Introduction

This paper deals with anomalies in the economic theory and economic modelling of the modern money economy. The anomalies per se have little to do with the performance of the real world economy, neither the microscopic level nor the macroscopic level. Thus the real world economy is the very one we live in and which we practically and theoretically have to cope with, so eventual anomalies in the confrontation of economic theory with the real world economy must have their roots in the very economic theorizing. Keynes wrote (1973: 383):

> *But apart from this contemporary mood, the ideas of economists and political philosophers, both when they are right and wrong, are more powerful than is commonly understood. Indeed the world is ruled by little else. Practical men, who believe themselves to be quite exempt from any intellectual influences, are usually slaves of some defunct economist. Madmen in authority, who hear voices in the air, are distilling their frenzy from some academic of a few years back.*

We have gone through a trying period in Europe in the aftermath of the sub-prime scandal in 2008. Before that there was a total focus on inflation which was absurd since everybody knows that inflation measures are delivering rather poor figures for analysis and policy-makers and financial market agents reacted not only on occasional percentages but on fractions of percentages measured on yearly basis. In Europe the inflation targets and the policy virtually wiped out growth of the European economies.

The links between growth and inflation are very intricate and the risk of juxtaposition is obvious in economies with changing dimensionality of the commodity space, but no one seemed to pay any attention to this. Furthermore the anti-inflation policy was obviously not sufficient to prevent the subprime crises.

The austerity policy following the subprime scandal has created social instability of a degree which is dangerous for the society and which might threaten further

economic growth and social stability. For the moment we witness an absurd show of central banks trying to create inflation to foster growth thus assuming complete macroscopic reversibility.

The basic thinking behind these social experiments has mainly been based on the neoclassical theory/thinking, a theory which bases its impressing mathematical superstructure on a fairly simple analysis of barter economy best expressed in a medieval village, and its very construction builds on a belief that economic analysis can be performed without regards to the

surrounding social, cultural and ethical structures. Luigi Amoroso (1938) wrote about Wilfred Pareto:

> *It is one of the ironies of life that Vilfredo Pareto, the denier of every creed, of every philosophy, is the artificer who, first and most valiantly, raises-on the ruins of the democratic dogma - the edifice of the new faith and of the new philosophy, anti-democratic, anti-humanitarian, anti-progressive, anti-evolutionary. For, by taking as a foundation the critique of the derivations, that is, of the logical and pseudological reasonings with which the socialist-democratic city justified its deterministic, laical, and international faith, he restored a theoretical value to religious and patriotic values, to the principles of individual responsibility and of the freedom of the will; the principles which the wisdom of the ages has taken as the foundation of all civil life.*

Projections of the World

Economic theorizing mostly uses a mishmash of neoclassical and Keynesian thinking, not necessarily wrong per se in practical work, but the most serious effect sare that Keynes' basic philosophical thinking is completely overlooked and even so called Keynesians accept the neoclassical approach to modelling, also with

respect to money, which indeed is curious since money in everyday sense is anomalous to the neoclassical theory in its axiomatic form.

Little efforts have been made to link Keynes' philosophical approach, which starts from the distinction between atomic and complex variables, to his economic thinking. In doing so we end up in the conclusion that Keynes' thinking and the neoclassical theory are contradictive in terms.

Scientific theories are projections of a multidimensional problem into a theoretical world of less dimensions.

The ancient Greek artist had a fabulous perception and apprehension of the human body and geometrical forms which was used for wonderful sculptures and buildings. However their ability to project the human body as well as nature at large onto a two-dimensional surface was poor. The Euclidian geometry was the theoretical basis for analysing the reality but through the axiom of parallels not even geometers were able to even understand projections of three dimensional objects into two-dimensional paintings.

The break-through came during the Italian Renaissance, it was an architect Filipo Brunelleschi (1377-1446) who developed the geometrical technique. It was however two artists, two of the giants of art Van Eyck (1390-1441) in Flanders and Andrea Mantegna (1431-1506) in Padua/Mantua who realized the principles of projecting three-dimensional motives on two dimensional surfaces in expressive art. Thus the leading personages in the development of projective theory were not mathematicians but architect and artists.

It had to pass some three-hundred years more until mathematicians produced the full theory of non-Euclidian geometry and projections. The two persons actually doing it were Nikolai Lobachevsky in his paper from 1826 "A concise outline of the foundation of geometry", and Janos Bolyai 1823 in a letter to his father, published 1832, "Appendix Scientiam Spatii Absolute Veram Exhibens", developed a non-Euclidian consistent geometry, dismissing the Euclidian axiom of parallels.

It is interesting to see that those actually working in practise with projections of the real world since long had anticipated the problems with the Euclidian axiom of parallels while it took a considerably longer time to understand the very axiomatic problem. Lobashevsky/Bolyai decided to do completely without the axiom of parallels and replace it with: *For any infinite straight line L and any point P not in it, there are many other infinitely extending straight Lines that pass through P and which do not intersect with L.* The simplest way to imagine this proposition is to think of a sphere projected on a two-dimensional surface.

The problem underlying these peculiarities does not however stem from the axiom of parallels per se but basically from Euclid's definition of a *Point* leading to a line where many points are closely succeeding each other. A *Point* is obviously undefined with respect to dimensionality[1]. Concerning projection it is important to realize that such an operation requires inert structures.

The postulate by Lobashevsky/Bolyai was developed by particularly Riemann into the modern curved space theory. Riemann's analysis started a veritable rush with respect to the study of the spatial conditions of the world and geometry was developed into topology, Hilbert, Aleksandroff, Hopf from the beginning of 20th century were key figures in mathematics. The mathematical analysis was accompanied by systematic studies of biological forms particularly comprehended and expressed by d'Arcy-Thompson. The development of new areas of mathematics were adumbrated by the developments of analytical philosophy particularly in the works of Russell/Whitehead, Wittgenstein, Reichenbach and the man of certain interests to us economists, John Maynard Keynes.

Our introduction alluding to geometrical matters perhaps seems a bit esoteric but in fact they are fundamental to understand Keynes' philosophical view. He announces it clearly in General Theory where he actually says (1936[1973]:16-17):

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[1]A compact and precise discussion of this can be found in Paul Alexandroff (1932/1961 in English)

The classical economists resemble Euclidian geometers in a non-Euclidian world who, discovering that in experience straight lines apparently parallel often meet, rebuke for the unfortunate collisions which are occurring. Yet, in truth, there is no remedy except to throw over the axiom of parallels and to work out a non-Euclidian geometry. Something similar is required to-day in economics. We need to throw over the second postulate of the classical doctrine and to work out the behaviour of a system in which involuntary unemployment in the strict sense is possible.

Keynes is certainly right in relating to involuntary unemployment but from our point of view his philosophical discussion of atomic and complex variables is the more fundamental if we want to study the neoclassical axiomatic structure per se and uncover hidden contradictions.

We have now reached the very start of our analysis. Two types of problems were frequently discussed in Cambridge at the time when Keynes became a student there: i) additive aggregation and ii) atomic versus complex variables. Both these problems will be of utmost importance in projecting empirically apprehended structures into mathematical/logical models.

If we look at John Maynard Keynes he discusses both these problems in his early philosophical works and particularly atomic versus complex variables in his "Treatise on Probability".

In a speech delivered to the Apostles 1903 at the age of twenty Keynes claimed with respect to additive aggregation:[2]

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[2]I am grateful to Lord Robert Skidelsky, Emeritus Professor at Univ. of Warwick, for interesting discussion on Keynes philosophical contributions and his kind help in sending me a draft from the early lecture notes by Keynes (1903) where Keynes rejects additive aggregation. The Apostles was a secret intellectual society in Cambridge.

> *...the unpopularity of the principle of organic unities shows very clearly how great is the danger of the assumption of unproved additive formulas. The fallacy, of which ignorance of organic unity is a particular instance, may perhaps be mathematically represented thus: suppose f(x) is the goodness of x and f(y). It is then assumed that the goodness of x and y together is f(x)+f(y) when it is clearly f (x+y) and only in special cases will it be true that f(x+y) = f(x)+ f(y). It is plain that it is never legitimate to assume this property in the case of any given function without proof.*

Additive aggregation is a risky affair in empirical sciences and particularly in applying mathematics/statistics to empirical problems in naive ways.

