ALLOKATION IM MARKTWIRTSCHAFTLICHEN SYSTEM

HORST SIEBERT (ed.)

INFORMATIONAL EFFICIENCY IN SPECULATIVE MARKETS

PETER LANG

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The purpose of this work is to provide a critical presentation and some extensions of two perspectives of informational efficiency: On the one hand the neoclassical perspective or 'arithmomorphic approach' explains efficiency in terms of a concept mainly based on an explicit economic theory. On the other hand, in the Austrian perspective or 'causal genetic approach' attention is drawn to the entrepreneurial element of human decision making related to an arbitrage theory of profit which is not traced back to anonymous market forces but rather to incessant discovery of information guided by entrepreneurial alertness.

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HANS-MICHAEL GEIGER

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A THEORETICAL INVESTIGATION

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C O N T E N T S

PREFACE

This book was originally planned as a doctoral dissertation to be defended at the European University Institute, Florence. Only a few more months of work remained to be done, when the author Hans-Michael Geiger, died under tragic circumstances. His death came as a great shock to all who knew him as an understanding, warm-hearted friend and as a keenly interested, gifted scholar.

From a scientific point of view it was very regrettable that a promising piece of work should remain unfinished and unpublished. Hence, as Geiger's supervisor, I was very pleased when Ehrentraud Graw, his friend for many years, who worked in the same field, suggested that she would try to bring the sizeable fragment into an editable shape in her free time. Horst Wenzel helped diligently to polish the English. Thanks to these efforts and with only one of the originally planned chapters missing, the results of Geiger's research can now be presented to a wider public.

Although the reader will be aware of the preliminary stage in which some parts of the analysis still are, the line of reasoning of the author as well as the depth of the analysis cannot be overlooked. Well acquainted with mainstream microeconomics as well as econometrics, the author set out to integrate information into the analysis with reference to a type of markets where information matters most, i.e., speculative markets in general and futures markets in particular.

The first chapter witnesses for his efforts to understand and interpret phenomena and concepts closely related to the information problem and difficult to handle by the conventional microeconomic approach. As examples may serve transaction cost, the

entrepreneurial profit as opposed to the managerial reward, the informational content of structures of organization, the diffusion of information and, last not least, the meaning of uncertainty, the relevance of probability concepts and the informational requirements of rational choice. Thereby he aims at integrating information into the equilibrium concept or the neoclassical approach in a way revealing a vincinity to Israel Kirzner and the Neo-Austrian School.

In the second chapter, the author presents those features of his reference system for the analysis of information problems - futures markets - which are relevant to the reflections in the following chapters. Given these foundations, he then tries to assess the analytical quality of the "Efficient-Market Theory" in the tradition of Muth and Fama as the key-approach to informational efficiency based on equilibrium theory. His first result is that the problems of acquiring and evaluating future relevant information are assumed to be solved by market participants. Hence the neoclassical approach is practically empty with respect to informational behaviour. The author also shows that this abstraction combined with the assumption that all market participants act on the basis of the same equilibrium model of market clearing allows to move from the individual agent to the market level. Such a move based on rather tautological microfoundations could be justified in a positivist way by stressing the predictive quality of the empirical model of price formation. However, the empirical model of informational efficiency suffers from the deficiency of providing only a joint test, namely of the equilibrium model of price formation and the informational behaviour of the market participants. The additional limitations of the model with respect to risk aversion, to non-linearities and to the postulated martingale or fair-game properties of prices are also discussed with remarkable competence.

In the fourth chapter, the author reconsiders the informational behaviour of the individual agent and the opportunities to trade in a speculative market from an "Austrian" subjectivist perspective. In consequence, he turns explicitly to some of the serious deficiencies of the neoclassic approach, i.e., the fixation on equilibrium, the emptiness of the concept of competition, the suppression of the knowledge problem, the treatment of the spontaneous coordination through market actions as an organizational problem solved by an outside and omniscient observer. This induces him (1) to reconsider the identification of hedging and speculation as representing the demand for and the supply of risk-shifting possibilities, (2) to set against neoclassical models of deterministic information signalled by prices the Hayekian interpretation of the abstract content of price changes induced by market actions, (3) to replace the implausibility of speculative trading based on homogeneous expectations by the concept of trade based on divergent beliefs, (4) to reconsider the allocational function of monopoly profits by stressing the incentive which is provided by the chance to gain a temporary monopoly position based on an informational advantage, and - as a consequence - (5) to contrast the neoclassical thinking in terms of perfect markets with the view that a certain degree of "imperfection" is required to provide incentives to informational activities. The chapter as such represents a competent and quite unique synthesis of the various Neo-Austrian criticisms raised against the neoclassical analytical treatment of speculative markets.

The missing fith chapter was supposed to provide a final comparison of the two approaches. Hans Geiger's original intention was to reconcile the neoclassical and the Neo-Austrian approach by specifying their theoretical location within a more general concept of market efficiency. It is futile to speculate on whether he would have achieved this objective by introducing a theoretical innovation. As his analysis stands and according to

our mutual discussions, a reconciliation was not very likely. And if he had had the opportunity to reconsider his first chapter in the light of the results obtained in the consecutive chapters, he would also have had a fresh look, for example, at the content of transaction and coordination cost as well as at the partioning of allocational and informational efficiency, particularly in the light of his acquired understanding of Hayek.

The author's untimely death produced a fragment, the result of a tragically interrupted process of thinking and rethinking. But what he left behind is mature and stimulating enough to allow others to make perhaps further steps on the necessarily shaky ground of our understanding of the complex economic phenomena.

Mannheim, June 1988 M. E. STREIT

Der Grad der Abstraktion, dessen die theoretischen Disziplinen in unserem Fach bedürfen, macht sie zumindest ebenso theoretisch, wenn nicht mehr wie irgendeine naturwissenschaftliche Disziplin. (Das Dilemma der Spezialisierung besonders in den Sozialwissenschaften) F.A. von HAYEK

INTRODUCTION

In the broad research field of 'market efficiency', a great amount of theoretical and empirical work is dedicated to the generation and the properties of prices entailing efficient market performance. Because of their special features, highly developed financial markets such as the stock market, forward markets, or futures markets are often chosen as favoured research objects. In particular, these smoothly-functioning markets can be characterized as 'forecasting markets', if price-movements within are considered to be a measure of adaptation to expected future events. For example, in the case of stock markets, the price of a certain share reflects to a great extent the capitalized value of potential returns and is partially determined by peoples' expectations about the future return situation. A price refers to 'value in exchange', not to 'intrinsic value': 'value depends entirely on expectations, either on future use in a closed economy or on a future exchange in an exchange economy', (GRANGER, C.W.J./MORGENSTERN, O., 1970, p. 9)[1)]. In the case of forward markets or futures markets it is even more obvious. Besides an actual price there exists a quotation of prices for

1) This is quite in contradistinction to FAMA, E.F.(1965, p. 36), who emphasizes the consistence of price formation with the notion of intrinsic value.

future commitments as assessed on information presently available. These forward or futures prices in particular can be regarded as a market-coordinated aggregation of individual assessments on future scarcity-relations. The conjectural nature of all these prices is due to the fact that decision-units are exposed to uncertainty. Thus, planning as a notional anticipation of future actions means to acquire future relevant information and to carry out the speculative evaluation of each market participant with regard to his individual needs and interests. Because of the coordinative power of the market, the quantity of all executed market actions finally results in one market price. Is this a price which entails efficient market performance? Since the pathbreaking works of Adam SMITH and Leon WALRAS a well accepted view exists of what is understood by efficient market performance. According to this opinion, markets perform completely efficient, if they lead to a PARETO-optimal state in which all marginal opportunity costs are equal[1)]. The derivation of such a result is only feasible on rather idealistic conditions, e.g., costless transaction possibilities, instantaneous adjustment, and perfect knowledge about the state of the world. But, quite obviously, real world markets are not like that. From an economic point of view, they are probably better characterized by time- and money-consuming transactions, frictional adaptation and imperfect information, 'shortcomings', which in all probability leave markets in a 'subefficient' state.

The introduction of transaction costs and coordination costs - as delineated in this paper - allows for the analytical handling of such an 'imperfect' situation. Given these costs the paradigm of PARETO-optimality must slightly be modified. Allocation efficiency, therefore, as a term is only of significance, if it is

1) This is so because Adam SMITH's invisible hand and WALRAS' general equilibrium are somewhat logically connected. 'SMITH's vague invisible hand gets reincarnated in WALRAS' auctioneer and PARETO's optimality result'.

understood as a relative measure of efficiency compared to the absolute character of PARETO-efficiency. Thus, allocation efficiency refers to the degree to which an optimal allocation of resources among competing aims is achieved.

To abandon the assumption of perfect knowledge leads to the second main task which markets should fulfill: The complete provision and exhaustive exploitation of relevant knowledge as an informational basis on which allocation decisions are to be founded. This aspect refers to markets as an information processing and information clearing device and as a social institution which has the particular quality to collect dispersed informations and to transform them in a socially desirable way. In the classical treatment of market performance the provision of knowledge was by definition 'perfect' and was hence excluded from further theoretical analysis. The investigation of 'imperfect decision situations' leads to what is labelled here as informational efficiency and will be analysed from two perspectives. The first one deals with the bulk or set of information which provides the informational basis for economic decisions. Do markets take all past and present information into account? Do expectations about possible future events completely and promptly enter the analysis? The answers to these questions reveal the completeness of usable information. The relevance of 'completeness of information' is conspicuous: One can presume that different sets of information - mutatis mutandis - probably will lead to different decisions and therefore create different allocative patterns. Closely related to this kind of reasoning is HAYEK's notion of 'Marktprozesse als heuristische Entdeckungsverfahren'.
Nevertheless, there is no valid 'a priori'-argument that vindicates the assumption that markets take all knowledge into consideration. Thus, the investigation of this problem refers to the completeness axiom.

