitive tendency to regard a person with a familiar face as someone inside our reciprocity sphere. We try to identify our relatives based on their social relation to us.

Eventually, people increasingly switch from gold coins to paper notes that represent legal claims to gold coins. When the trust problem is resolved, or at least considerably reduced, paper notes offer the user the same advantages as gold coins and the additional benefit that they are easier to handle and store. To the supplier, however, notes offer the decisive advantage that they are considerable cheaper to produce – and increasingly so as trade grows. This advantage benefits the public also, since they can place gold holdings with a banker in exchange for convertible paper notes and hence earn interest on their savings.[58] The banker is willing to pay interest since he, because of the law of large numbers, does not have to keep 100 percent in reserves and thus is able to provide credit facilities with a higher interest rate.

Nominal debt notes and cash cards

Nominal debt notes, or fiat money, are intrinsically worthless pieces of paper representing a claim for its nominal value to the issuer. The formal difference between a convertible debt note and a nominal debt note is that while the former represents a legal claim to a certain commodity, i.e. gold coins, the latter only represents a legal claim to a nominal value. The issuer of nominal debt notes does not have to redeem them in anything but new notes of the same kind. Instead of being legal claim to something in particular, they are *legal tender*. However, as we know, e.g. from the former Soviet Union, legal

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[58] Dowd (1996) suggests that initially, *goldsmith* bankers would charge a fee for storing and protecting gold coins and issue receipts, which gave the depositors the right to demand their gold back. These receipts gradually started to circulate as

tender is not enough to buy all goods. In civil society, it is not possible to force an unwilling seller to accept a certain payment technique only by referring to its status as legal tender. It is the special combination of a certain payment technique having legal tender status *and* the fact that most citizens are indebted to the issuer who makes nominal debt notes a generally accepted payment technique. Nominal debt notes are always issued either directly by the government or by a subsidiary to it, as a central bank. Hence, holders of the money expect the State to accept their own debt notes as payment of taxes and we can hence easily understand why they accept these notes in exchange for real goods. It is only required that the holders expect the State to accept the notes for at least as long as they intend to keep them.

Regarding the problem of securing payment and evaluating product quality, nominal debt notes entail no difference compared to convertible debt notes. The reason for its introduction must be sought elsewhere and will probably be found in the extra seignorage that it allows the government to obtain.[59]

Regarding the unit of account, however, the transition to nominal debt notes implied an important change. As long as gold convertibility was retained, the unit of account was tied to gold by the law of no arbitrage. However, it is important to understand that, although the unit of account derived its value from a fixed relation to gold, people did not use this relation to judge if the price of a good was fair. When we walk around in a grocery store and are confronted with a new brand of olive oil, we do not evaluate its value for money by comparing it to the amount of gold coins we could get for the same price. Rather, we compare its price to the price of brands of olive oil with which we are familiar. The point is that at this moment it is much more important that our debt notes are redeemable at fixed rates for all items in the grocery, than that they are redeemable for a certain amount of gold coins. This has two reasons: first, because it is more relevant to the actual choice we

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money and thus, a proportion of the gold was never circulated. This lay the foundation for fractional reserve banking.

[59] Cf. e.g. Goodhart (1998b).

face, i.e. in a grocery store, our intention is to buy food, not gold; secondly, because the debt notes' convertibility into gold is only valuable to the extent that we believe that gold can buy other goods, such as food. Most people are not good at evaluating the value of gold in its best opportunity use, i.e. its use in jewelry or its industrial uses. The average consumer knows the value of gold because he knows the prices of staple commodities as expressed in gold. This implies that people know the value of the unit of account through prices on items in their shopping basket, rather than through the value of gold.

We can generalize what we have just said: as long as there are fixed prices on items that you are familiar with, the fixed relation between the unit of account and gold brings no additional information value about the real value of the unit of account. On the other hand, as a theoretical matter, when you negotiate a long-term contract, you may know very little about the real value of the unit of account at the end of the contract and hence be forced to use your expectations on the relative price between gold and the goods in question. Thus, it is only in long-term contracts that the unit of account is determined differently under the fiat money regime than under the convertible money regime. In subsequent chapters, we will discuss at length how long-term expectations under such circumstances are determined.

Although we will treat the determination issue in later chapters, there is one point that must be stated here regarding the relation between the unit of account and central bank liabilities. A popular idea among monetary theorists is that central bank liabilities determine the value of the unit of account. For instance, Woodford (2000) writes:

> From whence could any special role of the central bank in equilibrium determination derive? The answer is that the unit of account in a purely fiat system is *defined* in terms of the liabilities of the central bank.

Moreover, on the next page he accentuates the idea by stating:

> But the market value of a dollar deposit in such an account [settlement account at the central bank] cannot be anything

> other than a dollar --- *because this defines the meaning of a "dollar"!*

How could that be? What would a promise to pay back a certain number of dollars be worth if no prices were quoted in dollars? No one would ever get the idea of issuing nominal debts in terms of dollars, pounds, krona or whatever, if the unit had not already been established as a unit of account. Paper money, and generally all kinds of money with a face value that is higher than its intrinsic value, presupposes an already established unit of account. This is most obvious in the case of inconvertible money: if the dollar were not already established as a unit of account, how would it be possible to put these notes into circulation? Legal tender would not be enough, because it has no meaning when no prices are quoted in that unit. It should be clear that to issue inconvertible money, it is essential that there are other contracts which determine the 'conversion rate' between the unit and its real value. Paper money that is convertible into gold coins would never have been issued if gold were not already recognized as a measure of value. Similarly, fiat paper notes would never have been issued were not the nominal unit of account recognized as a measure of value.

Close substitutes to paper notes, as cash cards and different kinds of *e-wallets* are equivalent to cash in most, economically relevant, aspects – the differences are mainly of technical nature. Obviously, cash cards require a much more advanced state of electronic development and they are associated with higher costs because they presuppose that the payee has the relevant equipment. On the other hand, they promise lower costs for shops and banks because of the reduced risk for robbery. Regarding our main issues, securing of payment, evaluation of quality and the unit of account, cash cards are equivalent to cash.

5.7 Middlemen

Payment techniques do not have to involve a physical medium of exchange. Some of the most important payment techniques, both historically and in contemporary society, take the shape of services rather than goods. In fact,

the single coincidence part of the double coincidence of wants problem can not be resolved without the service of middlemen. The same is true for the quality evaluation problem. This is the central message in Alchian's paper "Why Money" from 1977 – perhaps the single most important writing on money in the twentieth century.

Merchants

From our discussion, we can see that the problems of a single coincidence of wants and quality evaluation are not resolved through the use of any medium of exchange so far discussed. In his paper, Alchian (1977:133) demonstrates the conjunct function of money and middlemen in order to overcome the problem of asymmetric information regarding both of these problems.

> Ignorance of availability of goods and of their terms of trade and attributes will provoke efforts to reduce that ignorance in order to achieve more trade. Several institutions have evolved to reduce costs of reducing that ignorance: money; specialist middlemen who are expert in assessing attributes of goods, who carry inventories, and whose reliability of assurance is high; specialized marketplaces; and even unemployment. This paper concentrates on the way in which that ignorance leads to the use of money and how money requires concurrent exchange with specialist, expert, highly reputable middlemen.

We have already mentioned the role of merchants and marketplaces to the introduction of convertible debt notes. The main function of these middlemen was not, however, to provide paper money, but to overcome the single coincidence of wants problem and the problem of evaluating product quality, i.e. to reduce the *ignorance of the availability of goods and of their terms of trade and attributes*. As Alchian shows in his paper, the combination of reputable expert middlemen and an easily recognizable medium of exchange considerably reduces the transaction costs stemming from an asymmetric distribution of information about product quality. Still, it is not self-evident that the same agent should perform both functions. The middleman must primarily overcome the single coincidence problem by becoming an expert on finding buyers and sellers and keeping inventory. Secondary, he can offer the

additional service of quality assurance, which will enable him to charge a higher price. However, the producer could take on this role himself by investing in a brand name – this is a better description of many of today's more alienated markets. Nevertheless, it is probably correct to assume that the first middlemen performed both functions and that it was not until later that producers took on the quality assurance role. As long as business is sufficiently small-scale, the buyer/seller relationship was not a pure stranger/stranger relation and we could therefore expect reciprocity to be an important factor in all transactions.

Alchian does not discuss different kinds of payment techniques and the only hint regarding what he refers to is the following statement: *"We mean by money a commodity used in all, or a dominant number of exchanges." (1977:133).* While this statement appears to point in the direction of gold bullion – commodity – , the paper's argumentation rather points to gold coins. From the low inspection costs he ascribes to his money, one may conclude that it can not be gold bullion. On the other hand, in the summarizing paragraph below, it is clear that Alchian imagines his money to evolve with middlemen to overcome the costs of identifying quality (1977:139).

