3.0 The Logical Structure of a Monetary Economy

In the previous chapter we discussed a tradition in economic theory that emphasize the credit aspect of money and aims at integrating monetary theory and value theory in order to make room for effects of money in value theory. This must mean a rejection of real value theory, and the only thing that can replace real values without causing measurement problems is money flows. Thus it is argued that money flows is the only thing that we can measure in economics using a homogenous measure - the unit of account, and this should induce us to turn economics into a study of money flows.

In economics we do, however, not have very well-developed tools for the study of money flows. We have used the quantity equation to relate a stock of money to the level of economic activity, measured by either trade turnover or incomes. Here the concept of velocity is introduced in order to turn the stock of money into flows of money that accompanies flows of goods. This equation has been used as a basic tool in economics with different assumptions with respect to the character and stability of velocity attached to it.

We shall argue that the quantity equation is much too simple for serious analysis of money flows. Just like electrical currents or flows of fluids have their own logic that determines, e.g. what happens when two currents meet or when the diameter of a pipeline is changed, so do money flows have their own logic that constitute the logical structure of a monetary economy. In this chapter we shall develop methods for studying the logical structure of a monetary economy, and we shall see how much can be said about the functioning of a credit economy without implicating behaviour. The latter aspect implies that we take transactions within a period for given, and ask what may be deduced from this information.

3.1 Logistics of Exchange and the Quantity Equation

Since it is one of the most basic aspects of economic activity, we shall start out with a study of the logistics of exchange. By logistics of exchange we mean the money flows necessary in order to carry out a given pattern of real transactions using money as a medium of exchange. Thus we ignore Keynes' liquidity preference as well as any other motives for holding precautionary or speculative money balances. We shall play the role of the logistics expert who wants to know how much money to hold in order to carry out planned activities.

Logistics of exchange is not only basic with respect to economic activity, it is also basic with respect to economic theory since it constitutes the microfoundations of the quantity equation. Any theorist using the quantity equation must expect the stock of money held by an individual agent to be positively related to the volume of trade or alternatively the level of income of that particular agent - otherwise the quantity equation does not make sense. The velocity of circulation does not have to be fixed for the quantity equation to make sense - it may vary with e.g. the rate of interest or it may follow a time trend due to financial development or changing behaviour. What is important is that it

must be possible to determine changes in the velocity of circulation in order for the quantity equation to be more than a tautology.

One way to study money-holdings by individual agents is Baumol-Tobin inventory approaches. Within these approaches the logistics of exchange is related to economic decision making. The question that Baumol answers is, given a certain pattern of exchange, how large a fraction of their monetary wealth will agents hold in the form of money and how much will they hold in the form of bonds (i.e. interest-earning assets). The variables taken into consideration by Baumol is the rate of interest and transaction costs in moving between money and bonds. Transaction costs are assumed to be independent of the size of transactions. Given the exchange pattern, which in the case of Baumol is one income-receipt per period and continuous expenditures such that (receipts = expenditures) for the period, agents aim to minimize the cost of money management (i.e. transaction costs and opportunity costs in holding money).

Baumol deduces the aggregate demand for money from information on individual demands for money. Not surprisingly the result is that demand for money is related to the rate of interest and the existence of economics of scale in management costs. Thus Baumol's analysis is supportive of those versions of the quantity theory that allows velocity to vary with the rate of interest.

A later development of Baumol's approach by Clower and Howitt (1978) was not quite as supportive of the quantity equation. Their complication is to allow agents to choose their own frequencies of receipts and expenditures. They use transaction costs to argue that both sale and purchase take place at discrete time intervals rather than continuously through time. The agents continuously produce one good (**S**) at a given rate (**y**), and the total stock of **S** is sold at discrete points of time. Consumption also takes place continuously at the same rate as production (**y**), and the consumed good (**D**) is purchased at discrete points of time. Since stocks of **S** and **D** cannot be negative, the frequency of receipts and expenditures is determined once the maximum volume held of **S** and **D** has been decided upon. Besides **S** and **D** the agent holds money (**M**) that is needed in order to purchase **D**, i.e. Clower's cash in advance constraint is used. The decision problem of the agent is to choose the frequencies of **S** and **D** and thus the volume of **M** so as to minimize the cost of money management. Clower and Howitt introduce two further factors in the decision problem; ***timephasing*** which is the minimum length of time elapsing from a sale to a purchase and ***bunching costs*** which are costs related with simultaneous sale and purchase. If at some point sale and purchase take place simultaneously the time phase (**m**) is equal to 0.

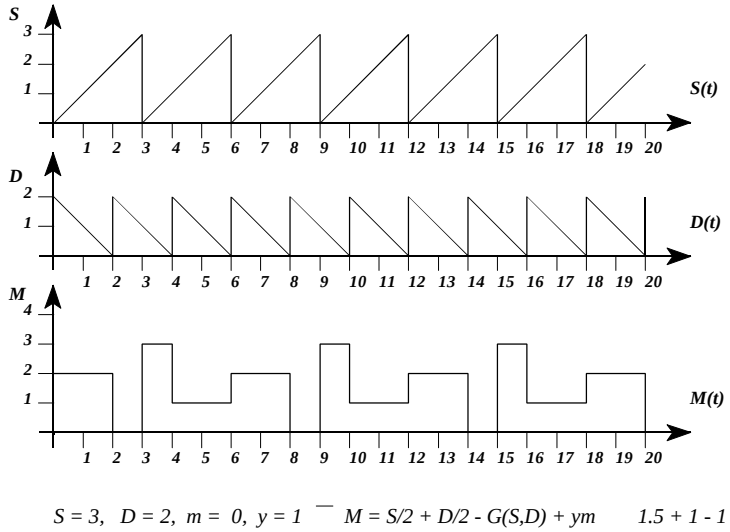
Clower and Howitt are interested in the average holding of money in their model which is determined by the following relation, which they call ***the finance function***:

$$\overline{M} = F(S,D) = \overline{S} + \overline{D} - G(S,D) + ym$$

Where ‾ is average holdings of the good produced, ‾ is average holdings of the good consumed, **G(S,D)** is equal to the greatest common divisor of **S** and **D** if **S/D** is a rational number and otherwise

is equal to zero. The term **ym** is the rate of production and consumption multiplied by the minimum time phase, i.e. the minimum time between a sale and a purchase. We shall not prove why this relation gives us the average money holdings, but notice that it is intuitively obvious that the more often sale and purchase take place, i.e. the smaller **S** and **D**, the smaller is the need for money and the more often a sale and a purchase take place with the minimum time phase, and the smaller the minimum time phase, the smaller the average holding of cash will be. We shall study the implications of the finance function through three examples:

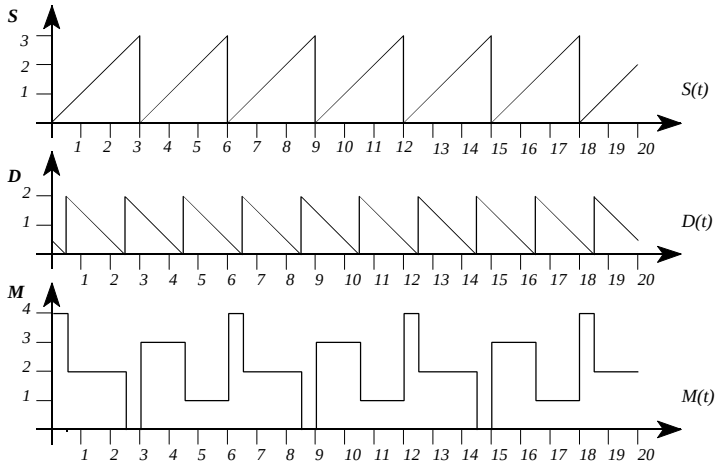
Figure 3.1.1



S = 3, D = 2, m = 0, y = 1 ¯ *M = S/2 + D/2 - G(S,D) + ym* *1.5 + 1 - 1 + 0 = 1*

First we have a situation where the timephase is equal to zero. **S** is equal to 3 and **D** is equal to 2, which gives us a highest common divisor equal to one. This gives us average money holdings equal to 1,5. Let us see what happens if we add a timephase:

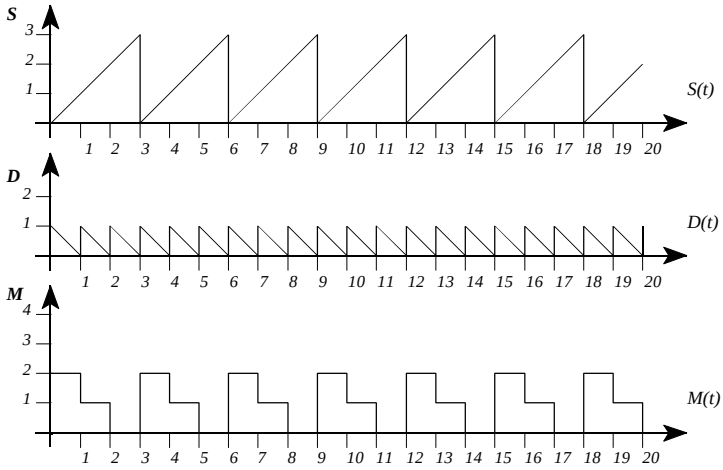
Figure 3.1.2



S = 3, D = 2 , m = 0.5, y = 1 — *M = S/2 + D/2 - G(S,D) + ym* *1.5 + 1 - 1 + 0.5 =*

By delaying purchase with half a period (**m**=0,5), the average holding of money has increased from 1,5 to 2.

