Kinds of Assumptions and Their Truth:
Shaking an Untwisted F-Twist

Uskali Mäki*

I INTRODUCTION

In his critique of Milton Friedman's methodological position, Paul Samuelson once dubbed as the 'F-twist' the thesis that the truth of assumptions is irrelevant to the acceptability of a theory, provided its predictions succeed (Friedman 1953, Samuelson 1963). This thesis has established itself as the shared point of reference in the ongoing controversy over the assumptions of economic theory -- which in turn is the most important methodological debate within the discipline. Yet, surprisingly little progress has been made in the discussion that has followed. One of the few papers that has been widely recognized as an uncontroversial contribution to our understanding of the issue is Alan Musgrave's insightful intervention, subtitled 'The F-twist untwisted' and published in this journal almost twenty years ago (Musgrave 1981). Musgraves's paper is often cited in methodological literature and it has been reprinted in a major anthology[1]. Yet, no systematic scrutiny of the suggestions of the article seems to have appeared thus far.

Musgrave's contribution is considered successful because it clarifies certain aspects of the assumptions controversy. He accomplishes this by pointing out that there are different kinds of assumptions in economic theory. Musgrave dis-

1. For examples, see Salanti (1987), Birner (1990), Mayer (1993), Mäki (1994). The anthology is Caldwell 1984. Sections IV, VI, and VII of the present paper draw from and revise the suggestions in Section III of Mäki (1993b)

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cusses three types of assumptions: 'negligibility assumptions', 'domain assumptions', and 'heuristic assumptions'; in a footnote, he mentions a fourth type, namely 'as-if' assumptions[2]. He argues, as against Friedman's famous thesis, that such assumptions – in particular those of the first three types – need to be true. This, Musgrave suggests, amounts to untwisting the F-twist[3].

While I take it as uncontroversial that Musgrave managed to clarify certain issues, the main purpose of what follows is to show that not all details in his message are entirely clear and unproblematic. I will clarify, redefine, contextualize, supplement, and in certain cases criticise some of the major ideas in the Musgrave paper. This amounts to revising and improving his attempt to untwist the F-twist rather than to re-establishing the F-twist.

II. ASSUMPTIONS AND THEIR TRUTH

The F-twist appears in many forms both in Friedman's essay and in the subsequent secondary literature. Musgrave begins by citing Friedman's strong claim that

'the more significant the theory, the more unrealistic the assumptions' (Friedman 1953, p 14).

However, it turns out that Musgrave is not actually arguing against this radical formulation of Friedman's thesis, but rather against such more moderate versions as,

'the relevant question to ask about the 'assumptions' of a theory is not whether they are descriptively 'realistic'' (Friedman 1953, p. 15)

Musgrave argues that it is good for a theory if its assumptions are true. Let us make sure that we understand what this might mean.

While Friedman uses the ambiguous and unfortunate term '*realism*' to characterize the assumptions of theory, Musgrave appears to talk about their '*reality*'; the title of his article makes reference to '*unreal* assumptions'. This is not a very good choice of words either; both realistic and unrealistic assumptions may be real in the sense that any sentences or statements put forth by a language

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2 Musgrave was not the first to remind us of the diversity of types of assumptions in economic theorizing, even though his typology is particularly useful Other typologies have been suggested, e. g , by Machlup (1955), Melitz (1965), Brunner (1969), and Mayer (1993).

3 Note that Musgrave's reasons for untwisting the F-twist are different from those of Samuelson's.

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user 'are there' or 'exist' as a possible target of commentary, and are therefore 'real'. If a given assumption were not real in this sense, the idea of debating or analysing it would make no sense. A better term for the property of assumptions that concerns Musgrave would be *realisticness*[4]. Indeed, Musgrave mostly discusses specific forms of realisticness and unrealisticness, namely *truth and falsehood*. Under the circumstances it seems reasonable to construe Musgrave's position as one which favors the truth of assumptions[5].

Given that many assumptions in economic theories appear to be clearly false, it may sound like a radical idea to insist that good assumptions are true assumptions. This might be taken to imply that most assumptions used in standard economics are to be rejected since they are far from the truth. This is not the conclusion that Musgrave reaches. His examples include the assumption that there is no government and the assumption that the government has a balanced budget; he also mentions the assumptions that goods are infinitely divisible, that consumers have a perfect knowledge and that transport costs are nil (1981, p. 377). Musgrave is not suggesting that because such assumptions are false, they have to be replaced by entirely different assumptions. The key to his argument is the idea that a *sentence* can be used to make a number of quite different *assertions*. This is important because the syntactic form of a sentence does not always reveal the assertion that it helps make. Musgrave shows that a given sentence may be used to make three different types of assertion and may therefore play three entirely different roles in economic reasoning: namely the roles of negligibility assumptions, domain assumptions, and heuristic assumptions. My reading is that *he suggests to argue that paraphrased in these three ways, assumptions had better be true*.