The second perspective of informational efficiency concerns the

extent to which a set of information is actually utilized. Given a specified bulk of information the question is: Are all conclusions correctly drawn from it, or must we assume that the information processing ability of a market economy is biased towards an inferior utilization of information? Similar questions also constitute the main point of contest in the discussion about the superiority of centralized as opposed to decentralized decisions made by the state or by a group of economic agents respectively. The exhaustive exploitation of information, therefore, turns out to be the second dimension of informational efficiency, which henceforth is referred to as the exhaustion axiom.
The degree of completeness and exhaustion taken together determine the actual degree of informational efficiency, which will later be discussed in greater detail.

The performance of real markets, however, must be assessed by using a composite measure aiming at the working of both subsystems, i.e., the allocation system and the information system. Thus, if in a very general sense we view a market system as to consist of an allocation system and an information system, we can speak of a system efficiency, comprising the efficiency properties of the two subsystems.

In the following pages, we try to give some theoretical insight into the processes which finally determine efficiency in the various systems. The term 'system' stands for the functionally integrated whole consisting of the two aforementioned parts. As a simple measure of system efficiency, some ordinary minimum function with both efficiency numbers of the subsystems could serve the purpose. The separation, however, is only for analytical convenience and does not serve any purpose beyond traceability. Because the previously mentioned types of financial markets are assumed to be of a high degree of allocation efficiency, it appears that the problem can be reduced to the investigation of

informational efficiency. This represents the first of the two approaches presented in this paper. The 'arithmomorphic approach'[1], explains efficiency in terms of a concept, which is mainly based on the following characteristic properties:

- an explicit economic theory (expected return theory)
- 'easily' testable implications in the field of empirical research (efficiency tests).

The second approach is not as easy to handle and not as amenable to a closed presentation as the aforementioned one. It is best viewed with respect to the theories developed by the 'Austrian School'. This approach provides a view of economic reasoning which objects to the treatment of the problem as it is tackled by the arithmomorphic approach mainly by doubting the adequacy of the methodology of this approach. The doubts concern

- the concept of an economic equilibrium in conjunction with a non-dynamic analysis, and
- the valuation of transaction and information costs as an insignificant argument to explain informational efficiency, in conjunction with the simplistic conception of expectations as a status of 'consensus omnium' that exclusively considers the result of a hypothetical information process and does not focus attention on the real process.

Thus, attention is drawn to what Israel M. KIRZNER calls 'the entrepreneurial element in human decision making' related to an arbitrage theory of profit which is not traced back to anonymous market forces but to incessant discovery of information guided by entrepreneurial alertness. Following Hans MAYER, this position is named a 'causal-genetic' approach[2].

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1) I first found this term used by Nicolas GEORGESCU-ROEGEN (1971).

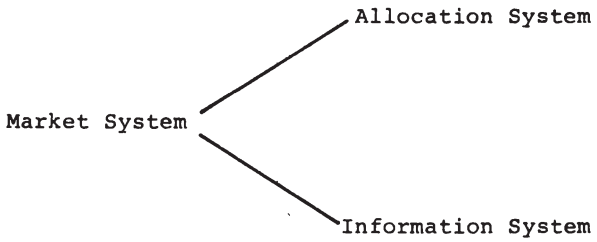
2) Hans MAYER (1879 - 1955) was the successor to SCHUMPETER in Graz. Together with Ludwig MISES and Alois SCHUMPETER he formed the body of the 'younger Austrian School'. MAYER puts great emphasis on a dynamical view in economics that moulds the basis for his 'causal-genetic'conception. MAYER, H. (1931).

The purpose of this work is to provide a critical presentation and some extensions of these positions. Chapter I deals with the terminus 'efficiency' in an extensive sense: Efficiency related to the performance of market economies, as it is treated and entrenched in economic theory. This detailed presentation is useful for the argumentation in chapters III and IV. A description of the empirical reference system is given in chapter II. In chapter III a brief presentation of the arithmomorphic approach or the 'neoclassical' perspective of informational efficiency is given. Two central points of this theory are developed and criticized: First, the theoretical model of expected returns in the frame of an informationally efficient market and second, the empirical implications of system efficiency (informational efficiency) with respect to successive prices (fair game property of price changes). In chapter IV the causal-genetic approach or the 'Austrian' perspective of informational efficiency is evaluated mainly by concentrating on some key positions as finite and costly adaptation processes as well as on the role of information processes for the explanation of individual economic behaviour.

CHAPTER I The Fundamental Issue: Efficiency in Market Economies

This part deals with the terminus technicus 'efficiency' in an extensive sense: Efficiency related to the performance of market according economic theory. The investigation is mainly conducted using the terms 'allocational efficiency' (A-efficiency), and 'informational efficiency' (I-efficiency). Occasionally, the terms 'allocation efficiency' or 'information efficiency' will be used.
Because in economic theory these above-cited notions are already widely applied carrying special meanings, the following exposition provides a framework of definitions.

A market is considered to be a composite unit of two related subsystems. These subsystems are referred to as 'allocation system' (A-system) and 'information system' (I-system).



The A-system comprises the traditional conception of market economies as based upon autonomous decisions of many legally independent economic agents. Thus one may think in terms of producers and consumers, of suppliers and demanders of labour and of goods and services. However, we only deal with the relations that are usually assessable in termini of prices. In order to clearly study these market conditions, we put on glasses to 'colour the

world' in economic categories thus blocking out all other possible interactions[1]. The fact that this type of strategy allows to focus on particular elements by hampering the digression to incidentals is the rational justification for all kinds of 'a priori'-views. This is usually called 'Werturteil im Basisbereich'. On the other hand, it bears the risk of a narrowed horizon, which suppresses access to better or more appropriate forms of explanation. This problem will later be of particular interest. We therefore refrain from a detailed discussion at this point in favour of future clarification.

The different actors' actions are guided by a commonly held principle, the profit or utility motive. This motive is only one particular aspect of an essentially broader concept, the Economic Principle, the origins of which are mainly credited to SMITH - who is sometimes honoured as both the Adam and the Smith of systematic economics[2] - and were later refined by his various successors. It is based on the very general presumption of human action, i.e., the pursuing and grasping of opportunities offering relative advantage[3].

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1) Thus, for example, we neglect quite deliberately the exchange of affectionate remarks between lovers on the parkbench, but not the fact that their meeting might not have been at random, but rather the result of a marriage broker's intervention. We are not interested in the 'Mona Lisa's smile' but in its price. See PIGOU, A.C. (1920) and KNIGHT, F.H. (1931).

2) See BOULDING, K.E. (1969, p. 1), in his presidential address to the AEA.

3) It should be noted that SMITH, who was originally educated as a philosopher, founded the principle not on purely abstract or selfish notions, but rather on highly moral categories. His main philosophical work (The Theory of Moral Sentiments, 1759), deals extensively with a concept of 'Sympathy' and 'Harmony' in human relations. He thereby constituted a moral viewpoint, which is again emphasized in his principal economic work (The Wealth of Nations, 1776), namely that each individual, pursuing his own self-interest, is led as if guided by an invisible hand to activities that promote the general welfare of all.

Humans by self-interest tend to move efficiently towards the most preferable operating position available[1].

Since the 'Neoclassical Revolution' in economic theory - mainly inaugurated by J. MARSHALL (Principles of Economics, 1890), and W.St. JEVONS (The Theory of Political Economy, 1871) representing the 'English School', and L. WALRAS (Éléments d' économie politique pure, 1874) and V. PARETO (Cours d'économie politique, 1897), representing the 'Lausanne School' - this basic motive is dressed up to the concept of maximization. From the producers' or suppliers' viewpoint, the concept is known as profit maximization and as utility maximization from that of the consumers or demanders[2]. This concept of maximization refers to the mathematical technique and application of marginalities. It constitutes the formal concept upon which the A-system is based.

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1) See FURUBOTN, E. G./PEJOVICH, S. (1972, p. 1138).

2) Utility maximization is the logical equivalent of the profit maximization and can be derived by the same maximization principle or, as N. GEORGESCU-ROEGEN (1966a, p. 18) wryly notes, can be marked by the same 'mechanics of utility and self-interest'; however, one may more sensibly speak of 'utilization maximization' instead of utility maximization, in order not to blur a subtle distinction, which might be fruitful in the course of the following discussion. The nuance is mainly based on the understanding that profit and utilization maximization is only one possible - but nevertheless the most severe and the most narrow, and for that the most clear - embodiment of the wider principle of maximizing utility as such. In the case of the firm it means that if it '...will sacrifice "profit" (no matter how measured) for whether prestige, or good public, or labour relations, or a quiet life, or liquidity, or security, or what have you, then it is clearly not maximizing profits. And if it is not maximizing profits it must be maximizing "utility", which is simply a more elaborate way of saying that it does what it thinks best', BOULDING, K.E., The present Position of the Theory of the Firm, (1960), cited in FURUBOTN, E.G./PEJOVICH, S. (1972, p. 1138). Thus BOULDING and many other authors (see for further references FURUBOTN, E.G./PEJOVICH, S. (1972, p. 1138)) are united in the opinion that profit and utilization maximization is too narrow a perspective to view the phenomenon. However much one twists and turns, utility maximization still means maximization, still requires the application of a clearly defined mathematical

(continued)

1 The Separability of Market Systems into an Allocation System and an Information System

1.1 The Allocation System

1.1.1 PARETO's Paradigm

A market in which economic welfare arrives at a maximal level[1)] is called a PARETO-market. A PARETO-market shows a most effective allocation pattern. Thus a PARETO-optimal or PARETO-efficient market performance refers to a maximum allocative performance, subjected to a set of constraints.