> Costs of identifying qualities of a good are what count. If costs for some good are low and generally low across members of society, the good will become a medium through which information costs can be reduced and exchange made more economical. But it will rise only with the rise of chains of experts in various goods and commodities, who know the goods cheaply, whose reputation for reliable evaluation is high, and who, because of that knowledge and the low cost of assuring buyer, become specialist middlemen in the good both as inventory carriers and buying and selling agents.

In order to incorporate Alchian's analysis into the framework of this paper, we have to reinterpret it slightly. More precisely, we need to reinterpret it in terms of the different payment techniques discussed. In an ideal state of indirect exchange, one commodity, such as gold bullion, is used as a medium of exchange and prices are stated in terms of that commodity, i.e. the unit of account is a certain amount of gold. By itself, it helps to reduce the double

coincidence of wants problem, and with *"chains of experts in various goods and commodities, who know the goods cheaply, whose reputation for reliable evaluation is high"*, it helps to reduce the single coincidence of wants problem as well as the quality evaluation problem. We can see that an additional service – which reduces transaction costs – arises from the *simultaneous* existence of a common unit of account and expert middlemen.

Standardized media of exchange, such as gold coins, further reduce transaction costs by greatly decreasing the identifying costs of the medium of exchange itself. No quality evaluation is required since it is sufficient to read the stamp on it to know what it is worth. This, in turn, is possible because the custom of indirect exchange with only one commodity acting as the medium of exchange has made people used to thinking of prices in terms of a unit of account, rather than in terms of relative prices. This is important because it is the habit of stating prices in a unit of account and recording debt in a unit of account that together with expert middlemen enable a society to reduce the transaction costs that arise due to an asymmetric distribution of information about product quality. Thus, physical money is not necessarily required, since there are other ways to record debt.

Another very important reduction in transaction costs comes from the combination of a common unit of account and middlemen acting as market makers. This enables the establishment of market prices, something which considerably reduces the cost for assessing one's opportunity set.

An important thing to learn from this analysis is that one can not understand all benefits from a monetized economy by studying the payment technique in isolation. The benefits of reduced costs for identifying the product quality do not appear if there are not also middlemen.

Debt-recording services

Under certain circumstances, there is no need for a payment technique represented by a common medium of exchange to overcome the problem of securing a payment, since there are other ways to fulfil a debt-recording function. At a medieval trade fair in Flanders for instance, all transactions

were recorded throughout the trading period and the remaining debts after clearing, were settled only at the end of the trading period, as seen in the passage below about the fairs of Champagne (De Liebaart (2001).[60]

> The grand fairs of Champagne clearly aimed at the international businessman. The organisation of a grand fair was strict and well defined. The first week was spent setting up trading stalls along the town streets. This was followed by a ten-day cloth sale, an eleven-day leather sale and nineteen days when various other goods were allowed to change ownership. A number of days devoted to the settling and closing of all accounts ended each fair.

This method of payment, involving a high degree of sequentiality, was successful since it was easy to assess if a person behaved fraudulent within the fair and since each participant had to take part in the fair to be profitable. Although the propensity for reciprocity may be important when such a system is initiated, eventually, it was the threat of being excluded from future trade that prevented the participants from cheating and made the system stable. This example illustrates how a monetary system that essentially is a bookkeeping system could survive within an entity with sufficient internal control. The decisive factor is the transparency of actions within the particular society or part of society. As mentioned before, if an agent's performance in transactions could be identified without any costs, long-term self-interest would motivate the agent to fulfil his obligations in various transactions. The payment technique sometimes referred to as *bank money* in literature makes use of this property. It can be checks, off-line debit cards or giro systems. The middleman always offers a payment service that, compared to nominal debt notes, provides lower opportunity costs and a smaller risk of theft. The middleman specializes in the particular technique required and in monitoring the customer's payment performance. By using the middleman's service, the customer makes his actions transparent to the middleman. One

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[60] Cf. also Pohl (1994:47). For another account of the long existence of cashless subsocieties, see Origo (1957). The scope of the merchant's business had nothing

of the characteristic features of a middleman is that he is powerful enough to be able to enforce the contract in most cases, and to survive losses from possible unsolved cases. This is probably the reason why middlemen in practice act as jobbers rather than as brokers; i.e. the middlemen take on the risk instead of the payee. Furthermore, the long-term benefits from being able to use the service bring most customers' self-interest in line with an honest behavior.

Nowadays, an increasing proportion of payments is made through on-line debit cards. Theoretically, this payment technique is quite different from those using off-line debit cards. While the latter can be characterized as *trust for hire*, the former is a pure debt-recording function. Payment is completed simultaneously as the goods are handed over. In the *trust for hire* business, the middleman is a specialist both in dealing with risks of non-performing debtors and in providing the required technique. With the on-line payment technique, the middleman specializes only in the technique, since the payments involve no risk. (There are, of course, other risks involved. Payment services are often combined with credit facilities. This gives rise to another kind of risk, but that is a different issue.) What is particularly interesting about the on-line payment technique is that it highlights the fundamental payment problem that money solves, i.e. how to know if the transaction counterpart is trustworthy.

The core of payment techniques based on debt-recording, on-line or off-line, is that there is a middleman who has specialized in providing the debt-recording service to overcome problems concerning how to secure a payment. Combined with expert middlemen and a unit of account, these payment techniques overcome the problem of value evaluation, too.

5.8 Conclusions

I draw on an analogy with length measurement to explore the nature of the unit for value measurement; unit of account. As the meter is defined as

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to do with his stock of "base money". The decisive factors were his trustworthiness

the length traveled by light in vacuum during 1/299 792 458 of a second, the unit of account krona is defined as the purchasing power of the medium of exchange krona. However, one should be cautious when drawing conclusions from this analogy. Our unit of account is defined in our medium of exchange, but it is meaningful because we can observe prices on real goods expressed in it. As it would be pointless to define the meter as the length traveled by light in vacuum during 1/299 792 458 of a second if we could not compare this length with anything else, it would be pointless to define our unit of account in something that is not priced.

In the chapter I have explained how different payment techniques help to overcome transaction costs in the market. In particular, following Alchian (1977), I argue that to reap the full benefit from the use of payment techniques, it has to be combined with the use of both a unit of account and specialist middlemen. The use of payment techniques helps to reduce costs due to sequential payment, but to reduce costs due to sequential quality evaluation, you need unit of account as well as reputable middlemen.

(perceived solidity) and the supply of profitable business opportunities.

6 Prices and the price level

6.1 Outline

In this chapter, we will make use of what we have learned about the function of money, and in particular a unit of account, to build a theory of price level determination. We will explicitly account for the simple fact that a price level is an index of individual prices, which are the result of decisions by individuals, who in turn base their decisions on their best judgement of future price levels. This would seem an obvious route to take. Nevertheless, it represents a stark break with the traditional view using the quantity identity as starting-point.

6.2 The transaction costs perspective on prices

An alternative to the aggregate perspective of quantity thinking would be to recognize the fact that the price level is not an object in the real world, and move on from there. The price level is, of course, not a variable in its own right but a convenient way to talk, in one word, about prices on many different items. The possibility to do so is important when we try to extract true information from encountered price changes. However, although the price level is a very useful concept, it is nonetheless inaccurate to treat it like a variable. We showed in chapter three that in the conventional thinking about money and prices - the quantity of money thinking - it is presumed that the quantity of money determines the general level of pries. Hence, we can not use those ideas when we want to answer precisely the question whether changes in the supply of money could lead to changes in the general level of prices. Economists in general have had faith in the conjecture that the quantity of money determines the level of prices, and thus seldom challenged it. The relation between money and prices in the quantity equation has in practice been accepted as a fact. As we saw in chapter three, this is doubtful, to say the least. Since it is difficult to imagine how changes in the supply of money could induce price makers to change prices, and since the

conventional theory has no realistic suggestions to how it could happen, we will not accept this standard conjecture.

Here, we will take a different, and admittedly more difficult, route and never employ aggregate 'laws' without justifying them on a concrete level. From this view, it becomes crucially important to recognize the existence, nature and consequence of Coasean transaction costs.[61] From our previous discussion, it should be perfectly clear that *in the absence of transaction costs, there would be no nominal prices*. As we argued in Chapters 4 and 5, this is because the use of nominal prices is a way to overcome some of the obstacles inherent in transaction costs.[62] If the buyer/seller has no transaction costs for contacting the prospective seller/buyer, assessing the value of the goods, negotiating, and monitoring the terms of the contract, neither *money* nor a *unit of account* would be needed.