Figure 3.1.3



S = 3, D = 1, m = 0, y = 1 — *M = S/2 + D/2 - G(S,D) + ym* *1,5 + 0.5 - 1 + 0 =*

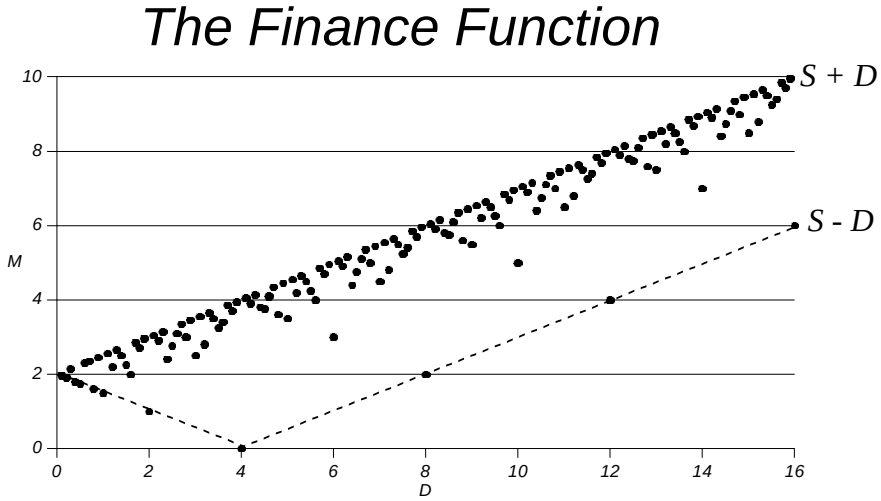
Above we have changed the volume of **D** while **m**=0 as in the first example. This has decreased the average holding of money from 1,5 to 1. These examples illustrates how small changes in the decision variables may have quite an impact on average money holdings.

The interesting result of Clower and Howit is that the functional relationship between average money

holdings and (**S**,**D**), i.e. the finance function, is discontinuous. This is illustrated in figure 3.1.4 where **S** is kept constant while **D** varies along the X-axis[1]. In the example **S** is equal to 4 and **D** varies in discrete steps of 0.1. With smaller steps the upper line (**S**+**D**) will appear to be almost continuous while there will not be further dots added to the lower line (**S**-**D**). The timephase is set equal to zero.

[1]One might have chosen **D** as the constant variable. Since G(**S**,**D**) is homogenous of degree one in **S** and **D**, what matters is the relation between **S** and **D** and not their absolute magnitudes.

Figure 3.1.4



Notice that every time **S**/**D** is rational there is a jump in the functional relationship. The smaller the highest common divisor, the closer average money holdings is to the upper line where there is no common divisor.

Clower and Howitt relates their observation to human behaviour by suggesting that agents choose their values of **S**, **D** and m such that the cost of money management is minimized. Since we are not interested in the behavioural aspects, we shall not discuss the optimization aspects further but go directly to the conclusion drawn by Clower and Howitt which depends of the logic of the finance function and not on behavioural assumptions:

> "It cannot be emphasized too strongly that the discontinuities in our basic model arise not from strained assumptions about the discreteness of time or the atomistic character of commodity and money units, but rather from the fact that trades involve stocks rather than flows so that small changes in the relative timing of transactions can produce large jumps in average finance requirements and in average bunching costs. These jumps would be less obvious if our model dealt with nonstationary processes so that between-trade time intervals were not necessarily uniform. **As a matter of logic, however, jumps analogous to those implied by our model must occur in any ongoing economy where trade takes place at discrete points rather than continuously in time**. Appearances to the contrary notwithstanding, therefore, the comparative-statics implication of our model are of more than purely academic interest.
>
> The most important comparative-statics conclusion to be drawn from our model is negative, namely, **the consequences of parameter changes upon equilibrium values of S, D, "" are generally ambigous**."
>
> Clower and Howitt (1978) pp.457-8 (bold my emphasis)

Due to the logic of exchange the relation between trade turnover and the volume of money needed in order to carry out exchange is discontinuous, and Clower and Howitt do not succeed in making the relation behave nicely by special behavioural assumptions since their decision problem appear not

to be computable[1].

Clower and Howitt's conclusion is crucial with respect to the relevance of the quantity equation. They find that there is no reason to expect the discontinuity to disappear once individual money demands are aggregated. If the relation between the need for money and the volume of trade is not continuous then there is no obvious reason why velocity of circulation should behave nicely. When economic activity rises we may as well expect the demand for money to decrease as increase. Thus we are left with a situation that cannot be described through the quantity equation. How are we to handle this information? We must attempt to find useful ways of studying the patterns of exchange to see whether we can come closer to deciding when the demand for money can be expected to fall and when it can be expected to rise.

Stützel (1954) has developed a new equation of exchange that takes more factors into account and avoids the vagueness of the velocity concept. It does not capture the discontinuities revealed by Clower and Howitt directly, but it does allow for the possibility that demand for money may fall when trade turnover increases. The central concept in Stützel's equation of exchange is the step phenomena, i.e. he argues that the need for money does not depend as much on trade turnover as it depends on the degree of step in the actiones of individual agents. This is an aspect that is also taken into consideration by Clower and Howitt who use it in arguing that discontinuities in the finance function cannot be expected to cancel out when the individual demands are aggregated:

> "In simpler models involving integer constraints on S/D or its reciprocal, individual demand functions will exhibit discontinuous steps, but the smoothing properties of aggregation may be invoked to argue that the aggregate demand function is smooth and behaves qualitatively, as indicated by the usual square-root formula [...]. The present model shows that this is generally not valid. For example, when y [rate of production and consumption] increases, some traders will increase $\overline{D}$ and others will decrease $\overline{D}$; the aggregate effect will depend crucially upon the form of the distribution of traders between the two categories."
>
> Clower and Howitt (1978) p. 458

Clower and Howitt have touched upon some very important aspects of the logical structure of a credit economy; the discontinuity of the finance function and the importance of the step phenomena. But there is a number of reasons why their work can only serve as an appetizer that points out interesting spots to be studied, and not as a foundation of further studies. First of all agents always consume at the same rate as they produce in their model - this leaves out vital aspects of a monetary economy. Secondly it is a microeconomic approach that does not allow us to aggregate directly. Thus we shall go to Stützel's analytical framework.

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[1]The uncomputability has not be proven, but Clower and Howitt have not succeeded in computing the function, and at the "Summer School for Computable Economics" held by Aalborg University and Center for Computable Economics, UCLA in 1992, Clower suggested its uncomputability. We shall return to the notion of computability.

3.2 Stützel's Mechanics of Balances

What Stützel aims at, is to provide economic theory with an indispensable building block comprising the logic of a monetary economic system. It is important for Stützel not to implicate any metaphysics or assumptions concerning human conduct what so ever:

> "...wir wollen mit dem vorliegenden Buch versuchen, dazu beizutragen, daβ über allen Gleichgewichts-, Verlaufs- und Wachstumsanalysen jene Zusammenhänge im Wirtschaftsleben nicht vergessen, sondern sachgemäβ berücksichtigt werden, die in *jedem* Falle bestehen (gleichgültig wie sich die Menschen verhalten, gleichgültig, ob Gleichgewicht oder Ungleichgewicht) und die den absolut strengen Rahmen bilden, in dem sich menschliches Verhalten überhaupt nur bewegen kann, und infolgedessen den Rahmen bilden, den auch jede gleichgewichtstheoretische und verlaufsanalytische Aussage zu beachten hat, wenn sie nicht von vornherein mangels Erfüllung der Minimalanforderungen, wenn sie nicht von vornherein einfach wegen eines Verstoβes gegen aritmetische Grundregeln zur Unbrauchbarkeit und Sinnlosigkeit verurteilt sein will."[1]
>
> Stützel (1958) p.10

Not until this building block, or indispensable framework, is defined, should economic theory take into account human behaviour, according to Stützel. To understand the distinctiveness of Stützel, it is necessary to start where he himself starts, namely by setting up the analytical framework. This framework is developed primarily in order to prevent aggregational problems or fallacies of composition, and in order to understand the interplay between statements applicable to parts of a system and statements applicable only to the system as a whole.

By applying this positivistic[2] framework to credit theory, Stützel hopes to take it into its third phase. In the first phase of credit theory the money creating abilities of banks was not realised; it was the liability side (deposits) of the banks bookkeeping that was assumed to determine the size of its activities. In the second phase the credit creating capabilities of banks was recognized, and now the asset side (loans) was supposed to determine the size of the banks activities. This is the approach of which Albert Hahn is the strongest exponent. According to Stützel neither of these theories is true since we have to take both the asset side and the liability side into consideration.

