WHAT ARE ECONOMIC PROBLEMS THAT WE MAY SOLVE THEM?*

PART I: THE LOGICAL STRUCTURE OF CONCEPTUAL ECONOMIC PROBLEMS

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Problems play a central role in the progress of science (Laudan, 1977). Many philosophers of science before and after Popper have agreed with his view that scientific inquiry proceeds from old problems to new problems (Popper, 1972:258) and that the task of the scientist is to solve problems (Popper, 1965:66).

Theories are essentially solutions to problems (Nickles, 1980:4) so problems offer direction to scientific activity. Without problems there would be no way of knowing whether science matters, whether it is approaching the ever-elusive "truth", and whether the methods that scientists employ are appropriate to this quest. So it only makes sense that those wishing to contribute to the progress of science should make an attempt to understand the structure and nature of the problems in their field.

What is true of science and scientists in general is, of course, also true of economic science and its own practitioners. Classical economists understood the importance of understanding the nature of economic problems, but struggled to fully grasp it until Robbins (1952) proposed his formulation of the universal economic problem that we find in economics textbooks to this day. An all-encompassing formulation, such as Robbins', offers a framework within which to formulate the specific economic problems. Problem formulation is a crucial step in problem-solving, so the ideal formulation of a discipline's universal problem is one that allows us to solve the specific problems of a discipline faster than new problems appear.

While rival formulations abounded since Robbins' essay in 1932, economic science seems to have settled on one or other variation of his original formulation i.e. that economic science should concern itself with problems of "…human behaviour as a relationship between ends and scarce means which have alternative uses" (Robbins, 1952:16). Though Robbins' grand formulation (and its variations) has served economic science well, there are reasons to believe that the mindset it engenders is partly responsible for the accumulation of unsolved problems that economists should have been able to solve.

One group of such unsolved problems is the stubborn economic underdevelopment of Africa. Africa's underdevelopment is clearly encompassed within the formulation of the universal economic problem, yet it has resisted efforts to solve it. Africa's stubborn underdevelopment is not just an anomaly,

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it suggests that economists still do not fully grasp the nature of economic problems.

A different formulation of the universal economic problem that is better able to inform efforts to solve Africa's problems, may well offer better guidance on approaching the many other unsolved economic problems. In this paper I attempt to find such an alternative formulation.

1 WHAT IS A PROBLEM?

The topic of the general structure and nature of problems has received relatively little attention among scientists and philosophers. Among philosophers, most of the literature is to be found in the field of erotetic logic (the study of structure and nature of questions) and to a lesser extent in the philosophy of science. Computer science (especially artificial intelligence) and mathematics are the only scientific disciplines to pay proper attention to the topic. There has been little investigation into this topic in the discipline of economics – a gap which this paper will address.

The word problem is derived from the Greek word *problema*, which could take on several meanings, all of them associated with some kind of impediment to action (Hattiangadi, 1978:353). The existence of a problem therefore implies intelligent agents, purposive action, undesirable states, goals, actions and constraints. Smith (1988:1491) captures the essence of various definitions of the concept of a problem, which he defines as mismatch between reality and an ideal that is difficult to close, but sufficiently important to engage the intentions of people in solution activities.

Ackoff's (1978:11-12) definition of a problem reminds one of Robbins' definition of the economic problem. According to Ackoff a problem has five components: decision makers, controllable variables, environment (uncontrollable), constraints and possible outcomes. A problem arises when there is doubt about the choice of action, and a choice only exists if there are two or more outcomes of unequal value that can be achieved by actions with differing effectiveness. The choice of action will therefore make a difference to the value of the outcome, and the action is taken to dispel doubt about alternative actions.

A useful distinction is that between well-structured and ill-structured problems. The concept of a well-structured problem assumes a clear structure in which goals are stable and known, the problem space is constant and the appropriate methods of problem-solving are available. It also assumes that the problem-solver has the computational ability to solve the problem and that the solver will know when the best solution has been reached. Well-structured problems assume an ideal world that does not exist (Simon, 1973:181-187) and it is similar to what Rittel and Webber (1973:155) called tame problems.

Most real problems are ill-structured, meaning that there is no known algorithm that can be used to determine if a solution exists (Nickles, 1981:87) because there is no structure for an efficient solution search. Ill-structure results from uncertainty and a lack of knowledge about goals, heuristics and the problem space itself. This is similar to Rittel and Webber's (1973:162-167) conception of a wicked problem. For a wicked problem there is no definitive formulation, no stopping rule for solution activities, no test to determine whether a solution has been reached, no specified set of permissible operations and no single explanation for the problem. In addition, every wicked problem is unique, is a symptom of other problems and its solutions have irreversible consequences. All important economic and social problems clearly fall into the category of wicked or ill-structured problems.

The understanding of problems is crucial to any scientific activity. Scientists are "students of problems and not of subjects" (Popper, 1965:66-67). We have to study problems, since all scientific knowledge is problematic. Knowledge is based on axioms or beliefs, and these beliefs are often inconsistent or incomplete. The result is that scientific theories fail constantly as they clash with each other or with reality. The history of science can be written not as a smooth advance towards the ultimate truth, but as a history of errors and about turns. The progress of science is clearly influenced by the way scientists engage with problems, so it is important to spend some time in the next section to explain why problems and their formulation are worthy of investigation.

2 THE IMPORTANCE OF PROBLEM STRUCTURE AND FORMULATION

A problem's structure is the elements of a problem and the relations between those elements. There are several conceptions of problem structure. For example, Hattiangadi (1978) follows Popper in seeing problem structure as consisting of beliefs, where some of those beliefs are inconsistent, while Nickles (1978) sees problem structure as a matrix of constraints. The erotetic logicians who regard problems as questions have also developed ideas about structure. For example Van Fraassen (1980:141) sees question structure as comprising a contrast class and a relevance relation determined by background knowledge. These conceptions of problem structure will be explained later.

Without an understanding of a problem's structure, it will be difficult to understand how problems arise or even be aware that problems exist. Even if there is an awareness of problems, without a way to think about problem structure, it will be difficult to find appropriate formulations of problems.

Structure is even more important when it comes to scientific problems. In order to understand reality, scientists give it a structure by conceptualising, categorising and building models. If scientific inquiry is directed at solving problems, then obviously scientists should ensure that the structure of their models matches the structure of their problems (Heylighen, 1988:950). Thinking about problem structure should precede any attempts to model or abstract from reality (Smith, 1988:1498). If the structures do not correspond, a scientist will at best solve the wrong problems, or at worst generate solutions that will exacerbate the problem. Fortunately, it appears as if this matching is usually an unconscious activity and is ensured by the paradigm or research programme in which normal science takes place (Kuhn, 1970:364-368). However, as a consequence of scientific activity, the problems inevitably change, which sets up a situation where the structure of the problems and the structure of the models no longer correspond. In such times of change, problem formulation becomes even more important than problem solving (Mitroff, Emshoff & Kilmann, 1979:583).

For practitioners in a field, who act on the abstractions and models of scientists, problem structure is also important. As Ackoff (1978:100) pointed out, action depends on an understanding of a problem's structure. The understanding of a problem's structure determines what information a person perceives as relevant, what variables a person will take as controllable and the relationships (e.g. causality) that person will believe in. An inappropriate problem structure will lead to inappropriate problem formulation and thus to inappropriate actions to solve the problem.