Traditional macroeconomics unfortunately has ignored this fact and this has had harmful consequences to our understanding of monetary economics. Since researchers in the field lack knowledge of why nominal prices are used, they have been puzzled by how the general level of nominal prices is determined. We could see this in Chapter 2 when we discussed different approaches to the possibility of a cashless society. Seemingly, the reason they felt puzzled is that they accept the neo-classical, or Walras-Arrow-Debreu (WAD), model of general equilibrium as a satisfactory description of the economy. To some purposes it certainly is, but not when we want to analyze nominal prices. The WAD model involves no transaction costs and consequently no need for nominal prices. All that is needed in the WAD world is relative prices, which for reasons of convenience (to the researcher rather than the agents) sometimes are normalized into the price of one good. Such prices are very far from actual prices in the real world. *Thus, since the very idea that money causes prices is a consequence of the circumstance that economists have been operating within a framework where nominal prices do*

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[61] Cf. Coase (1937).
[62] Cf. also Alchian (1977).

not exist, there is no prima facie reason to presume that money is involved in the determination of the price level.

6.3 Simultaneous contracts, sequential contracts and future price levels

In this section we will attempt to establish a basic intuition for a general theory on how nominal prices are set, based on the theories of transaction costs and incomplete contracts.[63] Prices stem from transactions and transactions imply contracts. However, due to the unfaithful nature of man, the establishment of contracts involves transaction costs for negotiating and enforcing them.[64] Consequently, trade would be very costly if all transactions were handled by simultaneous and/or complete contracts, for instance, if a worker somehow were to be paid continuously, or if a new contract were to be written between a car manufacturer and its subcontractors for each item delivered. Negotiations and the establishment of contracts would use up most of the efforts available.

Complex production that uses specialized labor therefore makes extensive use of sequential contracts. In some cases, transaction costs are so large that production is organized in hierarchies, i.e. firms, rather than in markets. This is a message that we know from "The Nature of the Firm" by Coase (1937). One important consequence of transaction costs is thus that in many situations, a *sequential and incomplete* contract is more efficient than a *simultaneous* contract, despite the apparent risk that conditions change during its existence.[65] From this point and forward, the term sequential contract will imply a contract in which the obligations of both parties - specifications of the product (quantity, quality, deliverance) and payment (nominal price and possible payment technique) - are determined in the contract from the start, while payment and deliverance are completed only at

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[63] Cf. Coase (1937) and Hart (1995)
[64] The cost of both collecting and interpreting information has been a part of mainstream economics since Stigler (1961).

one o several future dates; the critical feature is the predetermined nominal price. There are numerous examples of such sequential contracts in an economy, for instance wage contracts, utility contracts and contracts between a firm and its subcontractors. A wage contract, for example, normally runs for one or several years, and has a predetermined nominal value. The employer pays the employee once a month in return for performed work. The employee agrees to let the employer command his labor in exchange for a promise to be paid a pre-specified nominal value with an agreed-upon payment technique. The wage contract appears to consist of two sequential contracts, where one regulates the nominal labor value and the other the payment procedure along with a command over labor. The former, comprehensive, contract that regulates the nominal value of labor during the contract term is an example of the sequential contract that we discuss. In a simultaneous contract, on the other hand, deliverance and payment are simultaneous events, for instance when you pay for purchases at a supermarket.

The notion of the sequential contract is crucial to our analysis, since we claim that the stock of overlapping sequential contracts defined in nominal terms, determines inflation in the short run. Thus, our anchoring mechanism corresponds to concrete action and clearly breaks with the quantity tradition in which the anchoring mechanism is on the aggregate level, relying on predictions about a variable – the velocity of money – that does not exist in reality.

Nominal, sequential contracts are used in many different situations, in spite of the cost they involve in the form of inflation risk. In fact, the use of sequential contracts signals that the participants view the specific costs of using spot markets or writing comprehensive contracts as greater than the specific cost of the inflation risk that the sequential contract exposes them to. This leads to the conclusion that these contracts will not be reneged to adapt ex post to moderate changes in the inflation rate. This must be the case, since otherwise the nominal, sequential contract would not have been used in the

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[65] Cf. e.g. Posner (1972) about sequential transactions.

first place, but rather an indexed contract or a series of simultaneous contracts. I would say that the nominal, sequential contract is chosen precisely because the participants in the contract perceive the cost of making an inflation-contingent contract as higher than a possible inflation risk. To sum up this discussion, we will refer to *nominal* sequential contracts in the following discussion of sequential contracts. In each such contract, a number of nominal value units are related to a specified amount of goods or services and these contracts are consequently all that ties the real and nominal sides of the economy together.

It is nominal contracts that tie individual prices to the real side of the economy. Ideally, the price level is an index of all individual prices, their weight proportionate to their share of the total transaction value.[66] What determines individual prices determines the price level as well. Prices are established either in simultaneous or sequential contracts. The important difference in this regard, between simultaneous and sequential contracts is that while a price stated in a simultaneous contract can quite easily be changed from one day to the other, the same is not true for a price stated in a sequential contract. Simultaneous contracts only exist instantaneously, and a change in their terms only incurs a minimal cost with respect to transaction costs. That is, as a retailer e.g., you may have some menu costs for changing the prices on your goods, but you do not need to negotiate with the customers about price changes because you have no lasting contractual relationships. Simultaneous contracts can therefore not be decisive to the dynamics of the general price level, i.e. how the inflation rate evolves over time. On the other hand, if expectations of future inflation, or actual inflation, change, prices stated in sequential contracts can not easily be changed. Hence, sequential

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[66] More precisely, each individual has his own ideal price level, based on his preferred basket of goods and services. In the aggregate, the ideal price level should be based on actual aggregate sales. Alternatively, one could also argue that the ideal price level should be a direct sum of all prices, since this would express changes in one's opportunity set. However, since one actually consumes different quantities of different goods, the proportionate price level reveals more information about how one's possibilities for consumption actually have changed.

contracts will necessarily have an anchoring function on the inflation rate, as we will later discuss in some detail.

When a firm agrees on the terms in contracts on wages or long-term financing, it does so with certain expectations regarding the overall production efficiency in mind, i.e. regarding both internal efficiency and market conditions. Only if these expectations are fulfilled will the intended price charge be consistent with the desired and expected profit level. Thus, there is a unique price for their simultaneous contracts corresponding to the firm's sequential contracts, ceteris paribus. This implies that it is possible to forecast future prices from a firm's sequential contracts today, or more precisely, the future price a firm is expecting. The same is true for consumers. As employees, they enter wage negotiations with certain expectations about future inflation, which means that wage contracts will include an inflation compensation part, which in turn will reflect the employer's and the employees' expectations about future prices. When the wage contract has been settled, both sides will take it into account when they make decisions on other long-term contracts. Wage contracts is only one example, the same is true for all sequential contracts. Sequential contracts will therefore inevitably have impact on expectations about future inflation as well as realized inflation during the contract duration.

6.4 Short-term: overlapping contracts

Due to transaction costs, it is expensive to violate a sequential contract, and hence the contract is fixed within some boundaries, i.e. it requires rather strong incentives to induce a breach of sequential contracts.[67] To see how this affects the issue of price level determinacy, imagine that different groups engage in contracts of different length. This is a plausible idea since each business activity faces its own specific set of uncertainties. Then it follows that at the beginning of each period, there are a number of contracts that are

still valid. If the period studied is sufficiently short, there is just one contract (concerning the period in question) that has not yet been written. The parties that will negotiate about the particular contract observe all running contracts, estimate the inflationary component and thus have a link between nominal and real prices. All they have to do is to negotiate about a relative price and then use the existing price level to set a nominal price. Given the price level, there is a unique nominal price consistent with each specific real price. Thus, the nominal price level is, in a static sense, at every moment determinate. This does of course not imply that it is easy to negotiate a price, only that obstacles involved all concern the task of agreeing on a relative price. Neither do I suggest that people do in fact bargain in terms of relative prices – they do not have to since they know how to make reasonable predictions on the future value of the unit of account. There is a certain circularity here: it is precisely because we are continuously writing contracts in terms of the unit of account, we can continue doing this.

Think of two groups of employees, A and B, for example. A enters a two-period contract in period one, and B enters a two-period contract in period two. The problem is how they will respond to each other's contracts concerning period two. The answer is that since group B observes group A's contract, they will write a contract on an inflation level *in relation* to group A's. That is, depending on their objectives, they will try to include more, less or the same inflation in their contracts, compared to A's, i.e. they will set their inflation component in relation to A's. The group's objectives is presumably important when we analyze inflation, but it is of minor importance to the determination problem, since it is solved as long as there is *any* decision rule at all, as we will explore later. Given what we just said, A can figure out how B will behave and can therefore choose a nominal level without regard to B's action. This is because A knows that B will set its inflation component in relation to A's. Consequently, the nominal price level in this model could be

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[67] A sequential contract is evidently costly to break up, because if it were not, there would be no point in using a sequential rather than a simultaneous contract in the first place.

anything, *if* we assume that A and B are the only participants. It may therefore appear as if overlapping contracts are unable to pin down the price level. Nevertheless, this is not a problem in the short run, since there will always be other running contracts that can be used to extract the inflationary component. If we consider relatively short contracts, no one will actually be in A's situation, since everybody will face B's situation. We have used employees in our example, but we may as well have discussed the employer side, since it faces the same situations.