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[1]"With the present book we shall attempt to contribute to a situation where equilibrium-, dynamic-, and growth-analysis do not disregard, but make the necessary allowances for, economic relations that are true in all cases (no matter how agents behave, no matter whether there is equilibrium or diequilibrium), and build the rigorous framework within which human behaviour can take place, that is, build the framework that every equilibrium theoretical or dynamic analytical statement has to take into consideration to avoid not fulfilling the minimal requirements, when they do not want to violate basic rules of arithmetic" (my translation):

[2]Positivistic in the sense that all metaphysics is avoided.

3.2.1 Partial Theorems, Relational Theorems and Global Theorems

A central set of concepts in the work of Stützel is *partial theorems* and *global theorems*. The meanings of the concepts are indicated in the names; partial theorems are theorems that are only valid for parts of the whole system e.g. single economic agents or groups of agents. Global theorems are theorems that are only valid for the whole system. According to Stützel's definitions the two sets of theorems are disjunctive; if a theorem belongs to one of the sets it cannot at the same time belong in the other. The idea in distinctively operating with two types of theorems is to avoid fallacies of composition.

Another economist that has found interest in the difference between partial relations and global relations is Thomas C. Schelling who has discussed the subject in the book "Micromotives and Macrobehaviour"(1978). As indicated by the title, Schelling is mainly interested in the behavioural aspects of the relations whereas Stützel restricts himself to the logical aspect. One of the articles in Schelling's book is called "The Inescapable Mathematics of Musical Chairs". The title is chosen because the game "musical chairs" exactly reflects the relation between partial sentences and global sentences. In this game there is always one participant that will not get a chair - no matter how aggressively or intelligently the participants behave in general, they cannot escape this global rule. The individual may improve his chances of getting a chair by improving his behaviour, but if all participants improve their behaviour, it will only mean the participant is not worse of than before the improvement of behaviour. The same way that there will always be one participant that does not get a chair, there will always be some economic agents that experience a monetary loss if others experience a monetary gain, or the same way that it is impossible for all countries to improve their balances of payments simultaneously, or, as Schelling puts it, "we cannot all get rich by not spending our money" (p.50). Financial business cycles can also be explained as a game of musical chairs where, in the upswing there is always a chair too much, inducing a new participant to enter the game, whereas in the downswing the system is always one chair short.

Emphasizing the behavioural aspect, Schelling makes a stand against describing behaviour through aggregate behavioural functions as well as by looking at an individual isolated from his social context (i.e. methodological individualism). This leaves economic theory with game theory as the strongest formalization of economic behaviour. But Stützel is not interested in behaviour and thus not interested in game theory. To him the individual may ignore the global relations or not - in both cases the relation between partial and global relations must be described.

Stützel introduces an additional types of theorems besides partial and global theorems, namely *relational theorems* (größenmechanik). These are theorems concerning the relation between a partial theorem and a global theorem. This set of theorems could be compared to the feedback mechanisms of cybernetics in that a partial element may receive a feedback effect determined by a global theorem. To illustrate his concepts Stützel uses an example; a cinema where the variable to be discussed is the view of the spectators. Every spectator may affect his own view and the view of others by standing up or sitting down. Let us look at the three types of theorems in relation to this example:

Partial Theorems Are theorems that are valid for individuals or partial groups when feedback mechanisms offset by the global theorems are ignored.
E.g.: For an individual spectator the view is improved when the individual in question stands up, compared to what it would have been had he remained seated.

Relational Theorems Are theorems that are valid for individuals or partial groups when feedback mechanisms offset by the global theorems are taken into consideration.
E.g.: For a partial group of spectator the view is only improved by standing up if its complimentary group has heightened (and thus improved) their view less that the group in question.

Global Theorems Are theorems that are only valid for the system as a whole.
E.g.: It is not possible for the set of spectators as a whole to improve its view by standing up.

Within the field of economics a well known aggregational paradox is the relation between receipts and expenditure. This paradox is also known as Mandeville's paradox[1]. If a single individual increases his expenditures more than his receipts, then his wealth will decrease and thus his possibilities of expending tomorrow decreases. On the other hand, if all economic agents increase their expenditures then their receipts have to increase as well, and their wealth need not decrease. This paradox may also be set into Stützel's scheme:

Partial Theorem: The larger the expenditure of an individual unit, the smaller its monetary wealth, given the size of receipts.

Relational Theorem: An individual or a group can only spend more of its current receipts (i.e. decreases its monetary wealth) if its complementary group spends less of its current receipts (i.e. increases its monetary wealth).

Global Theorem: By an arbitrary increase or decrease of the aggregate expenditure, the change in aggregate expenditure will always be equal to the change in aggregate receipts.

Another well-known paradox in economics is the widow's cruse described by Keynes in Treatise (1931 p. 125) and also used by Kalecki to illustrate how the consumption of entrepreneurs determines the profits of entrepreneurs. In the scheme of Stützel this becomes:

Partial theorem: The more an entrepreneur spends on consumption out of his profits, the less he can spend on capital.

[1]From Bernard de Mandeville's "The Fable of the Bees" (see Keynes(1936) pp.359-62).

Relational theorem:	A group of entrepreneurs can only spend a larger fraction of their profits on consumption if their complementary group spend a smaller fraction of their profits on consumption.
Global theorem:	By an arbitrary increase or decrease in consumption by entrepreneurs, the change in consumption will always be equal to the change in the profits of entrepreneurs.

In connection to relational theorems, Stützel talks about *leading effects* and *slackness effects* (i.e. effects from falling behind). These terms may also be explained by use of the cinema example. In the relational theorem of this example, the group in question can only attain a better view if it can get a lead compared to its complementary group. To attain this lead the complementary group must experience a slackness effect. In the Mandeville paradox a leading effect would decrease the wealth of one group and a slackness effect would increase the wealth of the complementary group. It is important to remember that to obtain a lead one of three conditions must be fulfilled (p.54-5); (1) Complementarity in action of a group and its complementary group. (2) The group attaining a lead is active while its complimentary group is passive. (3) The group attaining a lead is passive while its complimentary group is active.

To these relations there are no assumptions concerning causality attached. Surely, if one group *attain* a lead, the other group must *be subjected to* a slackness effect. But to say what is a leading effect and what is a slackness effect, one must know what the aim is. Only by knowing which of the two groups is the one taking action in order to obtain something, is it possible to say which group is subjected to changes that they did not ask for themselves. This is also the reason for the naming of the two concepts; a leading effects moves the system towards a new goal, the slackness effect is representing the inertia of the system. Stützel's calls the two effects *deviational effects*. To understand why, we must know his conformity concept, which is to move in step or footfall.

3.2.2 The Concept of Moving in Step

The concept of moving in step or conjunction (gleichschritt) is related to the relational mechanisms since step occur when there are no leading effects or slackness effects. When Stützel talks about deviational effects he is therefore talking about deviations from a position characterized by step. In the cinema example step not only occurs if everybody is sitting down or standing up; step also occurs if everybody is moving towards one of these extremes with the same speed. Thus step can be characterized as a dynamic equilibrium concept, not to be confused with any of the usual concepts of equilibrium within economics[1]. Often the equilibrium concepts is attached to a desired position, but we cannot say whether moving in step is desirable or not.

[1]There is a number of different equilibrium concepts within economics some of which may be characterized as being dynamic and some of which implicitly entails the idea of moving in step. E.g. Stützel claims that general equilibrium requires both step in trade and step in payments. What is important to note is that step does not require market clearing or fulfilment of plans nor rest in any sense.

In economics we only know the step concept from credit theory where it is acknowledged that the credit creating capabilities of several independent banks depend on whether they extend their activities in step. If they do move in step, deposits will increase simultaneously with the creation of credit for all banks. But if only a group of banks extend their credit, they cannot expect an increase in deposits of equal size since some deposit will go to banks that have not extended their credit. Here the picture of slackness effect as an inertia in the system is very clear. Stützel claims that the concept of step may be put to use in many other parts of economic theory.

If a system is characterized by step, then the relevance of the partial sentences decrease; "Gleichschritt herrscht, wenn zufällig für jede Einzelwirtschaft dasselbe gilt, was für die Gesamtheit von vornherein gilt" (p.29)[1]. Again we may use the cinema example; when the system is characterized by step it is not possible for an individual to improve his view - this case has, however, already been stated in the global theorem. Thus, if one is sure that step will exist, one might as well ignore partial sentences.