While Musgrave makes an important point, it requires clarification. The problem is that he is not always clear about the formal identity of the three types of assumptions and thereby of the items to which truth values are to be assigned.

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4   The distinction between 'realism' (as a name of a family of theories of theories, among other things) and 'realisticness' (as a name of a family of properties of theories and their constituents) was suggested in Maki (1989)

5   Truth and falsehood are important forms of realisticness and unrealisticness. Other forms include, among others, observationality and non-observationality, plausibility and implausibility, practical relevance and irrelevance, partiality and comprehensiveness, abstractness and concreteness. see Maki (1989, 1992, 1993b, 1994, 1998b)

III. NEGLIGIBILITY

Musgrave defines the *negligibility assumption* as

'the hypothesis that some factor F which might be expected to affect (the) phenomenon (under investigation, say P) actually has no effect upon it, or at least no detectable effect' (Musgrave 1981, p 378)

What is surprising about this definition is that it does not mention the idea of negligibility at all; it talks about *detectability*. There is an important distinction here, since a negligible effect obviously does not also have to be undetectable; detectable effects may quite conceivably be negligible. Indeed, detectability and negligibility appear to be different notions: *while detectability can be characterized in terms of cognitive capacities and the power of measument instruments, negligibility is best characterized in terms of the purposes of cognitive subjects.*

This means that in the above definition Musgrave has actually characterized a separate type of assumption, a *detectability assumption*. The assumption that F has no detectable effect on P may be a true statement about the relationship between a cognitive subject and a causal relation between F and P; it is the statement that the cognitive subject is unable to detect some causal connection, given the prevailing state of instrumentation. Irrespective of whether the detectability assumption is a useful notion, it is not a statement about negligibility. Undetectability does not imply negligibility, nor does negligibility imply undetectability. Undetectable effects are often taken to be, but are not necessarily negligible, while negligible effects are not necessarily undetectable. From an epistemic point of view, one may even argue that negligibility presupposes detectability: in order to rationally judge whether an effect is negligible, one has to be able to measure it!

Take one of Musgrave's (and Friedman's) examples, Galileo's law of freely falling bodies. Musgrave says that when applying the law to compact bodies falling relatively short distances, the assumption that they fall in a vacuum may act as a negligibility assumption. He says that the assumption makes the assertion that air-resistance is negligible. Now this is compatible with air-resistance having an effect which is detectable by some measuring device; the effect is just small enough to be neglected for some purpose or other of using the law. Given the purpose at hand, this assertion may be true even if those bodies do not in fact fall in a vacuum and even if the actual effect of air-resistance is detectable. The important point is that *a negligibility assumption is a true or false assertion about a relationship between real effects and the purposes of cognitive subjects*. Thus it is not quite accurate to say that

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'Galileo's assumption that air-resistance was negligible for the phenomena he investigated was a true statement about reality' (Musgrave 1981, p. 380)

The varying grounds on which economists decide to include or exclude factors in modelling the economy also underline the distinction between detectability and negligibility considerations. Thus, in analogy to the Galilean vacuum case, economists may think that transaction costs (the supposed analogue of air resistance) and their effects are detectable (even if hard to measure accurately). Yet they may disagree on whether the impact of non-zero transaction costs on a given phenomenon is negligible or non-negligible, thus whether to exclude or include this factor in one's model by making or dropping the assumption of zero transaction costs (the supposed analogue of the vacuum assumption). Economists may agree that while the effects of technological and institutional innovation are detectable, they may be taken to be negligible for short-run analyses and indispensable for longer-term accounts. Both detectability and negligibility considerations have consequences for modelling decisions: a factor may not be included in a model if its effect is not detectable or if its effect is regarded as negligible for a given purpose. The point is that the grounds for these decisions are not identical.

Having argued that detectability and negligibility are different notions, I want to point out that there is a way of characterizing these two ideas that would bring them closer to one another. Consider defining them in economic terms, more particularly in cost-benefit terms. We might say that detectability is a matter of balancing the costs and benefits of measuring – or finding a method of measuring, or increasing the accuracy of the measurement of – the actual effect of a factor. The lower the costs relative to the benefits, or the higher the benefits relative to the costs, the more detectable the effect, we might say. Now this way of phrasing the idea of detectability – especially when we use the notion of opportunity cost – brings purposes to the picture. Given that the concept of negligibility involves that of purposes, and that the pursuit of purposes can be discussed in cost-benefit terms, we would have established a link between the two concepts. Nevertheless, there may be a limit to this: there may be a 'non-economic' component in the concept of detectability – it may be that the effect of a (change in a) factor cannot be detected at any cost.