This is the basic nature of short-term price level determination. Although it may be very important to analyze differing outcomes based on different objectives, this discussion will have to be postponed until future studies. Instead, we want to analyze the question of whether and how the price level can be determined. What price level will be determined is a quite different question.

6.5 Long-term: a coordination game

I have argued that overlapping sequential contracts provide a sufficient nominal anchor for a determinate price level in the short run. As a theoretical point, however, at the end we can not rely on the existence of overlapping contracts, since there must be some agents who enter a contract that is the first contract valid for a period in a remote future. Consequently, these agents will have to make a forecast about the inflation during the time period when the contract will be valid, without reference to any running contract. Hence, there is no obvious anchor for nominal prices, and expectations about the future price level are in fact all that pins down the price level in the long run. The price level is in that sense indeterminate. Still, if one wants to understand reality, it is not satisfactory to end up with the conclusion that in this setting the price level appears indeterminate in the long run, and then go on inventing blackboard 'laws' that pin down the price level. Agents have to live in this world and they do make expectations for such future periods. Our task is now to understand how agents form inflation expectations in real life, expectations that will in fact determine the actual inflation. In order to

understand the situation of price setters when they decide upon new long-term contracts, we will sketch the kind of game in which all price setters participate, whether they are aware of it or not.

In a period without any running contracts, what they believe that other agents will think about the inflation is all they have to base their expectations on. Thus, in the long run the inflation will be whatever the aggregate of individual agents believes it will be.[68] A solution of long-term determinacy demands a model of how long-term inflation expectations are established. The standard rational expectations hypothesis offers no solution under those conditions.[69] For a pure chain of expectations about expectations, it is not possible to derive a unique solution using bare logic (it is rational for me to expect the same as you expect and for you it is rational to expect the same as I expect, i.e. it is rational for me to expect what I expect), and we must therefore find another way to solve the problem of expectations formation.

Agents that are about to enter long-term contracts face a coordination problem. No matter if they publicly over- or underestimate their true expectations about future inflation, they would still like to base their decisions on the best possible expectation. Depending on the settings, we can describe this coordination in, at least, three different situations: in the first situation, only one contract group at each time writes a contract for the period in question. In this case, the first group would be indifferent to the choice of inflation component. As we have discussed earlier, they know that the following groups will use their contract as the nominal anchor. However, we ignore this situation since it does not appear to give a reasonable picture of the economy. The other two situations concern a case in which there are several groups that simultaneously write contracts for the future period. The case can be divided into two sub-cases. The first appears when the participating agents are able to cooperate explicitly. However, this description

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[68] Black (1995) expressed the same opinion, but without developing the idea further.

of the economy does not seem reasonable, either. It would induce huge transaction costs to find out who all the others are, contact them and to decide on a figure. Moreover, if there were groups that would like to exaggerate the inflation in their own contracts, then it would be costly to cooperate since a system for punishing those who are cheating would be required.

We are left with a situation, in which several groups simultaneously enter contracts concerning the same future and un-anchored period, without any possibility of explicit cooperation. We now propose that the concept of *focal points* could suitably be applied to this problem.[70] The concept is described as follows in the game theory textbook by Drew Fudenberg and Jean Tirole (1995):

> If the two players have not played the battle of the sexes before, it is hard to see just what the right prediction might be, because there is no obvious way for the players to co-ordinate their expectations. [...] However, Schelling's (1960) theory of 'focal points' suggests that in some 'real-life' situations players may be able to co-ordinate on a particular equilibrium by using information that is abstracted away by the strategic form.

The information that they refer to is what we could call the social and historical context where agents are living and which for example has decisive influence over the content of their imagination. The importance of social and historical context implies also that we should expect that the focal points used by agents vary from country to country and also over time. That is, if we find one particular institution to be a focal point in one country, we should not take for granted that the corresponding institution in a different country also is a focal point.

For the sake of simplicity, we will hereafter consider a case, in which all agents would like to include the ex post realized inflation in their contracts.

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[69] Cf. e.g. Frydman (1983: 118) : "The analysis in this chapter suggests that the rational expectations hypothesis does not, in general, characterize expectations formation of agents in decentralized markets."
[70] Cf. Schelling (1960)

The coordination problem is less complex to illustrate under this assumption and to our purposes, it is still relevant. This is because the outcome of a negotiation between two counterparts with conflicting interests may well mimic the outcome of a negotiation under mutual interest. Nevertheless, it would still be a coordination problem if we assumed conflicting interests.

Assume that we have two groups (each with two sides, as e.g. employers and employees) which, without the possibility to explicitly coordinate, simultaneously will be the first to write contracts for a future period *t*. Assume, to begin with, that they both can identify three different strategies, i.e. choose one, two or three per cent as the inflation component in their contract. The two groups have a mutual interest in coordinating, because otherwise they would face the cost of making their decisions on a basis of inaccurate expectations (this cost could be, e.g., the risk of being insufficiently compensated for actual inflation). This cost could be expected to increase with the difference between their chosen inflation compensation. The payoff matrix could then be the one shown below.

		A		
		1%	2%	3%
B	1%	A: 0 B: 0	A:-1 B: -1	A: -2 B: -2
	2 %	A: -1 B: -1	A: 0 B: 0	A:-1 B: -1
	3 %	A: -2 B: -2	A:-1 B: -1	A: 0 B: 0

In this payoff matrix, we find three Nash-equilibria on the diagonal. Moreover, if we remove our restriction of only three possible strategies, we would have an infinite number of Nash-equilibria, but none of them a dominant strategy. In the absence of a focal point, any expectation is as good as the other. The question is hence which strategy constitutes a focal point and this will be in our focus in the next chapter. For the rest of this chapter,

we will look at the properties of our model in more detail under the assumption that there is a focal point solution to the coordination problem.

6.6 A simple model of prices in a fiat money world

A simple model that captures the basics of what we call the contractual approach to the price level may facilitate our understanding of the idea. The basic structure is borrowed from the Fischer model of staggered labor contracts, although with some important modifications: we are only interested in the nominal side of the economy and for reasons that should be apparent by now, our model does not include any monetary variables.[71]

Consider the following equations, all variables expressed as logarithms:

$$w_{t,t} = E\left[P_t \middle| t\right]$$

$$P_t = \sum_{i=1}^{n} \sum_{j=0}^{\infty} \alpha_{t-j,t}^{i} \times w_{t-j,t}^{i}$$

$$E\left[P_t \middle| t\right] = \sum_{i=1}^{n} \sum_{j=1}^{\infty} \alpha_{t-j,t}^{i} \times w_{t-j,t}^{i} + \sum_{i=1}^{n} \alpha_{t,t}^{i} \times E\left[w_{t,t}^{i} \middle| t\right]$$

The variable w stands for wages, which we assume are the only prices determined in sequential contracts in our model. There is no productivity growth and each nominal wage is set to achieve a constant expected real wage in each of the two periods. Hence, the wage increase w_t in period t, determined at the beginning of period t, is set equal to the expectations $E[P_t]$ of inflation P in period t, based on the information available at the beginning of period t. The labor market is divided into n parts, each consisting of the two counterparts employer and employee. The parameter α denotes group i´s influence on the price level, i.e. the share of total volume of sales it governs. Inflation expectations are established in accordance with the price equation.

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[71] Cf. Blanchard and Fischer (1989) about the Fischer model. It should be noted that the Fischer model is about the transition of monetary shocks to real production. I have just borrowed some parts regarding the formation of inflation expectations. The results derived here are thus not a consequence of the original Fischer model.

Those who write sequential contracts for the period *t* at the beginning of period *t* observe all contracts made in period *t-1* and earlier, but have to forecast the inflationary content in other contracts written at the same time.

To keep notation as simple as possible, we simplify the model further and consider an economy where a third of the labor market is negotiating a three-period contract in each period, with possible different wages for each period. Applying rational expectations, we can derive the following wage equations:

$$w_{t,t} = \frac{1}{2} w_{t-1,t} + \frac{1}{2} w_{t-2,t}$$

$$w_{t,t+1} = w_{t-1,t+1}$$

$$w_{t,t+2} = w_{t,t+2}$$

When the parties negotiate a wage for the first and second periods, they set them equal to a weight-adjusted mean of already running contracts for the period. As we should expect, the model displays a high degree of self-fulfilling expectations in the short run.