Scientists and practitioners employ various methods to search the problem space for solutions. For methods to deliver the desired results, they need to be suited to the structure of the problem. For example, if a problem is structured as the achievement of a goal within certain constraints, it is obvious that it should be approached using optimisation techniques, rather than ethnographic studies or discourse analysis. The problem's structure suggests which methods are most likely to lead to a satisfying solution (Ledden, 1948:254, Simon, 1973:182).

Given the ill-structure of most social and economic problems, special attention needs to be given to understanding their structures. Without an understanding of a problem's structure, it is impossible to find a suitable formulation. Problem formulation is halfway towards problem-solving (Nickles, 1981:110), and in the case of ill-structured or wicked problems, problem formulation and problem-solving are indistinguishable (Smith, 1989:979). In fact, problem formulation <u>is</u> the problem in the case of wicked problems (Rittel & Webber, 1973:161).

In the case of ill-structured problems, scientists may never achieve a complete understanding of the structure of these problems, but nevertheless need to have some way to think about the formulation of such problems. Problem formulation "is capable of having spectacular effects on problem solving efficiency" as one of the earliest studies in artificial intelligence found (Amarel, 1968:21). Without a way to think about problem structure, the scientist will struggle to find appropriate formulations. For this reason, problem formulation is in itself seen as an important scientific achievement and the skill of a professional scientist or practitioner is expressed in their ability to structure and formulate the problems of their field (Coyne, 2004:6).

What is true of science is true of economic science. Robbins emphasised the need to understand the nature and structure of economic problems. Without such an understanding, economic scientists are likely to waste their time solving the wrong problems or approaching these problems with inappropriate methods. As Robbins (1952:2-3) put it: "…the unity of a science only shows itself in the unity of the problems it is able to solve… one of the greatest dangers which beset the modern economist is the preoccupation with the irrelevant – the multiplication of activities having little or not connection with the solution of problems strictly germane to his subject".

In the next section I shall consider the structure and formulation of generally well-behaved problems (i.e. well-structured or tame problems). While there is a difference in the definitions of well-structured and tame problems, for now I shall refer to both kinds by the collective noun of "well-behaved problems". It is clear from Robbins' formulation of the universal economic problem that he regarded economic problems as well-behaved. If they are not well-behaved, it means that the structure of economic problems no longer corresponds to the structure of economists' models and solutions, and that economists need to rethink how they formulate economic problems.

3 THE FORMULATION OF SCIENTIFIC PROBLEMS

Scientific problems often take the appearance of well-structured or tame problems. Herbert Simon (1973:182-183) attached six characteristics to well-structured problems: (1) Known criteria for testing solutions and a process for applying those criteria; (2) A single problem space in which the initial state, goal state and all other plausible states in between can be represented; (3) All attainable states can be reached from other attainable states in the problem space; (4) All knowledge is represented in the problem space; (5) Everything that can happen in the external world can be represented accurately in the problem space; and (6) The computational power to solve the problem is available. A well-structured problem may be complex, but it is one of which can be solved because it matches our understanding and abilities. Well-structured problems are "ideal" and assume an ideal world and an ideal problem solver – in other words, such problems do not exist (Simon, 1973:186-187).

Although scientific problems of any significance are usually ill-structured (Simon, 1973:186, Coyne, 2004:8) scientists have found ways such as problem reduction, to convert such problems into well-behaved problems. Problem reduction fits and adapts an ill-structured problem to a variation on the representation of a known well-structured problem. In this way, problem reduction renders problems suitable to the application of standard heuristic and problem solving algorithms (Nickles, 2003:7-12).

The kinds of problems or questions that philosophers of science have in mind when discussing the nature of problems, are generally well-behaved problems. That is, they tend to consider the problems of science as they appear after scientists have transformed ill-structured problems into well-structured problems that suit the available methods. Well-behaved problem is nevertheless a useful starting point in the exploration of the general structure of problems.

Some of the first serious exploration into the structure of problems came from philosophers who saw scientific inquiry as the finding of answers to questions. However, it is not really questions, but rather problematic questions that drive scientists to seek knowledge. The following discussion starts broadly with an review of the structure of scientific questions before moving on to the more narrowly defined subset of questions i.e. scientific problems.

3.1 The structure of scientific questions

Erotetic logicians study the nature of scientific problems by studying the logic of questions. They define a question as a range of admissible answers together with a request that an answer be selected that satisfies certain conditions (Belnap & Steel, 1976:35).

Sylvain Bromberger (1970:66-69) regards all scientific activity as being in response to why-questions. He distinguishes why-questions from whether-questions, that can only have "yes" or "no" answers. All meaningful why-questions are asked within a framework of presuppositions. The presuppositions of meaningful why-questions are the whether-questions with a "yes" answer. For example, a question such as "how do we alleviate poverty?" presupposes that poverty exists and can be controlled. In other words, the answer to the question "does poverty exist?" would be "yes". Bromberger (1970:70) makes a further distinction between p-predicaments and b-predicaments. A p-predicament is a question that a person believes has a correct answer, but the person cannot think of any given his background knowledge. A b-predicament has a correct answer but the answer is beyond anyone's mental repertoire. From Bromberger's distinction one can conclude that predicaments are questions that are unanswerable relative to the prevailing set of concepts and beliefs (or presuppositions). If a question is unanswerable, it is because people are somehow limited to a certain set of concepts and beliefs.

Van Fraassen (1980:100-146) expands on Bromberger's analysis and agrees that questions are only meaningful within a set of presuppositions. He defines a presupposition of a question as a statement that is implied by all direct answers to the question. For him the structure of a question consists of a core question plus a contrast class plus a relevance relation. The contrast class is the complete set of alternative answers. The presuppositions of the question favours one particular answer over all the others in the contrast class. A question becomes problematic when current background knowledge favours members of the contrast class other than the one expected. The relevance relation determines what will count as an explanation, and in turn this is determined by the purpose of the question.

To illustrate the analyses of Bromberger and Van Fraassen, consider the question "why is the rand currently fluctuating around R6.50/$?" The basic presupposition of the question is that the rand is fluctuating around R6.50/$. If this presupposition were not true, the question would be meaningless. The contrast class depends on the context and purpose of the question. One might imagine that the questioner wanted to know why the rand is at R6.50/$ – and not at R8/$ or R4/$. So other levels of the R/$ exchange rate would form the contrast class. In such as case, an answer such as "because the rand is an unstable currency" would not be meaningful, even though it might be meaningful if the questioner had another contrast class in mind. If the questioner is an economist, that person's purpose would probably be to know what current market conditions have caused this particular level. The relevance relation would therefore include answers about the demand and supply of currencies, and exclude answers relating to historical or political factors. If the questioner's background knowledge (e.g. faith in the theory of purchasing power parity) leads him to believe that the rand should instead be at R5.50/$, the question becomes problematic. If the economist cannot answer the question given his background knowledge, but believes nevertheless that there is an answer, that person would be in a p-predicament. If all economists are in a p-predicament, then the economics profession as a whole finds itself in a b-predicament relative to its set of concepts and beliefs.