Stützel also operates with the concept of equilibrium, but there is no relation between step and equilibrium. Stützel defines equilibrium as the situation where planned and expected variables are equal to realized variables. Thus he adopts the *ex ante - ex post* analyses from the Stockholm school. Let us, again in the cinema example, imagine that the movie is boring half of the spectators while the other half feel themselves entertained. In this case one could imagine that half of the spectators would let the height of their view fall (maybe they sleep better this way), while the other half straighten up in order to get a better view. If, further more, we assume the distribution of the two groups of spectators do actually allow one group to get a better view and the other group to get a worse view, then we may speak of an equilibrium being attained. Nobody will want to make more changes in their positions since the purposes of both groups where fulfilled. But in no way may we talk of step in this case. Step only occurs if the quality of the view does not change for any of the spectators - whether that is an aim or not.

3.2.3 The Mechanics of Balances

We are now ready to introduce the concept, *mechanics of balances*. When deviations from step, i.e. leading effects and slackness effects, have the form of balances, then the relational theorems are called mechanics of balances.

> "Als "Saldenmechanik" aber wollen wir jene Sätze zur "Größmechanik" bezeichnen, die sich aus

[1] "We have a situation characterized by step when, for every individual unit, the same things are true, as are always true for the system as a whole".(my translation)

> Globalsätzen über zahlenmäβig strenge gesamtwirtschaftliche Größenbeziehungen ableiten lassen, wenn die Abweicheffekte die spezielle Form von *salden* haben."[1]
>
> Stützel (1958) p.56

What is special about mechanics of balances, for instance compared to the relational mechanics of the cinema example, is that mechanics of balances deal with the relation between *flows* and *stocks*. The stocks, or the balances, only change if the flows deviate from step. Thus, as was the point of Clower and Howitt, there is no simple relation between flows and stocks. The balances are not determined by the absolute value of the flows, but their deviation from step. As we shall see later this is a central point for Stützel:

> "Effektiv besteht also nie eine einfache Korrelation zwischen dem Niveau dieser Strömungsgröβen (also der "Strömstärke") und den Veränderung der zugehörigen Bestandgröβen, sondern stets nur eine Korrelation zwischen Abweichungen vom Gleichschritt und den Veränderungen der fraglichen Bestandgröβen."[2]
>
> Stützel (1958) p.50

It is now possible to clarify what exactly Stützel means by the third phase of credit theory. The orthodox theory of credit only dealt with partial sentences, which in the case of credit creation means that it is impossible for a single bank to create credit. The modern theory of credit, on the other hand, only dealt with global theorems, the implications of which is that the only limitation of banks credit creation is demand for credit which depends upon the rate of interest set by the banks. This makes banks very powerful institutions - as Keynes noted, the banks hold the key position (Keynes (1937b) p.222). What Stützel wants the third phase of credit theory to do, is to concern itself with the relational theorems of credit creation, i.e. banks can only increase the volume of credit if some agents are ready to increase their holdings of bank notes and bank deposits. If this is not the case then the law of reflux takes over, i.e. newly created credit results in destruction of older credit, the volume of credit remaining the same. To understand the volume of monetary balances it is necessary to look at the liability side of banking as well as the asset side.

Stützel also presents his theory of credit as a synthesis (p.219). The orthodox theory of credit presented the thesis that no bank may grant credit without previously having received a deposit of equal size. The modern theory of credit delivered the antithesis; that growth in credit creates growth in deposits, i.e. credit must grow in order for deposits to grow. Stützel's aim is to formulate a synthesis consisting of the orthodox theory as a partial theorem and the modern theory as a global theorem. As described above, the way to combine partial theorems and global theorems is to look at the relations between the two.

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[1] "As mechanics of balances we shall denote every relational theorem which may be derived from global theorems [...] when the deviational effects have the special form of balances". (my translation - partial)

[2] "Actually a simple correlation between the level of this flow magnitude (i.e. the intensity of the current) and changes in the stock related to the flow does not exist, only a correlation between deviation from step and changes in the stock in question." (my translation)

Stützel suggests that this method may be applied more general in economic theory as a way of uniting microeconomic theory with macroeconomic theory[1].

> "Wir werden diese "Mechanik den Vorsprungseffekte" auf zahlreiche volkswirtschaftliche Problem anwenden. Wenn A. Weber meint[2], es sei "bisher noch keinem Autor gelungen", eine Brücke zwischen einzelwirtschaftlichen und gesamtwirtschaftlichen Aussagen zu schlagen, so hoffen wir, deutlich machen zu können, daβ die Entwicklung von Sätzen dieses Typs (Mechanik der effektiven Größenveränderungen, der Vorsprungs- und Nachhinkeeffekte) vielleicht geeignet ist, wenigstens für gewisse Bereiche der Nationalökonomie die von Weber a.a.O. geforderte Brücke zu liefern."[3]
>
> Stützel (1958) p.28

In our time a lot of weight is assigned to microfoundations - theories are not accepted unless they have the proper microfoundations. The price of this development must be that macro-relations that do not immediately follow from micro-relations are de-emphasized. The kind of macro-relations that are easily ignored are relations as Mandeville's paradox and the widow's cruse. These are relations that it is very hard to obtain by deducing from a representative agent. Using Stützel's scheme we no longer have to choose between doing macroeconomics that have no microfoundation and microeconomics that ignore macro-relations. Again there is a similarity with Schelling's research programme. Economics cannot do with methodological individualism, nor can we ignore microeconomic relations all together.

3.2.4 Receipts and Expenditures

> "Wir bevorzugen in dieser Arbeit das Rechnen mit Einnahmen und Ausgaben, obwohl es bisher weithin üblich war, die Beziehungen zwischen volkswirtschaftlichen Strömen mit hilfe der *einkommens*rechnung darzustellen."[4]
>
> Stützel (1958) p. 75

Another characteristic of Stützel's method is that he studies money flows (accounting patterns) rather than "incomes". The income of an agent for a given period is the net addition to the wealth of the agent in question within that period. The addition to wealth may consist of real wealth (a collection

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[1] Stützel (1958) p. 19 n.2

[2] Adolf Weber, Allgemeine Volkswirtschaftslehre, 6. Auflage 1953, p.32 (Stützel's note)

[3] "We shall apply this "mechanics of leading effects" to a number of economic problems. When A.Weber claims that "no author has yet succeeded" in building a bridge between microeconomic and macroeconomic statements, we hope to clarify that development of this type of statements (mechanics of effective changes in magnitudes, the mechanics of leading effects and slackness effects) may be suitable, at least for certain areas of political economics, to supply the bridge demanded by Weber." (my translation)

[4] "In this work we prefer to operate with receipts and expenditures although it has been prevalent to study the relation between economic flows by the help of income arithmetic." (my translation)

of objects) as well as monetary wealth (a debt denominated in the unit of account). To study incomes it is necessary to apply some method for transforming collections of real goods into monetary values. As already discussed, monetary theory has no rigorous method of doing this. What Keynes did was to estimate incomes as defined above, and this is what forced him to take the ambiguous concept of usercosts into use. The receipts and expenditures of an agent, on the other hand, is monetary phenomena, i.e. they are already measured in terms of the unit of account. Rather than attempting to estimate incomes, Stützel suggests that we restrict ourselves to the study of receipts and expenditures. In doing this Stützel professes in the most direct manner, a theory of money values rather than real values.

But why study both receipts and expenditures - why not look at only one side of transactions? According to Stützel, studying both sides has a number of advantages. First of all it is possible to set up a system similar to the input-output system of Leontief. The purpose of Stützel, however, is not the same as that of Leontief who wanted to focus on the interdependence between different sectors of the economy. The purpose of Stützel is the same as the purpose for which Walras presented his general equilibrium system; they both want to present the economic system as a system of simultaneous equations. But the project of Stützel is not as ambitious as that of Walras since Stützel has no ambitions of finding an equilibrium solution. As a matter of fact, Stützel has no price theoretic ambitions what so ever. He wants to illustrate the logic contained by the system independently from human behaviour.

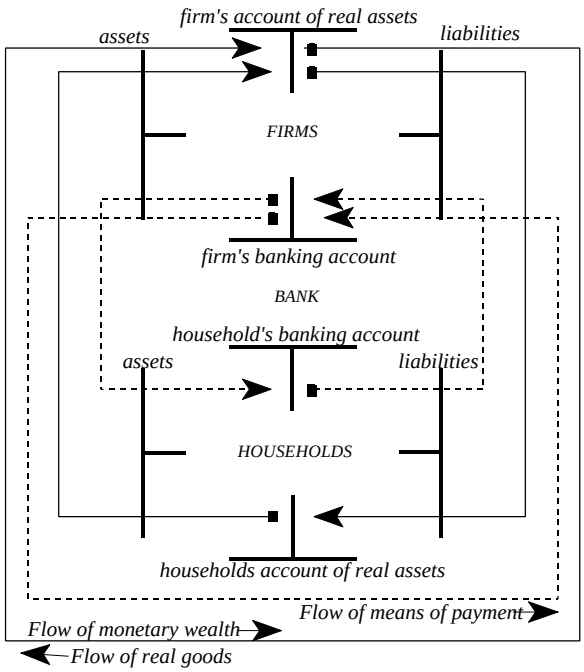
Stützel makes use of the system of double entry accounting and succeeds in illustrating the economic process as a set of arrows between balances (see fig. 1). By starting an imaginary process of production and during this process keeping an eye on movements at the balance sheets, you are provided with a clear picture of monetary flows related to economic activity. How the credit system is functioning in relation to the process of exchange and financial intermediation is also possible to illustrate in fig. 1. However, if one wants to operate with several agents, the double entry book keeping system no longer suffice - it simply cannot handle the complexity of the data.