Our earlier conclusions about long-term properties become clear when we look at the wages for the last period. For period *(t+2)*, the wages are indeterminate under rational expectations. The model provides no guidance as to which implicit inflation component should be included in the parties' contracts. While some may argue that this is an undesirable feature of this model, I would claim the opposite. For example, it is precisely because the price level is indeterminate in the long run that it is possible for economies to develop hyperinflation, as real economies evidently do sometimes. Interestingly, it is also the reason why a monetary policy at all can be successfully pursued. If the price-setting process actually were determinate, there would be no role for central banks in it.[72]

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[72] Remember that the only way for the central bank to influence inflation is to influence the price-setting agents' expectations about inflation. If expectations

6.7 Introducing exogenous influence

We will now proceed to look at the dynamic properties of the model under the assumption that price-setting agents follow a simple, backward-looking rule when forming their long term expectations (i.e. this rule is their focal point). Consider how an exogenous shock to the price level is propagated through the model under the assumption of the following simple rule for long-term expectations: $w_{t,t+2} = 1/3\left(p_{t-1} + p_{t-2} + p_{t-3}\right)$, i.e. the third period's wage change is set equal to an average of the three last observable inflation rates. Let us assume that half the mass of nominal contracts is of *simultaneous* character. The shock implies that prices in those contracts are inflated due to a, yet, unexplained reason. The diagram below shows the lasting effect on the general price level of a one-time shock to simultaneous contracts by the magnitude of *one* in period *three*, with the prevailing rate of inflation normalized to zero. The shocks are randomly distributed with a mean of zero and do not influence expectations ex ante.

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formations were a purely logical problem, such an influence would be impossible, or at least very unlikely.

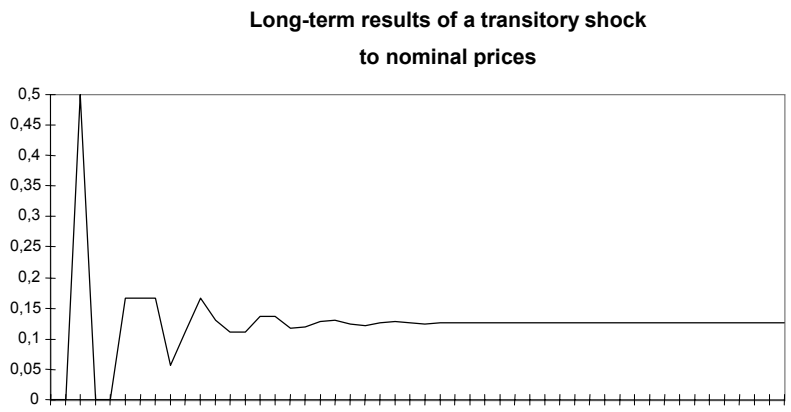

Figure 1.

We can see that a perfectly transitory shock, under our set of assumptions, will result in a permanent shift in the inflation rate. Admittedly, another set of assumptions would generate a different result. However, for the moment, it is sufficient to conclude that in this model of overlapping contracts, purely transitory shocks may result in permanent shifts in the inflation rate. It should be noted that this property is not the result of assuming some specific irrationality in the behavior of the agents. Instead, it follows from the incompatibility of the rational expectations hypothesis and individual decision making in decentralized markets. As for example Hayek (1948) and Roman Frydman (1982, 1983) have argued, mathematical calculations are not sufficient to make those decisions, there is an inevitable need also for subjective guesses. Hayek consistently argued that the fundamental characteristic of decentralized markets is that a society under such conditions utilizes very much more knowledge than is given to anyone individual. Frydman (1982: 664) suggests that:

> …in addition to information contained in market prices, social norms (in particular business practices) imposing some restrictions and coherence on the individual decisions and

> information generated by institutions external to the market may play important roles in understanding decentralized market processes.

Frydman's findings seem to support our suggestion that agents are following some kind of rule when making their predictions about longer term inflation. The function of this rule is to supply the 'information' that is impossible to calculate objectively in accordance with the rational expectations hypothesis, i.e. information about the *average opinion*. However, the rule supplies information to the individual agent only if it is indeed followed by other agents. We will soon return to the question what could be a suitable rule to follow.

It follows from figure 1. that the influence on *expectations* from an exogenous shock is far more important than its direct effect, since it may distort prices for a long time after the direct effect has vanished. This is a desirable property of the model since it corresponds well with some stylized facts about financial markets in general. A stock market crash or a suddenly arising pressure on a currency can not possibly be understood as caused by the arrival of new information concerning profit margins or general competitiveness. Rather, investors make up short-term strategies based on expectations about other investors' short-term behavior.[73] The point is that although a majority of changes in the nominal price level, a general stock market index, a currency or the nominal interest level, is driven by expectations of expectations, their existence still depends on the possibility of shocks from variables which are exogenous to the formation of expectations.

Shocks and costly information

Implicitly, in our basic model, we assumed that all agents possess complete information about all other agents' contracts and that this can be used to estimate the embedded inflation compensation exactly. We also assumed that the relative price structure is known with certainty, for now and for the

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[73] Cf. Kirman (1997) for a, in my view, similar assessment.

future. If we loosen up these assumptions, we inject two sources of uncertainty that may force inflation rates to change. In the previous section, we discussed the primary source, which consists of the possibility of shocks to relative prices that would force the ex post inflation component in a contract to differ from what was ex ante expected. The secondary source is the possibility of a wrongly estimated inflation component in other agents' contracts. It becomes interesting once we allow shocks. The combined fact that future shocks may make a forecast that is currently the best possible all wrong, and that it is very costly to make the best possible forecast, provides a strong case for the use of simple rules of thumb rather than the best possible forecast based on already running contracts.

We have already said that, as a theoretical point, in the very short run, basically all nominal contracts can be thought of as sequential, and the price level is hence fixed. As we consider an increasingly distant future, the proportion of already running, sequential contracts to not yet negotiated contracts decreases. Consequently, the possibility for new information to influence the inflation rate increases with its distance from the present. Accordingly, sequential contracts become decreasingly important as guidelines for inflation expectations, while our simple rule for inflation expectations becomes increasingly important. In our basic model, it was only at the end that the rule was needed to determine inflation expectations. If we consider that some contracts are valid for very long periods, the rule does not appear to be of much importance in practice. However, we now acknowledge that shocks to relative prices, amplified by the circumstance that agents have incomplete information about other agents' contracts, may induce changes in the inflation rate. Then we will find that the need for a rule applies also to contracts of shorter duration. For example, a decision regarding the inflationary content of a medium-term sequential contract would hence involve forecasting those primary and secondary changes, in addition to the need to extract inflationary content from the stock of sequential contracts. It may well be the case that the cost for acquiring and interpreting information about other contracts and about possible shocks is high enough to make it

more profitable to individual price makers to follow a simple rule, or a professional forecaster, than to make their own forecast.

We now have a model that shows some of the features that can be observed in reality: *(a)* variability in inflation, i.e. that the actual inflation rate may deviate from the ex ante expected (i.e. to explain the shock to prices in simultaneous contracts in the basic model), and *(b)* path dependency in inflation, i.e. that the expected inflation rate may change due to actually transitory shocks. This would lead to a permanent shift as in figure 1 above. Beforehand, it is not obvious why *(a)* should lead to *(b)*. However, as figure 1 showed, this may be the case if the rule for long-term expectations include a retrospective element. Of course, there are good reasons why it should – after all, history is all we have got. Our next tasks will now be to find out *(a)* what could create exogenous shocks to the price level, and *(b)* what *the simple decision rule* may look like.

The origin of exogenous shocks

We started by picturing the inflation rate as self-repeating in the absence of exogenous shocks and went on to show how the presence of such shocks would induce the model to produce a fluctuating inflation such as we are accustomed to observe in the real world. Our next task will be to investigate what events may cause such shocks. As explained before, it is sufficient to find one-time shocks to explain both volatility in the inflation and shifts in the inflation level.

While macroeconomic textbooks state that, in the long run, the fundamental determinant of inflation is growth in the money supply, inflation's short-term behavior has been more controversial.[74] However, since the 1970s, many economists have stressed the role of supply, or price, shocks. Essentially, supply shocks are changes in certain relative prices. For instance, the famous supply shocks of the 1970s were increases in the

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[74] E.g. Dornbusch and Fischer (1990:650): "The answer to the question of whether inflation is a monetary phenomenon *in the long run* is yes."

relative prices of energy and food. As a theoretical concern, it is not clear that such relative-price changes are inflationary. According to traditional theory, real factors determine relative prices, while the money supply determines the price level. Adjustments in relative prices are accomplished through increases in some nominal prices and decreases in others for a given money stock, so as to cancel each other out. This logic applied to the above shock to the oil supply, implies that when the price on oil goes up, it requires purchasers to spend more on oil, leaving them less to spend on other items. This makes prices on other items go down. This story makes sense, but only when prices are flexible. Since sequential contracts are common, we can not expect all prices to be fully flexible, and with some prices fixed, those who are flexible would adjust less then what would be necessary to wholly cancel out the initial shock. A comprehensive study on the flexibility of prices can be found in Alan Blinder (1991), who has interviewed managers in a large, representative sample of U.S. firms. One of his questions is how often the firms change their prices. He finds that 37.7 percent of firms change their prices once a year and another 17.4 percent change their prices less than once a year. The median firm in the economy changes its prices about once a year. On the other hand, it is true that many prices are quite flexible. Blinder finds that 10.1 percent of prices are adjusted more than once a month. The most extreme cases are the prices of commodities traded on organized exchanges, which change almost instantaneously.