For those reading Keynes carefully it is fully evident that he follows his own statement and reject sexplicitly or implicitly additive aggregation but for clearly defined problems.

The neoclassical theory however explicitly *postulates* additive aggregation. Thus it is, from a mathematical point of view, not possible to mould Keynes' writings into a neoclassical form: *Keynes' approach to economics and the neoclassical theory contradict each other in terms.*

Projections of Real World into Mathematics

We have always to translate an analysed piece of reality into a kind of projection suitable to logical analysis. The projection of a certain space into a space of less dimensions raises two principle problems. The first has to do with the very choice of dimensions which we choose, the second has to do with precise mathematical form of the variables we prefer to deal with. These two can be named as the *translation problem*.

Wittgenstein's formulates a proposition 6.211 in Tractatus Logico-Philosopicus:

> *Indeed in real life a mathematical proposition is never what we want. Rather, we make use of mathematical propositions only in inferences from propositions that do not belong to mathematics to others that likewise do not belong to mathematics. (In philosophy the question, "What do we actually use this word or this proposition for?" repeatedly leads to valuable insights.)*

We may illustrate it like in **Figure 1** and we see one distinct problem namely that the causal structures of the reality are almost always irreversible while logical/mathematical structures are almost always reversible.
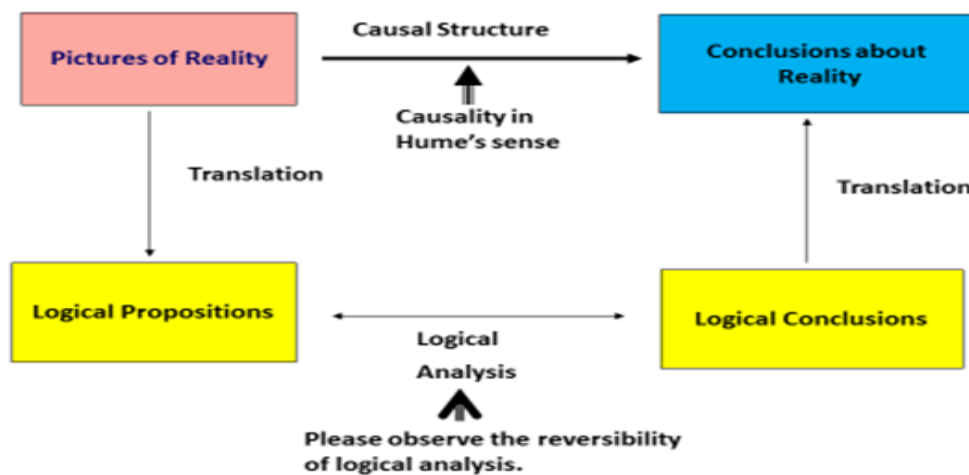

Figure 1: Illustration of Proposition 6.211

The neoclassical axiomatic structure has as a corollary the so called *principle of revealed preferences*, which means that given general equilibrium the optimization problem of maximizing utility given prices and incomes can be replaced by minimizing costs given utility. This correlate utilizes the very feature of

reversibility in mathematics/logics without any reference to the real world.[3] The essential role of this correlate is that it has to be believed in if we work with the usual inflation indices.

However the problem of projections has also a deeper philosophical aspect which becomes apparent in the difference between Immanuel Kant and David Hume and the difference between a claimed ideal world and a sensual perceivable worlds. Kant made a distinction between "Das Ding an sich" and "Das Ding für sich" where the former was the correct and un-perturbed representation of objects of the real world while the second was the perturbed representation we achieve through our senses and interpretations of mind based upon that picture. Based on this view, and by all means other considerations, Kant came to the conclusion that the mathematical representation would be an unperturbed picture of both the object and its relations to other objects. Kant's philosophy has had an enormous impact on our thinking for good and worse but with respect to our discussions of projections and interpretations of reality he seems a bit naïve not to say obsolete.

Hume, on the other hand who with his investigations on causality is fully up to the analytical philosophy of our time, has a contradictive view in relation to Kant, since he only discuss the sensual perceivable world. He looks at reason/logics/mathematics as humble servants of passion. Thus he points towards the conclusions of Cantor/ Russell/ Whitehead/ Wittgenstein/ Gödel that the logics/mathematics is empty of any real content, it is a language which at best might be consistent but that is unprovable (Gödel). There is a famous quote from Hume:

> *Nothing is more usual in philosophy, and even in common life , than to talk of the combat of passion and reason, to give the preference to reason, and assert that men are only so far virtuous as they conform*

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[3] This result is often a bit embarrassing to economic theorists and Georgescu-Roegen rejected it for dynamic analysis, in the 1930s, while Samuelson tried to explain it and give it an empirical meaning in late 1940s.

themselves to its dictates. .... I shall endeavour to prove first that reason alone can never be a motive to any action of the will; and secondly that it can never oppose passion in the direction of the will. (Hume, 2002[1740]: 265)

Hume uses passion in a fairly broad way meaning interests, preferences, purposes, will in a broad sense.

Thus if we follow Hume as well as modern analytical philosophy a mathematical analysis of certain features of the reality can be consistent without being true. Our example above with respect to the increased quality of apprehension and ability of projections of the physical space shows that the theory of projecting the world was not an à priori construction but the skilfulness of some talented architects and artists and their sensual perception combined with a masterful ability of expressing themselves in drawings and paintings and *then* we got the mathematical/logical development.

Moreover Picture 1 and the quote from Wittgenstein implies that the very logical analysis per se is the most trivial part of the analytical procedure. How we actually form our axiomatic projection of the reality is the question of overwhelming importance and that is what this paper is about concerning the mainstream economics and its relation to the neoclassical theory.
Thus a mathematical picture is, should and can be nothing but an interpretation of sensual apprehensions in empirical science.

Models and Reality

When we read economic thinkers up to the second part of the 19th century economic theoreticians were fully occupied with analysing the peculiarities of the *money economy.* Jean Baptiste Say, who has come to symbolize the neoclassical general equilibrium through his putative law, actually explicitly rejected the

existence of a general equilibrium by rejecting any form of prices and money as a general measure in economic science.[4]

However from the 1860s/70s economic analysis took another path, instead of working with an open system of the economic world the analysis became closed in trying to reach some form of parallel to Newton's physical equilibrium system. This was achieved by introducing the concept of *utility* which was an abstract concept, a common "substance" to all commodities.

Rationality was also explicitly imputed in the analysis, and its links to the Kantian analysis is obvious. If we look at Hume and the philosophical and mathematical development during the 20th century the word rationality used in the economic analysis during the end of the 19th century is indeed naïve. In mathematics/logic rationality/reason per se is empty of any empirical content. Thus applying the word rationality implies that we also must reveal an empirical structure onto which the word rationality can be utilized.

Basically the concept of rationality must be based on a common measure. It is thus instructive to read Jean Baptiste Say who rejected prices as well as money as any kind of general measure. Thus Say only saw an equilibrium price as a local and temporal phenomenon. He has a brilliant example to illustrate this:

> *When I am told that the great pyramid of Ghaize is 656 feet square at the base, I can measure a space of 656 feet square at Paris or elsewhere, and form an exact notion of the space the pyramid will cover; but when I am told that a camel is at Cairo worth 50 sequins, that is to say, about 90 ounces of silver, or 100 dollars in coin, I can form no precise notion of the value of the camel; because, although I may have every reason to believe that 100 dollars are worth less at Paris than at Cairo, I can not tell what may be the difference of value.* Say (1834[1803]: 247)

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[4] A more comprehensive discussion of Say is found in Ekstedt (2012: 54-57). "Say's Law" originately appears in Say (1802): Chapter XV.

And he states:

> *Money or specie has with more plausibility, but in reality with no better ground for truth, been pronounced to be a measure of value. Value may be estimated in the way of price; but it can not be measured, that is to say, compared with a known and invariable measure of intensity, for no such measure has yet been discovered* (Say 1834[1803]:246).

A meter is defined as the distance which light covers in vacuum during $\frac{1}{299\ 792\ 458}$ second, which obviously has to be seen as a local and temporal earthly business. However this medium of measure is defined from the inert reality which scientists agree on because of its observability.