This paradigm is referred to in economic theory as the 'complete competition model' or the 'Neoclassical Allocation Model'. It is perfect in the sense that no other allocative pattern can improve some individual's welfare position without harming another's, given the relative scarcity of inputs, technological production possibilities and individual preference.

The assumptions underlying this model are as follows:
- assumptions about available inputs and their possible combinations,

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footnote continued.
algorithm with reference to a well-behaved 'objective function'. Whether the objective consists only of the argument of profit or also of prestige, a quiet life, security, diffidence or whatever one might consider worth striving for, is in the first instance only a matter of analytical difficulties which must be tackled, but on no account a question of principle. In view of this, suggestions such as that of BOULDING do not seem to overcome the deficiencies, which are already recognized in the case of the classical profit maximization approach.

1) Optimum is the proper word because, the maximization has to consider a set of constraints. The difference here, however, does not cause any harm as far as the problem is delineated .

- a welfare-function,
- an atomistic market structure (sufficient, but not necessary),
- free access to the market (no entry barriers at all),
- a perfect market.

A perfect market, on the other hand, is characterized by:

- perfect homogeneity of goods,
- perfect market transparence (perfect knowledge),
- independence of time and space (time- and space-less concept).

Given these assumptions a PARETO-market roughly works according to the following sequential analysis: According to a cost-minimizing strategy, the typical producer combines all input factors on the production possibility-curve in a way to maintain a relation that corresponds to their price ratio, thus production is located on the least cost expansion path. This well-known relationship allocates rewards to resources according to their marginal value[1]. In this regard we could speak of the production-economy. On the other hand, a step further, production is extended until the market's revenue - the market price - entirely covers the marginal costs of the last unit produced. By reaching such a production level, the producer maximizes his profit, i.e., the difference between market price and production costs. This level is referred to as the enterprise-economy. The like-minded efforts of many such producers reveal two remarkable properties. First, all producers have the same goal in mind. Their competition with each other forces market prices down to a level of pure cost prices. This well known result of fully competitive markets will be referred to as the commodity-production-economy[2].
Thus, competition only permits the regaining of all expenditures which are directly or indirectly related to the production of commodities. Besides the direct costs, like those of diffe-

1) See ALCHIAN, A.A./DEMSETZ, H. (1972, p. 778).

2) The idea of this threefold partition is due to GEORGESCU-ROEGEN, N., (1935, p. 283).

rent inputs, machines and other physical devices, all indirect costs are compensated by the market's revenue as well. These are mainly fixed costs[1], like the costs of management in the first case or the costs to build up the firm.

Second, the process of competition causes a selection among the supplying producers. Only those who succeed in achieving a technical and organisational structure which forces costs per unit of output down to the cost level of the most advanced supplier (prime supplier), remain in the business. Those who fail to achieve this essential requirement are forced out by non-profitability. In this sense the system ensures a selection which only favours the most advanced suppliers.

With regard to his budget constraints and his preferences each individual consumer, who should be considered the best judge of his own welfare, chooses the very bundle of goods that gives maximum utility to him. Ceteris paribus, the consumer's principle of utility maximization requires 'choice by price'. Thus, in the end it is the consumer's autonomous choice which drives resources to different competitive purposes of use (consumer's sovereignty).

The analytical treatment of the PARETO-model finally exhibits some optimality conditions, manifesting themselves in the equality of the marginal rates of substitution in consumption and production[2].

1) Fixed costs are costs independent of the level of output with respect to a certain time span.

2) Looking at the huge amount of literature on 'Welfare Economics', only a few can be referred to here: BOULDING, K.E. (1952, p. 23), ROWLEY, K.C. and PEACOCK, A.T. (1975) for extensive exposition and discussion, and a collection of papers selected by ARROW, K.J. and SCITOVSKY, T. in the A.E.A. Series (1969): 'Readings in Welfare Economics', as well as for a discussion from a more epistemological point of view an articel by HICKS, J.R. (1939) about the foundations of Welfare

(continued)

The assumptions underlying the model assure an instantaneous and final movement to a stable state of equilibrium. This result is primarily due to the model's analytical construction, which is tailored to a situation where all individual 'ex ante'-plans are perfectly compatible or similar to a situation in which market-clearing prices and quantities are hypothetically predetermined by an auctioneer before production has started (WALRAS' Auctioneer Model). In this sense, the model exhibits a performance which in terms of efficiency is absolutely perfect.

By neglecting the various types of costs such as the cost of searching and the cost of risk and advice, the assumption of costless complete knowledge together with the absence of all adaptation processes toward a hypothetical state of equilibrium marks an extremely narrow perspective to explain market performance with. Thus, a central point to be noted is that the widely held view of economics as a coordination problem is utterly ignored, as well as the fact that the future is by definition uncertain and can at best be conceived as a bold trial and error elimination process, but certainly not as a phenomenon of perfect knowledge.

Considered from this extended viewpoint, the partly vehement criticism among economists seems not at all surprising, especially since the PARETO-model became one of the most dominating cornerstones in economic reasoning. The range of criticism therefore runs from DEMSETZ's (1969) notion of a 'Nirvana Approach' to BOULDING's (1969) more appealing comparison with 'Snow White (the fairest of all) and the Seven Marginal Conditions'.

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footnote continued
Economics. Concerning the German literature, see for example: LAUSCHMANN, E. (1955), who gives an extensive overview of the subject, or WEBER, W. (1954), who especially treats the concept of the 'Social Welfare Function'. For a very comprehensive and illustrative discussion see also GIERSCH, H. (1961) and , STREIT, M.E. (1982b).

Both authors apparently deplore the fact that the process of scientific enquiry has reached such a degree of abstraction that the deduced statements of factual knowledge about the phenomenon itself cease to include any usable information. Scientific enquiry is always striving to provide explanations, but while concentrating on particular characteristics, it often neglects certain other aspects. This is what R.A. GORDON (1976) emphasizes as 'the pursuit of rigor at the expense of relevance'. Most economists today endorse the view denying any usefulness of the PARETO-model. We will examine if there is room for a more differentiated criticism. One possibility is to extend the PARETO-model by relinquishing the requirements of the space- and time-free concept. The extended model would then be employed as a prototype from which the PARETO-model is deduced as an extreme and particular case (see chapter I 2.2).

1.1.2 Extension: Market Costs

The aforementioned assumptions of the model can be appraised with respect to their severity. 'Perfect homogeneity' is not a requirement as demanding as the premise of a space- and time-less concept. To a certain degree, however, the relation between time and space can be compared to a coin: One side is not conceivable without the other. Space cannot exist without time, and vice versa. Nevertheless, despite the absence of precise methods to separate time and space, the justification for pursuing a time- and space-distinction is of a purely theoretical nature: It allows to scrutinize two interrelated phenomena in an analytical expedient way.

In the following analysis we elaborate on the basic structure of the model. First, we remove the restriction of a 'spot market' and allow for a spatial dimension. Second, the dimension of time is introduced by the analysis of a hypothetical development.

Because our study is focused exclusively on the economic consequences of these extensions, we are able to include them into the familiar concept of costs[1]. These kinds of costs are related to the particular concept of the 'A-system' (in short: the market); therefore they are referred to below as 'market costs' in general, and specially as 'transaction costs' and 'coordination costs'.

1.1.2.1 Transaction Costs

The concept of a spot market in the PARETO-model allows to neglect transaction costs. Transaction costs (T-costs) are expenditures which come into existence if a PARETO-market is extended by the spatial dimension. T-costs burden each single transaction to a lesser or greater degree. Thus, T-costs are highly individual and variable costs. Their existence has a particular effect on the concept of a PARETO-efficiency. Although the analysis is still carried out under the paradigm of marginality conditions, positive T-costs create 'substitutional gaps'. As far as their influence on the optimality requirements is concerned, the precise conditions are no longer entirely valid. Instead, one may think of the PARETO-conditions as being surrounded by a penumbra within which the marginal conditions still remain prescriptive. Thus, we still deal with a market in equilibrium showing all the agreeable characteristics already pointed out, but remove the assumption of zero space. Transportation costs are a typical example of T-costs, but in a broader view, one can also add policing and enforcement costs of contractual activities as well as information costs[2].

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1) This presupposes considerable aspects, most obviously assignment and assessment. But as mentioned above, we necessarily restrict the analysis to those relations, which are assessable in monetary terms.

2) For an authoritative discussion of this point, see COASE, R.H. (1960), and DEMSETZ, H. (1964).