There is yet another questionable feature in Musgrave's definition. He says that a negligibility assumption suggests that some factor 'actually has *no effect* upon it, or at least no detectable effect'. It is the 'no effect' case that can also be found problematic. If the factor has no effect upon the phenomenon under investigation, then one would expect that there is no need to invoke the issue of negligibility in the first place. Negligibility is a context-specific notion which has concrete contents only against the background of specific purposes of ap-

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plication. On the other hand, there is nothing context-specific of this sort about a factor having no effect. For factors that have no effect, it cannot be the case that relative to one purpose the factor might be negligible, while relative to some other purpose it might not be negligible. It seems that if a factor has no effect at all, the issue of negligibility will have been settled without having been raised at all.

Since economists obviously ignore detectable effects when these are sufficiently small relative to a given purpose, and because the 'no effect' case does not seem to be part of the issue of negligibility, another definition of a negligibility assumption appears to be needed. I submit the following revision of Musgrave's definition: *A negligibility assumption is the hypothesis that some factor F that might be expected to affect the phenomenon under investigation actually has an effect upon it small enough to be neglected relative to a given purpose.*

With this redefinition the identity of negligibility assumptions should be relatively clear. It is also now obvious why the F-twist needs to be untwisted in the case of negligibility assumptions. Take Musgrave's example of the assumption of a balanced budget. The statement

(B)   The government has a balanced budget

is often false, while

(NB)   A given budget imbalance has negligible effects on the pheno-
            mena under investigation

may be true. Indeed, it is relevant to ask of assumptions of type (NB) whether they are true or false, and it is good for the theory in which they appear if they are true. Note that (B) is a statement about economic reality, while (NB) is a statement about economic reality plus certain purposes of the economist making the statement. (B) is a statement about the existence of a 'factor', while (NB) is a statement about its causal powers, viewed from a pragmatic perspective, that is, from the point of view of the purposes of the users of the assumption.

In general, negligibility assumptions are what their name indicates, namely statements about the fact of negligibility. As such statements, they may be true or false, depending on whether the fact obtains. It is good for the theory – including its predictive abilities – if they are true. Therefore, the F-twist has to be untwisted in the case of negligibility assumptions. As I will demonstrate below, there is less clarity about the other two types of assumption. Before considering the other two types, I would like to suggest an amendment to Musgrave's typology.

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IV. JOINT NEGLIGIBILITY

It seems useful to consider what may be called *joint negligibility assumptions,* a type of assumption that is not discussed by Musgrave. While his negligibility assumptions state that factor F is singly negligible in an explanation, joint negligibility assumptions state that factors $F_1, \ldots, F_k$ are jointly negligible. There are at least two possible reasons for joint negligibility. First, it may be that each factor $F_1, \ldots, F_k$ is singly negligible, in which case a joint negligibility assumption is just a conjunction of singular negligibility assumptions. However, the logic of negligibility assumptions is such that a conjunction of true singular negligibility assumptions is not necessarily true; the separate effects that are singly negligible may add up so as to generate a non-negligible joint effect. Secondly, it may be assumed that the actual separate effects of single factors $F_1, \ldots, F_k$ – whether or not singly negligible -- cancel out each other to the extent that their actual joint effect is negligible relative to a given purpose. Note especially that joint negligibility is consistent with some of those factors being singly non-negligible; false singular negligibility assumptions can go together with a true joint negligibility assumption. This second case is the primary reason for considering a separate category of joint negligibility assumptions. The idea of such assumptions can be seen in the following artificial example:

(JNB)   A given budget imbalance and the imperfect knowledge possessed by the agents and... have negligible joint effects on the phenomena under investigation

More detailed studies are needed to identify the forms in which this kind of assumption appears in economic reasoning, such as in the recurring appeal to the Law of Large Numbers and in some versions of the *ceteris paribus* clause. It is obvious that the rules of the use of joint negligibility assumptions are more complex than those governing singular negligibility assumptions. Even if the truth of assumptions of type (JNB) may be necessary for their acceptability, it is most likely not sufficient. In any event, the F-twist has to be untwisted in this case, too.