The measure in the neoclassical axiomatic structure called a price-vector, which has nothing to do with prices in everyday sense, is only defined in a general equilibrium in an economy with constant dimensionality of the commodity space.

That brings us to a passage in a famous letter from John Maynard Keynes to Roy Harrod 10th of July 1938 (Keynes: Collected Works):

> *My point against Tinbergen is a different one. In chemistry and physics and other natural sciences the object of experiment is to fill in the actual values of the various quantities and factors appearing in an equation or a formula; and the work when done is once and for all. In economics that is not the case, and to convert a model into a quantitative formula is to destroy its usefulness as an instrument of thought. Tinbergen endeavors to work out the variable quantities in a particular case, or perhaps in the average of several particular cases, and he then suggests that the quantitative formula so obtained has general validity. Yet in fact, by filling in figures, which one can be quite sure will not apply next time, so far from increasing the value of his instrument, he has destroyed it. All the statisticians tend that way. Colin, for example, has recently*

Hasse Ekstedt	Contradictions in Economic Theory and The Economic Modelling of The Modern Economy

> *persuaded himself that the propensity to consume in terms of money is constant at all phases of the credit cycle. He works out a figure for it and proposes to predict by using the result, regardless of the fact that his own investigations clearly show that it is not constant, in addition to the strong a priori reasons for regarding it as most unlikely that it can be so.*

These are remarkable words if we just look at them in the current mode of economic modelling but they are based on Keynes' early philosophical works and are in the line of the development of analytical philosophy during the 20th century concerning the emptiness of logic with respect to real content.

It may also explain a rather curious exchange of thoughts at Salvatore Dali's place in Figures, north of Barcelona, November 1985 when the Nobel laureate in chemistry Ilya Prigogine met René Thom, the great French mathematician, in a public discussion:

> *Thom: You should very carefully distinguish between what belongs to mathematical theory and what belongs to real systems. Mathematics has nothing to say to reality.*
> *Prigogine: That's your point of view, it's not mine*

René Thom seems to be right in the very fundamental sense that mathematics is a language and as such neutral to the substance of the analysis. Furthermore mathematics has almost always to work with atomistic variables while in reality such variables almost never exist.

Prigogine may also be right, but then we think more about abstract geometric and topological forms analysed in mathematics which allow us to analyse different complex *mathematical* structures with logical precision and that may give rise to fruitful inventions of new perspectives in empirical sciences.[5]

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[5]The discussion is partly available at www.dalidimension.com

When we enter mathematics the variables are expected to be defined in an atomistic way and that has to be observed carefully. In fact most of the natural sciences, physics, chemistry and medicine use their laboratory experiments almost solely for the reason to find a precise variable with one and only one definition. In such a way these sciences might approach a set of almost atomic variables, and the repetitiveness is to establish an inert parametric structure. As Keynes points out this is not possible in social sciences and consequently there is no truth value of a certain parametric solution but for the actual mathematical/statistical operation. True that convincing argumentation of an inert structure may persuade us *to attach some relevance to a parametric structure as such but not to the parametric values*.

Equilibrium – Disequilibrium

The turn to a mathematical treatment of equilibrium became more or less completed when the utility theory entered in a systematic form and we got a closed relationship between the individuals and the commodities. It is very interesting to compare Mill's and Jevons' writings leading to Jevons' mathematical formulation of a utility function for the individual. Mill strived towards a complete macroscopic formulation but had difficulties to get around the interrelations between individuals; his discussion actually points toward Arrow's paradox in some aspects (Mill 1990[1863]). Jevons realized these difficulties and defined utilities as well as individuals in atomistic terms and thus directly dismissed the parts which troubled Mill and could consequently find a way of representing the relation between the outer market supply and the interior of the individual given the *rational* individual.

The result was a rift between the mathematical representation of the macroscopic vis-à-vis the microscopic economics.

The fully logically consistent representation of an economy populated with "rational" individuals was shaped during the period 1930s to 60s and reached an axiomatic form in Arrow& Debreu (1954), and in Debreu (1982) the equivalence between Nash-equilibrium and Arrow-Debreu competitive equilibrium was shown, which was the ultimate step in the completion of the neoclassical theory.

It is worthwhile to notice that the theory often is used inter-temporally and this actually seems in line with Jevons although not expressed explicitly. To the author it seems that the only ranking economist who explicitly *rejects* this is Gerard Debreu; we will come back to this later.

Disequilibrium approaches are more difficult to get hold of. It contains Keynesianism, institutionalism, evolutionary economics and several other approaches that often build on analogies to other sciences as neurology, biology, and may be others. This is natural since contrary to equilibrium theory there are no unifying models for economic affairs only local and temporal, social, political and cultural forces.

The equilibrium model has a most sophisticated mathematical form and thus seems to be the theory *par preference*. The neoclassical general equilibrium means on one hand that the price vector for the defined commodity space is unique, given the distribution of initial distribution of commodities and/or productive resources. This means that the agents maximize their utilities/welfare given initial *endowments.* In early days these were regarded as a stock of commodities of different kind but in Makarov & Rubinov (1977) we got the final link between the Neumann-Gale production analysis and the Arrow/Debreu equilibrium; thus we could replace (within the taken presumptions) commodities with productive resources.

Consequently the neoclassical equilibrium theory has been developed to cover not only individual optimizing but a social optimum, which also achieves the highest form of distributive efficiency, Pareto efficiency. The market process is subsequently neutral with respect to distribution. It is obvious that such an approach seems tasteful both from a scientific as well as an ideological/ethical point of view.

With respect to ethics we implicitly can identify two opposite states; both build on the facts that the individuals act as independent atoms and that in equilibrium unanimously must rule. That means that either we have a state of complete in-deterministic chaos or we have a strict rule for the individual to make all other

individuals' preference functions restrictions for the own behaviour which is rather similar to the Kantian imperative, *'Act externally in such a manner that the free exercise of thy will may be able to coexist with the freedom of all others, according to a universal law'* (Kant 2007[1795]:398).Thus the Kantian imperative is consistent with a Nash-equilibrium, which means that given the distribution of endowments the agents maximize their welfare given the preference relations of all other agents.

Axiomatic Structure

The neoclassical axiomatic structure as in Table 1 has two parts: defining rationality and defining the properties of the preference ordering. There are three axioms in each group:

Table 1: The Neoclassical Axioms of Arrow/Debreu

Economic Rationality	Properties of the Preference Ordering
1. Axiom of Completeness *All commodities in the commodity space are known to everybody*	4. Axiom of Continuity
2. Axiom of Reflexivity *All commodities are identical to themselves*	5. Axiom of Convexity
3. Axiom of Transitivity *For any three commodities holds that if $xRy \wedge yRz \Rightarrow xRz$*	6. Axiom of Local Non-satiation *for any commodity basket A there exists at least one commodity x_i such that $A(x_1,---, x_i+\varepsilon, ---, x_n) \square A(x_1,---, x_i, ---, x_n)$*

The 6th axiom replaces the obsolete marginal decreasing utility hypothesis.

From a mathematical point of view one might raise an (or even both) eyebrow because the axioms 1 to 6 actually define an ordered Euclidian space. The implication of the axioms is that the commodity space is seen as a Euclidian space where the *n* commodities are the dimensions respectively, and consequently the *m* agents are represented by n-dimensional vectors. This implies that neoclassical

aggregation is actually a simple vector addition. Given a certain moment we may assume that all preferences are fixed. If we then impute a certain price vector over the commodity space we will have an optimum for all the agents with regard to that price vector. All agents will then optimize their budgets and we will have m vectors, which in the two-dimensional case can be illustrated as in **Figure 2**.
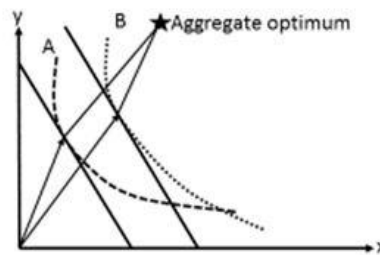

Figure2: Aggregation of Individual Optima

As a momentary picture this is no problem. All contextual considerations are done and we have to make the temporal choice. That is actually what Gerard Debreu advocates (Debreu 1987[1959]: 29-32) when he claims that commodities must be indexed according to time and space. Expressed in such a way the general equilibrium approach is a quite acceptable description of the market process. But then the optimizing choice by the agents is not really a choice but an equilibration of choice criteria created in the contextual considerations and then effectuated when the ruling price vector is applied. Thus in the market exchange there is no real choice but a deterministic application of an optimizing rule, and as we see the time is lacking since we assume that the agents and the commodity space and the context is given.