1.1.2.2 Coordination Costs

In the following step, the behaviour of the A-system throughout time is considered. Thus, the condition of a timeless concept is relaxed; the market's performance is viewed as a dynamic process (in short: market process). At a first stage, therefore, the idea of an equilibrated system is abandoned; instead, a situation is of interest where the actors' 'ex ante'-plans are not fully compatible, but subjected to an unspecified process of mutual correction and adaptation. By assuming a disequilibrium situation, we must be aware that we violate one of the basic requirements of the model. PARETO-efficiency is correctly defined in terms of some particular marginal conditions. Hence disequilibrium must necessarily indicate some form of inefficiency as a result of deviations from the optimality conditions. Early economic theory has almost exclusively concentrated on the paradigm of equilibrium, especially since WALRAS, in his 'Théorie d'Économie Politique Pure', concisely pointed out the characteristics of an equilibrium state, followed by the already classical work of ARROW and DEBREU (1954) and the stability analysis in the tradition of HICKS and SAMUELSON.

However, with the analytical treatment of disequilibrium a problem arises from the fact that in the PARETO-model only one set of conditions exists which entails equilibrium, but an infinite number of possibilities for disequilibrium. Fortunately, the latter are all similar in some relevant sense, and we will treat them as pure transitional stages toward an equilibrated state. The apparent advantage of this kind of analysis lies in the fact that the direction the market processes take throughout time is identifiable, if we assume convergence toward a stable state of competitive equilibrium.
As a decisive disadvantage could be considered, that the concept of equilibrium is not abandoned at all, but merely modified or disguised in a dynamic shape, without reaching substan-

tially different results in the end. To meet these objections at least partly, it is important to note that it is not claimed that a competitive equilibrium is ever actually attained, although it admittedly marks the crucial reference point the system is supposed to approach. The theoretical justification for this 'convergence assumption' is founded in the competitive behaviour which governs the market, although, as J.R. HICKS (1979, p. 46) correctly emphasizes: 'the Economic Principle by itself gives no guarantee that equilibrium can be established'. Despite these methodological intricacies, we will hold this idea for the moment and give credit to the conviction that market processes converge towards a hypothetical state of equilibrium[1].

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1) If we do not adhere to this belief, we are left alone in a world of disarray, without any principle of order. This is recognized by HAHN, F.H. (1970) when he notes, that 'the most intellectually existing question of our subject remains: Is it true that the pursuit of private interests produces not chaos but coherence, and if so, how is it done?' (p. 12). In this case, any effort to explain the phenomenon would be superfluous. Fortunately, the experience of life rather tends to support the view of some kind of 'stable laws' on which one can rely with a high degree of surity. Some physical laws such as the law of gravity seem to strengthen the argument. But one may reasonably doubt that human behaviour as considered in economic theory is also conducted by such firm principles. Perhaps we are better advised with reference to the dogma of 'man's free will' to comprehend human action as a purely random walk in the maze of evolution. But here we may confidently follow W. HEISENBERG (1955, p. 15), who objects quite correctly, 'daß der Mensch zwar tun kann, was er will, aber er nicht wollen kann, was er will'. Thus, it is true that mankind's old dream of flying has been realized, but is still governed by the severe laws of nature, as ICARUS had to experience with fatal consequences. So, we are probably not totally ill-advised, if, in the field of economic behaviour too, we presuppose the existence of what H. ALBERT (1975) somewhat less stringent compared to a law of nature calls 'strukturelle Tiefenkonstanten'. This precisely describes our notion about a 'movement towards equilibrium'. Anyway, may the world be chaotic or systematic, the question presumably cannot be answered definitively (if at all) without leaving the firm ground of scientific argumentation. This problem is to be discussed again later in this work.

In this case we are able to speak of the 'coordinative power of a market system'. Coordination costs (C-costs) are all costs in a disequilibrated situation necessary to ensure convergence to equilibrium. When equilibrium is reached, they become extinct, except for that part which was referred to as T-costs. In contrast to T-costs which were pointed out as variable costs, C-costs mainly resemble fixed costs or, as KIRZNER labels them 'sunk costs'[1].

After the initial build-up efforts (e.g., of infrastructural devices or legal titles), the concomitant costs appear as 'once and for all costs', as a kind of lump sum costs, which become independent of the extent and number of transactions actually carried out under the refined system of conditions. Therefore we can generally speak of C-costs as expenses specifically related to coordination mechanisms and facilitating a smooth and immediate adaptation toward equilibrium. In more concrete terms, one may think of C-costs as the setting up and 'maintenance and repair' costs of infrastructural equipment in a market system. In the first instance, we do not only meant physical devices, but also an appropriate legal framework and in particular the existence of relevant markets for property rights, i.e., tradeable legal titles.

What seems to be quite obvious and is presupposed without discussion in the Neoclassical Allocation Model[2], has quite severe consequences when not taken for granted. Underdeveloped market systems, in this sense, are suboptimal and inefficient per se, because of an induced conduct which in economic theory is referred to as the 'Prisoner's Dilemma', and is basically due to

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1) See KIRZNER, I.M. (1973, pp. 191-195).

2) The analysis carried out now goes far beyond the original notion of competitive markets as treated by neoclassical marginalism.

the presence of unassigned property rights[1].
The problem of free goods is juxtaposed to the concept of 'externalities'[2]. In the context relevant here, this refers to a situation where a potential market price fails to entirely take into account all cost and benefit aspects which arise during the process of production, exchange and consumption of economic goods. Thus, in terms of a full cost-benefit account, the market price may either be too low, indicating the case of positive externalities on the demanders' side, or too high, creating negative externalities for demanders and positive ones for suppliers.

In either case a difference exists, which is not compensated by the prevailing market price. However, it is apparent that, with the emergence of externalities, the price system loses its accurate signaling function and fosters the non-efficient use of scarce resources. This is the starting point of the 'theory of property rights'[3] which, given this situation, focuses on the specification of legal titles and claims that '... (the content) of property rights affects the allocation and use of resources in a specific and predictable way', (FURUBOTN, E.G./ PEJOVICH, S., 1972, p. 1139), so that '... a more complete specification of individual property rights diminishes uncertainty and tends to promote efficient allocation and use of resources' (FURUBOTN, E.G./PEJOVICH, S., 1972, p. 1141).

With respect to this viewpoint, property rights are developed to internalize externalities, in order to maintain the market as an

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1) From the viewpoint of modern decision theory BOULDING, K.E. (1976, p. 83) labels the situation '... als einen perversen dynamischen Prozeß, der dazu führt, daß schließlich jeder schlechter dran ist'.

2) See for broader discussion, e.g., COASE, R.H. (1960), or STIGLER, G. (1961).

3) See for detailed exposition the above-quoted review article by FURUBOTN, E.G./PEJOVICH, S. (1972).

incentive-compatible mechanism of resource allocation. Private property rights give forward to efficient use of scarce resources (GOTTHOLD, J., 1982, p. 12). By that token, efficient markets may be evaluated by identifying the necessities and needs which society reveals throughout the course of time[1]. If all types of costs are disregarded, these rights are entirely defined, allocated and enforced. Moreover, as R.H. COASE (1960) showed independent of the initial assignment, these titles are finally reallocated as to their best possible use.

It is now important to recognize that the process of redefining and reallocating property rights cannot be regarded as a self-evident or self-maintaining operation, but is rather quite intentionally imposed by the authoritative power of the state. It is in this role that the state itself appears as has an economically important function for the first time. In the pure PARETO-model the LEVIATHAN, which plays an entirely passive role, now assumes responsibility for the delicate task of designing the legal framework and thereby initiating different market structures. According to A.A. ALCHIAN (1965, 1967) the different systems of property rights confront the decision maker with different incentive structures initiating different alignments of resources and different input-output configurations. In this sense, the theorie of property rights is simultaneously a theory of the state (FURUBOTN, E.G./PEJOVICH, S., 1972, p. 1140).

It should be emphasized that the state apparatus does not work without costs, but rather uses resources to accomplish its assigned task. Thus, an additional main concern of the property

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1) This evaluation also constitutes the main theses developed in a remarkable work by WEGEHENKEL, L. (1981), in which he investigates interrelations between equilibrium, transaction costs and evolution. In this WEGEHENKEL describes a market system as to have the characteristic '...homöostatisch die komplexer gewordene Umwelt auf die wirtschaftlich relevanten Merkmale zu reduzieren', (p. 38).

rights approach is to emphasize '... That externalities are associated with the costs of defining, exchanging, policing or enforcing property rights', (FURUBOTN, E.G./PEJOVICH, S., 1972, p. 1143)[1]. The introduction of this cost aspect clearly indicates that from an economic viewpoint property rights are only worth defining when the potential gains of internalisation exeed the potential costs of internalization. Thus these assignment costs, as a proper part of C-costs become a decisive determinant in the assessment of market performance.

1.1.2.3 Transaction Costs versus Coordination Costs

The distinction between T-costs and C-costs is not fixed per se. Common to both types of costs is their capability to facilitate or to alleviate the coincidence of supply and demand. As already pointed out, constitutive elements which distinguishes these costs are the different market stages they correspond to: T-costs as 'inevitable' market costs and C-costs as expenses related to disequilibrium in order to maintain adaptation and convergence processes.