V. APPLICABILITY

Now consider the second class of assumptions in Musgrave's typology: 'domain assumptions'. A *domain assumption* is a hypothesis concerned with the domain of applicability of a theory: it is the statement that theory T applies only if factor F is absent (p. 381) Therefore, it might also be called an *applicability*

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assumption. While in the case of negligibility assumptions F is supposed to have a negligible effect on the phenomena under investigation, in the case of domain (or applicability) assumptions F is supposed to have significant, i. e., non-negligible effects; for this reason the application of T is restricted to situations where F does not obtain or where F has only negligible effects.

The identity of domain assumptions is not entirely clear in Musgrave's article. Unlike in the case of negligibility assumptions, he does not give any general formulation of domain assumptions, and his example of the balanced budget assumption is ambiguous in this respect. It is not quite clear whether the relevant domain assumption is intended to be the non-paraphrased statement

(DB)   The government has a balanced budget

or the meta-level paraphrase

(DB*)   The theory only applies where budget imbalance is absent.

However, a careful reading of Musgrave's article might be taken to suggest that (DB) is the relevant assumption. He says that

> 'if a domain assumption is always false, then the theory containing it can be applied to no actual situation and is in fact untestable If governments never balance budgets, then a theory about what happens *if they do* cannot be tested' (pp. 381–382)

Therefore, if we happen to appreciate testability, then we should hope that our domain assumptions are true of as many actual cases as possible. Now this point is relevant about (DB), but not about (DB*), since (DB*) may be always true even if (DB) is always false. This suggests that, for Musgrave, (DB) is the relevant domain assumption that may be true or false.

There is a problem with this suggestion. Note that (DB) is identical with the non-rephrased sentence (B). In the case of negligibility assumptions, sentence (B) is used for making assertion (NB), while according to the above suggestion about the identity of domain assumptions, this same sentence is taken to make assertion (DB) which may be true or false. However, if (DB) is taken as the assumption of applicability, it cannot do its job alone. (DB) is unable, by itself, to identify the domain of applicability for a theory or model. (DB) is a statement *of* the domain of applicability, but not a statement which would inform us *that* this is the appropriate domain. (DB) can be *used for* identifying the domain, but this purpose has to be identified by some other statement. This is where (DB*) enters the picture: the functioning of (DB) is interpreted in the light of (DB*). Note that while (DB) is a statement about economic reality, (DB*) is a meta-level descriptive statement about an economic theory or model.

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For this reason we might want to make a further distinction between two kinds of closely related assumptions, namely domain assumptions and applicability assumptions. While (DB) is a statement *about the relevant domain*, and hence constitutes the domain assumption, (DB*) is a statement *about a property of a theory*, namely its applicability to the domain partly described by (DB); thus, (DB*) constitutes an applicability assumption. Likewise, the assumption that the agents' behaviour is solely calculative and self-seeking may serve as a domain assumption, while the assumption that that assumption applies to market behaviour but not – or, alternatively: as well as – to political or family behaviour, is an applicability assumption. Note that the truth values of these two types of statement behave differently; while (DB) may sometimes be true and sometimes false, this is not the case with (DB*) which is either true or false all the time. One hopes that (DB*) is always true and that, for the sake of testability, (DB) is true as often as possible. This justifies the untwisting of the F-twist in the case of domain assumptions and applicability assumptions.

VI. EARLY STEP

Now consider Musgrave's third category of assumptions, those which he calls *heuristic assumptions*. They should be understood in a dynamic context: they are assumptions first made and then relaxed. Here a scientist develops his theory in two stages:

> 'in the first stage he takes no account of factor F, or 'assumes' that it is negligible, in the second stage he takes account of it and says what difference it makes to his results' (p 383)

The assumption made in the first stage is a heuristic assumption. They might be better called *first-step assumptions*, or, generalizing a bit, *early-step assumptions*, so as to encompass a few early steps whereby some restrictive assumptions are step-wise relaxed while others are retained.

Musgrave is not very clear about the identity of such early-step (or heuristic) assumptions; he does not provide any formulations of such assumptions per se[6]. His example,

6   That Musgrave is not clear about the identity of 'heuristic assumptions' manifests itself in his suggestion that 'Friedman may have had 'heuristic assumptions' in mind when he said that 'the 'assumptions of a theory'   are often an economical mode of describing or presenting a theory' (1981, p 384) I am inclined not to agree with this characterization of Friedman's view The passage cited seems to have affinities rather with an eliminativist approach to scientific theory (see Maki 1986)

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'Assume for the moment that the budget is balanced (we will relax this assumption shortly)' (p. 386),

is a different kind of formulation than (NB) and (DB). It is a performative sentence the uttering of which amounts to an illocutionary speech act of *making the assumption (and giving a promise about its forthcoming relaxation)*, not to the assumption itself. Of these two performatives – making the assumption and giving a promise – it seems the latter may be essential. Perhaps the early-step assumption in this case is meant to be a conjunction of the non-rephrased non-performative statement (B) and a *meta-level promise* that (B) is going to be temporary, that it will be relaxed in due course. In other words, what we may have here is the conjunction of (B) and (E-SB):

(B)   The government has a balanced budget.