Another example will help to illustrate the function of the contrast class. Given the presuppositions of perfect competition, an economist might ask why a firm produces at a quantity of Q_1 in the long run. The contrast class for an economist is probably all other quantities ($Q_2 \ldots Q_n$). Everything that does not fall into the contrast class is held constant e.g. sales, management or shareholding (so *ceteris paribus* does not have a fixed meaning). Given the contrast class, an answer such as "because shareholders expect an ROE of 20%" is meaningless. If Q_1 is the point where MC=MR, it is clear that the economist believes that firms tend to maximise profit. Identifying the contrast class therefore also serves to make the questioner's presuppositions explicit. If the economist's background knowledge leads him to rather expect sales maximisation or some kind of satisficing, the question becomes problematic.

From this discussion of scientific questions, it is evident that all questions contain presuppositions. This is confirmed by Collingwood (1960:23-27) who makes the point that all statements are made in answer to questions, and that all questions involve presuppositions. Presuppositions form part of our knowledge, and their logical efficacy depends on whether they cause questions to arise. A question cannot arise if it involves a presupposition that is not being made.[1]

Not all questions are problematic. Whether a question is problematic or not has something to do with the presuppositions of the question. A study of problems will therefore involve a study of the presuppositions that make questions meaningful. The lessons we learned from erotetic logicians will now be carried forward into an investigation of scientific problems.

[1] Collingwood (1960:27-28) makes a distinction between beliefs, presuppostions and assumptions. Beliefs are statements taken to be true. Presuppositions need not be true since their logical efficacy depends on whether they cause questions to arise. Beliefs are therefore a subset of presuppositions. Assumptions are those presuppositions that scientists consciously choose to make. In economic theory, many presuppositions are used even though they are known to be false, because they are 'useful fictions' that cause meaningful questions to arise. Such false presuppositions would be seen as assumptions. Assumptions are therefore also a subset of presuppositions.

3.2 The structure of scientific problems

We are concerned with scientific problems because they impede our efforts to take the actions required to achieve our goals. Hattiangadi (1978:348) makes a useful distinction between practical and intellectual problems. Solving practical problems allows us to reach specific goals, whereas we solve intellectual problems to remove obstacles to goal-directed activity in general. For example, a practical problem may be how to achieve a growth rate of 6% in South Africa, while an intellectual problem is to develop a general theory of economic growth.

Within intellectual problems, Laudan (1977) makes a further distinction between conceptual problems and empirical problems. Empirical problems are gaps in our knowledge or unexplained anomalies in the data. Conceptual problems are non-empirical and relate to the internal and external inconsistencies, circularity or ambiguity in the theories, or to conflict over methodology (Koertge, 1984). New or adjusted theories result from the solution of conceptual problems, and these theories form the mental constructs that guide the collection and explanation of data. For example, an empirical problem would appear when data on relative inflation rates don't explain the changes in the current R/$ exchange rate, while a conceptual problem would be the inconsistency between the explanations of the purchasing power parity theory and psychological theories for currency movements. A theory which reconciles the inconsistent theories will offer a new framework for data collection and the interpretation of that data.

Again the role of presuppositions becomes clear. Empirical problems are only meaningful given the presuppositions of the theories that led to the collection of the data and suggested the problematic explanations. The presuppositions of intellectual activity also guide us in the solution of our practical problems.

The set of accepted and apparently coherent presuppositions in a particular scientific field or school of thought forms the metaphysical framework and paradigm of that field or school. The problems of a school arises within that school's paradigm, and due to its presuppositions, every school will have its own set of problems.

According to Kuhn (1970:360) it would be more appropriate to refer to the problems that arise within a paradigm as "puzzles". These puzzles can be of three types: (1) determination of significant facts; (2) matching of facts with theory; and (3) the articulation of the theory (Koertge, 1984). A paradigm directs attention by determining the legitimate puzzles and methods, and ensures that the methods are suited to the puzzles. Variables that are unanticipated or irrelevant (given the paradigm's relevance relation) are controlled (i.e. placed in the paradigm's contrast class). Puzzles are problems that are so well-structured by the paradigm, that their solutions are presupposed and guaranteed. As Kuhn (1970:366) stated, a paradigm provides everything except for the detail of the solutions to its puzzles. In terms of questions, puzzles can be seen as whether-questions, what-questions and which-questions.

Puzzles are not the real problems - anomalies are the real problems of a paradigm. They appear when the paradigm is unable to explain certain phenomena or consistently offers false predictions, and thus calls the paradigm's presuppositions into question. Given a paradigm's presuppositions, an anomaly will not appear to be meaningful (at least initially). In terms of questions, anomalies can be seen as why-questions, and they are ill-structured relative to the paradigm from which they arose.

An accumulation of anomalies may eventually lead to a new paradigm with a different set of presuppositions and methods. The new paradigm may solve the old paradigm's problems, but it is more likely that it will simply dissolve the old problems by making the old problems meaningless given the new set of presuppositions.

Metaphysical frameworks determine which scientific problems are important and generate the presuppositions that scientists will accept or test (Agassi, 1964:189-199). Presuppositions seem to form coherent whole within scientific research programmes or paradigms. These sets of presuppositions clearly have a hand in the creation of problems, and form part of the structure of scientific problems.

Scientists seek knowledge to enable humans to act in such a way as to achieve their goals. This knowledge consists of groups of statements (or theories) about the world derived from certain presuppositions (or axioms). Scientists also seek knowledge to remove the problems that impede their own progress, and these problems arise from their beliefs and other presuppositions that they make (Hattiangadi, 1978:351).

Unfortunately we cannot do without our beliefs and presuppositions. Presuppositions, in the form of beliefs and expectations, have evolved because they are necessary for our physical survival. Without such presuppositions, crucial cognitive processes would be slowed down so much as to make everyday activities and responses in emergency situations impossible. The same applies to scientific knowledge. At an elementary level our knowledge is deduced from a set of presuppositions that cannot be proven. Without these foundational presuppositions we would not be able to create knowledge. Presuppositions also arise from attempts to deal with uncertainty and imperfect knowledge (Mitroff & Mason, 1980:331).

From the infinite range of human behaviour, our presuppositions rule out some thoughts and actions while making others more likely. Presuppositions, whether in everyday life or in normal science, therefore act as constraints. A scientific paradigm, for example, comprises presuppositions that constrain the kinds of problems to be solved, define the general problem space and dictate the methods that can be used to search for solutions within this space. In other words, by acting as constraints, presuppositions help to structure the problems of a certain paradigm.

Not all presuppositions act as constraints – only those presuppositions that scientists do not wish to challenge or those of which that they are not aware.

According to Collingwood's definition (see footnote 1), constraints would therefore include some assumptions, all beliefs, and all presuppositions that are held unconsciously. These constraints are generally derived from the metaphysical framework and the theoretical background of scientists working within the same paradigm or scientific research programme.

It is inevitable that a single scientist's or a whole paradigm's presuppositions will be inconsistent, for several reasons. Presuppositions change and are added over time, so that our knowledge changes imperceptibly over time, and inconsistencies arise as a result as one part of our knowledge base becomes misaligned with other parts. It may be that those presuppositions that are consciously held (i.e. assumptions) will conflict with presuppositions held unconsciously, so that the inconsistency may exist for some time before becoming apparent. The implications of certain presuppositions are not always understood, which provides another possible reason for the existence of inconsistencies.