If we were to look at general equilibrium in this way we would have no possibility to explain a time trajectory other than in the case that all relative prices and endowment vectors as well as the preference structures are assumed constant.

Still we may claim that we might use the neoclassical general equilibrium model as a kind of general but simplified model of the real economy and thus analytical derivations may give us hints of the direction in how to act with respect to the real economy in policy matters.

Such a claim is the general claim of defence for the proponents of the neoclassical theory. To discuss this sort of claim we need to go deeper into the axiomatic structure and we must complete that with some comments on Arrow's paradox.

The role of the axiomatic structure is to claim that the interior processes of the individual can be described in exactly the same way as the outer commodity space and then to be handled in an ordered Euclidian space. Given Brouwer's dimension invariance theorem: *P^n is Homoeomorphic to P^m if and only if n = m* we may then perform the same manipulation on the two spaces.[6] Thus we make the interior choice space of the individual pointwise equivalent to the exterior commodity space. This was actually what Jevons tried to do but the Arrow/Debreu approach is more efficient from a mathematical point of view, replacing utilities with a preference order. Applying Brouwer's theorem we however run into a terrible jumble when we try to introduce the time aspect. How do we actually handle the case where the dimensionality of the commodity space changes? Keynes mentioned actually this problem in the preface to the French edition of General theory (Keynes 1973[1936]:xxxi-xxxv). This means that any change of the dimensionality of the commodity space will create a discontinuity, which of course can be assumed in different ways but if so we enter a social analysis outside the realm of mathematical considerations. If additive aggregation should be possible according to Brouwer's theorem all preference structures must have the same dimensionality and all commodity baskets must contain the same kinds of commodities.

The axiomatic structure ends in two important principles: the independence of irrelevant alternatives and the principle of revealed preferences. Both these principles grant the reversibility of choices and actions.

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[6] See for example **Weisstein, E.W.**, (1999). Entry: *Dimension Invariance Theorem.*

Axioms 1-3 are particularly interesting since they together with the symmetry definition give rise to an *equivalence relation*. An equivalence relation implies that two spaces are numerically equivalent:

> *Thus assume two spaces X and Y. We have then an* **equivalence relation** *between X and Y if there is a correspondence f from X to Ysuch that $x_i \square x_j$ in X imply $f(x_i) \square f(x_j)$ in Y.*

Consequently we understand that the concept of equivalence relation is the very basis for all manipulations within a Euclidian space for example. By using the first three axioms as a definition of rationality we achieve the situation illustrated in **Figure 3**. The first three axioms, although they are sprung out of pure mathematical logics, has come to represent what we call Axioms of Rational Choice. Indeed it seems a bit curious that purely mathematics could be so easily transformed to represent empirical processes. So let us look a bit at the three axioms what they really say.
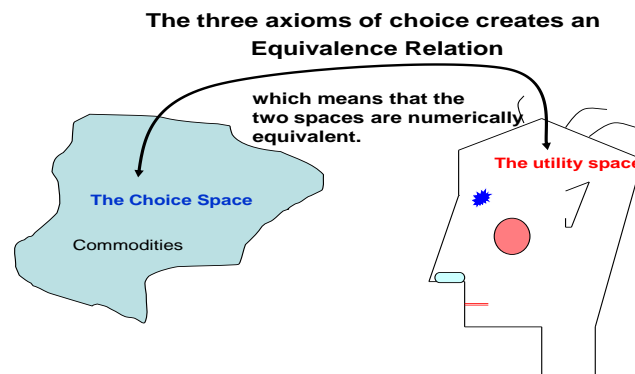

Figure 3: Numerical equivalence between interior and exterior space of the agent.

Axiom of Completeness implies on one hand that all commodities in the analysed basket are known and desired by all agents, furthermore all commodities can be chosen by all agents. Thus we have some idea of a perfect financial market.

Axiom of Transitivity looks a bit complex but it is necessary to achieve logical consistency. Per se the axiom is not particularly problematic if the choice is seen as a local and temporal act but over time we will have troubles but these are in fact in conjunction with axiom two.

The second axiom, *Axiom of Reflexivity*, is however the most crucial one, and we enter the Euclidian space as we relate to Euclid's axiom of a *Point* which is *independent of any structural relationships*. So when we go back to Keynes' allusion to the Euclidian axiom of parallels and the way it is linked to Euclid's axiom of the point as something which seems to be one-dimensional but at closer inspection has a dimensionality set by the chosen dimension of the actual analysis; the Point per se seems as a matter of fact dimensionless.[7] Inspecting the concept of a commodity, as it is defined by the neoclassical axiomatic structure, the axiom of reflexivity makes it independent of all structures. But once we have defined the dimensionality we have also closed the analysis as a consequence of Brouwer's invariance theorem. Thus when we allow for additive aggregation the society *is* the vector-sum of all individual preference curves given a certain price-vector which is also the general equilibrium. We then have to understand that such a locus, which is indicated by a star in **Figure 2**, is nowhere dense. Nowhere dense implies that loci thus defined has no environment. They actually form a sort of unique universe which you are either in *or* it does not exist. This is by the way the fundamental content of Arrow's paradox which we will later say some words about.

The Axiom of Reflexivity is also remarkable from another point of view. Often we try to persuade readers that a certain axiom seems to be relevant in a certain

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[7] We actually receive a Cantor set of Points which are nowhere dense and which Lebesgue measure is Zero. The Cantor Set in conjunction with Cantor's Unaccountability Theorem was important for Russell in formulating Russell's paradox which we will use extensively later.

context but seldom that an axiom per se is trivial. Certainly in mathematics when defining an equivalence relation the axiom of reflexivity cannot be disposed of and that means that if we want to define a Euclidian space the axiom of reflexivity is fundamental. Many text book authors for medium and advanced levels of economics, really are making efforts to persuade readers that this axiom is trivial. Hal Varian (2006:35) tells us that *"the second axiom, reflexivity, is trivial. Any bundle is certainly as good as an identical bundle. Perhaps as children we may occasionally observe behaviour that violates this assumption, but it seems plausible for more adult behaviour"*.

Hausman (2012: footnote 1 p. 13) writes: *Reflexivity is trivial and arguably a consequence of completeness, whereas continuity, which is automatically satisfied for any finite set of alternatives, is needed to prove that preferences can be represented by a continuous utility function.* There are two problematic statements in the latter quote; the first is of course the triviality and the second is that reflexivity follows from the axiom of completeness, this is simply not true from a mathematical point of view. In an axiomatic structure every single axiom brings a particular aspect which is necessary to obtain the particular structure.

Anyway the reflexivity axiom states that a certain commodity is identical to itself, which seems plausible. However, as is shown in **Figure 3**, we deal with two different spaces; the interior choice space of the agent and the exterior commodity space and we try to define the first one so that we can use the Euclidian space for both the spaces given Brower's dimensionality theorem, which implies numerical equivalence. With respect to the outer commodity space we only need to deal with the physical characteristics of a commodity, the firms only produce physical things/processes. From the agents' point of view it is however different. The axioms states that the commodities are all independent of any structural relationships in the mind of the agents. So the axioms actually tell us that the agents are unable to form structures of commodity if we want to use the axiomatic structure inter-temporally.

This is actually why Debreu, basically a mathematician, made his specification of commodities in space and time, which of course seems correct vis-à-vis the real world.

Thus the consumers are denied to regard structures of commodities.

In such a case we also deny them the possibility of a choice which is context-dependent. The one who makes the choice is the one who controls the price vector.

If we reject the Axiom of Reflexivity and accept that consumers' choicesare context dependent we will have a rift between the demand and the supply side, the latter only producing commodities in their physical meaning. We then have to accept non-unique price vectors. Furthermore it invalids any form of additive aggregation of agents and/or commodities.