One should be aware, however, that no sharp criteria exist which attribute costs to one or the other category. Despite this methodological insufficient separation, statements of general plausibility can still be made, for example the conjecture that, the higher the level of coordination in a market system is, the

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1) See FURUBOTN, E.G./PEJOVICH, S. (1972, p. 1143). It must be emphasized here that, according to the concept of costs outlined above, virtually only 'the defining of property rights' as an 'once and for all' undertaking, causes 'pure' C-costs, which are clearly attributable to an unequilibrated state of the economy. In contrast, costs of 'exchanging', 'policing' or 'enforcing' must not necessarily become extinct after equilibrium is reached, but rather constitute a part of T-costs and thus determine, among other components, the prevailing level of transaction costs.

lower the prevailing level of T-costs may be, ceteris paribus. As an extreme case, an A-system is conceivable, which is so developed that T-costs are reduced to an absolute minimum. Such a market would have reached its specific maximum of allocational efficiency according to its institutional structure. In the case where T-costs truncate to zero, we again consider the PARETO-model as a special case of efficient markets. It is precisely in this sense, therefore, that the PARETO-model is efficient in absolute terms because all positive T-costs which occur impair efficiency.

The following example may serve to illustrate the argument. Consider a situation where a supplier faces costs of the following kind whenever he negotiates a contract with his potential customers: Since it is in his interest to reduce the risk of default to an acceptable level, he must collect and evaluate costly information in order to check the reliability of his potential customers. If these costs become prohibitively high, no purchase will be made. In the sense of the above-stated criteria of efficiency, the example obviously characterizes a subefficient market situation completely in accord with the concept of allocational efficiency. Now suppose that the legal framework is extended in a way that through legal requirements some kind of improved protection against default is established. One may think of certain qualification requirements or of trade licensing. If one of the characteristics of the license system is to signal a certain level of qualification or credit-worthiness, then the setting up of such kinds of 'obligations' reduce T-costs[1)]. It may even happen that all information costs become sunk due to institutionalizations, except those related to informations about the

1) Given that case, we immediately run into a problem. What is defined as a 'trade license' is appraised from a different viewpoint as nothing less than a 'barrier to entry', and this is in conflict with another precondition of the model, namely 'free access'.

meaning of the institutionalizations. However, it is not necessary to argue that virtually all costs of this particular kind are to disappear. For argument's sake it suffices to show that in the situation outlined above already a part of the prevailing T-costs will be transformed into C-costs. This improves the coordinative power of the A-system which is sometimes called 'adaptive efficiency' (MARRIS, R./MUELLER, D.C., 1980, p. 33).

There are two remarkable distinctions which refer to the different character of these costs. First, C-costs are fixed and unique costs. Therefore, they lose weight throughout time (sunk costs). In this sense these costs increase the stock of institutional infrastructure of the market system. T-costs, on the other hand, are individually variable costs and accompany each single transaction. Second, the partial conversion of T-costs into C-costs helps to avoid possible distortions of competition. The point is clarified, if in the above-mentioned example one considers two potential suppliers, one of whom is assumed to possess some particularly relevant information about the quality of a possible customer, while the other one must first undertake some costly research. In this way, the asymmetrical distribution of information which intrinsically has nothing to do with the pure act of selling and buying makes the competitive forces unequal.

The less informed supplier may suffer from a relative competitive disadvantage. This disadvantage could be neutralized, and competitive strength of the market could therefore be enhanced, if the market system in consideration were to be extended in the following way: Buyers and sellers would no longer make contracts with each other, but only through an intermediate clearing center which would guarantee the proper fulfillment of the contract for both sides. Then the individual risk of default is shifted away from the contracting parties to an institution which is specially designed to handle this risk. The market, therefore, can be expect to work more efficiently. To summarise the result derived

in this section, the following table may be applicable, in which the main differences between both kinds of costs are categorized. The interpretation of the table should be clear in connection with the above explanation. Nevertheless, the point should again be stressed that the suggested results only make sense on the stipulation that the characteristics of the PARETO-model are taken as a benchmark of efficiency and therefore as desired properties.

Table 1 Transaction Costs versus Coordination Costs

Costs / Effects	Market Costs	
	Transaction Costs	Coordination Costs
Category of Costs with Respect to Output	variable	fixed
Attribution	individual	general
Effect on Competition	distorting	equilibrating
State of the Allocation System	equilibrium	disequilibrium

1.1.3 Factor Earnings

In this section, we look more closely at 'factor earnings', the ways in which they can be handled, and how they could be compensated. These factor earnings are here divided into 'input costs' and 'managerial rewards'.

1.1.3.1 Input Costs

The microeconomic underpinning of the PARETian explanatory approach clearly marks the conditions of optimal production. Optimal production is achieved under the assumption of cost minimization with given technical knowledge. It is particularly necessary to mention that, for each factor used in the production process, a special factor market should exist. In this sense an A-system is considered, in which property rights on factors are totally specified and assigned. The point is that in this situation no effects occur which are usually a consequence of the existence of free goods. In addition, all types of externalities are excluded. The exclusion of externalities stipulates the specification of property on economically relevant factors and their exchange through established factor markets.

In the case where market costs are positive, the argument must be slightly modified. If specification and assignment of property rights is not costless, externalities still remain, thus leading to a discrepancy of private and social costs. This kind of distortion, for example, can be reduced through private negotiation which, as far as attached costs are concerned, must be attributed to current transaction costs. Apart from this argument, it is of great importance that private negotiations do not necessarily lead to efficient allocative solutions, as was already mentioned above. This describes the case which is subsumed under 'Prisoner's Dilemma' and essentially marks a 'free rider'-situation. However, as soon as the discrepancy between private and social costs become too large in a specific factor market , this type of private T-costs exeeds a certain threshold, which leads to undesired competitive distortion. It is therefore opportune to establish a new factor market through institutionalization.

As the standard example, a situation might be considered, where

clean water is abundant. Now assume that due to a change in technology this water becomes a scarce input factor. As long as water is legally considered to be a free good, the situation leads to the well-known result of over-utilization. On the other hand, private negotiations among the potential users will most likely result in suboptimal solutions, among other reasons due to the lack of incentive-compatibility. Here a point is reached where by defining the right to pollute water, an additional factor market comes into existence, in which the allocation of that specified right is undertaken by virtue of revealed demand and supply. By that token, one deals with a complete A-system, in which the use of factors is only feasible through buying and selling activities in the considered markets.

The point deserves such emphasis because of the particular characteristics of those markets. In such perfect systems, prices exactly fulfill their allocational and informational function, which within the PARETO-model is necessary to ascertain all optimality conditions.

1.1.3.2 Managerial Reward

In the foregoing pages, the problem of input costs in the context of a time and space extended PARETO-model was discussed. It was found that in such a perfect system all inputs required for production are exchanged through markets.
The market system also includes a market for managers. Without any difficulties, this market is functioning with the ruling conditions of the labour market in general. The market for managers is treated separately for two reasons. First, a manager's performance is of a quality quite different from labour in the usual sense. Normally labour (i.e., human labour capacity), is considered to be more or less directly connected to the

process of production in a purely technical sense. Thus one may imagine workers operating with machines, a secretary or a doorman who all contribute specific parts by means of their abilities and skills in a variable but well defined network of production. The managerial task is different insofar as it consists of establishing a network or plan of production. Thus, what is meant by the managerial task, is the combination of all the various production factors. This combination must be found and established. Hence, managers produce productivity.
Second, the knowledge about these efficient combination possibilities is normally seen to be limited by the production function. But this perspective is too narrow. The managerial task of finding efficient production combinations must, as a matter of fact, be viewed as going beyond the application of a purely technical relationship between amounts of input and amounts of output. On an enterprise level, the notion of efficient production also includes the efficient organisation of all the peripheral circumstances which cannot be set directly within the technical scheme.

It should be noted that the analysis is still carried out in a world of nearly perfect knowledge. The set of information and knowledge about efficient production already exists and is complete. There are no uncertain elements such as innovations. Uncertainty in a more narrowly defined sense may enter the analysis, mostly in terms of random disturbances, which are superimposed on this static model of knowledge without changing its qualitative characteristics. This may cause some probabilistic vagueness in an otherwise clear and unambiguous world.

Thus, we are concerned with a fixed and accurate stock of knowledge. It is, however, important to recognize that this knowledge is not a common property because not everyone has it. Equally, this does not mean that knowledge is a free good with zero costs of aquisition. Instead, the existence of a factor market of know-

ledge must be assumed where, without any exception, all prospective customers are permitted to buy. The person of the manager himself can be considered as one special embodiment to transmit such knowledge. 'The managers of a firm rent a substantial lump of wealth - their human captial - to the firm, and the rental rates for their human capital signalled by the managerial labour market are likely to depend on the success or failure of the firm' (FAMA, E.F., 1980, pp. 291f.). Thus managerial performance is envisaged as nothing more than a particular form of specialized labour.

In the light of this interpretation, we can draw the following two conclusions: First, if the market for managerial services (the market for managers) can be assumed to be sufficiently competitive, its price will be balanced by supply and demand capacities in the usual way of equalizing the marginal value products of alternative usage. Second, by the same token we may speak of a wage rate of managerial services. To distinguish this from the usual wage rate of labour it is referred to as the 'managerial reward', which quite conspicuously, as far as its determination is concerned, requires no different treatment compared to the one that has already been elaborated for all other factor markets.