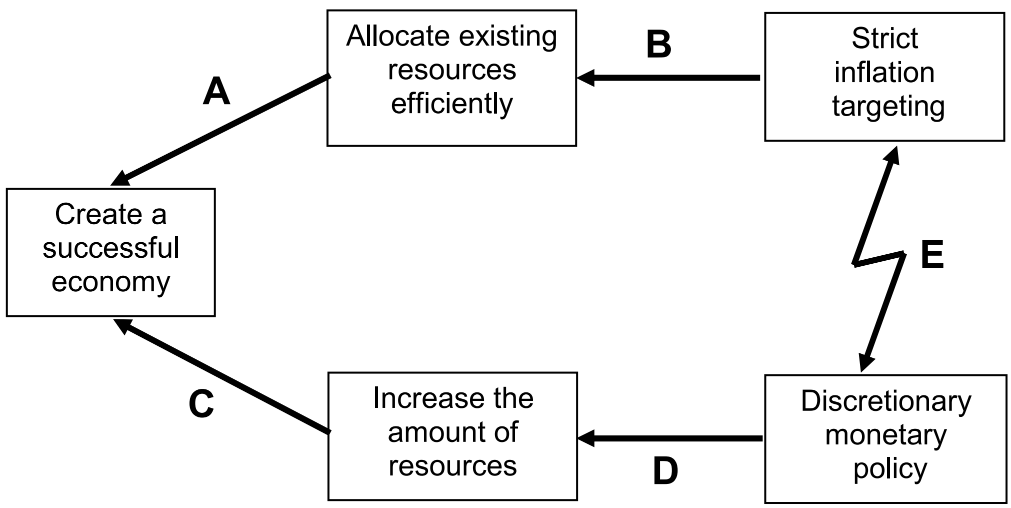
When there are inconsistencies in a set of presuppositions, any statement can be derived from those statements, including statements that contradict each other (Hattiangadi, 1978:352). This threatens to make all theories derived from those presuppositions useless for achieving goals. For example, if such a theory were to be used for economic policy-making, it may generate the conclusion that the central bank should increase the interest rate and decrease the interest rate at the same time. At best, such theories lead to indecisiveness and movement between extremes; at worst they lead to actions that aggravate the problem. In other words, inconsistent presuppositions impede the achievement of goals and thus constitute a problem.

The description of the basic structure of problems as contradictions created by inconsistent presuppositions was propagated by Popper (1972) among others, and significantly elaborated upon by Hattiangadi (1978). However, as several philosophers have pointed out, not all problems fit into this structure (Giunti, 1988:421-439; Nickles, 1981:94; Wettersten, 2002:487-536). This kind of structure fails to describe the structure of empirical problems (e.g. fill-in-the-blank problems such as the completion of Mendeleev's periodic table) but is rather more suited to describing conceptual problems (and some practical problems). This structure is nevertheless very useful, especially for describing economic problems, as will be explained later.

For problems that fit this basic structure, Goldratt (1994) suggested a representation that provides a simple yet powerful way to think about problems. He originally called it an "evaporating cloud diagram" after the imagery used by Richard Bach in his book *Illusions*. However, I will stick to the simpler name of conflict diagram. Figure 1 shows a possible conflict diagram involving a problem in monetary policy.

Figure 1 shows the "two-handed" reasoning of economists (even if they may not agree with everything in figure 1). According to the figure, the goal of economic policy is to create a successful economy. On the one hand, to achieve this goal, we have to allocate resources efficiently, and for this to occur we need to employ strict inflation targeting. On the other hand, to achieve the goal, the amount of resources and production need to be increased, and for this to occur we need discretionary monetary policy. The result is a problem for any central bank because strict inflation targeting is in direct conflict with discretionary monetary policy. It wants to control inflation, but it also does not want to harm growth. Such problems can be overcome by ignoring one side of the conflict, by compromising between the extremes, or moving from one extreme to the other. History suggests that the last option is the most likely one.

Figure 1: Representation of a problem in monetary policy



Most economists will look at one side of the conflict diagram and not agree with the conclusions. For example, most economists will challenge the statement that to increase the amount of resources in an economy we need to use discretionary monetary policy, and proceed to give several reasons for their view. When they do so, they are in fact challenging the presuppositions that underlie the logic of arrow D, thereby hinting that that presuppositions are what created the problem and maintains it. A different set of presuppositions may dissolve this particular problem.

Every one of the statements that appear in the boxes in figure 1 is a logical consequence of certain presuppositions. The presuppositions are contained in the arrows labelled A to E. The presuppositions are found simply by asking why the statement in one box follows from the statement in another box in the direction of the arrow. For example, one may ask why it follows that strict inflation targeting will lead to an efficient allocation of resources. This will lead one to find the presuppositions underlying arrow B. One may also ask why it follows that strict inflation targeting is in conflict with discretionary policy, and so find the presuppositions of arrow E. Following such a process, it is quite easy to find twenty or more presuppositions that provide structure to the problem.

The presuppositions create the problem because they either lead to conflicting statements (arrows A, B, C or D) or because they lead to the belief that a contradiction exists (arrow E). As explained above, presuppositions can only lead to a contradiction if at least one of them is inconsistent with at least one other presupposition. For example, under arrow B one may find a presupposition that interference by the central bank will have no long term influence except for causing unexpected changes in the price level (derived from the neoclassical paradigm). However, under arrow D one may find a presupposition that central bank interference can have a stabilising influence on the business cycle. The two presuppositions are inconsistent, and thus lead to contradictory conclusions.

The presuppositions also act as constraints. For example, a presupposition that one may find under arrow C, such "economic growth is an important measure of an economy's performance", will constrain policy actions. It will rule out any policies that are likely to slow down growth in the long run.

Nickles (1978) proposed the idea that scientific problems can be structured as sets of constraints. Nickles (1981:109) defined a problem as all the constraints on the solution plus a demand that a solution be found that satisfies all the constraints. A problem makes scientific inquiry possible when at least one of its constraints is known, and the more constraints are known, the better the problem is structured. If we can expect some presuppositions to be logically inconsistent, it means that the constraints will also be inconsistent. Problems with inconsistent constraints are overdetermined, meaning that it is impossible to find solutions that satisfy all constraints (Nickles, 1981:87).

Hattiangadi's (1978) conception of the structure of problems as contradictions, and that of Nickles' are closely related. Though they appear different, they are easily reconciled if one considers that problems are anchored in a body of presuppositions. These presuppositions are inevitably inconsistent, and become manifest in a single conceptual entity we call a contradiction. Nickles' conception of a problem is broader than Hattiangadi's since it also explains the structure of empirical problems, while Hattiangadi's conception only covers the structure of conceptual problems.

An understanding of conceptual problems must precede an understanding of empirical problems. Some of the reasons for this have been hinted at before. The presuppositions contained in, and the theories developed as solutions to conceptual problems dictate what data is relevant and how this data is to be interpreted. Empirical problems involve conceptual constraints, while conceptual problems need not have any empirical component (Nickles, 1981:93). Empirical problems are necessarily derived from conceptual problems, but conceptual problems do not necessarily follow from empirical problems. Science aims to give us a coherent and complete picture of the world at a conceptual level, and the main task of scientists is therefore to solve conceptual problems. Conceptual problems point to vague concepts, possibilities for new predictions or gaps in our knowledge, and this in turn sets the empirical problems that will be addressed through empirical research. In solving empirical problems scientists ultimately seek information to help them evaluate competing solutions to conceptual problems (Nickles, 1981:103).