There is now a rich body of literature in the field of nominal rigidities, the early criticism concerning the lack of microeconomic foundation is nowadays bypassed by a variety of methods of deriving sticky prices.[75] From the view of transaction costs economics, it seems quite a remarkable claim that prices generally are of the flexible-price kind – it strongly underestimates the existence of all sequential contracts, for example wage contracts. Evidently, if contracting were free, no sequential contracts would be written. The incitement to engage in sequential, incomplete contracts and thereby take on

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[75] Cf. Ball and Mankiw (1994) for a survey of this literature.

nominal risk is that the alternative would impose even higher costs. To presume sticky prices is not really to add a new assumption to the model, but rather to remove the assumption of an auctioneer or central planner who determines all prices. Moreover, the existence of some fixed prices has important consequences on prices in general, Lawrence Ball and Gregory M. Mankiw (1994) argue that a fixed-price model best describes such a world of both flexible and fixed prices. The reason is that flexible-price firms obviously desire fairly constant relative prices. Hence, they do not adjust their nominal prices as much when others do not adjust theirs, as they would have done if all firms had been of the flexible-price kind.

The evidence of sticky prices fits nicely with our distinction between *sequential* and *simultaneous* contracts. Due to the transaction costs, it is often more efficient to engage in long-term, *incomplete* contracts than to work out long-term, *complete* contracts that take every possible contingency into account, or to engage in a series of simultaneous contracts.[76]

Although it is not our purpose here to model why prices are sticky, we will give two examples of possible explanations of the phenomenon. One category of sticky prices is examined by Paul Krugman (1986), who reports evidence on *pricing to market* and discusses alternative explanations. Krugman is interested in the phenomenon that US import prices not fully reflect movements in the exchange rate. In that paper, Krugman favors a dynamic model of imperfect competition to account for this kind of price stickiness. His preferred explanation stresses both supply side dynamics and demand side dynamics. On the supply side, it is costs of adjusting marketing and distribution capacities and on the demand side, it is costs from reputation building. To us, it is not as important to model the causes of price stickiness as it is to confirm their relevance. Nevertheless, it is encouraging to see that there are several reasonable ways to explain the phenomenon, and we will therefore mention yet another approach to explain sticky prices, which has

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[76] Cf. Coase (1937), Posner (1972), Williamson (1985) and my discussion in previous chapters.

the additional property that it suits our distinction between simultaneous and sequential contracts very well.

Ball and Mankiw (1992) develop an analysis under the assumption of costly price adjustment and an asymmetric distribution of shocks to desired relative prices.[77] The essential implication is that firms adjust prices in response to large shocks, but that it is not worth adjusting them to small shocks. Consequently, large shocks have a disproportionately large effect on the actual price adjustment. To see their point, consider the example in which the desired relative oil price rises sharply following an adverse shock to the oil supply. According to traditional theory, other prices must go down to balance this increase. However, this is supposed to come into effect through a decrease in aggregate demand for all other items and thus, one should expect small decreases in prices for a wide range of goods, rather than large decreases in just a few prices. Thus, Ball and Mankiw argue that the distribution of desired price changes is asymmetric and since changing prices imply a cost, all desired price changes (i.e. those that would have taken place in a frictionless economy) will not take place in reality. The increase in oil price is larger than the aggregated decreases in other sectors, and the aggregate price level rises.

I find great sense in the notion of asymmetric distribution of shocks to relative prices. The very nature of such a shock is that it has a more significant impact on one or a few sectors than to all others, otherwise it would be an aggregate shock. Indeed, Ball and Mankiw (1992) report strong empirical evidence for a skewness in the distribution of relative-price changes in post-war United States.

We end this section by concluding that there seems to be both theoretical and empirical support for the claim that prices are not fully flexible, i.e. that not all prices adjust to exogenous shocks. From this we infer that exogenous shocks will sometimes lead to changes in the inflation rate.

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[77] Although I find their analysis appealing, I think it would benefit from being explicitly derived from transaction costs. Moreover, it seems a bit arbitrary to discuss inflexible prices without any reference to Coasean transaction costs.

6.8 A rule to follow

Once we have concluded that the inflation rate can change because of uncertainty concerning some real economic factors and because of a costly verification of other's contracts, uncertainty both about running and future contracts arises, too. Above, we argued that it would therefore be reasonable for an agent to follow a simple rule of thumb rather than try to extract all possible information from already running contracts.

However, in reality, we have more options than to choose either one of two extremes, i.e. to follow a simple and rigid rule, or to make the best possible prediction. It would seem reasonable to believe that most agents in fact would do something in between. While it is costly to extract information from other agents' contracts, it could still be worth the effort to extract some of the potentially available information, particularly if you are good at it. We should therefore assume that agents will try to improve the simple rule and that some agents will become considerably better at it than the average agent. These *specialists* will then be able to profit on this ability, either by acting on their prediction on the market or by selling it to the average agent.

Thus, it is not obvious that a simple and rigid rule is in fact a natural choice for inflation expectations. In an economy with a history of a very stable inflation rate, people may coordinate on an expectation of self-repeating inflation, but under different circumstances, people may learn to coordinate on something else, for instance a Royal forecast or a politically set goal for inflation. Under yet other circumstances, the public may not be able to coordinate at all. In this case, society is prone to developing hyperinflation. In the next chapter, we will consider the nature of the focal point in more detail.

6.9 Conclusions

In this chapter, I have pictured a model of how inflation is determined when its determination is viewed as a coordination game without a dominant equilibrium. In the short run, it is straightforward since the already running, sequential contracts pin down the price level. In the long run, however, the

coordination game is more subtle. With no dominant equilibrium, we can not from the strategic form of the game say that one expectation is better than another. On the other hand, leaving the blackboard we can for example argue that *if* the rate of inflation has been stable for a while, it would be reasonable to expect it to continue on roughly the same level. Generally, assuming that inflation is in fact determined in a coordination game as we argue here, we can draw upon observations of reality and claim that whenever inflation does not follow a random path, people do seem to follow some rule when predicting future price levels.

7 The nature of a focal point for future price levels

7.1 Outline

In this chapter, we will consider the concept of focal point more explicitly and try to answer the question regarding whether the central bank would be a suitable focal point for inflation expectations. Schelling's concept of a focal point appears in a variety of economic contexts. In short, it predicts that a particular equilibrium of a game may be selected because it appears to be a natural choice for the participating agents to make.

7.2 Focal points

Schelling (1960:54) illustrates the idea with the case of a couple who has lost each other in a department store. Although they may not have consciously thought about where to meet if they get separated, the chance that they will think of the same place to meet is far grater than what a pure random choice would suggest. Schelling (1960:58) further emphasizes that imagination is as important as logic to be successful in this kind of coordination game.

> Logic helps - [...] - but usually not until imagination has selected some clue to work on from among concrete details of the situation.

The point here is that the notion of focal points captures rational behavior that is difficult to express in logical terms. It is rational to use a focal point, although we can not logically argue that the focal point is a more likely coordination point than the alternatives. Thus, to be rational is not only to make logically consistent decisions, but also to make purposeful decisions with respect to all consequences, as in the pragmatist view of rationality, here expressed by Richard Rorty (1992:581):

> Rationality is the name of an ability which squids have more of than amoebas, which language-using human beings have more of than nonlanguage-using anthropoids, and which human beings armed with modern technology have more of than those

> not so armed: the ability to cope with the environment by adjusting one's reactions to environmental stimuli in more complex and delicate ways. This is sometimes called "technical reason", and sometimes "skill at survival".

The model, which we were sketching on in the previous chapter, predicts that in the long run and in the absence of a focal point, any expectation is as good as the other. The choice of an inflation level to incorporate into a long-term contract looks similar to the choice of a meeting place in Schelling's example. Therefore, the focal point concept seems indeed relevant to an analysis of the determinants of inflation.

7.3 Understanding the logic of focal point coordination

Although the coordination of a focal point requires more than logic, there is still a logic part in it, and we can attain insight into how agents coordinate by considering this part of the solution. Schelling (1960:57-58) describes the general character of focal point solutions as follows:

> A prime characteristic of most of these "solutions" to the problems, that is, of the clues or coordinators or focal points, is some kind of prominence or conspicuousness. But it is a prominence that depends on time and place and who the people are.

A potential point of coordination must have some prominence to be expected to be recognized. However, prominence is not enough, writes Schelling (1960:58):

> Equally essential is some kind of uniqueness; the man and his wife cannot meet at the "lost and found" if the store has several.