1.2 The Information System

1.2.1 The Concept of an Information System

What is labelled here as information system, (I-System), must at a first glance simply be understood as an element of planning. By the term 'planning' we mean the notional anticipation of future action. Planning clearly requires information. The I-system in the first place refers to corresponding information

activities. As outlined below, it primarily comprises 'the production, dissemination, and manipulation of information in the market context' (HIRSCHLEIFER, J., 1973, p. 31) in a way, to finally reflect the totality of all information activities on the market level.
It may appear strange to consider an I-system like the one just outlined. Nevertheless, it can hardly be described as an extravagant view. The traditional description of allocation patterns essentially refers only to physical and therefore visible characteristics. For G.L.S. SHACKLE, however, things only provide a secondary focus of interest, economics thus being primarily concerned with thought[1]. This is because action is not carried out arbitrarily but based on plans. Thus every action must be considered as the physical realization of a preconceived action or plan. By that token 'all economic phenomena are intelligible only as the outcome of planned action' (LACHMANN, L.M., 1976a, p. 57).

An essential feature of the I-system used here is that inventions form an integral part of it. An 'invention' is defined as the discovery of hitherto unknown information. In this sense, an invention represents nothing else than ordered knowledge about specific relationships not previously identified. Closely related to invention is the term 'innovation'. The term innovation describes an invention after that has undergone economic transformation.

Invention-innovation as a rather heterogeneous activity is only deficiently measurable[2]. For our purposes, the term is used in the sense of a special case of the more general notion of <u>future relevant information</u>. This kind of information may contain revelations about the physical environment and/or strategies or beha-

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1) See SHACKLE, G.L.S. (1972, p. 244).

2) See SHAW, R.W./SUTTON, C.J. (1976, p. 200).

viour of other individuals[1], in other words, every piece of information which reduces uncertainty. Future relevant information must be distinguished from other items of information, such as 'secondhand' information - information subject to cognitive transformation by others - which can be purchased in special markets (information markets). Both kinds, however, constitute what is labelled new information. However, only future relevant information can be obtained by direct inquiry.
Information as a tradable commodity retains the same features attributed to all marketable goods. However, this does not prevent information to be 'new' to its purchaser[2].
In contrast, future relevant information create for its owners an informational competitive advantage or an informational lead. This links to the notion of an informational monopoly, as a concentration of future relevant information[3]. By that token, future relevant information is information which is not possessed by everybody, and is hence not commonplace. As it is defined here, future relevant information is pertinent and correct. In view of this simplifying restriction, future relevant information is defined as every form of information, which, once transformed into economic activity, will lead to entrepreneurial profit. This definition states that future relevant information is information with a 'positive future value of return'[4].

The foregoing characterization tends to be misleading in one respect. The way in which future relevant information is defined

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1) See HIRSHLEIFER, J. (1973, p. 33).

2) For similar classification see HIRSHLEIFER, J. (1973).

3) MARRIS, R./MUELLER, D.C. (1980, p. 53) argue similarly: 'invention, innovation, and information gathering are classic "natural monopoly" activities'.

4) According to this interpretation future relevant information obviously consists only of such information which entails economically relevant consequences.

may favour the conclusion that the entrepreneurial activity of searching for such information cannot be erroneous. This view is, of course, not supported here. Choice among uncertain alternatives includes error, leaving aside the fact that error might not only concern means but also ends[1]. In the light of this interpretation it is not excluded that information, assessed as correct, will in the end turn out to be wrong.

A further particularity included in this approach concerns the possibility of describing the process of discovery of future relevant information. To a certain extent, however, this resembles an attempt to disentangle the Gordian Knot. Without going into the subject very deeply at this point, there are at least two reasons which render such conjectures useless.

First, information has not a single dimension as a value. Rather it depends on a variety of potential uses. The value of information then becomes a very precarious measure if - as in this particular case - it is conceived as of 'value to the user'. Hence it is a concept which primarily 'relates information value to the choice behaviour of an information user'[2].

Second, since the process of discovering future relevant information depends mostly on unobservable elements, the isssue evades

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1) See KNIGHT, F.H. (1931, p. 61).

2) EPSTEIN, B.J. (1979, p. 13). There have been many attempts to construct unidimensional concepts, concepts which relate information exclusively to a single attribute. The most popular one is presumably the 'quantity approach of information' by SHANNON, C.E./WEAVER, W. (1949). This approach only takes into consideration a quantitative aspect (for example, the length of a message), and is theoretically based on BOLZMANN's H-formula as used in the field of thermodynamics. Although this theory was initially thought to provide an explanation of the way information is disseminated (i.e., efficiency of communication channels), it was also used to relate 'value' and information with the help of this formula. This latter application has only led to deficient explanations when focusing on the 'decision-maker's level'. Thus this, as it is the case with all unidimensional concepts known so far, cannot be considered 'an adequate measurement strategy of information value' (EPSTEIN, B.J., 1979, p. 20).

direct analysis. It is argued that due to the complexity of and dependence on unique circumstances this process is only accessible to a very limited extent with scientific methods[1]. These mainsprings must be left unexamined, and we are only interested in the use of information and do not examine the process of their generation. Future relevant information is assumed to be given exogenously.

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1) This is mainly because scientific research tries to reach generally valid statements, while the process of discovery, on the contrary, has its roots in unique and solitary constellations. It is probably not total nonsense to state that the entrepreneur makes 'something out of nothing' (similarly, see KIRZNER, I., 1973, pp. 48f.): ''all' he needs is a gamblers nerve, a fortune-teller's foresight, and a prospector's nose for gold'. As a result one should not conclude that innovative processes in a more narrow sense cannot be the focus of scientific research (see, for example, deBONO, E., 1968). However, explaining the basic structures of creativity certainly lies more within the research programme of psychology (or as K.R. POPPER, is reputed to have said: 'woher die Einfälle kommen überlasse ich gerne den Psychologen'). But even they cannot overcome one constraint: There is no basis for predicating a 'driving force' for knowledge. Future knowledge cannot be known in advance and by that token is in principle not deducable from any methodological analysis (see, for example, POPPER, K.R., 1957 preface and p. 105). In its logical conclusion, 'innovation' means 'increase in knowledge' which by its very nature cannot be foreseen, a constraint, explicitly illustrated by REICHENBACH, H. (1951, p. 231): 'Der Entdeckungsakt entzieht sich der logischen Analyse; es gibt keine logischen Regeln, nach denen man eine "Entdeckungsmaschine" konstruieren könnte, die die schöpferische Funktion des Genies übernehmen könnte'. REICHENBACH's remark seems quite at odd to the ideas the doyen of cybernetics N. WIENER advocated in his famous work on control and communication in the animal and the machine (WIENER, N., 1961, 1st ed. 1948). It is certainly not a bold oversimplification to rate WIENER in the tradition of R. DESCARTES and J. LOCKE. To DESCARTES all lower animals were automata and to LOCKE ideas are (mechanically) bundled according to the principle of similarity, contiguity and cause and effect. According to WIENER the logic of computing machines resembles the human logic, even including the ability to learn, (p. 126). This machina ratiocinatrix processes information based on the principles of mathematical logic; a logic, which is again powerful in the artificial mechanization of processes of thoughts, (p. 12).

As outlined so far, the I-system already differs in one important respect from the A-system. The latter is characterized as being endowed with perfect knowledge properties, while the I-system is based on a diametrically opposed assumption. The search for future relevant information cannot be regarded as 'gambling on a certainty', but it is always vulnerable to misjudgement. Hence the 'classical' problems of risk and uncertainty are related to the sphere of information.

This view provides an alternative explanation of future relevant information: It is information which helps 'to shape the future', or, in more concrete terms, it consists of events that tend to modify the subjective probability distribution[1)] of individuals. While uncertainty according to J. HIRSHLEIFER (1973, p. 33) may include both technological uncertainty and market uncertainty, it nevertheless presupposes limitations of events, a requirement which is relaxed by a broader concept of ignorance. Problems inherent to those approaches will be dealt with later. It is important at this point to note that, to a certain extent, these approaches are formulated in the language of a probability theory.

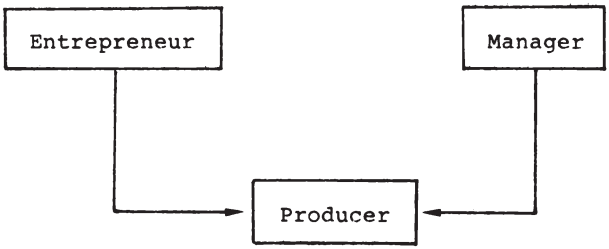
1.2.2 Entrepreneurial Activity and Managerial Performance

1.2.2.1 The Mode of Interaction

The proposed distinction between an A-system and an I-system seems artificial. Human activity normally takes place in both of them and cannot be attributed to one or the other at every moment. Each actor in an economy has to make plans - thereby he is acting within the I-system - about what he will produce or consume - thereby then acting within the A-system. Thus each

1) See HIRSHLEIFER, J. (1973, p. 33).

activity in the A-system has to be planned and by that token predetermined in the I-system[1] (if rational behaviour of the actors is presupposed). Taking this point of view, every producer theoretically can be envisaged as being composed of two artificial figures[2]. One comprises the pure entrepreneur (entrepreneurial element), the other the pure manager (managerial element):



The aim of this classification serves two purposes. First, it permits the analysis of how the two subsystems interact. Second, it makes the traditional apprehension of the producer as a virtual person redundant. Essentially, the two above-mentioned elements must be present, and they must not necessarily be unified in one person.