In his system Stützel has two different sets of balance sheets, representing three different decision units; the firms and the households. Each set of balances sheets consist in a balance keeping track of real goods (labour, consumption goods and capital goods) and a banking account keeping track of monetary balances. In addition there are two stock-keeping accounts; one keeping account of assets another one keeping account of liabilities. In the scheme we have two different types of transactions, represented by two different kinds of arrows. We have payment flows represented by the dotted lines and flows of real goods and services represented by the full-drawn lines[1].

[1] Note that Stützel has put a movement of monetary wealth as the equivalent of a flow of goods and services, only it is moving in the opposite direction. This follows from the assumption that the monetary wealth of an agent only can change through transactions involving goods and services, i.e. theft and philantrophy is ignored. This the *quid pro quo* of the system - an agent can only obtain ingoing payments by either parting with real goods and services or a financial asset. If he part with a financial asset for money his monetary wealth is

(continued...)

Figure 3.2.4.1



There are two inputs to production; input from households (labour) and inputs from the production process itself (capital). Besides going back into production, output from production goes to households in the form of consumption goods. The movements of real goods to and from households are also registered in balance sheet in the bottom. The flow of goods are accompanied by flows of payment that move in the opposite direction. Remark that in accordance with double entry accounting all movements are entered twice; one debit posting and one credit posting.

Besides being sure of not violating accounting rules, another advantages of looking at both receipts and expenditure is that the step concept becomes very easy to handle. If the system moves in step then it is true for all units that their receipts are equal to their expenditures. When both variables are taken into consideration it is therefore possible to decide the degree of step immediately, while it may be quite difficult to decide if only one side of transactions is considered.

> "Wärend es - wie erwähnt - unter Beschränkung auf *eine* unabhängige Variable (Ausgaben) bei komplizierte Strukturen bereits sehr schwierig gewesen wäre, die *Gleichschritt*bedingungen anzugeben, wird dies durch hilfsweise Heranziehung der Zweiten unabhängigen Variablen (nähmlich

[1](...continued)
not affected, as we shall see later. Thus a flow of monetary wealth must have an equivalent flow of goods and services.

> der Einnahmen) kinderleicht:Gleichschritt herrscht, *wenn bei jeder Einzelwirtschaft die Eingänge gerade so hoch sind wie die Ausgänge*, also gerade keine Salden auftreten."[1]
>
> Stützel (1958) p. 49-50

Stützel does not take his receipts-expenditure method into use without drawing some parallels back to the terminology of income analysis. Thus he gives us some examples of how his conclusions may be transferred to the terminology of income analysis. To do this he uses the following definitions:

> The income of an economic unit = growth in wealth + consumption
> Growth in wealth = growth in real wealth + growth in monetary wealth
> Monetary wealth = monetary balances + assets - liabilities

If negative user costs are regarded as the monetary value of the growth in real wealth, this is the exact same definition as Keynes used in his "General Theory". However, Stützel is not willing to let any subjective evaluation enter his analysis, and therefore he chooses to operate only with receipts and expenditures and ignore the growth in real wealth. The problem of evaluating real goods is avoided by applying Keynes' method of setting the growth in real capital (**I**) equal to savings (**S**). Since, aggregated, the growth in monetary wealth is 0, and since the growth in wealth (**S**) for a single unit is equal the growth in monetary wealth plus the growth in real wealth, then, in the aggregate, the growth in real wealth must be equal to aggregate savings. Thus, as noted by Keynes, **I=S** becomes a tautology because of the way income is defined. The only difference between Stützel and Keynes is that Keynes adds user costs to the growth in real wealth measured by **I**.

> "Diese Formel [I=S] ist lediglich eine übersetzung des Globalsatzes von der Unveränderlichkeit der Summe aller Geldvermögen aus der Einnahme-Ausgabe-Sprache in die Einkommensprache."[2]
>
> Stützel (1958) p. 78

This makes the **I=S** formula a tautology independent of the theory of prices or behaviour (p.79). By using the receipts-expenditure analysis, Stützel obtains the advantage that he avoids the ambiguities related to the concept of real capital.

3.2.5 Flows of Monetary Wealth and Flows of Means of Payment

In figure 3.2.4.1 we have drawn two different types of money flows; flows of monetary wealth and

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[1] "While it is usually difficult, in the case of complex structures, to deduce the step requirement under restrictions of one independent variable (expenditure), this becomes very easy by implicating the second independent variable (i.e. receipts); there is step when for every individual unit receipts have the same size as expenditures, i.e. when there are no balances." (my translation)

[2] "This formula [I=S] is merely a translation of the global theorem in receipt-expenditure language of constancy of the sum of all monetary wealth." (my translation)

flows of means of payment. Flows of monetary wealth we call receipts and expenditures and payment flows we call ingoing and outgoing payments. Flows of monetary wealth naturally affect monetary wealth whereas payment flows affect monetary balances. In a currency economy where Clower's cash-in-advance constraint is fulfilled and where there are no credit relations excepts from the credit represented by the currency, we only need to consider one type of money flows since a flow of monetary wealth would have to be accompanied by a payment flow (cash-in-advance) and since a payment flow would have to be accompanied by a flow of monetary wealth (there are no assets and liabilities to purchase).

In a credit economy a transaction may consists in only flows of monetary wealth (i.e. exchanges where the monetary wealth of the exchanging parts shifts, but where no money is involved), it may consist in flows of monetary wealth and payment flows (i.e. monetary exchange) or it may consist in only payment flows. Transactions that do not affect monetary wealth, but merely changes the size of the gross balance[1], or changes the composition of the net balance (proportion between assets and monetary balances), are called *pure financial transactions* by Stützel.

To be able to separate flows of payment from flows of monetary wealth one must be capable of deciding where the line is to be drawn between monetary balances and other assets. Stützel notes that the concept "a means of payment" is a relative concept (p.65). By this he means that what is a means of payment for one group (e.g. non-banks) need not be a means of payment for another group (e.g. banks). This is a clear statement of Machlup's monetary pyramid; money used in a certain level of the hierarchy must be issued at a higher level[2]. In the following we shall only discuss means of payment that are means of payment for non-banks. This allows us to discuss credit money as claims on the banking system as a whole and thus disregard means of payment between banks or between commercial banks and a central bank. This implies that money is created and destroyed continuously through ordinary transactions between banks and non-banks. The moment a means of payment is repaid to the bank it is no longer a means of payment (p.236).

Stützel operates with three different kinds of credit; (1) direct claims between non-banks, (2) bank-credit and long term bank loans, (3) means of payment. One may also talk of three different credit volumes;

The credit volume of a society:	The sum of all assets of the economy, i.e. the sum of all claims, bank-deposits and means of payment.
The credit volume of banks:	The sum of all bank deposits and means of payment.
Means of payment:	The sum of all monetized claims.

[1]Net balance = monetary wealth = monetary balances + assets - liabilities
Gross balance = monetary balances + assets (or liabilities)

[2]Money used by non-bank units must be issued by banks while money used for interbank clearing must be issued by a central bank.

It is already possible for us to state that changes in the volume of means of payment depend upon the relation between flows of monetary wealth, payment flows and changes in the volume of direct claims. If liabilities remains unchanged then changes in means of payment are equal to changes in monetary wealth. If, on the other hand, flows of monetary wealth only change direct claims, there will be no shifts in means of payment.

3.2.6 Step in trade, Step in Payments and the Volume of Credit

In accordance with the step concept described earlier, Stützel characterizes a situation where there are no changes in monetary balances, as a situation with *step in payments*. Thus in a situation with step in payments, every agent holds exactly as much money after exchange has taken place, as he held before exchange. This may also be characterized as a situation with perfect capital markets since any receipts-surplus is immediately transferred to a unit with an expenditure surplus.

A situation where there are no changes in monetary wealth, i.e. a situation where it is true for all agents that their receipts are equal to their expenditures, is called a situation with *step in trade*. The preconditions for step in payments and step in trade respectively, are independent. That a period is characterized by step in trade is no guarantee that it is also characterized by step in payments. This follows from the fact that flows of payment may arise independently of flows of monetary wealth. Even if there are no changes in monetary wealth, flows of payment may arise from pure financial transactions.

It is now time for us to return to the question asked by Clower and Howitt; what are the implications of the two step concepts with respect to the volume of outstanding credit? Whether a flow of monetary wealth affect the credit volume of society depends upon the wealth-status of the expenditor and the recipient respectively. If the monetary wealth flows from a unit with a positive monetary wealth to a unit with a negative monetary wealth this will increase the volume of credit. Flows of monetary wealth between units with positive monetary wealth, on the other hand, will not affect the credit volume of society. This is the case because the volume of credit depends upon the dispersal of wealth.