We have an interesting logical paradox which indicates some sort of peculiarities in the axiomatic structure, Arrow's paradox. Unfortunately more intellectual power has been devoted to discuss efficiency of democracy, voting procedures and such matters instead of trying to understand the precise meaning with respect to the axiomatic structure.

A logical paradox signals that concepts used has no unique interpretation. Arrow defines the axioms concerning the social welfare function by relating them to the axioms of choice, axiom 1 to 3 above, which means that we will have the standard additive aggregation if the agents comply with those axioms of choice and consequently the social optimum will coincide with the standard general equilibrium. But then he populates this economy with agents who are able to consider the aggregate result and to change that through compromises and/or voting schemes. Such agents are contradictive to the neoclassical agents and subsequently the conditions of additive aggregation will not hold and an eventual different aggregate result will not coincide with the neoclassical general equilibrium. This is actually a more precise discussion of the Mill/Jevons problem. Mill realised that the fact that people were taking aggregate results of the market exchange process into consideration in their decisions made it difficult to find a

link between the microscopic and the macroscopic levels so Jevons simply did not discuss the aggregate level but just for the momentary individual choice. The only ranking economist who has taken this problem seriously is actually Gerard Debreu when he indexes commodities according to time and spatial coordinates which make inter-temporal equilibria virtually impossible.

Thus between the two lines of economic thinking: the equilibrium and the disequilibrium approaches, there exists no possibility of compromise, they are contradictive in terms.

Atomic Fact Versus Complex Facts

The axiom of reflexivity thus tells us that the consumer values a commodity irrespective of its environment. Consequently it is independent of its appearance in structural compositions. That is also in fact recognized in general equilibrium theory where a corollary is that all commodities in binary comparisons are *independent of irrelevant alternatives*. Thus we in fact say that in our basic theory the agents' valuation of commodities are completely independent of structural matters.

We have consequently transformed the commodities and even so the agents to atomic facts with no substance. Thus we have a commodity space where the different commodities appear as the axis and the agents as vectors. However since commodities as physical items only occur as positive items, a commodity exists or not but it cannot in physical sense appear as a negative item. Furthermore all agents must consume all commodities by axiom 1 otherwise we get a problem with Brouwer's dimensionality theorem. We also rule out all kind of addictive behaviour through the Axiom of Convexity and furthermore we rule out the existence of lexicographic preference orders which are a reality in a negative sense for millions of people in the world.

Thus our transformation of the market exchange into a mathematical form and consequently commodities and agents into atomic variables in order to be able to

23

work within a Euclidian space has severe implicit effects for the meaningfulness of the neoclassical approach.

As earlier mentioned this was among the key issues of the analytical philosophy during the 20th century.[8]Russell makes the problems precise: *Attributes and relations, though they may be not susceptible of analysis, differ from substances by the fact that they suggest structure, and that there can be no significant symbol which symbolizes them in isolation* (Russell 1924[2007]:337).

This is fundamentally the problem underlying Keynes letter to Harrod and this is why the neoclassical theory based on a fairly simple 19th century thinking has missed the last 150 years of philosophical development in logics and mathematics.

Epistemic Cycles, Barter and Disequilibrium

We have rejected the Axiom of Reflexivity and by that we have also rejected reversibility as expressed in the Revealed Preference Theory.We have also rejected additive aggregation and the correlate of Independence of Irrelevant Alternatives.
It seems that there is not much left of the neoclassical theory with respect to the macroscopic level.
As a natural, but not perhaps easily seen, correlate to these rejections we may prove a theorem which will fundamentally affect our view of the concept of aggregation. It is quite natural not to say evident but we need to formulate and prove it.

Proposition I:

> *Assume a system A^* consisting of a finite number of subsystems, which are to be regarded as proper classes, s_1 --- s_n. If then we have a measure allowing us to define an optimizing rule both on A^* as well as s_1 --- s_n; optimization of the global system A^* must imply that at least one of the subsystems s_i must sub-optimize.*

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[8] In Ekstedt (2015; ch. 2) you will find a presentation of the main issues of the discussion.

If on the other hand all the subsystems, s_1 --- s_n are optimized according to the same optimizing process the global system A* must sub-optimize (Ekstedt, 2012: 83).

Proposition 1 can never be proved within the axiomatic structureassuming general equilibrium. It is a generalized conclusion of a disequilibrium as the one appearing in Arrow's paradox. However we do not want to give up the concept of rationality but we will come back to that after an introduction of a particular concept.Gerard Debreu defines an agent as ($\square_i$, e_i) where $\square_i$is the i-th agent's preference relation and e_i is the corresponding endowment vector.

So let us define the out-of-equilibrium agent as ($\square_i$, c_i, e_i)where c_i is a set of epistemic cycles of the i-th agent.

The concept of *epistemic cycles* was first used by Thomas Brody (1993) and we introduce his concept in an extended form. We may illustrate epistemic cycles as in **Figure 4**.
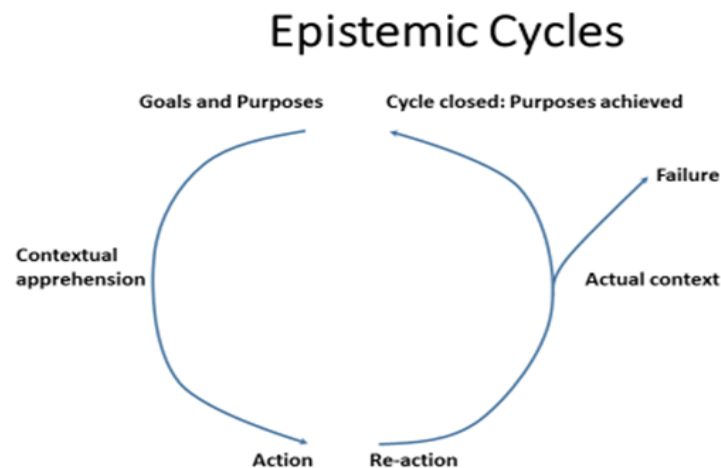

Figure 4: Epistemic Cycles

As we see the agent besides purposes and budgets has a contextual apprehension which may be different with respect to different purposes/commodities. We also see that a failure in closing the epistemic cycle will most probably imply reconsiderations of purposes and/or contextual apprehension which means that the conditions for the future will change.

As we see the concept of epistemic cycles will change the definition of the agents but it will also utilize the fact that commodities are contextually determined. Thus the commodities/purposes will be seen as part of apprehended structures.

From our new definition of the agent follows that we actually keep the neoclassical definition of rationality but now as a necessary but not sufficient condition. Rationality in this form implies two parts: one is the ordinary neoclassical rationality but the second part is the contextual apprehension.

If we touch on the difference between Immanuel Kant and David Hume we can see that while the neoclassical rationality is purely defined in a Kantian way since the choice space is only defined for the positive orthant. Rationality in the context of epistemic cycles however becomes parallel to Hume's analysis, since the execution of rationality is empty of any real substance/meaning per se, it is governed by passion/will or whatever we will call it.

The two approaches were actually brought to an ultimate test in the trial of the Norwegian mass-murderer Breivik, some years ago. One group of psychiatrists and psychologists claimed that Breivik was not rational, which means that he was not responsible for his actions. The reason for this was mainly his bizarre apprehension of the society. Thus the apprehension affected the concept of rationality.

The other group of psychiatrists and psychologists claimed that Breivik's apprehension of the society was not limited to him only but could be found in written texts both on internet and in other sources. Thus he could have deliberately chosen a set of available apprehensions, and given these apprehensions his actions were perfectly rational given his purpose to kill as many as possible. Consequently

he was found guilty of the mass murder and could not be seen as mentally sick to the extent that he was not responsible for his actions.

Proceeding to the proof of Proposition 1 we now need to bring in Russell's paradox together with understanding of the approach to numbers as in Cantor's paradox.