(E-SB)   (B) is an element in an early formulation of the theory and will
             be removed as the theory is developed.

'Musgrave does not say much about the truth of early-step assumptions. He briefly discusses Newton's inquiry into the solar system where Newton 'first neglected inter-planetary gravitational forces by 'assuming' that there was only one planet orbiting the sun' (p. 383)

Musgrave then claims that

'you miss the point if you object that Newton's assumption is false, because our solar system has more than one planet' (p. 383)

This is probably so because of the promise that the assumption will be relaxed, not because Musgrave thinks that promises do not have truth values (that they are neither true nor false).

Yet, even if we were to miss the point if we object to Newton's assumption *because* it is false, we are justified in thinking *that* it is false. Similarly with the economic example: it may be mistaken to object to (B) due to its falsehood, but there should be no problem with holding (B) to be false whenever the budget in fact is not balanced. The situation is similar to that in the case of negligibility and applicability assumptions, as we have seen; (B), construed as an assertion, may well be false as such. The difference between the three kinds of assumptions is that while (NB) and (DB*) may be true, (E-SB) cannot be true in the same way, provided it is construed as involving a promise; this supposes that promises are neither true nor false. If (E-SB) were construed as a prediction or some other kind of descriptive claim of the development of an economic theory, it might sometimes be true (such as when a closed-economy

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model is transformed into an open-economy model). In the case of many such assumptions, it would be false, however, since the non-performative parts of those assumptions often fail to be relaxed even in the very long run of theory development.

Musgrave seems to imply that the first, non-performative part of the early-step assumption is false. As quoted above, he says of a scientist that

'in the first stage he takes no account of factor F, or 'assumes' that it is negligible' (p. 383)[7]

This means that (B) can be construed as a negligibility assumption (NB). In this case, however, (NB) would have to be false, otherwise it would not make sense to give the promise that it will be relaxed. From this perspective, an early-step assumption would involve a false negligibility assumption: it would be a conjunction of a false negligibility assumption and a truth-valueless promise.

All this implies that Musgrave is on a shaky ground when he says (without argument) that the F-twist does not hold in the case of early-step assumptions (p. 385)[8]. Contrary to Musgrave, I see no reason to deny that significant theories typically involve radically unrealistic assumptions in the sense that the 'first approximation' they provide of their subject matter contains false assumptions such as (B) or (NB). There seems to be no good reason to prefer a theory which has all of its early-step assumptions true. More strongly, the idea of all early-step assumptions being true is not intelligible or coherent: such early-step assumptions would be identical to final-step assumptions, while the very idea of an early step implies that of distinct later steps. The conclusion is that there are no good reasons to untwist the F-twist in the case of early-step assumptions.

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7   Musgrave says two things that seem to conflict with one another he first says that in the first stage of theory development the assumption is made that a factor 'is negligible', a few lines later he says that when Newton first neglected inter-planetary gravitational forces by assuming that there was only one planet orbiting the sun, 'this assumption was not a negligibility assumption' and then justifies this claim by saying 'Newton knew that planets would sometimes have detectable gravitational effects on one another' (p 383) It may be that the conflation of negligibility with detectability has led Musgrave to this conflict

8   As I said in the beginning of Section II, Musgrave mostly discusses the moderate formulation of the F-twist in terms of the relevance of the truth of assumptions. In the context of early-step assumptions, however, he refers to Friedman's dictum 'the more significant the theory, the more unrealistic the assumptions'

VII. CORE ASSUMPTIONS AND PERIPHERAL ASSUMPTIONS

Before considering the fourth formulation of assumptions in terms of 'as-if', it is useful at this point to put Musgrave's typology in a larger context. Indeed, Musgrave seems to classify certain assumptions within a subcategory without identifying the subcategory. To see this, we may invoke the distinction between what may be termed *core assumptions* and *peripheral assumptions;* a distinction that has appeared in several guises in the economics literature. This distinction does not actually appear in Musgrave's article, but it is useful to make it in order to see the nature of Musgrave's suggestions.