The solution to conceptual problems lies in the rejection or modification of the inconsistent constraints. No constraint is absolute; in fact, constraints must be flexible for conceptual change to be possible. All innovative solutions violate at least one of the constraints of the originating conceptual problem i.e. invalidates one or more of the presuppositions (Nickles, 1978:139-141).

For conceptual progress to take place in science, the presuppositions that underlie conceptual problems must be surfaced, examined and questioned. Possible problematic presuppositions give direction to empirical research. Empirical research serves conceptual problems by attempting to make possibly problematic presuppositions more certain or consistent (Mitroff et al, 1979:589) and to reveal which presuppositions should be questioned (Jackson, Stoltman & Taylor, 1994:10). By revealing problematic presuppositions, empirical research may lead scientists to new conceptual problems.

To illustrate, the conceptual problem represented in figure 1 sets empirical problems for economic scientists. Economists need to establish the empirical truth of the presuppositions in arrows B and D if they wish to find ways to dissolve the problem. If empirical research conclusively shows that discretionary policy leads to little or no growth, while strict inflation targeting leads to efficient resource allocation <u>and</u> resource growth, the problem would be dissolved. The bottom leg of the contradiction will then have been broken, and policy makers will no longer have a problem. Empirical research could also show whether the presuppositions, which suggest that strict inflation targeting is in conflict with discretionary monetary policy, are true. If not, arrow E will be invalidated, the two extremes reconciled, and the problem dissolved. In the absence of such empirical research the problem will remain. Policy makers will continue to move between the extremes or find a compromise between the extremes.

The unusual word "dissolve" is deliberately used to distinguish it from other ways to deal with conceptual problems. Ackoff (1978:39-40) identifies two ways:

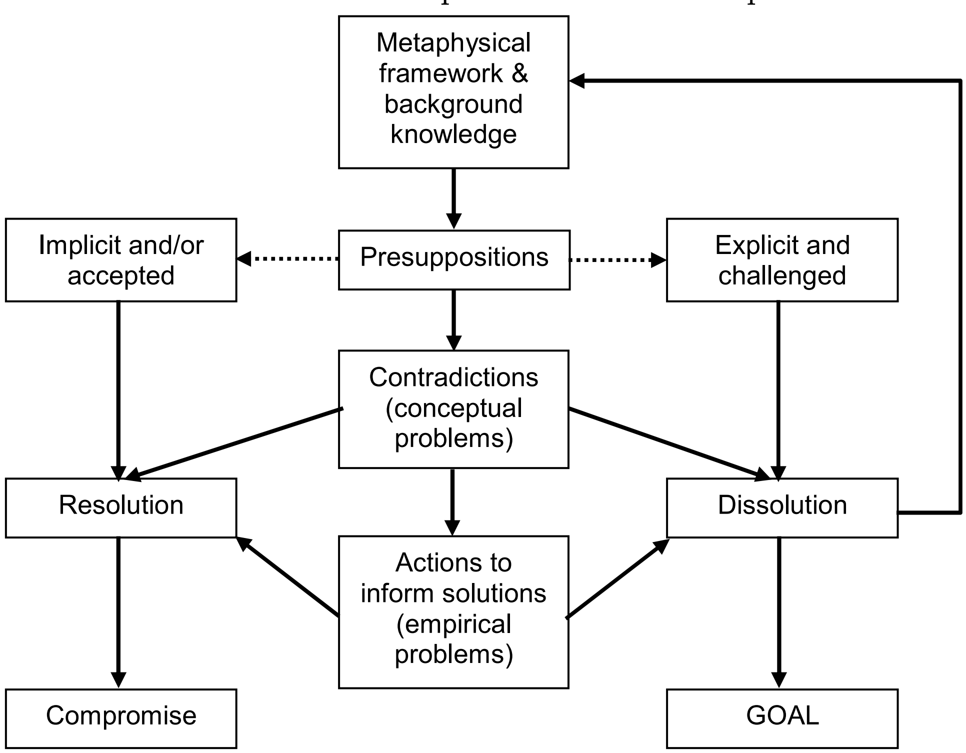
- Resolving the problem by accepting the conditions that created the contradiction. Such solutions achieve the goal at the expense of other goals or at the expense of the same goal in the long run. It suggests strategies that aggravate the conflict (e.g. competition) or seeks to alleviate it through compromise (e.g. negotiation or fair distribution of losses). For example, this may involve the central bank trying to find an optimal level for the interest rate that allows the highest possible growth rate while minimising price instability;

- Dissolving the problem by changing the conditions that create the contradiction so that the problem disappears. This way is preferable as it uncovers innovative solutions that enable the achievement of goals at a

> lower opportunity cost (or achieving more at the same cost). Finding the dissolving conditions requires empirical research.

Figure 2 summarises the discussion thus far. All scientists pursue goals, some immediately useful (e.g. finding a cure for an illness) and some more esoteric (e.g. proving a theorem). Metaphysical frameworks together with background knowledge are the source of the presuppositions that guide scientists in the pursuit of their goals. These presuppositions set constraints on the achievement of goals, and are inevitably inconsistent. Inconsistent presuppositions make themselves known to scientists as contradictions. Presuppositions are the elements of a conceptual problem's structure that are perceptually integrated in the phenomenon of a contradiction. Conceptual problems are impediments, not only to the achievement of specific goals, but also to goal-directed activity in general, and hence need to be solved. Two strategies to solution are possible – resolution and dissolution. Resolution occurs when scientists choose to remain unaware of their presuppositions or choose to accept them. Resolution does not lead to a complete achievement of the original goal, but instead aims to find an acceptable compromise. Dissolution seeks to make possibly problematic presuppositions explicit and to challenge them. Solving conceptual problem may require actions to inform resolution or dissolution. This sets empirical problems for scientists (such as finding an optimum point) when following a resolution strategy, or finding the information necessary to establish the plausibility of a presupposition in the case of a dissolution strategy.

Figure 2: Structure and relationships between scientific problems



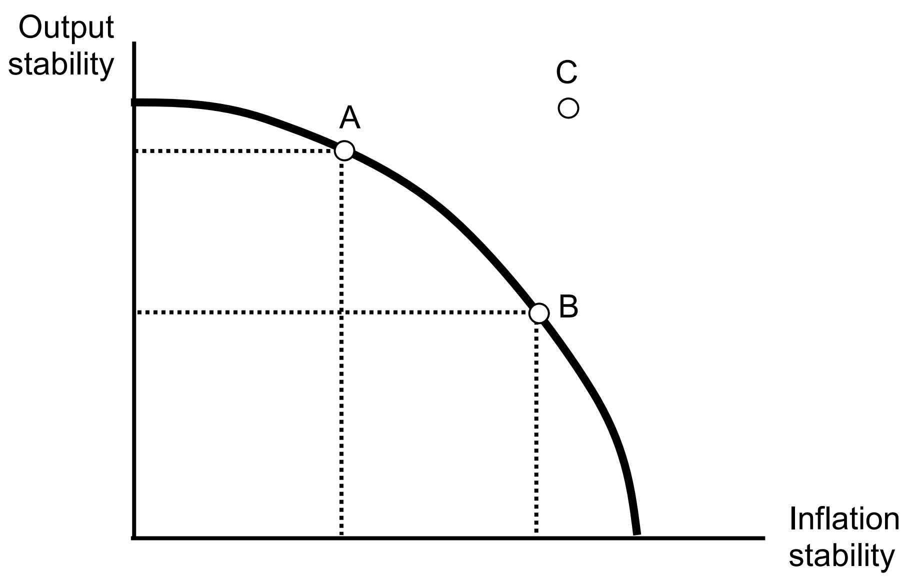
Not all scientists will work on exactly the same goals – scientists working on empirical problems will have different goals from those working on conceptual problems. Empirical problems will also be structured by constraints, but will not necessarily directly involve contradictions. However, solutions to empirical problems ultimately inform the solution of conceptual problems, which in turn removes obstacles to goal-directed activity in general.