In its origins, this presentation is based on I.M. KIRZNER's (1973) concept, which from an operational point of view reduces

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1) The dichotomization is more familiar and neatly accepted in the case of the WALRASian auctioneer model. There, all plans are precoordinated according to which consumption or production is carried out. A serious difference, however, exists: While in the WALRAS'ian case plans are perfectly coordinated before action takes place ('ex ante'-coordination) this is not assumed here. As will be seen below, it is imperfect ex-post coordination, which bears the interesting features of informational efficiency.

2) Actually, what is meant by this are concrete functions of managers and not managers himself.

'productive action' to 'decision-making action' and 'economizing action'. To a great extent this overlaps with the classification presented here. 'Decision-making' pertains to the I-system, 'economizing', in a broader sense, to the A-system.
Appraised from a historical and/or dogmatic standpoint, KIRZNER's analysis fruitfully combines L. MISES' (1949) image of an alert entrepreneur (manager) with L. ROBBINS' (1935) image of a skillfull economizer.
Thus in the context delineated here, entrepreneurial activity means activity in the I-sphere (discovering future relevant information), while managerial activity belongs to the A-system, applying optimal strategies to achieve maximal realization of goals.

Both elements together determine the functioning of the market system. Competition - as the market process - forms the junction where both elements meet, thus connecting the two systems in a distinctive relationship of mutual interdependence. Profit - as a result of this market process - although realized in the A-system has its very origins in the sphere of information[1].
The introduction of KIRZNER's producer then allows the interpretation of a typical market process in the following simplified way:

- As a first step initial research may produce information like an invention for example. It is only this stage in which creative participation of an inventor is required.
- Further research and developemt are then required to establish

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1) To understand this argument more thoroughly, one should recall the perfect knowledge situation as it is analysed in neoclassical theory. Although all managers act under the principle of profit maximization - making as large a difference as possible between turnover and costs - in the end they can achieve nothing more than what they have spent. This is the striking feature in neoclassical theory of a fully competitive market in a world of perfect knowledge. Competitive forces of the market bring prices down to the utter level of marginal costs. By that token we may speak of an equilibrium position of the economy.

the pertinence and correctness of the invention. The procedure of sorting, assessing, and processing new information is just a case in point. However, if actually carried out, this phase decides the validity of new information. If this is correct, one may speak of future relevant information (although, strictly speaking, only in a subjective sense). Up to this moment the producer has acted entirely within his capacity as an entrepreneur.

- The exclusiveness of future relevant information constitutes an informational advantage and by the same token an informational monopoly for its possessor.
- In a next step the transmission of invention to innovation follows, e.g., the introduction of the invention to the market. The producer's activity must now be envisaged as shifting 'from the I-system to the A-system'. The declared aim now is to capitalize as remuneratively as possible the aquired monopolistic information position by means of production and sale. Hence at this point entrepreneurial and managerial elements melt together. In the further course of the process, however, the producer acts exclusively as a manager. Manangerial performance mainly appears in the organization at the economic and technical level (e.g., establishing the plant and organizing the process of production). Combined with this is the requirement to increase the efficiency of production in order to achieve a more favourable allocation, and to constantly expand production until it becomes unprofitable.

- On the market level another characteristic still requires consideration. If the market is sufficiently populated by individuals seeking to maximize profit, it works as a dissemination and propagation device for such 'profitable' information. The first stage refers to expanded production by another producer, as a result of adaptation and imitation processes. The final stage constitutes for the most part competitive pressure as exerted by the parallel striving for profit.

The analysis propounded here is idealized in several respects. The stages may not occur in such a simplified linear order. Production may require further research, or result in further novelties[1], thus the process of invention-innovation may be cyclical[2].
Furthermore, as already noticed, there is no necessity for this process to be personally unified. It may be that the inventor also acts as an innovator, i.e., manages his own (science based) firm. However, in reality, a more common feature is probably the division of the process between separate individuals, namely one who actually invents and another who actally runs the business[3].

1.2.2.2 Entrepreneurial Profit

Once KIRZNER's concept of the representative producer is accepted, the payment the producer receives encompasses two similar aspects: According to his managerial performance he earns his managerial reward, which, as mentioned above comprises a part of the usual costs and which is determined in the respective factor market. According to his entrepreneurial activity, he obtains what is labelled here entrepreneurial profit[4].
Due to the particular nature of profit, it is pertinent to define it as the difference between actual salary and managerial reward. This means that profit, first of all, is a residual[5]. Second, it

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1) This argument parallels a contention set forth by E. HOPPMANN (1971, p. 302): 'technische und organisatorische Fortschritte ... werden innerhalb des marktwirtschaftlichen Interaktionsprozesses endogen induziert und in ihrer Richtung gesteuert'.

2) See SHAW, R.W./SUTTON, C.J. (1976, p. 200).

3) See LEIPOLD, H. (1978, p. 92).

4) The expression and its notion is due to KIRZNER, I.M. (1973, pp. 47-52).

5) This is mainly F.H. KNIGHT's (1921) apprehension.

is a residual of uncertain range whose effect will, moreover, be of uncertain duration.

The character of profit as a residual results directly from the fact that it is the 'spoil of monopoly power' (LAMBERTON, D.M., 1972, p. 196). Thus, it is a monopoly return, which in itself results from the economic exploitation of future relevant information. By that token, profit as the reward of entrepreneurial activity becomes the 'visible' measure of entrepreneurship. The determination of this measure, nevertheless, as R.F. HARROD once noticed, rests more or less on an assumption of ignorance[1]. Profit in connection with future relevant information is only explainable by a theory of information which includes a theory of error. This subject is still largely missing. By that token, profit is a highly volatile indicator of the extent to which expectations have proved to be fallible[2] or, in other words, to the extent to which future events have been predicted correctly.

As far as the actual amount of profit is concerned, both possibilities exist 'a priori'. Profit may be positive or negative. This is principally a question of the correctness of the predictions involved. Hence, entrepreneurial profit resembles to a large extent the characteristics of loss or gain according to a risk bearing game. This also includes especially those cases in which profit serves as a risk premium. The way in which future relevant information is defined throughout this work, however, only allows positive amounts of profit[3].

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1) See HARROD, R.F. (1952, p. 153).

2) See SHACKLE, G.L.S. (1969, p 99).

3) This is possible without any loss of generality, because the process as presented here works symmetrically in both directions, as far as the problem of informational efficiency is concerned. False expectations, when not corrected in time, lead to losses, as long as they are not adjusted.

The question of entrepreneurial profit is closely related to the central question of informational efficiency, a question, which will soon be dealt with below. Another problem of efficiency - effects to efficiency from the structure of organization - is revealed by the artificial figure of KIRZNER's producer as both entrepreneur and manager.

1.2.2.3 Structures of Organization and Efficiency

The above-mentioned problem of efficiency has received considerable attention in the ensuing literature. It was essentially not originated but first introduced, although in a rather peculiar way, by H. LEIBENSTEIN (1966). LEIBENSTEIN then developed it in a series of articles[1].

LEIBENSTEIN describes a situation where a particular kind of efficiency loss occurs, which is due to the allocation of managers. In a previous section, when managerial performance and managerial reward were introduced, the whole emphasis was laid on the proper working of the allocation mechanism of a competitive market for managers. According to LEIBENSTEIN there is a hidden difficulty involved, which is due to the exposed position which a manager usually occupies. One characteristic of his performance among others is that he not only defines the actual activity of the plant but he also determines his own level of productivity. Therefore possible mismanagement is amplified on a large scale, with greater effect than is possible in other cases of productive labour. Due to that impact, firms normally fail by a large margin to minimize their costs, and thus do not produce on their PPC[2].

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1) See especially H. LEIBENSTEIN (1979b, 1981).

2) In its essence, this is also the central proposition already made by MONSEN, J.R./DOWNS, A. (1965) who, in a related vein, lay more emphasis on the size of the firm, but come to the same conclusion, namely a considerable dysfunction of the modern corporate system. For this problem see also KAY, N.M. (1983).

Because this peculiar situation is apparently not dealt with in the standard microeconomic neoclassical textbooks, H. LEIBENSTEIN distinguishes it from the usual term of allocational efficiency by X-(in)efficiency.
Since the problem essentially revolves around the question of whether managers bestir themselves as sufficiently as they should[1], an improvement in X-efficiency in contrary to an improvement in A-efficiency, may be reached without requiring additional resources for the plant[2].
By that token the concept of X-efficiency is an attack on the neoclassical assumption of profit maximization or, more correctly, of cost minimization. X-efficiency allows - according to the usual line of reassessing - the explanantion of an observed fact which is not revealed and even not involved by the standard axioms of the ruling theory. In other words: 'micro-economic theory focuses on allocative efficiency to the exclusion of other types of efficiency, that, in fact, are much more significant in many instances' (LEIBENSTEIN, H., 1966, p. 392).
These types fall within the scope of a neglected branch of economics, i.e., the micro-micro theory[3]. In such a theory, A-efficiency, imposed by competition, is to be considered as the external efficiency-making force, acting on the level of the commodity production economy, while X-efficiency focuses on internal efficiency-structures and thereby on the level of the production economy[4]. Given that view, the traditional concept of A-efficiency would be identical to 'market efficiency' and X-efficiency

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1) See LEIBENSTEIN, H. (1966, p. 397).

2) See SHAW, R.W./SUTTON, C.J. (1976, p. 198).

3) See LEIBENSTEIN, H. (1979a).