Variations of this distinction can be found in Machlup (1955), who draws a line between 'fundamental postulates' and 'assumptions of specific conditions'. Machlup mentions the assumption of rational maximization as an example of a fundamental assumption, while his examples of specific assumptions include those referring to types of goods involved, cost conditions, market forms, central bank policy, fiscal policy, property rights, enforcement of contracts, and monetary system. Melitz (1965) makes a similar distinction between what he calls 'generative assumptions' (such as profit maximization) and 'auxiliary assumptions' (such as ceteris paribus). Another recent variant is Hahn's (1985) distinction between 'axioms' (such as people having preferences and trying to satisfy them) and 'assumptions' (such as perfect competition). Such suggestions can be interpreted from the point of view of J. S. Mill's (1843) ontological distinction between 'minor causes' and 'major causes'. On this interpretation, core assumptions are about the major causes while peripheral assumptions refer to the minor causes of the phenomena under study[9].

The first thing to note is that the emphasis of Musgrave's discussion seems to be on peripheral assumptions. His examples (infinite divisibility of goods, perfect knowledge, zero transportation costs, balanced government budget, non-existence of the government) seem to be peripheral assumptions; it is notable that the maximization assumption appears only in passing in Musgrave's footnote on

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9. Two qualifications can be made here. First, in some cases at least, the distinction between core and peripheral assumptions may be transformed into a continuum along the dimension of more or less central or peripheral assumptions. Second, the distinction can be grounded on either pragmatic or ontological considerations. If the distinction is taken to be based on nothing more than a decision to treat some propositions as fundamental and some others as less fundamental, then the distinction is pragmatic. For example, in Imre Lakatos's methodology of scientific research programs the distinction between unrefutable hard core assumptions and the assumptions on the refutable protective belt is usually treated as pragmatic On the other hand, if the distinction is taken to be based on an idea of the world itself being divided into core factors and peripheral factors relative to some phenomenon, the distinction is ontological Mill's distinction between major and minor causes is of this kind

as-if hypotheses. However, given his general typology, both core assumptions and peripheral assumptions can in principle serve as negligibility, applicability and early-step assumptions – even though core assumptions seldom function as early-step assumptions in a sequence of models within a given framework of analysis: they are the stable 'all-step' assumptions. In particular, it seems that core assumptions can also serve in making negligibility and applicability assumptions. One may grant that a core assumption such as the maximization assumption is not strictly true, while arguing that the actual degree of its falsehood has negligible consequences for some purpose or other. This same assumption can be used to delimit the domain of applicability of a theory. One may state, for example, that a theory involving it only applies to domains where divergencies from calculative maximization behavior are negligible in their consequences – but not to certain individuals or organizations within a given culture, or to actors in some other cultures or to certain realms within a given culture (such as the realm of kin and friendship), where the divergencies are not negligible.

The second point that will be argued for in the next section is that as-if assumptions may play the role of both core and peripheral assumptions. This is related to the point that, contrary to Musgrave's suggestion, the as-if formulation is not totally distinct from his three-fold typology.

VIII. AS IF

While the as-if formulation of economic assumptions is too large an issue to be discussed adequately in this paper, I would like to make just one comment directly relevant to Musgrave's argument. In a long footnote (pp. 384–385), Musgrave refers to Friedman's as-if formulation of hypotheses and says that they

'are not obviously 'assumptions' of any of the three types I have distinguished'

Given this, it is surprising that earlier in the paper he uses the as-if formulation for expressing a negligibility assumption; he says that the assumption that

'air-resistance is *negligible*'

may be expressed by using an as-if statement that falling bodies

'move *as if* there were no air-resistance or *as if* they were in a vacuum' (p. 378)

Indeed, there does not seem to be any reason why the as-if formulation cannot be used to express statements that involve peripheral assumptions such as negligibility and early-step assumptions. Consider the following example:

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(A-IB)   The phenomena under investigation behave *as if* the government had a balanced budget.

The sentence following 'as if' can quite intelligibly be interpreted either as a negligibility assumption or as an early-step assumption. In the former case, (A-IB) may be true, and it is good if it is true. In the latter case, (A-IB) may be false, but it does not matter much even if it is, since the assumption is supposed to be removed in due course.

Thus, it seems that the as-if formulation is not quite as distinct from the assumptions in Musgrave's three-fold typology as he suggests. On the other hand, given that Musgrave's typology is mainly within the realm of peripheral assumptions, his suggestion becomes more understandable, since his examples of the as-if formulation in economics involve core assumptions rather than peripheral assumptions. His prime example is the maximization assumption:

'under a wide range of circumstances individual firms behave *as if* they were seeking rationally to maximize their expected returns' (Friedman 1953, p. 21, cit. Musgrave 1981, p. 384).