The case is similar with respect to step in payments, but here we can only talk about effects on the volume of means of payment, not the volume of credit in general. Because means of payment is a relative concept we have to restrict ourselves to non-banks. Whether a flow of payments affects the volume of means of payment depends on whether it goes from a bank-debtor to a bank-creditor, in which case the volume will increase, or from a bank-creditor to a bank-debtor, in which case the volume will decrease. Again flows between two debtors or two creditors do not affect the volume of credit.

How the credit volume of society as well as the volume of means of payment are affected by different kinds of transactions is best illustrated by some examples. Table 1 contains four different examples. The examples comprise six different units; five private agents and one bank. The examples are

simplified so that they only deal with two different types of assets; direct claims and bank deposits (both types may be negative in the example, which simply means that they are liabilities rather than assets). Bank deposits are liquid means of payment, and are best perceived as a demand deposit with overdraft facilities. This simplification makes the size of the balance of banks equal to the volume of means of payments.

The first column of table 1 displays stocks in the beginning of the period. The second column displays receipts and expenditures or flows of monetary wealth. The third column displays changes in cash balances following from receipts and expenditures. The fourth column displays flows of payment that do not correspond to flows in monetary wealth. We assume that the receipts of unit **a**, **b**, **c** and **d** always stems from unit **e**, and that expenditures of unit **a**, **b**, **c** and **d** always goes to unit **e** (this would be the case if units **a**, **b**, **c** and **d**, where workers employed by unit **e** and purchasing goods produced by unit **e**).

Let us look at the effects of a deviation from step in trade on the volume of means of payment. This is an indirect effect since we may only see how deviations from step in trade affects the credit volume of society of which means of payments is a part. We cannot know how this effect is distributed between changes in monetary holdings and changes in other assets. We have chosen to solve this by assuming step in payments, i.e. all effects are on asset changes. In example A we see that the units that have a receipts-surplus also have a positive monetary wealth. The three units with a negative monetary wealth also have an expenditure surplus. This means that there has been a larger dispersion in monetary wealth. In the example the credit volume of society has been enlarged from 300 to 375.

Table 3.2.6.1

Step in Payments → *Step in Trade* →

		Example A					**Example B**					**Example C**					**Example D**				
		1	*2*	*3*	*4*	*5*	*1*	*2*	*3*	*4*	*5*	*1*	*2*	*3*	*4*	*5*	*1*	*2*	*3*	*4*	*5*
a	*receipts*		*100*					*100*					*100*					*100*			
	expenditures		*50*					*50*					*150*					*100*			
	cash balances	*100*		*+50*	*-50*	*100*	*100*		*+50*		*150*	*100*		*-50*	*+25*	*75*	*100*			*+50*	*150*
	assets	*100*			*+50*	*150*	*100*				*100*	*100*			*-25*	*75*	*100*			*-50*	*50*
	monetary wealth	*200*				*250*	*200*				*250*	*200*				*150*	*200*				*200*
b	*receipts*		*100*					*100*					*100*					*100*			
	expenditures		*75*					*75*					*125*					*100*			
	cash balances	*75*		*+25*	*-25*	*75*	*75*		*+25*	*+25*	*125*	*75*		*-25*	*+25*	*75*	*75*			*-25*	*50*
	assets	*25*			*+25*	*50*	*25*			*-25*	*0*	*25*			*-25*	*0*	*25*			*+25*	*50*
	monetary wealth	*100*				*125*	*100*				*125*	*100*				*75*	*100*				*100*
c	*receipts*		*100*					*100*					*100*					*100*			
	expenditures		*125*					*125*					*75*					*100*			
	cash balances	*-25*		*-25*	*+25*	*-25*	*-25*		*-25*		*-50*	*-25*		*+25*	*-25*	*-25*	*-25*			*-25*	*-50*
	assets	*-75*			*-25*	*-100*	*-75*				*-75*	*-75*			*+25*	*-50*	*-75*			*+25*	*-50*
	monetary wealth	*-100*				*-125*	*-100*				*-125*	*-100*				*-75*	*-100*				*-100*
d	*receipts*		*100*					*100*					*100*					*100*			
	expenditures		*125*					*125*					*75*					*100*			
	cash balances	*-75*		*-25*	*+25*	*-75*	*-75*		*-25*		*-100*	*-75*		*+25*		*-50*	*-75*			*-25*	*-100*
	assets	*-25*			*-25*	*-50*	*-25*				*-25*	*-25*				*-25*	*-25*			*+25*	*0*
	monetary wealth	*-100*				*-125*	*-100*				*-125*	*-100*				*-75*	*-100*				*-100*
e	*receipts*		*375*					*375*					*425*					*400*			
	expenditures		*400*					*400*					*400*					*400*			
	cash balances	*-75*		*-25*	*+25*	*-75*	*-75*		*-25*	*-25*	*-125*	*-75*		*+25*	*-25*	*-75*	*-75*			*+25*	*-50*
	assets	*-25*			*-25*	*-50*	*-25*			*+25*	*0*	*-25*			*+25*	*0*	*-25*			*-25*	*-50*
	monetary wealth	*-100*				*-125*	*-100*				*-125*	*-100*					*-100*				*-100*
b a n k	*CASH BALANCES*	*175*				*175*	*175*				*275*	*175*				*150*	*175*				*200*
	ASSETS	*125*				*200*	*125*				*100*	*125*				*75*	*125*				*100*
	CREDIT VOLUME	*300*				*375*	*300*				*375*	*300*				*225*	*300*				*300*

Column 1: Stocks in the beginning of the period.

Column 2: Receipts and expenditures (flows of monetary wealth).

Column 3: Change in cash balances following from receipts and expenditures[1]. If there are no entries in the column we are dealing with a situation with step in trade.

Column 4: Movements between cash balances and assets. If all entries in column 3 (i.e.

[1]In the example Clower's cash in advance constraint is fulfilled since changes in monetary wealth is assumed to result in changes in cash balances, and only after the volume of cash balances has changed is it possible to transfer the effect on monetary wealth to assets rather than cash balances. This, however, has no impact on the need for money in the system since it is merely the way we have chosen to illustrate transactions in order to clarify the difference between step in trade and step in payment, and the transactions in column 3 and 4 may be assumed to take place simultaneously so that the cash is never present.

changes in cash balances) are "neutralized" by being converted into asset changes, we are dealing with a situation with step in payments (i.e. perfect capital market). Notice that for each individual agent, transactions in this column add up to zero.

Column 5: Stocks in the end of the period.

The effect of a larger dispersion of wealth on the credit volume has been clarified by Stützel through the following relation:

$$\text{Dispersion effect of shifts in monetary wealth} = \frac{\text{The net-volume of current shift in monetary wealth from units with negative monetary wealth to units with positive monetary wealth}}{\text{Gross volume of current shifts in monetary wealth}}$$

The dispersion effect is an effect of shift in monetary wealth on the credit volume of society. The gross volume of current shift in monetary wealth is the sum of all receipt surpluses (or the sum of all expenditure surpluses). The net volume is shifts between the group of units with negative monetary wealth and its complimentary group, i.e. units with positive monetary wealth. In the example **A** the gross volume of current shifts is 75. In the example the net volume of currents shifts from deficit units to surplus units is also 75 since there are no shifts between two surplus units or two deficit units. The dispersion of effect in this example is thus as large as possible, namely 1. The opposite extreme of the dispersion effect, in which all units with a positive monetary wealth has an expenditure surplus, is -1. This is the case in example **C**.

Payment flows affect cash balances rather than the credit volume of society. Thus, in example **D** where there is step in trade, the total credit volume remains the same, while the distribution between cash balances and assets changes. Whether a payment flow increases, decreases or leaves unaltered the volume of monetary balances depends upon whether it goes from a bank-debtor to a bank-creditor, from a bank-creditor to a bank-debtor or from two units belonging to the same group. In the first case the volume of monetary balances increase, in the second it decreases, and in the third case it is left unaltered.

A non-bank unit that deposits more with the bank than it borrows from the bank is said to have a financial surplus of outgoing payments. Such a surplus decreases the volume of monetary balances. We may also talk of a financial surplus of ingoing payments, or a deficit of outgoing payments, which increases the volume of monetary balances. The sum of all financial payment surpluses of outgoing payments is called *the gross volume of financial shifts in means of payment (under non-banks)*. In example **C**, the unit **d**, as the only one, has a financial payment surplus on 25. The corresponding financial payment deficit is with unit a (-50 + 25). The effect on the volume of means of payment depends, again, on the position of the agents with the bank, i.e. whether they are bank debtors or bank-creditors. For this phenomenon Stützel has defined another dispersion effect:

$$\text{Dispersion effect of shifts in monetary balances under non-banks induced by financial transactions} = \frac{\text{Net volume of shifts in monetary balances from bank-debtor to bank-creditor due to finance}}{\text{Gross volume of shifts in monetary balances}}$$

The dispersion effect is of financial transactions on the volume of monetary balances. Financial payment flows may cancel the effect of flows of monetary wealth on the volume of means of payment. But financial payment flows may also, by itself, have an effect on the volume of means of payment. As is the case in example **D**, we may have situations characterized by step in trade but not step in payments. Notice that with respect to net volume of shifts in monetary wealth the demarkation criterion was negative or positive monetary wealth, while for net volume of shifts in financial means of payment it is bank-debtor or bank-creditor.