The combination of prominence and uniqueness is what counts. One might say, however, that prominence is of primary importance, since a unique detail that no one is aware of can not be a focal point. Michael Bacharach (1993) recognizes the importance of prominence and uniqueness and proposes a logical procedure to solve this kind of coordination problem in a

way that involves identifying relevant frames for the game.[78] A typical example in the single-frame case describes a 'matching pennies' game where the two players are awarded if they choose the same bottle in a sample of at least three bottles where one bottle is hock-shaped and the others are claret bottles. Bacharach argues that both players will choose the hock-shaped bottle, since if both players manage to identify the two strategies, *to choose hock-shaped* and *to choose claret*, they would ascribe, for the other player's action, an equal probability to choose either strategy. The players will choose the strategy that would yield the greatest probability of choosing exactly the same bottle, were the both players to choose the same strategy. Evidently, the probability of choosing exactly the same bottle when they use the same strategy is greater if they choose among the under-represented type of bottles. Bacharach demonstrates that by ascribing a frame to a game, the number of feasible outcomes is reduced and in some cases, as the one described, a unique solution sorted out.

The Bacharach approach to determine the focal point, however, can only be expected to fully solve designed games, since real world games are far too complex to be solved explicitly. In the real world, imagination first makes the agent aware that the shape of the bottle may be a suitable feature to build strategies on, rather than all other particular details that may differ between the bottles.

To illustrate the idea of a focal point solution to the price level coordination game, let us imagine an almost trivial partition of all possible strategies. Start with all real numbers as possible strategies and then divide them in two groups. In the first group we have the real numbers that are greater or equal to the historically lowest realized inflation rate and less or equal to the historically highest realized inflation rate, and the second group consists of all other numbers. Then, following Bacharach's method, the participants in the game would choose among the strategies in the first category. If we then add sufficiently many additional frames – or dimensions

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[78] See also Bacharach and Stahl (1997).

of strategies – we would finally come up with a unique solution to the game. However, we still need imagination to find and describe the strategies in the first place and real world situations are too complex to be definitely solved.

7.4 Applying the focal point concept to price level predictions

Surveys on the public's expectations about future inflation often show that recent inflation rates are important explanatory variables. Empirical work by Mats Kinnvall (1995), for example, suggests that a strategy relying largely on self-repetition would be at least partly successful. Indeed, according to the price-setting process we have put forth, one should expect the inflation rate in one period to depend partly on the inflation in previous periods. Imagine for example the two counterparts in a contract that will be valid during several future periods for which no other contracts are yet written. If they agree on an inflation expectation for one of these periods, it is hard to find any reason why their expectation for the other periods should be different, considering that there is no 'correct' expectation – any choice is as good as the other. It therefore appears sensible to expect partly self-repeating inflation rates.

We have already said that some agents will specialize in extracting information from running contracts and become specialists in making predictions over short-term and medium-term inflation. What we have called long term here is a quite vague concept, only applied to make the theoretical point that, eventually, someone must be first to write a contract for each specific period. It is therefore likely that the specialists who have earned credibility for making good forecasts in the short or medium-long run will also be used by the public when it comes to long-term forecasts. If we apply Bacharach's logic, we can thus say that price-setting agents will choose to coordinate on a forecasted rate of inflation rather than on any other possible rate, since there are fewer choices in the group of forecasted rates.

Imagine now that one of the agencies manages to discern its forecast distinctly from the others, as you can discern the hock-shaped bottle from the

claret bottles. It is then not only possible but also likely that this particular forecast agency will constitute a strategy of its own, and therefore become the focal point. Among forecast agencies, the central bank is the first that comes to mind as an imaginable candidate to be that particular agency. As we argued in chapter two, the central bank's long history, its nimbus, and not to underestimate, its name, make it a reasonable choice as focal point: it is both unique and conspicuous among banks and other forecasting agencies.

Although the central bank seems to be a reasonable focal point, as a theoretical point, it is just one imaginable focal point among all inflation forecasts. Another interesting possibility is that forecast agencies can be divided into categories of *participants* and *non-participants* in the price-setting process. We can observe that important participators, e.g. labor market organizations, regularly publish their inflation forecasts. An obvious reason for using forecasts from large contracting groups as guidelines is that their contracts invariably will have considerable impact on the actual inflation outcome. It should be stressed that it is worth noticing their forecasts even if you do not believe that these correctly reveal their expectations, if you only have an idea of their objectives (to underestimate or overestimate). Nevertheless, an impediment to the use of these groups' forecasts is that there might be many of them and one has to assess the relevance of each of them. That is, while they are prominent, they are not unique. Furthermore, there is the additional problem that each agent is likely to change his expectation after having received information on the average opinion of concerned agents, which in turn would make this information misleading. Frydman (1982: 654) associates this problem with Knight's distinction between uncertainty and risk:[79]

> …to form optimal forecasts of next period's price, individual agents have to guess *ex ante* the value of the average opinion.
> […]

[79] However, it should be noticed that this problem does not apply to an already established focal point since the focal point *is* known ex ante.

> The existence of Knightian uncertainty in the model implies that individual guesses of the average opinion cannot be known or modeled by an "outside observer" and other agents.

On the other hand, one should not overestimate these problems, since a distinguishing feature between participators', and non-participators' forecasts is that the participators have an incentive to reveal the inflationary content in their future contracts. By publishing their inflation forecasts, they implicitly reveal what nominal level they are trying to achieve in future contracts and probably hope that other groups will use their forecasts as a focal point. Pre-play communication in the appearance of published inflation forecasts may in fact be a way to overcome transaction costs that impede straightforward cooperation. Indeed, we should expect that readily available facts about future inflation will be used as the primary source of information. Most people are quite familiar with the level of wage increases in running contracts. If they know, e.g. that the inflation compensation part of the running contracts is on average two percent, they would use this information and be reluctant to believe any forecast about inflation that deviates considerably from this number. Although we should expect people to habitually follow previously successful strategies, we should not expect them to do so uncritically.

7.5 Choosing among forecasts

In the following, we will analyze in more detail how a choice between different forecasts, or forecasting methods, can be accomplished. If, over time, one particular source of forecast evolves to perform better than others, agents would follow that forecast. Subsequently, it would perform better than others in the near future because its forecast would be embedded in many sequential contracts and therefore be partly decisive for inflation. That is, if one particular forecast is believed to be right, it will perform better on average than other forecasts. However, it is still possible that an unexpected event would move nominal prices sufficiently far away to make another forecast better ex post. If we assume the existence of heterogeneous agents, some of them would shift their faith to the best forecast during the last period, while

some of them would stay with the first one. In subsequent periods, it is more ambiguous what forecast will perform better, since the distribution of believers is less concentrated. If the next unexpected event works in the same direction, even more agents would change their beliefs. In "On the Transitory Nature of Gurus", Alan Kirman (1997) has developed an analysis that offers an explanation as to how agents on financial markets use expert forecasters to form their own expectations about future prices. In order to introduce the approach, I include the following quotation from Kirman:

> In asset markets, decisions as to how much buy or sell are made on the basis of expectations as to future prices. The standard way to solve for equilibrium prices in such a situation is to make the assumption that individuals have "rational expectations". Yet, in many cases agents do not form their own expectations about the prices of the assets. They instead follow the advice of "experts" or "gurus". The question then arises as to which guru they should follow. If, as is the case in financial markets, the number of people that are following a particular forecaster has a direct impact on the price on the asset, the individuals have to consider this when making their choice. Thus, Keynes' well-known "beauty queen" problem can be thought of as an example of one of Schelling's focal points. Think of the contestants as financial experts and then think of the economic agents as choosing amongst them. Suppose that the situation is completely symmetric and that if everybody chose a particular expert his forecast would turn out to be correct.

Kirman's analysis, which originally was applied to the spot market for currencies, should apply as well, and maybe even better, to nominal price level determination. As we have said, we have no fundamentals at all to rely on in the (ultimate) long run. The price level is hence freer to vary with expectations than are prices on financial assets. Kirman's analysis explains how it is that a forecaster who has the public's confidence eventually may be abandoned although the public's expectations are largely self-fulfilling. Kirman makes the following conclusion:

> This paper has explored the idea that individuals will learn to follow certain experts as a result of their experience. This tendency is self-reinforcing. In a situation in which none of the

> experts is perfect there will always be swings from one guru to another. Popular opinion will, however, follow 'better' gurus for longer periods than those who are less satisfactory predictors. Gurus are thus self-sustaining focal points. This simple notion captures many of the features of financial markets which are difficult to explain in more conventional terms.

For a moment, let us turn back to the simple model discussed before. We now assume a different rule for long-term expectations: $w_{t,t+2} = 1/2 \times 1/3\left(p_{t-1} + p_{t-2} + p_{t-3}\right) + 1/2\, RF$. It differs from the first in that the agents put half their weight on the *Royal forecast* made by their precious *King*, who as a matter of fact always forecasts that the inflation will be zero. The story is that they want to believe in their King but can not wholly neglect the fact that his forecast historically has proved to be occasionally wrong. In figure 2 below, the results for long-term inflation are compared to that of the first rule.