Now while it is important to understand that the as-if formulation can be applied to both peripheral and core assumptions (see Mäki 1992, 1998a), it is also the case that the as-if formulation is less problematic for peripheral assumptions than it is for core assumptions. It is one thing – and philosophically less dramatic – to say that

(A-Ip)   The phenomena under investigation behave *as if* a certain peripheral factor were absent or constant (and we know they are not).

It is quite another thing – and philosophically more radical – to say that

(A-Ic)   The phenomena under investigation behave *as if* the core factors were real (and we know they are not).

While (A-Ip), exemplified by (A-IB), can be interpreted as involving either a negligibility strategy or an early-step strategy, (A-Ic) seems indeed to lie beyond Musgrave's typology of assumptions. It is this latter case that is illustrated by his examples, the maximization assumption in particular. His statement that the as-if formulation is distinct from the assumptions in his typology may therefore be an indication of the fact that he lacks the distinction between core and peripheral assumptions.

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IX. THE ART OF PARAPHRASE AND ITS LIMITS

As I have characterised it, Musgrave's strategy in arguing against Friedman's thesis is based on paraphrasing the assumptions so as to make their truth appear as a virtue. We have seen that in the case of negligibility and applicability assumptions, Musgrave's point is well taken – even if it needs clarification and elaboration – but that in the case of early-step assumptions his argument seems wrong.

As we have seen, meta-level commentaries such as (DB*) and (E-SB) play a role in Musgrave's paraphrases. Now I would like to emphasize the fact that such meta-level statements are very flexible devices in transforming the truth values of assumptions. Given this flexibility, it seems that we should be aware that there are limits of the art of paraphrase. Almost any sentence can be used for making a potentially true assertion if it is suitably 'meta-paraphrased'. A popular class of such paraphrases in economics consists of pedagogical meta-paraphrases; such a *pedagogical assumption* might look like this:

(Ped)   To assume that the government has a balanced budget serves a useful pedagogical purpose.

Even if (B) were dramatically false, (Ped) might well be true. We might proliferate such paraphrased assumptions just by imagining various purposes with regard to which a statement which is false as such may be useful and thereby generate potentially true statements. For example, an *aesthetic assumption* might truthfully state that

(Aes)   To assume that the government has a balanced budget helps create aesthetically pleasing models

As an even more dramatic example of the power of the paraphrase, we could imagine cases where making a given assumption functions as an entrance condition for a research paper; say, the acceptability of a paper for publication or even serious consideration may depend on whether it contains certain critically important assumptions. We could then state our beliefs or hunches about this matter truly or falsely by making *entrance or acceptability assumptions*, using paraphrases such as

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(Ent)   To assume that the government has a balanced budget is a neces-
             sary condition for getting one's paper accepted[10].

These examples show the power of paraphrasing; they also show rather dramat-
ically that there must be limits to the art of paraphrase. It cannot be the case that
just any sentences can be justified by paraphrasing them as true statements even
if these paraphrases were informative as such. For example, while it may be
adequate to justify a given assumption by paraphrasing it variously as a negli-
gibility, applicability, and early-step assumption, some of us might become in-
creasingly suspicious if it is justified only by paraphrasing it as a pedagogical,
aesthetic, and entrance assumption.
    Even though it may not be easy to draw the boundary line beyond which the
art of paraphrase becomes inappropriate, a general principle can be suggested.
Not surprisingly, the general principle says that *a paraphrase can be used to
justify a sentence if it transforms the sentence into a statement that involves fac-
tual claims about the domain of study.* Now it appears that negligibility, appli-
cability, and early-step assumptions do involve such factual claims, while ped-
agogical, aesthetic, and entrance assumptions don't. The former involve true or
false claims about economic reality, while the latter involve (again, true or
false) claims only about the social world of the discipline of economics.

X. CONCLUSION

I have attempted to show that there is a need for clarification and elaboration in
Musgrave's valuable contribution to our understanding of how assumptions
function in economics. As I see it, his main contribution is to show that, by suit-
ably paraphrasing any given sentence, it can be used to make a number of dif-
ferent assertions – hence different kinds of assumptions – and that it is these
assertions that we have to examine with respect to the issue of whether they
should or should not be true. The root problem in Musgrave's article is that the
formal identity of the kinds of assumptions that he distinguishes is not quite
clear. Once we make their identity more precise, we begin to see some other
problems as well as opportunities for further refinement.