3.3 Cases from economics and economic theory

The basic description of the structure of conceptual problems so far is: a set of inconsistent presuppositions, made in pursuit of a goal, and perceived in the whole as a conceptual entity of contradiction. An economist might translate this as: the structure of a conceptual economic problem shows itself in the achievement of an objective (normally some kind of maximisation or minimisation) that is hindered by inconsistent constraints and revealed in the form of a trade-off. A trade-off is an exchange of one thing in return for another – it normally takes the form of sacrificing one benefit in order to gain another benefit.

Returning to the example of figure 1, an economist would not represent the problem as a contradiction, but instead as a trade-off between inflation and unemployment (as in the popular version of the Phillips curve) or more accurately as a trade-off between price stability and output stability (see Taylor, 1995:38-41). One possible representation is shown as figure 3.

Figure 3: A possible version of Figure 1 from an economist's perspective

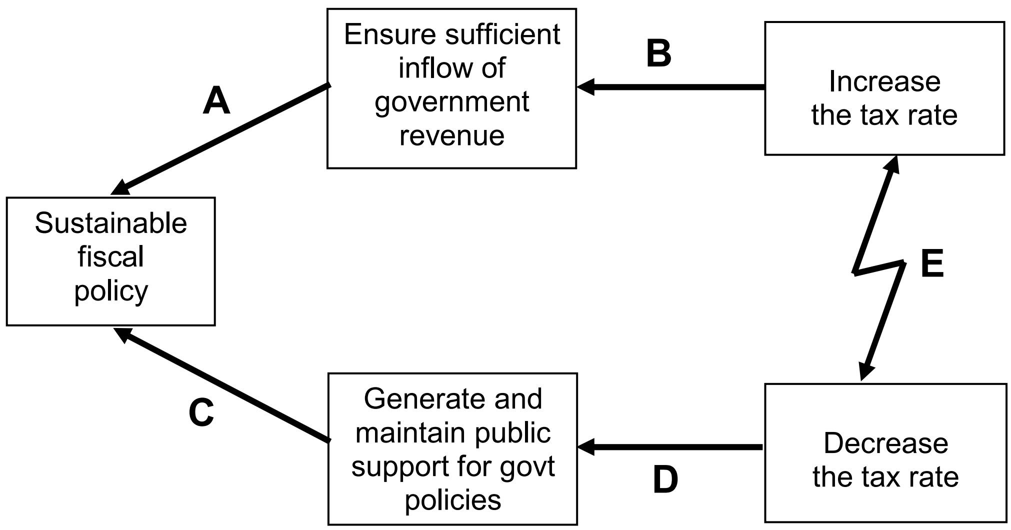


Source: Adapted from Taylor (1995:38)

The concave curve in figure 3 shows all the possible combinations of output stability and inflation stability that are possible given existing knowledge. Point C is impossible given our existing knowledge, so economists tend to pay more attention to the points on the curve (e.g. A and B). The trade-off is visible when the economy moves from point A to point B – inflation becomes more stable, while output becomes less stable. In exchange for inflation stability we must sacrifice output stability.

Another well-known example from the theory of fiscal policy may help to clarify the ideas presented thus far (see figure 4). The goal is sustainable fiscal policy. Given certain presuppositions, it is logical to argue that to achieve this goal, there must be sufficient inflow of government revenue which in turn requires an increase in the tax rate. On the other hand, sustainability will only be possible if there is support for the government's fiscal policy, and to ensure this support, the tax rate must be reduced.

Figure 4: A problem in fiscal policy



The conflict diagram makes it easy to identify the presuppositions that comprise the problem. Some of the many possible presuppositions contained in figure 4 are:

- Arrow A: Fiscal policy depends on revenue; fiscal policy involves spending; the government executes fiscal policy; less revenue will lead to worse service delivery; and government uses revenue efficiently.

- Arrow B: Sources besides taxation are not significant; government cannot generate its own revenue; most people pay tax; tax rate determines tax revenue; tax avoidance is not possible; monitoring costs are negligible; and people feel government is delivering.

- Arrow C: Public can derail government policy; and tax is a key political issue.

- Arrow D: Tax payment is a measure of public support; people believe a low tax rate is fair; tax avoidance cannot be prevented; lower tax rate leads to more work leads to more income and more tax revenue; lower tax rate changes cost-benefit balance of tax avoidance; tax avoidance is caused by a high tax rate; and people are not aware of the benefits of tax.

- Arrow E: Only one kind of tax exists; taxes cannot be separated in time; and everybody is affected by tax in the same way.

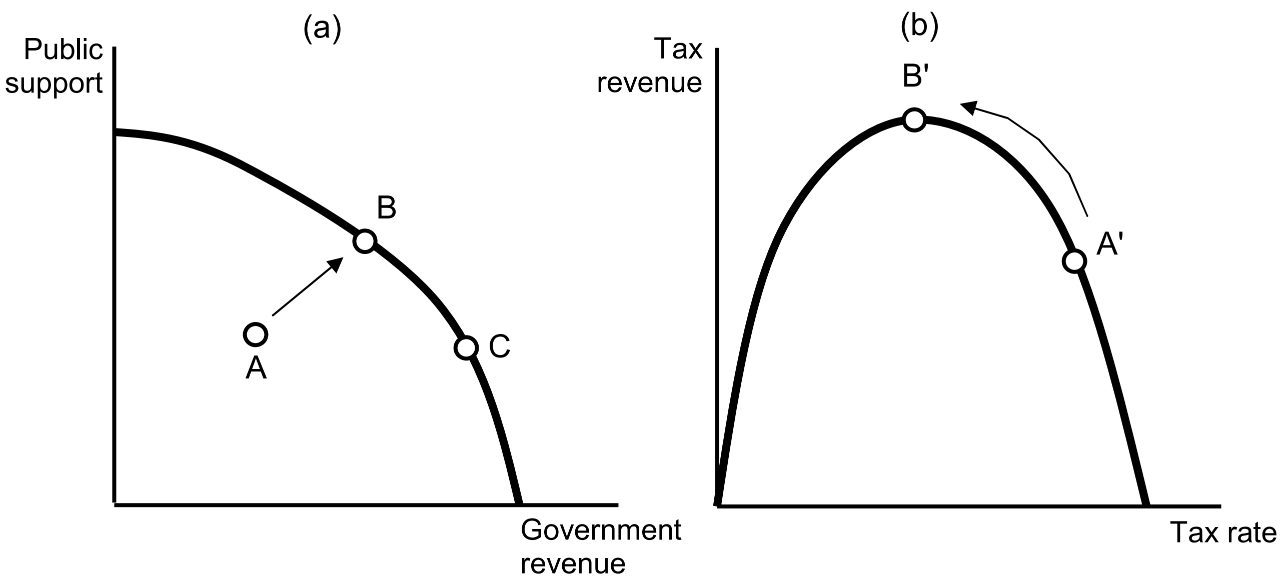
Going through the presuppositions, it is not difficult to find why the contradiction exists. Some of the presuppositions are inconsistent e.g. "tax avoidance is not possible" (arrow B) and "tax avoidance is caused by a high tax rate" (arrow D).