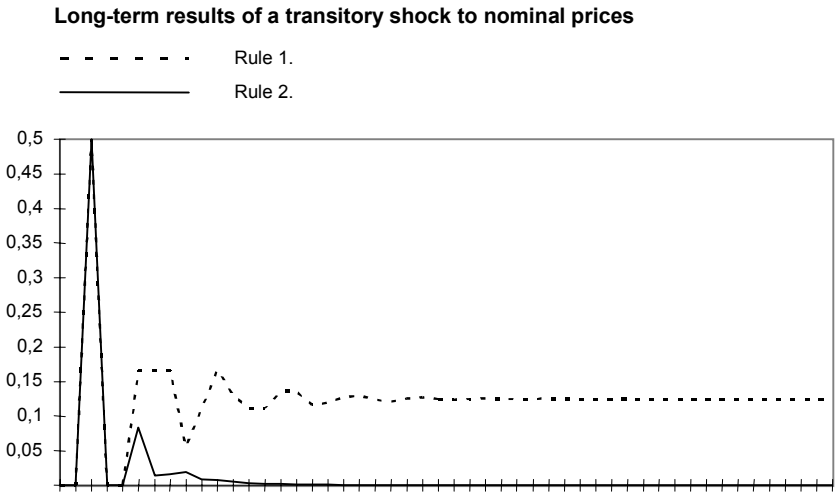

Figure 2.

The figure tells us that the King is able to decrease the effects of a transitory shock.[80]

The central bank as guru

Now, let us interpret the King as the central bank. Hence, the focal point approach will offer a way to explain some particularly interesting stylized facts about nominal prices. The actions that central banks take, and indeed the announcements they make, in order to achieve some goal for the monetary policy, is granted a lot of attention from the financial market participants as well as the media. If one combines this observation with the fact that we have not seen either the central bank or money play any role in the price level determination so far, one would have a puzzling observation. However, if we apply Kirman's approach, we are able to explain: *(a)* why the market pays

[80] This example is an unsophisticated application of the analysis developed in Kirman (1997).

attention to central bank(ers), *(b)* why central banks strive to receive as much attention as possible when they change their interest rates or publish inflation forecasts - the difference compared with other banks or forecast agencies is significant - and *(c)* why the central bank most often makes very small changes in its interest rate, often as small as a quarter of a percentage point, although the inflation rate is far away from the target.[81] Our answer to *(a)* is that the central bank acts as a focal point for expectations of inflation and nominal interest rates. Our answer to *(b)* is that the central bank has a goal for the inflation and has to make the market believe in it in order to attain it. Our answer to *(c)* is that, in the language of Kirman, the central bank must defend its position as guru in the forecasting business, and consequently can not afford to be too wrong too often. It faces a trade-off between moving as fast as possible towards its target and preserving its focal point status.

We have suggested that the central bank is a natural choice as focal point for future inflation. There are additional reasons why the central bank would emerge as a natural choice as focal point for inflation expectations (and short-term interest rates), most notably its former active role in the price level determination through currency and credit regulations. Its possible persistence as an important player for inflation determination rests, however, on its capability to remain a self-sustaining focal point, i.e. to be reasonably successful. To be successful is to keep the inflation rate close to the target rate, which is a task that the central bank can only achieve if it succeeds in convincing the market that the inflation rate will indeed stay close to the target. Whether or not central banks will continue to accomplish this mission is basically a matter of how good they are at rhetoric; the central bank's control of inflation is true as long as it is believed.

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[81] A phenomenon that is broadly recognized, see e.g. Goodhart (1998a).

7.6 Conclusions

Following up the claim from the previous chapter that people seem to follow some rule when predicting inflation, in this chapter, we have claimed that this rule in many cases could be suitably described as a focal point. We try to defend this claim by exploring what it would mean to an agent to follow a focal point for inflation and arguing that this is consistent with observations of price-setting agents.

Our second claim is that the central bank provides the focal point for inflation in the western world today. Central banks are suitable focal points since they are both conspicuous and unique. Moreover, to view central banks as focal points for inflation helps to understand both the behavior of central banks and the attention the financial markets pay to central bank announcements. Even the almost bizarre speculation about what Mr. Greenspan actually intends with his speeches becomes reasonable. This is not a minor achievement of our model, I think.

8 Summary and conclusion

I have proposed the hypothesis that central banks derive their influence over the economy from a role as focal point for expectations of inflation and nominal interest rates. To support my thesis, I have argued that the use of money and the use of a nominal price system based on a unit of account are both techniques to overcome certain transaction costs (Chapter 4). From that insight, I have been able to clarify how money and units of account are interrelated and, equally important, how they are not related (Chapter 5). Taking the individual price setter's decision as the fundamental unit of analysis, in Chapter 6 I offer a model of how individual prices determine inflation and how expectations of future inflation in turn influence individual prices in a basically self-reinforcing fashion. Finally, in Chapter 7, I study the concept of focal points in more detail and provide arguments in particular regarding why the central bank would be a suitable focal point for expectations of future inflation rates.

My motive has been a curiosity about the real world rather than a desire to add another piece to the great puzzle of normal science. Hence, I think it is appropriate to conclude this thesis by asking a few questions about the real world and answering them with the help of the theory developed here.

Question

If we assume that the inflation rate has been constant for a few years, ceteris paribus, what inflation rate should we expect in the near future?

Answer

We should expect the inflation rate to stay constant. With a very stable rate of inflation, and without any extraordinary events, it is hard to imagine any other focal point than stable inflation.

Question

Generally speaking, what features characterize a focal point for inflation expectations?

Answer

Uniqueness and conspicuousness are prerequisites. Thus, we can imagine it to be easily distinguishable from similar institutions. It would presumably carry a strong brand. It would not be surprising if it were in some way connected to God, the King, the Party or any other important potentate in the particular society in question. Either it would have a long history or it would have to be accompanied by a massive propaganda campaign (that is, the ECB could compensate its youth with a conspicuous launch). It would be relatively correct in its forecasts most the time, and especially so when the inflation is steady.

Question

How would a forecaster presumably act, if it wants to obtain or maintain a position as focal point?

Answer

It would try to distinguish itself from other possible candidates. It would undertake careful investigations about future inflation by analyzing running contracts and through surveys on inflation expectations and then position its forecast close to its true expectations. If it had a goal for inflation, its published forecast would lie somewhere in between its true expectation and the goal. The deviation from true expectations would be smaller in an environment of stable inflation than when the inflation rate is more volatile. In terms of its credibility as a forecaster, it would be costlier to make biased forecasts in an environment of stable inflation than in an environment of volatile inflation, because the competition from the almost natural focal point of stable inflation.

Question

The focal point has been dramatically discredited through some remarkable circumstances as e.g. a series of major scandals or bankruptcies in the financial industry, international sanctions against the country or the outburst of war or similar unrest in society. What would happen to the general price level?

Answer

It may well result in hyperinflation. More generally, we can not say, since no anchor for inflation expectations exists any longer. As for all social changes of

revolutionary character, it is impossible to predict either its coming or its result.[82]

Question

What causes sudden outbursts of hyperinflation?

Answer

A breakdown in the coordination of inflation expectations triggered by some exceptional event in the economy, as those mentioned above.

Question

Suppose that there is a country, which has painful memories of hyperinflation and therefore has developed public resistance to inflation. Ceteris paribus, should we expect that country to have a higher or a lower inflation than a country where people are more indifferent to inflation?

Answer

Lower, because in the coordination game, an agent would tend to choose the lower alternative of two otherwise equally possible expectations. Ceteris paribus, the focal point would tend to be a slower inflation rate in a society with significant public resistance to inflation.

Question

In Sweden, we are going to vote about the EMU-question this autumn - to join or not. In monetary terms, what would it mean to change kronor for euro?

Answer

If we put issues of politics and supervision of the banking system aside, it would mean to change our measuring unit of value, i.e. what we usually call our unit of account. It is equivalent to a change of measuring unit for, say, length. Obviously, we would also change our measuring sticks - notes and coins - for new ones, stated in the new standard, euro.

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[82] Cf. Sztompka (1993)

Question

But what about interest and inflation rates?

Answer

Well, obviously the Sveriges Riksbank would no longer serve as a focal point for interest rates, or inflation rates. The idea of the EMU-project is that the ECB should function as a focal point for European interest and inflation rates, much like the Bundesbank did for Germany. If it will succeed is a bit premature to say; so far rates have been quite stable globally and the ECB's role is impossible to know. Time will tell if people will accept the ECB as a focal point.

Obviously, my choice of questions to raise about reality is biased by the way I see reality. This of course depends on my theory about the same reality – that is the old problem of theory-laden observations: we can not observe the world without a theory. In this respect, my approach is of course no different than others, this feature is for example evident in M. Friedman and Anna Schwartz' (1963) impressive work on the monetary history of the United States. A future extension of this thesis would be a reconstruction of M. Friedman's and Schwartz' work, but from the viewpoint of my theory instead of the quantity of money. In short that would mean looking for particular focal points of particular times as well as particular events that bring an end to the success of a particular focal point. However, one would need to be careful to assess the meaning of non-market conditions, such as regulations on currency and credit, which have been present under long periods during the 20th century and each case would have to be evaluated in its own right.

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