If the dispersion effect for financial shifts in means of payment is deducted from the dispersion effect for shifts in monetary wealth between bank-debtors and bank-creditors, you get the effect on the volume of means of payment. If the effect from changes in monetary wealth is not cancelled out by shift in holdings of financial assets, then they will have an effect on the volume of means of payment. And, the other way around, if effects of changes in financial wealth are not cancelled out by changes in monetary wealth, they will have an effect on the volume of means of payment.

We already discussed example **A**, now let us take a look at the other examples in table 3.2.6.1. Example **B** is similar to example **A** except that an extra transaction has been added; unit **e** borrows 50 in the bank to buy assets while **b** sells assets for 50 and deposits the 50 in the bank as monetary balances. This is a financial payment transaction from a bank-debtor to a bank-creditor. This has a positive effect on the volume of means of payment since a bank-debtor increases his debt with the bank while a bank-creditor decreases his debt. The aggregate effect on the volume of means of payment is 100.

In example **C** differences in monetary wealth are counterbalanced since units with a positive monetary balance have an expenditure surplus while units with a negative monetary balance have a receipts surplus. The negative effect on the volume of monetary balances is 75. But, since there is a financial shift in means of payment from bank-debtors to bank-creditors, the aggregate negative effect on the volume of means of payment is only 25.

In example **D** we have a situation with step in trade; there are no shifts in monetary wealth. There are, however, three financial transactions; unit **a** sells 25 units of assets to unit **b** and 25 to unit **c**, while unit **e** sells 25 units of assets to unit **d**. The gross volume of financial shifts in means of payment is thus 75. The sale from unit **a** to unit **b** has, however, no effect on the volume of means of payment since both unit **a** and unit **b** are bank-creditors. For the same reason unit **e**'s sale to unit **d** has no

effect since they are both bank-debtors. Only the sale from unit **a** to unit **b** has an impact on the volume of means of payment.

The examples shows us how the volume of means of payment may change with different kinds of transactions. Stützel's concepts of step in trade and step in payments makes it easy to see, whether a change in the volume of means of payment is due to receipts and expenditures or pure financial transactions. Most of all, however, the example leaves us with the impression that the volume of means of payment is very unstable, and that there is not much to deduce from changes in this volume.

3.2.7 The General Quantity Equation

Stützel uses the conceptual framework that he has developed to put forward what he calls a general quantity equation. It is called a quantity equation because it deals with the relation between transactions involving goods and services, pure financial transactions and the volume of means of payment. What makes the equation general is that it is valid without any limiting assumptions. Thus the classical quantity equation must be a special case of the general quantity equation, which we shall see later. The general quantity equation looks like this:

(trade turnover * deviation from step in trade * dispersion effect for mon.wealth)
+ (shifts in monetary balances induced by finance*dispersion effect for financial trans.)
- increase in long term bank deposits
= increase in the volume of means of payment held by non-banks

In the first line we have trade turnover multiplied by deviation from step in trade. This gives us the gross volume of current shifts in monetary wealth. By multiplying with the dispersion effect between bank-creditors and bank-debtors for monetary wealth we get the increase in the volume of bank credit due to transactions of goods and services. We must also know how bank-credit is affected by financial transactions. Thus we have shifts in monetary balances due to finance multiplied by the dispersion effect for financial transactions. We now have changes in the position of non-banks with the bank, but this includes both changes in monetary balances and changes in long term bank deposits. Thus we must deduct increase in long term bank deposits to get the change in the volume of means of payment held by non-banks[1]. Stützel points out, that in this relation there is no assumptions with respect to causality:

> "Auch durch diese beziehung [the general quantity equation] wird, wie durch alle trivialen

[1]In our examples we have ignored the existence of long term banking accounts.

> Größenbeziehungen, lediglich ein Gefüge von Bedingungen beschreiben, ohne daβ damit bereits irgendwelche Entscheidung gefällt wäre, bei welcher der Größen der ursächliche Autrieb, bei welchen aber die Folge zu suchen ist."
>
> Stützel (1958) p.228

What we may deduce from the general quantity equation is that normally there is no simple relation between trade turnover[1] and the volume of means of payment. Trade turnover may increase while the volume of means of payment decreases. Under special assumptions, however, the orthodox quantity theory with its fixed stock of money and stable velocity holds. In order to obtain a fixed stock of money it is necessary to assume that agents have a preference for holding money, and not just for using it in performing transactions.

In the example that Stützel presents where the orthodox quantity theory holds, he assumes that labour is paid in advance, and that workers hold their wages is monetary form until it is spend on real goods. It is necessary to assume that the wages are spend concurrently with the delivery of the labour services. Thus we have a situation with step in trade but not step in payments. The firm must hold the cash needed in order to pay for the labour (it cannot borrow from the bank since this would alter the stock of money). Following, when the firm gets the money back by selling goods, it will keep the money rather than depositing it with the bank. This makes it possible to keep the stock of money constant. The size of the necessary stock is determined by the peak deviation from step in payments, which in this case is equal to the wage bill (W). We now have a linear relation between trade turnover and the stock of money:

Trade turnover = velocity * the stock of money

In the example above trade turnover must be 2*W (W for sale of labour services and W for sale of goods), the stock of money is W. Thus velocity must be 2. If this relation is assumed to remain fixed over time it is necessary to keep the following variables constant; (1) the deviation from step in payment due to pure finance, (2) deviation from step in trade. Since there is no apparent reason for assuming these variables to be constant it is easy for Stützel to dismiss the quantity theory as irrelevant for the monetary economies we know.

Let us have a look at the quantity equation in relation to our four examples in table 1. First we need to know the trade turnover which may be found in column 1. In example **A** trade turnover is 775. To get the dispersion effect we need to know the net-volume of shifts in monetary wealth from units with a negative monetary wealth to units with a positive monetary wealth. We see that unit **e** spends 200 which goes to the surplus units **a** and **b**, but at the same time **a** and **b** spends 125 which goes to

[1]When we write trade turnover we are, of course, talking about it in monetary terms since we may not know the real magnitudes.

deficit units and thus have to be deducted from the 200. Thus our net volume is 75, our gross volume 775, and the dispersion effect is 0.097. Since in example **A** there is step in payment there is no effect from payment flows, and the total change in the credit volume is 75. In the same way we can use Stützel's quantity equation to find the effects of flows of monetary wealth and flows of payment on the volume of cash balances:

example A:	775 * 0,097	= 75
	75 * -1	= -75
	75 - 75	= 0
example B:	775 * 0.097	= 75
	25 * 1	= 25
	75 + 25	= 100
example C:	825 * -0,909	= -75
	50 * 1	= 50
	-75 + 50	= -25
example D:	800 * 0	= 0
	75 * 0,333	= 25
	0 + 25	= 25

The examples illustrates the need to take the two different dispersion effects into account and thus the importance of distinguishing between flows of monetary wealth and flows of means of payment.

3.2.8 The Need for Means of Payment

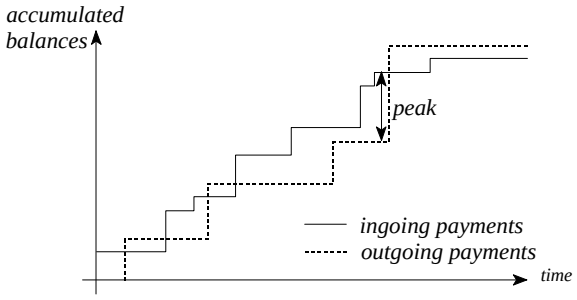
Stützel is not satisfied with the quantity equation; he wants to be able to say more about the need for means of payment. This desire arises from realising that the need for means of payment may not be determined by turnover within a given period, but rather by the peak load on means of payment within the period. The variable to be determined in the work of Clower and Howitt was the average money holdings, but what is interesting must be the maximum money holdings within a given period of time. If the financial system is not capable of satisfying the demand for means of payment at the peak, then the financial system may prevent certain transactions from taking place. To catch this phenomenon Stützel introduces the concept *peak deviation*:

$$\text{peak deviation:} \quad \frac{\text{peak balance within the period}}{\text{trade turnover within the period}}$$

How do you find the peak balance? You simply observe the size of balances (all positive money balances or all negative money balances) in the beginning of the period, and observe them throughout

the period. If there is step in payment then outgoing payments and ingoing payments would always take place at the same time so that balances do not change. But without step in payments the size of balances may change during the period.