Not all the presuppositions listed are constraints – only those that we are not aware of and those we do not wish to challenge. Constraints rule out certain solutions. For example, if we believe that the presupposition "the government executes fiscal policy" is above question, we will not consider any solutions that involve handing responsibility for fiscal policy to a private agency, and this presupposition then becomes a constraint.

If those presuppositions regarded as constraints contain an inconsistency, then the problem cannot be dissolved, and we will be stuck with a trade-off. Given a specific trade-off relationship that cannot be dissolved, the only strategy available is to resolve the problem by means of compromise.

Two possible ways in which economists may represent the same problem (as in figure 4) is shown in figure 5. Figure 5a is the conventional trade-off diagram that appears in various guises as illustration to almost all conceptual problems in economic theory. Figure 5b is the well-known Laffer curve, and employs a representation less commonly used to depict economic problems. Figure 5a uses the two center boxes (from figure 4) as dimensions, while figure 5b uses the rightmost boxes together with top center box (from figure 4).

Figure 5: Possible versions of Figure 4 from an economist's perspective



When moving from A to B in figure 5a, both public support and tax revenue improves. If it were tangent to some kind of social indifference curve, point B could be a Pareto optimal point. Point A is inefficient. By moving from an inefficient point to an efficient point, both dimensions improve, so it initially appears as if the trade-off does not exist. The trade-off only appears once you reach the efficient points on the frontier. So the existence of a trade-off assumes efficient use of resources i.e. opportunities for Pareto improvement have been exhausted. In Figure 5b, point A' corresponds to point A in figure 5a, and B' corresponds to B. Going from A' to B', tax revenue increases even as the tax rate is dropped. The optimal point is B' and the inefficient point is A'. Moving from A' to B' it appears as if there is no trade-off, when in fact we are simply moving from an inefficient to an efficient point. Once the optimal point is reached, the trade-off appears.

It was stated before that scientists take care to ensure that the structure of their problems match the structure of their models. Representations such as those in figure 5, in a generic form, seem to match the structure of conceptual economic problems as contradictions (or trade-offs). Such representations are easily converted in mathematical form to model various aspects of economic reality.

The structure of a problem suggests which methods are most likely to lead to a satisfying solution. Given problem representations such as those found in generic versions of figure 5, the obvious matching solution strategy is that of finding the optimum. The problem in figure 5a is to achieve the highest social utility, perhaps represented by an indifference curve (which represents yet another trade-off), given the possibility frontier. This method is also known as constrained maximisation. In figure 5b the problem is to find the optimum tax rate – the tax rate that maximises tax revenue within the constraints that created the trade-off relationship.

As Pullen (1982) explains, Malthus was probably the first classical economist to have recognised that the structure of economic problems call for optimisation. Malthus' "juxtaposition of apparently inconsistent ideas" was not evidence of muddled thinking, but rather an application of what he called the "doctrine of proportions" (Pullen, 1982:270). Malthus' doctrine eventually became known as optimisation, and Wicksell was the first economist to explicitly use the word "optimum". Malthus realised that solutions to economic problems could be expressed in the calculus of maxima and minima points. While he never employed calculus, he applied the thinking behind optimisation to saving, population, wealth distribution, taxation, national debt, public works and various other economic problems. Malthus' logic suggested diagrams such as those found in figure 5, where limits set in after a certain point and compromise becomes the only viable course of action (Pullen, 1982:271-278).

Malthus believed that the source of all erroneous economic reasoning lay in the extremes. Simple-minded extremism involves ignoring one of the dimensions on a trade-off diagram, and makes it appear as if there are no exceptions or limitations. While extremism makes economic reasoning appear unmuddled, it is not only useless, it is also deceptive. As Pullen (1982:283) explains, if we ignore Malthus' warning, we make economic science "…much more uncertain in its application, by believing it to be what it is not".

Scarcity (in its many forms) is the cause of all trade-offs. So perhaps it is not unreasonable to claim that Malthus was the first to recognise the nature of the universal economic problem. Robbins defined the universal economic problem by its cause (scarcity) while Malthus defined it by its method (finding the optimum). Malthus' definition is arguably the better one since it makes the application of economic principles more immediately obvious. Some of the work for which Becker (1993) won the Nobel Prize seems obvious if looked at through the filter of Malthus' definition of the economic problem, but less so when looked at it from Robbins' perspective. If economists took Malthus more seriously, they probably would not have needed to wait until Robbins' 1932 essay to make them shed their overly narrow definition of the universal economic problem as one concerning material welfare.

The structure of economic problems presented here can be found in the purely theoretical problems of economics as well. Shackle's (1967) documentation of the great advances in economic theory that took place from 1926 to 1939 offers excellent illustrations of the ideas in this paper. One such illustration is his discussion of the problems that appeared in value theory and their eventual dissolution (Shackle, 1967:13-60).

Progress in value theory was halted by what came to be known as Sraffa's dilemma. Simply put, the dilemma was that under conditions of perfect competition, the firm can sell as much as it likes at the prevailing market price (which is set independent of how much the individual firm sells). However, as the quantity that the firm sold increases, its average cost falls, so that there is no limit to an individual firm's expansion. If there was no limit to the quantity sold, an individual firm with even a small head start would eventually become a monopoly. There is a contradiction because the theory of perfect competition rules out the possibility that an equilibrium can exist where any firm has market power (Shackle, 1967:13).

The cause of the contradiction were presuppositions of which no one was aware i.e. that the supply price was the same as marginal cost and that the demand curve was also the marginal revenue curve (Shackle, 1967:15,24-25). Once it was realised that there was a conceptual separation between the supply price and marginal cost, and between the demand curve and the marginal revenue curve, Sraffa's dilemma was dissolved. The dissolution allowed value theorists (such as Harrod, Robinson and Chamberlin) to introduce a number of new theoretical inventions in the form of the theory of imperfect competition. However, the inventions introduced new dilemmas and problems (e.g. the disappearance of a definite supply curve) and propelled value theorists to further advances.

The same pattern appears throughout the history of economic theory – a contradiction caused by unknown inconsistencies in the presuppositions impedes theoretical progress, only to be unleashed again when the presuppositions are surfaced and challenged. Knowing the structure of economic problems also provides us with a thinking framework within which to reconstruct past problems and improve our understanding of how progress occurs in economic science. Hattiangadi's (1979:52-53) claim that good scientists are also good historians of science may well be true in most cases.

One reason for the dominance of the so-called neoclassical paradigm is the belief that the presuppositions of the paradigm are consistent. Arrow, Debreu and Hahn were able to prove, by deduction from accepted neoclassical presuppositions, that a unique general equilibrium existed. There appears to be no major conceptual problems in the neoclassical paradigm. No other paradigm in economic theory has come close to achieving this intellectual consistency.

The focus of the paper thus far has been on the structure of conceptual problems. The dissatisfaction with the predictions and policy recommendations of the neoclassical paradigm shows that dissolving conceptual problems alone is not sufficient. Most economists outside universities are confronted only by practical problems, and Africa poses plenty practical problems that the conceptually consistent neoclassical paradigm cannot solve. This calls for a further investigation into the structure of practical economic problems, and this will be the topic of a future paper.