Russell's paradox version 1:

> *If for a set S_1 of elements, all possible subsets as well as the universal set belongs to S_1 we may say that S_1 belong to a non-proper class of sets. If however we have a set S_2 where the universal set of possible subsets does not belong to S_2 then S_2 belong to a proper class of sets. Consequently while the subsets of S_2 belongs to proper classes of sets the universal set S_2 does not, and that shows the paradox.*

Formally we can express it

Russell's paradox version 2:
> *Let S^* denote the set of all sets which are not members of themselves. Then S^* neither belongs to itself nor not belongs to itself.*
> *Formally we thus have*

$$S^* = \{x | x \notin x\} \, then \, S^* \in S^* \, iff \, S^* \notin S^*.$$

The agents produced by the neoclassical axiomatic structure are defined as vectors in the commodity space which is a measurable Euclidian space. To do so we must be able to treat both commodities and agents as atomistic variables. That implicitly means that all agents are facing the same context and for all commodities hold that the physical entities are defining their role as commodities, thus either all items of commodity x_i have exactly the same physical features or all items of commodity x_i possess a substance which is the same for all items of x_i and which is desired by the agents.

27

So defined we may look at two sets of agents, s_i and s_j, which we may obtain by enumerating the different vectors. Let these sets of agents belong to an aggregate set $[s_i, s_j] \subseteq S_i$,and since $S_i \subseteq S_i$ we can proceed with the creation of new sets.

Thus for the universal set S* we find that the set $[s_1, \dots, s_i, \dots, s_n, \ S_1 \dots, S_m] \subseteq S^* \wedge S^* \subseteq [s_1, \dots, s_i, \dots, s_n, \ S_1 \dots, S_m]$, which implies that the universal set of agents is a set of agents. Consequently in Russell's terms neoclassical set of agents belongs to *non-proper sets*.

However, given that epistemic cycles are different, which is the case if we define agents as subjects, that means final causes, than the context of an agent contains all other agents but not self, which imply that agents, as subjects, belongs to proper classes.

Thus we have that the neoclassical agents form a universal set which belongs to itself implying additive aggregation. Our definition of agents which include epistemic cycles thus implies that the aggregate of agents never belong to itself.

The actual proof is to utilize the difference between non-proper and proper classes. Let us start with the first part concerning the optimization of the aggregate body will leave at least one agent sub-optimizing. Since the aggregate does not belong to itself the aggregate will affect the price-vector exogenous to the barter process among the individual agents, due to asymmetric effects on prices. The only occasion when we have a full and unanimous acceptance of the aggregate result irrespective of its effects on the price vector, but that is exogenous to the market process.

The second part when all agents optimize implies that the optimization efforts of the aggregate body will not affect the price vector and since the the aggregate body is not a part of itself and will subsequently sub-optimize.

Thus Proposition 1 is true for a barter economy as the neoclassical theory deals with it.

The result is self-evident since we reject additive aggregation and since our rejection of the reflexivity axiom also mean that commodities are not atomistic but complex. Technically this is rather trivial since we only add some further restrictions on the problem and that is the very essence of the concept of epistemic cycles but these might include social and moral aspects and might also be dependent on the individual's information, education, current social structure and similar factors. We can summarize the very disparate matters that might affect the set of epistemic cycles as:

- An Epistemic Cycle (EC) is a set of concepts and axioms in a certain epistemology which creates a proper logical structure.
- An EC may be inert or dissipative in the sense that influences from the environment may change the epistemology as well as the axioms.
- An EC may be created by a set of systematic observations as well as by scientific traditions.
- An EC may be formed by ethical, historical, religious and cultural traditions.
- An EC may be formed by ignorance, prejudges and lack of information

But important is that an agent can be assumed to be rational within an epistemic cycle. It is also important to keep in mind that authorities on aggregate levels have their epistemic cycles set by the, bureaucratic traditions and agendas internal to the authority in question. The concept of EC may be developed considerably but that is outside our purpose in this paper.

The Mysterious Money

We live in a money economy. We do not purchase commodities in a barter system. Money is an anomaly in the neoclassical economy. The *price vector* is a unique measure of a specific equilibrium in an ordered Euclidian space, which may allude to prices/money but it has not anything with prices/money in ordinary business to do. Keynes discusses "primitive stone moneys of Polynesia" in the beginning of *Treatise of Money* (1930: 14) which is a better allusion to money.

The price vector of the neoclassical equilibrium measures the precise optimizing exchange relations for *one and only one* precise general equilibrium, and to each kind of possible combination of ($\square_i$, e_i) there exists one unique equilibrium. Subsequently we have infinite different optimal price vectors in the economy. Furthermore the different possible equilibria are not connected but *nowhere dense*.

Consequently it is hard to interpret the general equilibrium price vector in what we understand as prices in everyday business.

Furthermore the fact that different equilibria are nowhere dense implies that no convergence processes exist, since the equilibria has no environment. This is why Walras discussed two converging processes; the auctioneer and the tatonnement processes and during these convergent processes no exchange takes place since we then has the case of false trading. When we enter the more precisely expressed axiomatic structure of the Arrow-Debreu setting this is fundamental since an axiomatic structure always defines a set which is nowhere dense. Either you are in the defined structure or you are not, it has no environment. Consequently we cannot even think of a set of different states of general equilibrium and mathematically describe a converging process during which economic exchange can take place. Suggested methods as lump-sum taxes and other ingenious tricks fail if the agents do not behave as prescribed by the axioms so the question is who are going to inform them that the initial endowment distribution is wrong, which is a natural question in the realm of Arrow's paradox.

In Keynesian or other approaches we base our analysis on money values and/or manipulated money values. Often Keynesian models make some money market arrangements for money but we seldom see the concept of money discussed. Furthermore the dimensionality problem, essential with respect to all form of price indexing, is even more seldom discussed although Keynes noted that problem in particular (1936[1983]:xxxv). It is with respect to price indices the dimensionality of the commodity basket becomes a sensitive issue. In Ekstedt (2015: 131-134) it is shown how a change in the dimensionality affects the prices. A period of growth in the number of commodity dimensions will if it is not explicitly accounted for in the

inflation indices appear as increased inflation and subsequently a strict anti-inflation policy in such a case leads to deflation in real terms.

This appears since the concept of real growth builds on nominal prices and the manipulation of these. Since the underlying theory of price indices refers mostly to the neoclassical theory, as the most formalized theory, we arrive at the conclusion that these inflation indices are meaningful for the real economy if we are in a general equilibrium, if not, there is a theoretical mismatch where no conclusions can be drawn scientifically.

The Fundamental Contradiction of The Money Economy

Whatever inflation index we use it is related by some function to the current nominal prices. We work with the current money values of commodities and production factors. Money values, current and also fixed, can always be additively aggregated since money is classified logically belonging to non-proper classes. That means that the universal class of money values belongs to itself.

The result in Proposition I builds on the fact that the commodities are complex in the sense that the agents relate them to desirable/non-desirable structures. Money values however are independent of the underlying demand-structures and the commodities per se. That means that the axiomatic structure of the neoclassical theory relates a particular money value to one and only one commodity which is independent of any context. But that also means that aggregate money values are independent of the real content of underlying commodities.

We then find that Russell's paradox is no longer applicable and we have to draw the following most annoying conclusion:

Proposition II:
With respect to a real analysis equivalent to barter, the proposition I holds.
When we pass over to a non-equilibrium analysis where goals and restrictions are formulated in monetary terms we lose all logical relations to the real economy and consequently proposition I has no meaning.

This proposition is most unsatisfactory since it indicates no logical links between analysis of a barter economy in equilibrium and a monetary economy ofany sort. As we claimed in the beginning: *the neoclassical analysis and Keynes' analysis where proper attention is paid to the problem of atomic and complex variables are contradictive in terms.*

Proposition II is a pure logical contradiction not derived from empirical observation but rises out of the very character of the concept and the difference between real commodities and money as we think of it in daily business. Let us therefore scrutinize the concept of money a bit more. Let us first of all allude to Jean Baptiste Say's resolute rejection of money and prices as a kind of general measure. His examples of the Pyramide of Ghaize and the price of camels indicate that prices are contextually determined. That means that local and temporal equilibria are the only existing equilibria. Money however can be used for local and temporal exchange without any relation to exchange in other loci in space/time. We arrive at a local and temporal state of equilibrium when the momentary price is agreed upon and that will certainly affect the respective agents with respect to budgetary and liquidity matters but how that affects future actions remains to be seen. The important point however is that money in the everyday sense adapts to such a non-equilibrium economy of any real shape. Thus motives, desires, contextual apprehensions are hidden but we actually know the sums involved in the market exchange.