Figure 3.2.7.1



But even with knowledge of the peak balance it is still not possible to say how large the volume of money must be in order to satisfy the demand within a given period. To do that it is necessary to have knowledge of the *liquidity preference* of agents(p.243). The demand for money balances may be divided into three different categories: (1) need for trade turnover[1], (2) speculative motive, (3) precautionary motive. What Stützel is concerned with is only the demand for money due to trade turnover, i.e. he poses exactly the same question as Clower and Howitt did. The demand that would still be there, even if there where no uncertainty. The demand arises because of lack of synchronization between ingoing payments and outgoing payments due to a capital market that is not perfect (p.243 n.1).

When Stützel talks about liquidity preference it is not the same liquidity preference as Keynes introduced since it is concerned with time preference, i.e. the length of the period with which economic agents are concerned when they plan their holdings of monetary balances. Since Keynes takes into account the speculative and precautionary motives, Stützel's liquidity concept is much more simple than the one of Keynes. The concept that Stützel chooses to work with is called *liquidity-concern period*. In general one can say that the longer the liquidity-concern period, the larger the need for monetary balances. This is due to the fact that the need for monetary balances determined by trade turnover is equal to the negative peak balance in the liquidity concern period. The longer the period that agents want to hold monetary balance as large as their peak balance, the larger is the need for monetary balances.

If agent **A** and agent **B** both have a liquidity-concern period on 20 days starting on the same day, and the peak

[1]Stützel calls this the "turnover-motive", but it can hardly be called a motive since it is a necessity in order for trade to take place. The agent does not have a choice and thus no motive.

balance of **A** is 15 occurring in the first 10 days while **B** has a peal balance on 15 during the last 10 days, then the need for monetary balances will be 30. Had the two agents had a liquidity-concern period on ten days, then the need for monetary balances in the first 10 days would be 15 + **B**'s new peak balance, which must be smaller than 15. The need for monetary balances in the last 10 days would be 15 + **A**'s new peak balance which also must be smaller than 15.

Stützel attempts to sum up his observations by determining the relation between the need for monetary balances and trade turnover. He must conclude that the needed volume of monetary balances usually is not proportional with trade turnover (p.245). Rather than being determined by trade turnover, the needed volume of monetary balances is determined by:

A. Deviation from step in payments, which is determined by:
    a. deviation from step in trade
    b. deviation from step in payments due to pure financial transactions
    c. dispersion effects
B. liquidity-concern period.

Unfortunately none of these variables are fit for empirical analysis. With available statistical data we do not stand a chance in estimating the deviations from step or the dispersion effects. In a simulation model we can however obtain the needed data, and in our next chapter we shall observe these variable in our simulated economy.

3.2.9 Stützel and the Theory of Money Value

We have now presented the main arguments in Stützel's work and it is time for us to ask what we may learn from him. Is his work merely a pedantic way of illustrating that we should not draw too hasty conclusions from observations of the volume of monetary balances, or does he provide us with a useful building block in the development of a monetary theory of production? If the latter is the case, what exactly should this building block consist of? In this section we shall discuss how the methods of Stützel may be applied to theories of money value and thus how Stützel's theory may be combined with a theory of money value.

The most important elements of Stützel's work are methodical and methodological. The methodological point of Stützel is that we should study the logical framework of the system before we introduce metaphysical or behavioural assumptions. The methodical innovations are the division of money flows into payment flows and flows of monetary wealth and the study of mechanics of balances as relational theorems between partial theorems and global theorems. The way in which he puts these methods to use, e.g. his development of a new quantity equation, may not be very illuminating we respect to understanding the process of monetary production. We cannot know the relevance of the new

quantity equation until we see its variables in action. If e.g. the dispersion effects turn out to be very unstable in the real world, the equation is hardly very useful. Even if its variables are stable the volume that it determines, i.e. the volume of monetary balances, may have no significance for the economy. Thus its relevance must depend on human behaviour.

To question the relevance of Stützel's deductions may be perceived as a critique of Stützel's methodology; to look at logical structures before human behaviour is taken into consideration. This is not the case, but one must realize that it is impossible to set up a fully developed theoretical framework before human behaviour is considered. As mentioned in our introduction, someone once wrote that German economists writes down everything that is true whereas English economists writes down everything that is true and interesting. Writing down everything that is true is a useless deed, and what is interesting is very much under the influence of human behaviour. But this is no excuse for neglecting logical structures.

Why is the distinction between flows of monetary wealth and flows of payment so important? First of all it is important because it allows us to study the impact of pure financial transactions. But it may be even more important if it is related to a theory of money value. We already saw how Schmitt and Cencini inspired by Keynes set the value of production equal to the monetary balances, or credit, needed in order to finance the production. Stützel does not use the same method since his refusal to deal with any metaphysics prevents him from using the concept of value. All that he can do is to record flows of monetary wealth. Still Stützel's approach is very similar to that of Schmitt and Cencini, and by combining the two it is possible to improve the theory of money value.

The first thing that is needed in order to turn Stützel's theory into a theory of money value is to distinguish between goods and labour services. To Stützel they are both flows of real services which are moving in opposite direction of flows of monetary wealth. Stützel does not attach any assumptions to the real flows. What he observes are the flows of monetary wealth, and from these observations he concludes that real services must change hands. In the form of this *quid pro quo* assumption a metaphysical object has sneaked its way into Stützel's theory[1]. What a theory of money value claims is that the value of real services must be measured by the flow of monetary wealth that their production gives rise to.

It is not interesting to look at aggregate flows of monetary wealth because they add up to zero. A theory of money value claim that the same is true with respect to flows of goods and labour services

[1]To be strict Stützel can only define flows of monetary wealth as flows that affect monetary wealth. He cannot say anything about real goods what so ever. Americans have a habit of throwing money into whatever puddle they come across (especially in Las Vegas). This is a flow of monetary wealth, but there is no flow of real goods or services. Thus there is no logical law saying that where there is a flow of monetary wealth there is a flow of real goods and services.

measured in value terms. Stützel divides the flows of monetary wealth into flows from units with a positive stock of monetary wealth to units with a negative stock of wealth. This division does not make sense with respect to flows of real goods and services. The division of value flows into labour services and goods is not interesting either since they are equal by assumption. What may be interesting to observe is the division of inflows of value and outflows of value between firms and households.

Let us have a look at figure 3.2.6.1 again. It is possible for firms to build up a positive balance of monetary wealth. This only requires that they demand more monetary wealth for their goods than they pay for labour services[1]. The only way this is possible is if households builds up a negative balance of monetary wealth by parting with more monetary wealth in paying for goods than they receive for their labour services. But in this case the flow of labour services is not equal to the flow of real goods, both measured by their price in monetary wealth. Thus we must conclude that a flow of monetary wealth is not the same as a flow of money value. In order to apply Stützel's framework to a theory of money value it is necessary to apply a third set of arrows to figure 3.2.6.1, representing value flows. The arrows of goods and services from households to firms would be the same for both value and monetary wealth, but the arrows of goods and services from the firms to the households are likely to differ from the flows of value from firms to households. It is possible to define a dispersion effect that tells us how flows of value affect the distribution of value between firms and households:

$$\text{dispersion effect of shifts in value on the distribution of value between firms and households} = \frac{\text{The net volume of current shifts in value from households to firms (=value held by firms)}}{\text{Gross volume of current shifts in value (=value of current production)}}$$

We must not think of value as a stock in the same sense as monetary wealth. Money value can only exist within the current period and without making further assumptions we can only discuss its distribution between firms and households, not between individual firms.. Because we have no invariable measure of value we cannot compare values created in different periods, and thus they cannot be added into accumulated stock as we do with monetary wealth. We must think of value as disappearing once the period ends. This discreteness is one of the reasons why quantum mechanics is a good way of thinking about monetary values. We can only think of value flows as changes in stocks by thinking of the labour power of workers as a stock of value. Thus firms may have no initial stock of value and the minimum value of the dispersion effect, where the firms holds no value at all, is zero. The maximum is, as was the case with monetary wealth, 1.

[1]We may ignore inter-industrial relations since we are dealing with the whole sector.

We have now defined three different types of flows that our theory must be capable of handling; payment flows, flows of monetary wealth and flows of value. The distinction between payment flows and flows of monetary wealth makes it possible for us to study the impact of pure financial transactions. The distinction between flows of monetary wealth and flows of value makes it possible for us to study the impact of the pricing mechanism on the distribution of value. We thus get a richer perception of the functioning of the economy by operating with all three kinds of flows than we may get by only observing value flows.

3.3 Conclusion

The quantity equation, which is the dominant tool of monetary theory, is much too simple to handle even the most basic aspects of money flows and logistics of exchange. Rather than relying on the concept of velocity, we must specify what determines the need for money. We found that deviations from step in trade, which is also the determinant of the volume of monetary wealth, together with deviation from step in payment, are important determinants. Another important determinant is the peak deviation. The usefulness of these concepts to economic analysis depend on their level of stability, which must be determined by human behaviour. Unfortunately an empirical test is impossible, but in our simulation model we are capable of measuring the dispersion effects as well as the monetary peak.