5 TOWARD A REFORMULATION OF THE ECONOMIC PROBLEM

Robbins' formulation of the economic problem as scarcity served its purpose to clarify what kinds of problems are relevant to economic scientists. This formulation suggested that economic problems be structured as trade-offs between ends within the constraints of scarce means. Problem formulation affects problem solving efficiency (Amarel, 1969:21) and as hinted at the start, there is reason to believe that Robbins' formulation and its many variations are reducing this efficiency.

In this paper the trade-off representation of economic problems as suggested by Robbins' formulation (see figure 3 and 5) was compared against the conflict (or contradiction) representation (see figures 1 and 4). It should have become clear from the previous section that the two representations lead to different approaches to an economic problem.

The conflict representation explicitly shows the logical relationships that hold the problem together and provides cues (in the form of the arrows) to find presuppositions. Once the presuppositions are found, constraints can be separated from questionable assumptions and inconsistent presuppositions identified. The questionable assumptions can then direct empirical research that will either confirm the assumptions or reveal possibilities for invalidating the assumptions and so dissolving the problem. Inherent in the conflict representation of the structure of economic problems is the understanding that any economic problem is self-imposed and that the problem is not permanent. Change is latent because human ingenuity can challenge its own assumptions, dissolve the problem and create new contradictions.

In contrast, the trade-off representation is inherently static. It presents the problem as finding the optimum point, or a choice between the points, on a given trade-off relationship. This representation offers no obvious way to peer inside the elements and relationships that structure the problem, and hence offers no handle on dissolving the problem. The solution strategy by such a static representation is resolution through optimisation. If dissolution does occur (e.g. when the frontier expands from point A to C in figure 3) it is seen as due to exogenous forces over which economists have little direct influence. The trade-off representation hides the fact that (dis)solutions are often endogenous.

In the trade-off representation of economic problems as suggested by Robbins, ends are given and means are governed by natural laws. Both are beyond the economist's control. Within this representation, the solution to economic problems reduces to a search problem - that is to find the optimum point for a specified trade-off relationship.

To illustrate how the conflict representation opens up further avenues for the solving of economic problems, I return to the fiscal policy example of figures 4 and 5. Figure 4 provides a structure through which to surface presuppositions. Once the constraints have been removed from the set of presuppositions, each one can be challenged by asking any of the following questions about the presupposition: (1) Is it necessarily so that [presupposition]?; (2) Is [presupposition] true under all conditions? or (3) What actions will make [presupposition] invalid? If a way can be found to invalidate any of the assumptions, the relevant arrow will be broken, and the problem dissolved. For example, arrow A suggests that fruitful empirical research would be to determine if the government uses its revenue efficiently. This research may show that the presupposition is invalid, and point out many opportunities for more efficient use of revenue. This breaks the logical flow along arrow B, and allows movement along arrows C and D without being encumbered by the opposite leg of the contradiction. In other words, if the government uses its revenue more efficiently, it no longer needs to increase the tax rate. It can now decrease the tax rate without endangering the sustainability of its fiscal policy. Ideas suggested by challenging the presuppositions of arrow E will reconcile both sides of the contradiction and also dissolve the problem. Such ideas are temporal separation of tax, increasing the range of taxes or passing on of tax through informal or unofficial channels. Another way to find dissolving conditions is to do a diagonal challenge, for example, asking how it could be possible to increase the tax rate while maintaining public support.

The above paragraph barely touches on the richness of the conflict representation in suggesting empirical research and ideas for dissolving the problem. None of this depth is evident from the trade-off representation, which is likely to suggest fewer directions for empirical research and less powerful solutions to the problem.

The trade-off representation of the economic problem ignores a number of aspects about economic problems that are obvious from the conflict representation. These conclusions will be used as the basis of future papers:

- Economic problems do not have an objective existence. Problems are self-imposed through the inconsistent presuppositions of economic agents and institutions;

- Optimisation is not the ideal solution strategy to non-objective economic problems. One reason is that it does not get rid of the problem, so that progress is limited to the trade-off relationship that is taken as give. Another reason is that it is practically impossible to find the optimum point in real-life trade-offs. Even if the optimum point can be found, it is not stable and can change through a change in the actions or even thoughts of economic agents;

- Economic problems cannot be dissolved simply by getting the valuation right as Robbins (1952:36-37) suggested. Valuation through the market can at best help to resolve the problem by leading us closer to the optimum point on a particular trade-off relationship. The market is a logical system that is unable to operate outside its own constraints, but to dissolve problems; one needs innovation by challenging constraints. It is impossible for the market to fulfill this function (Nonaka & Toyama, 2002:1006). The market cannot create radical innovations (that dissolve problems); the best it can do is to induce incremental innovation through changes in relative prices (Ahmad, 1966; Schmookler, 1966) or to balance contradictions via the price mechanism (Nonaka & Toyama, 2002:999).

The conflict representation does not challenge the structure of economic problems as identified by Malthus and Robbins. What it does is offer an alternative formulation of the economic problem than the trade-off representation implied by Robbins. The conflict representation suggests a possible reformulation of the economic problem which opens up a wider range of approaches to economic problems.

The ideal solution to economic problems is dissolution. While the cause of such problems is scarcity, formulating economic problems from a scarcity perspective (trade-offs) does not tell economists how to dissolve economic problems. If economic problems are caused inconsistent presuppositions, it means that scarcity exists because of some kind of human ingenuity gap.

As Homer-Dixon (1995) has shown, the idea of an ingenuity gap offers an alternative perspective on the economic problem that can accommodate both resolution and dissolution strategies. He defines ingenuity as ideas applied to solve problems. Ingenuity is broader than innovation, since ideas need not be novel to solve problems. Ingenuity can be divided into technical ingenuity (ideas to address problems in the physical world) and social ingenuity (ideas to address problems in the social world). Social ingenuity has to be available for a sufficient amount of technical ingenuity to be generated (Homer-Dixon, 1995:590-592).

The demand for ingenuity is the amount of ingenuity required to counteract the disutility caused by scarcity, while the supply is simply the ideas generated to solve all problems (Homer-Dixon, 1995:593). An ingenuity gap exists when the demand for ingenuity exceeds the supply. Formulating the economic problem as the bridging of an ingenuity gap (especially the social ingenuity gap), recognises that economic problems are essentially problems with our ideas. As Popper (19xx:xx) argued – all problems exist in World 3 – the world of ideas. The solution of problems therefore requires more and better ideas, which will lead to a closing of the ingenuity gap and so address the scarcity problem.

Both the trade-off and conflict representations of the economic problem assume that economic problems are well-structured, or can be reduced to well-structured problems. This is a questionable assumption, and before this assumption is addressed a reformulation of the universal economic problem cannot be offered. The ideas of this paper will be carried over into a future paper where the challenge of reformulating the economic problem will be completed.

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PART II: THE STRUCTURE OF PRACTICAL ECONOMIC PROBLEMS

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1 HOW SIMILAR ARE ECONOMIC AND SCIENTIFIC PROBLEMS?

What is wrong with Robbins
What needs to considered?
Wicked and ill-structured

2 AN ALTERNATIVE FORMULATION OF THE ECONOMIC PROBLEM

3 CASES IN POINT

3.1 Mauritius

3.2 The work of Stiglitz

3.3 The work of De Soto

4 CONCLUSION