Thus we come to the question of how we shall understand money. We have earlier mentioned the three usual dimensions involved in the concept of money: medium of exchange, liquidity and accounting measure of historical, current and future assets/liabilities.

Money as a medium of exchange is as Hume writes (Essay I of Commerce: 45): "*It is <u>none of the wheels</u> of the trade: It is the oil which renders motion of the wheels more smooth and easy.*" (Our underlining). Thus we can imagine that manipulations of the items supposed to be contained in the concept of money will

have effects but these effects are not linked to the basic causes of trade but to the circulation and use of money.

Thus if we are able to affect the total volume of money it will certainly affect the trade in different ways but in a non-equilibrium economy there is no way in which we can measure the microscopic effects out of the macroscopic. This is actually why we can handle the aggregate economy per se in money terms. But the macroscopic effects will have asymmetric distribution effects of which we can say nothing in the pure macroscopic analysis but only by further microscopic investigations. Consequently the microscopic effects will have future effects on the workings of the macroscopic level by affecting the underlying "wheels" of trade, in Hume's wording, but the character of the effects are to be seen by investigating the actual socio-economic structures. The Swedish economist Knut Wicksell was actually one of the first to express this thought when he accept local and temporal stability on the microscopic level due to reversibility but rejects reversibility at the macroscopic level and thus also stability. This was supported by Keynes in his discussion in General Theory (1936[1973]: 17-18).

Money as a medium of exchange is the most fundamental dimension of the money concept since that creates the basis for the other two intrinsic dimensions. The liquidity aspect is linked to lexicographic preferences, which is outside our scope in this paper, but in Ekstedt (2012: 162-164) there is a comprehensive analysis and we concentrate on money as a measure of assets and liabilities which has been the central aspect of the current austerity policy.

Our rejection of general equilibrium and additive aggregation together with the propositions I and II implies that we have to ask two quite different questions. The first is how macroscopic policy affects the microscopic level and economic structures. The development of income and wealth distribution is utterly important to scrutinize, "Oui Bono?", is the ever fundamental question which can be replaced by – "Who Pay?". When we pay back a debt, how do we compare the initial nominal value inter-temporally when we are in a disequilibrium economy. This is actually a rather scary question and points towards redistribution processing and socioeconomic effects in a longer run.

The Real Bill and The Quantity Equation

The subprime scandal 2008 was primarily an effect of careless lending and careless supervision of the financial system. Many economists of course early realized the danger of the development of subprime lending but the rally was unstoppable. But from the reactions afterwards from financial organizations and actors it seems that they also were surprised of the large effects of their own carelessness. Among the deeper effects was the fact that the systemic trust disappeared and furthermore the concept of risk had to be reconsidered.

In fact the subprime scandal revealed a more fundamental institutional change in the international credit system and we can say that the current development is a reversed development compared to that which was initiated by Henry Thornton and David Ricardo in England and took a definite form in Ricardo's Ingot Plan 1826, published posthumously and installed in the Bank Charter Act in 1844. Money supply and banking matters were then put under the control of Bank of England. We then could talk about the money supply and the Quantity Equation. The Bank Charter Act was much discussed and it was a debate continuing the issues discussed in the Bullionist debate but now the different sides were called the Banking School analogue to the Real Bill principle and the Currency School analogue to the Bullionist approach. According to the former the Quantity equation was meaningless and in the light of the latter is was a central instrument of control. It is interesting to see Wicksell's comments on the theoretical issue with respect to a possible Theory of Money:

> *I already had my suspicions – which were strengthened by a more thorough study, particularly of the writings of Tooke and his followers – that, as an alternative to the Quantity Theory, there is no complete and coherent theory of money. If the Quantity Theory is false –or to the extent it is false – there is so far available only one false theory of money and no true theory* (Wicksell, 1936: xxiii).

Thus Wicksell realized the complexity of money but this complexity was not touched upon in the mid-19th century debate. However in the bullionist debate Henry Thornton par preference discussed the deeper problems of money.

Let us however look at the foundation of the subprime scandal. The Bullionist debate in the beginning of the 19th century actually concerned the basic principle of subprime lending. It is closely linked to the Real Bill principle, which was advocated by Smith and contrary to monetarism/Currency School.

The real bill principle has little to do with money supply and the quantity equation and consequently inflation is generally regarded as created by excess demand or other real factors. Bank lending should be related to appropriate securities which means that a loan is not drawn from a permanent stock of money but is related to the abilities of present sufficient securities. Thus if an agent present a sufficient security we can obviously transform the loan into a bond which given a calculated risk can be sold to the general public and in the next instance could be used as a security, thus with modern technology the amount of law money/regular money can be increased to almost infinity.

The monetarist approach which during the 20th century was more or less regarded as the theory of money has to do with currencies as the Currency School indicates. In order to keep the balance of payment money had to be controlled both with respect to external as well as internal affairs in order to balance the external trade. The Quantity Equation of money is identically true, thus we can write:

$$M \cdot V \equiv P \cdot Y$$

and as such no theory. It becomes a theory when the variables are properly defined with respect to the empirical phenomena and here lies the difficulties. In a closed economy it might be possible to define them approximately but advanced technology and changing credit structures may make it difficult enough. For a globalized economy it is virtually impossible to define the variables of the Quantity Equation. This globalization process is actually the prime cause why we have a movement back on the credit market to the real bill principle.

The currency factor in business more is affected by financial flows than by real flows. That also means that regional/national inflation will have a different role then for example during the Bretton Woods days or during the 1970s/80s when countries tried to stabilize the currency variations. Inflation was then thought of as a real variable while nowadays the role of inflation has to do with the relative valuation of assets and liabilities according to present value calculations like in a formula as:

$$K_0 = f \left[A_0 , \quad \frac{Y_t}{(1 - (r + p))^t} \right]$$

Where r is the real rate of discount and p is inflation. A_0 stands for a sort of general uncertainty/nervousness factor which relates to the believed macroscopic status affecting real production and financial flows. It may sometimes cover traditional uncertainty factors but sometimes it covers social unease and particularly the public (in a broad sense) reaction to this. What has happened after 2008 is not only that the solidity factor has been crucial but also a greater concern of global risk factors. To try to give a mathematical form and more specifically parametric values to A_0 based on economic theory of any form is a vain occupation.[9] Thus inflation affects inter-temporal valuation according to purely accounting principles. Hyman Minsky adds a growth factor into the discount factor but sadly to say when dealing with global business with a great variety of macroscopic events on different geographical and structural arenas financial organisations are seldom able to calculate such a complicated matter for broad financial flows, which naturally means that inflation receives a heavy role in the volatility of the financial market beside the expectation/nervousness factor.

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[9] There are however mathematical methods which are developments of Black&Scholes, the Heston approach for example aiming to find appropriate option prices based on the most recent actual market prices and the most recent volatility. Methodologically the method do not say anything on the causes of changes in volatility and distribution but accept the imputed data as it is. The approach cope with daily business and are not to be used with respect to structural long term questions.

So we can say that during the 1980s/90s inflation came to be a factor in the valuation of assets and liabilities and since the cross-border financial flows were 10-15 times greater than the real flows the effect of inflation on financial flows became the most important. Not that the real flows were unimportant but they were more interpreted as affecting the A_0 in the present value calculations above. The general feeling was that inflation had to be coped with immediately and that is was not the governments but the central banks which were in the focus of policy making. For macroeconomists the whole development seemed to be completely out of bounce but if we realise the change of policy from macroeconomic structural policy to more or less pure accounting policy for banks and other financial organisations it is easy to understand. The valuation of historical liabilities and of future perspectives with respect to lending and borrowing seemed to become the most important macroeconomic goal leading to permanent unemployment and little interest of negative growth. In figure 5 we illustrate the relation between the developments of the world trade and the world GDP. As we can see we have a remarkable slow-down of world GDP and international trade but the GDP slow-down is the most notable.
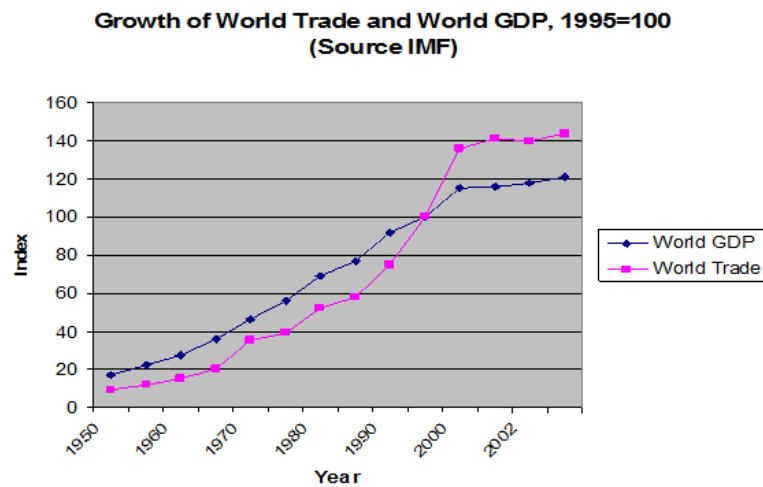

Figure 5: Growth of World Trade and World GDP

This policy went on for a couple of decades when we got the final catastrophe due to the scandalous behaviour of banks and money supervising authorities autumn 2008. So what went wrong?