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10. It is unlikely that (Ent) is a true statement, since the balanced budget assumption is a peripheral
    assumption. It is rather core assumptions – such as maximization or rational expectations – that
    may play such a critical role as entrance conditions For a discussion of entrance conditions in
    economics, see Máki (1993 a, pp. 92–100)

My suggestions can be briefly summarized as follows. (1) We should not talk about the 'reality' of assumptions, as Musgrave does, but rather about their realisticness. (2) Musgrave's definition of negligibility assumptions in fact defines a different type of assumption, namely detectability assumptions. Negligibility assumptions have to be redefined as statements about negligibility. (3) A new type of assumption can be added to the typology of assumptions, namely joint negligibility assumptions. (4) A further distinction is needed between domain and applicability assumptions; the latter should be understood as involving meta-level commentaries about the applicability of a theory to domains identified by the former. (5) Early-step assumptions are best understood as involving meta-level promises that a given assumption will be relaxed in due course. (6) Musgrave's typology of assumptions seems to be mainly in the realm of peripheral assumptions, in distinction to core assumptions. (7) The as-if formulation of hypotheses is not distinct from Musgraves typology in the case of peripheral assumptions, contrary to what he says. (8) Musgrave's argument is based on paraphrasing assumptions so as to make their truth appear a virtue, as against the F-twist. There must be limits to the art of paraphrase, though; otherwise any sentence can be justified as a legitimate assumption. The limits are determined by considerations of whether the paraphrased assertion is about economic reality. (9) It is correct to untwist the F-twist in the case of negligibility, joint negligibility, and applicability assumptions – i. e., these assumptions should be true – but not in the case of early-step assumptions.

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SUMMARY

In an insightful article published in this journal, Alan Musgrave (1981) has argued that once we distinguish between three kinds of assumptions, Milton Friedman's F-twist – according to which the truth of the assumptions of an economic theory is irrelevant to its acceptability – can be untwisted It is shown that once we bring in more clarity on the formal identity of the different kinds of assumptions, Musgrave's contribution can be further refined· distinctions can be drawn between detectability and negligibility assumptions, and between domain and applicability assumptions; the suggested gap between as-if assumptions and other kinds can be removed: another type, that of joint negligibility assumption, can be introduced, the untwisting of the F-twist can be accepted in all cases except in the case of early-step (heuristic) assumptions, and the art of paraphrase is shown to constitute the basis for Musgrave's strategy and to have limits.

ZUSAMMENFASSUNG

Alan Musgrave stellte 1981 in einem lehrreichen Artikel in dieser Zeitschrift die These auf, dass Milton Friedmans 'F-twist' (die Akzeptabilität einer okonomischen Theorie hängt nicht vom Wahrheitsgehalt der zu Grunde liegenden Annahme ab) durch die Unterscheidung von drei verschiedenen Arten von Annahmen gelöst werden kann Wir zeigen, dass Musgraves Beitrag mit einer klareren formalen Definition der verschiedenen Arten von Annahmen noch verfeinert werden kann man kann zwischen Annahmen zur Feststellbarkeit und Vernachlässigbarkeit unterscheiden sowie zwischen solchen zum Gebiet und der Anwendbarkeit Auf die vorgeschlagene Unterscheidung zwischen Alsob-Annahmen und anderen Arten kann verzichtet und dafür eine neue Art, die Annahme der verbundenen Vernachlässigbarkeit, eingeführt werden Das Entwirren des 'F-twists' ist ausser bei heuristischen Annahmen in allen Fallen akzeptabel Schliesslich zeigen wir auf, dass Musgraves Strategie auf der Kunst der Paraphrasierung basiert, die ihre Grenzen hat

RÉSUMÉ

Dans un article intéressant publié dans ce journal, Alan Musgrave (1981) argumentait qu'en intro-
duisant une distinction entre trois types de suppositions, le 'F-twist' selon Milton Friedman (une
théorie économique ne doit pas se baser sur des suppositions vraies pour être acceptable) peut être
détordu Nous montrons que la contribution de Musgrave peut etre raffiné en portant plus de lumière
sur la forme des différents types de suppositions On peut établir une distinction entre les supposi-
tions de détectabilité et de negligibilité, et entre des suppositions de domaine et d'applicabilité Le
décalage suggéré entre les suppositions 'comme si' et d'autres types peut être omis En revanche,
nous introduisons le type de la négligibilite conjointe Détordre le 'F-twist' peut être accepté dans
tous les cas sauf celui des suppositions heuristiques Finalement, nous révélons que la stratégie de
Musgrave est basée sur l'art de la paraphrase, qui a également des limites