Let us start with two **figures, 6** and **7**. These figures represent the extreme cases which we do not have in any country but we can see a clear movement from **Figure 6** to the case illustrated in **Figure 7. Figure 6** represents broadly the monetarists/currency school. The central bank controls the money supply and banks and the general public have to comply with a set of rules.

Figure 7 represents the real bill approach/banking school. Banks lend money in the first instant but these loans are securitized and securities are sold to the general public as well as the financial sector. The banks earn money mainly by the interest difference between outstanding debt and the liabilities to the depositors. However due to the globalization and new financial instruments and growing derivative markets non-financial firms were able to raise money outside the regular bank-sector, SWAPS and other derivatives were used for both short and long term finance and to a certain degree the general public and particularly big conglomerates became competitors of the bank on markets which before were only for banks. This implied that banks in the 1980s/90s suffered from decreasing profitability.
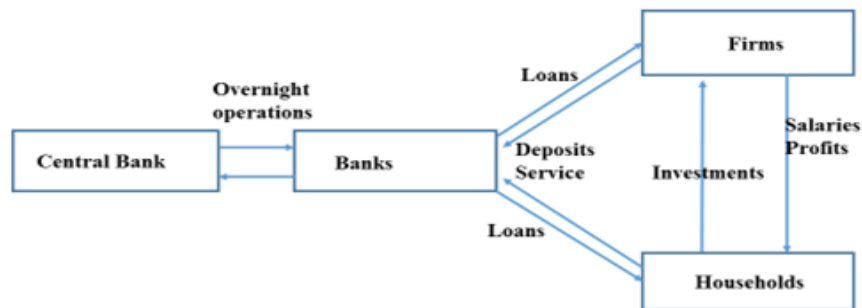

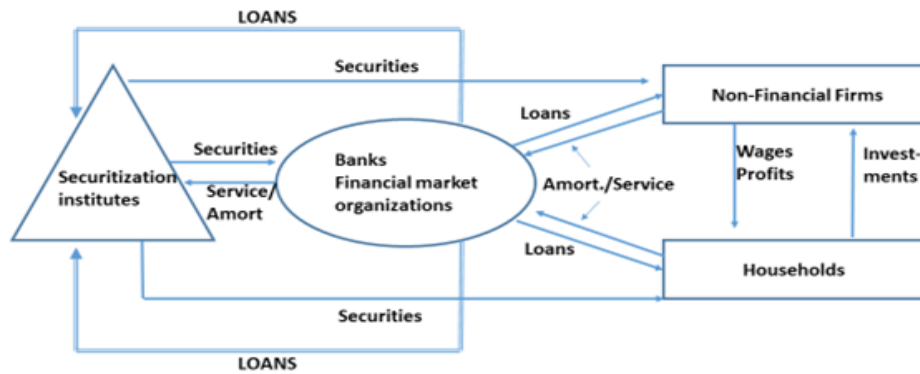**Figure 6:** Central Bank controlled monetary system

Figure 7: Real Bill System

With respect to **Figure 6** the banks in principle have to take all the risk for the outstanding debt while in **Figure 7** the banks are just mediators between the clients and the securitizing institutes. The banks run virtually no risks with respect to the outstanding debt but for the portion of outstanding bonds bought by the very bank itself.

How do the banks earn money in this system? First of all the banks take a fee for transferring money to the securitization institutes and secondly they cut a fraction of the nominal bond rate. That means that on the interest rate paid by the public to the securitization institutes is laid a fraction going to the bank mediator. Evidently the situation of the banks will change substantially. In principle all risks are transferred to the security holders and furthermore the profit of the banks will be positively related to the volume of lending. But who controls this system? Fundamentally it is the banks themselves which are the ultimate controllers, they have to check the bona fide of all borrowers but the borrowers of one bank are as we said only a tiny fraction of the total market so there is no substantial risk in being a bit easy going on such controls but that means that if we take the standard categorization of un-systemic and systemic risks we understand that we will have a decrease in the un-systemic risk at the expense of an increase in systemic risk. This

39

was intensively discussed during the bullionist debate in the early 19th century and particularly Henry Thornton warned about this problem.[10]

But during the late 1990s and early 2000s the financial markets and the responsible authorities were either naïve or not with respect to the ongoing process which was seen by many economists who warned against it but not seen or consciously neglected by more. The basic problem of a system like that in figure 7 is thus the security problem furthermore if we think of rather tight controls and fairly severe consequences with failure it is not unreasonable to think of a redistribution of bank lending in favour of lending to house for rich people and for strong companies. Particularly small scale companies and entrepreneurs will have difficulties to raise money.

The ongoing process of increase in importance for systems like the one illustrated in figure 6 at the expense of a decreasing importance of traditional central banks, and how the latter should influence production and employment is a meaningless question. Matters like money supply becomes meaningless to discuss. Already Henry Thornton (1802[1939]: 18) discussed the creation of money and made a distinction between the capability of circulation and forced circulation of a paper, forced circulation was attached to law money while securities had the capability of circulation meaning that the latter were possible to use as money while the former were defined as money. A consequence of the digital revolution is that in the time dimension the capability of circulation of a paper might approach infinity.

What is said here is directly opposite what was discussed in the Bullionist debate. We have thus to understand the historical context of that debate. It started during and in the aftermath of the Napoleonic wars. It was a period when the national borders were strengthened and national interests were at the top of the political agenda and it became vital to build up national defence as well as a strong national financial system.

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[10] As a matter of fact Sproul (2000) attacks Henry Thornton's analysis as being accusing bankers to be unethical.

Hasse Ekstedt	Contradictions in Economic Theory and The Economic Modelling of The Modern Economy

Consequently we shall not discuss whether one or the other system is better or worse as was done during the 1980s/90s but which system is the workable during the specific context. Most of all the institutional system with respect to rules and supervision has to adapt to the specific features of the respective system. However it is interesting that the concept of money per se does not change although the question of the money stock of the state disappears more or less as a policy variable and also as an analytical variable.

Thus the complexity and the intrinsic contradictions of the concept of money due to the different roles of money which are created by its role as a medium of money imply that we are probably never able to create a general theory of money but to observe and analyse the role and patterns of money and finance in the current context.

We have mentioned about the austerity policy during the recent years. It is obvious that we cannot finance our consumption by printing state bonds or increase the circulation of money per se. Furthermore lending/borrowing operations has to be performed at the pleasure of those involved and risk incurred has to be accepted. A sound economy requires production and consumption. This is practical wisdom from before Aristotle's times.

To crave austerity in order to pay bygone mistakes is even more problematic. What are we really paying back? In a certain sense the neoclassical economy is sound namely that it takes the stance in the real economy, you cannot eat money. That means that applying accountancy rules and the same perspective on macroscopic affairs as we were dealing with on the microscopic level is indeed questionable.

The question who is responsible for an economic policy which have destroyed economic growth for years, to have created social conflicts and instability, to have created poverty among large groups and made the rich richer and the poor poorer. Certainly we economists are to blame who have sacrificed economics as a social and empirical science in order to be able to trot around with an economic theory built on the axiomatic structure of a medieval village, a theory incapable of handling a central concept like money.

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