4) X-efficiency 'asks (within the firm an outside of the exchange relationship) what are the motivating forces that determine effort and productivity, including the motivating forces leading to maximizing or less-than-maximizing behaviour' (LEIBENSTEIN, H., 1983, p. 831).

identical to firm efficiency[1]. The cleavage between these types of efficiency is pointedly revealed in a statement by an interviewed company executive:[2]

> 'We don't think there is much change in sales when a restaurant is operated by a franchisee-owner instead of a company manager, but we do think profits go up. This is because franchisee-owners just watch the little things close; they utilize the cooks and waitress better; they reduce wast'.

The statement above leads to a position, which seems to confirm the existence of a particular kind of efficiency loss. Contemporary neoclassical theory apparently cannot offer a coherent explanation, which is in accordance with its postulates. The central focus of LEIBENSTEIN's concept may be more precisely handled as a problem of incentives. In this regard, the term X-efficiency would better be replaced by 'motivation efficiency', this being the central term of a theory which inquires into the consequences of different motivation-incentive structures on A-efficiency[3]. The origins of such a theory can be found in at least two empirical phenomena. The first item is of a psychological nature: In general and under normal circumstances, nobody works always as hard as possible[4]. The second is based on a more physical fact. It refers to the circumstance of incomplete measurement in general[5], as (i) contracts of labour are incomplete, (ii) the

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1) For a similar argumentation, see also P.J. McNULTY (1967, p. 1250). An extensive discussion of the theory of the firm is provided by MARRIS, R./MUELLER, D.C. (1980). See also CYERT, R./MARCH, J.G. (1963), or A.A. ALCHIAN (1965). A theory of firm from a biological point of view gives HIRSHLEIFER, J. (1977b).

2) The quotation is taken from SHELTON, J.P. (1967, p. 1257).

3) For similar argumentation, see G.J. STIGLER (1976, p. 213).

4) For the majority of people this may be reasonable by introspection.

5) See H. LEIBENSTEIN (1966, p. 412).

production function is not completely specified, and (iii) not all inputs are marketed.
The combination of all these 'shortcominigs' then make way for opportunities of discretionary effort, (e.g., shirking), at the expense of productivity and cost minimization.

To understand LEIBENSTEIN's concern more concretely using the terminology as expounded here, further analysis should focus more closely on two junctions within the hierarchy of a firm. The first link concerns LEIBENSTEIN's initial conjecture of possible suboptimal managerial performance, thus concentrating on the position which the manager holds with regard to the firm. The second link concerns, from a purely technical viewpoint, the relation in which workers are involved in their work.
With regard to the first item, it is pertinent first of all to point out the fact that managerial performance must be viewed as not being principally distinguishable from other kinds of labour. In the same vein, managerial reward is considerd as a manager's wage, as determined by the arithmetic of neoclassical assumptions. This treatment of managerial performance, however, bears implications which can easily be explained with the help of KIRZNER's separation. That this concept is not as artificial as it might appear at first glance, is already indicated by the sheer fact that most large modern firms are run by purely professional managers and not by entrepreneurs and capital owners. The problem, however, does not mainly lie in this fact but rather in its consequences: Managers receive a salary, but they cannot claim the profit (except managers who are at the same time owners of the firm). The residual belongs to his companion, the entrepreneur.

If, for the sake of argument, the entrepreneur is considered as being not only the lender of future relevant information, but

also as the lender of capital[1] - because it is usually the capital owner, who claims the profit - then LEIBENSTEIN's argument can be reformulated in the following way:

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1) This is not so strange an idea (see, e.g., CHRISTENSEN, L. R. (1971) who measures entrepreneurial income as being a 'mixtum compositum' of labour wage (self-employed), and a capital residual), because in the same way the capital owner lends his human capital (his idea) to the entrepreneur. Of special importance is the stipulation that the capital owner as well as the entrepreneur can legitimately claim the profit. However, the legitimacy arises not in the least from a moral viewpoint, but simply from a legal perspective. Stipulated interests, for example, must be regarded as based upon contracts with the capital owner. They are in no way different to all other factors of production. However, there is a trap involved to which I would like to draw attention. If the capital owner is not identical with the entrepreneur, then capital has to be considered as an input factor as labour and managerial work. Capital is rewarded in the same way as be all other production factors, including the different kind of labour, namely through the interplay between the balanced competitive forces of supply and demand. If we assume that ideas just fall straight from heaven (which means that we neglect the entrepreneur's claim), then the conclusion we reach from the analysis is inescapable: In a firm with fully developed contractual relations according to the standard neoclassical requirements no prerogative claim exists according to which the recipient of the residual can be decided. Neither the owner of capital, nor the manager, nor the worker are privileged to be the favoured heir to the profit: The firm is simply a coalition of different resource owners, 'bound by contracts', with fixed wages. Profit still exists, and cannot be ignored. Therefore a more practical approach is based on the convention according to which the one who provides the capital also deserves the surplus. To the most of us, this appears to be so evident that it is almost regarded as a principle: The natural relative of profit is capital and not labour (see also MISES, L. , 1963, pp. 255f.). Nevertheless, if one wants to avoid relying exclusively on moral criteria, an additional assumption is required to justify this. One favourite and frequently stressed argument is to point to the guarantee-role of capital in the case of losses, or more generally, the character of capital as a stake. Profit is then considered as the gain of the game. Thus the riskbearer is rewarded by profits and threatened by losses. But, quite obviously, this is beyond the assumptions stipulated for the moment, according to which capital (only) earns a fixed

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First, only those firms are concerned which are not managed by their capital owner. In this case the firm is directed by an 'employee-manager' as distinguished from an 'owner-manager'[1]. Thus, X-efficiency does not concern all sorts of ownership of a firm, but only organizational forms such as privately owned corporations (e.g., joint-stock companies), worker-managed

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footnote continued
and safe interest, whatever the situation may be. However, apart from the fact that although modern ownership certificates (stocks) limit the possible loss, but not the possible height of the gain, it is not at all obvious that it is capital alone which is burdened with the risk of production. If one accepts to be evident that monetary capital as compared to human capital is essentially much more homogeneous and for that reason also much more liquid (those who do not accept this are invited to consider to whom, mutatis mutandis, they would be more easily prepared to lend a considerable amount of money: To an extremely clever brainworker who has nothing, or to an average steelworker with considerable property), then one must also concede that in the case of a firm's loss-liquidation', the long-time, 'learning-by-doing'-experienced worker faces disproportionately more difficulties and obstacles of reemployment and reintegration compared to the manager, to say nothing of the capital-owner, who just picks up the daily newspaper to study the investment-opportunities (for a similar attitude, see SUMMER, C.W., 1980, p. 25). SMITH was rigorously engaged in studying an economy which he considered as being in a position of equilibrium. And there, as already argued, profit dwindles away and leaves no problems concerning its ownership. If he also had studied the functioning of markets which are essentially beyond the penumbra of equilibrium, he would certainly have touched on this problem, which is basically a problem of distribution, the illumination of which MARX was profoundly interested in throughout his life. Hence, one is probably not totally ill-advised to assert that in this respect SMITH was a fore-runner to MARX: For the first, profit simply did not exist, while for the second it was the very germ of all evil.

1) According to ALCHIAN, A.A./DEMSETZ, H. (1972) ownership of a firm is defined by the bundle of property rights consisting of the 'income-right' and the 'control-right'. E.F. FAMA (1980) contests 'that a corporation has owners in any meaningful sense'.

firms and also, in a broader sense, all bureaucracies[1]. X-efficiency does also concern the internal organisation of a firm. Second, although both kinds of managers largely determine the level of the firm's productivity, they are to a considerable extent not subjected to direct supervision. This, nevertheless, would not cause any further problems, if one could safely assume that the interests of the capital-owners (the entrepreneur) and the managers were essentially identical. If this assumption is unrealistic, the partitioned ownership entitlement between the entrepreneur (e.g., stockholder) and the manager employee involves the risk of inefficient solutions. This is the consequence of the fact that the right to use a resource (usus) and the right to internalize all the returns resulting from its use (usus fructus) are separated and not attached to the same person. As a consequence, the manager lacks what could be labelled achievement orientation.

It goes without saying, that quite evidently, from the point of property right theory the relation between the residual claimant and the firm has to be a contractual one[2]. However, the crucial

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1) In principle H. LEIBENSTEIN raises a point which seems to be more logically embedded in a theory of bureaucracy, essentially because firms are hierarchical and bureaucratical organisations (including the state). R.D. AUSTER (1974, 1976, 1983) recently presented a concept of 'institutional entropy' to explain bureaucratic efficiency. Institutional entropy is largely based on the hypothesis that an institution shows a tendency to become increasingly disorganized throughout time, on grounds of faults accumulated in the past, connected with a deficient adaptation mechanism in the present, an effect which occasionally is referred to as 'institutional sclerosis'. The age of an institution must therefore be taken into consideration, when the efficiencies of alternative institutional forms (AUSTER, R.D., 1983, p. 212) are compared. This approach is not pursued in more detail here, because it can be handled in the same manner as is demonstrated with LEIBENSTEIN's concept. A possible chain of argumentation in this direction can be found in DOBRA, J.L. (1983).

2) See FAMA, E.F. (1980).

point is to recognize that this contractual relation is defined as an assignment of property rights, which transfers only the decision making power to the manager employee and thus the right to direct resources, without transferring the right to claim the residual, which is the product of his endeavours as well. Therefore the manager, who is employed to maximize productive efficiency, is supposed to conduct decisions in order to preserve interests which are not his own. This seems to be the central topic involved in the X-efficiency concept, which can essentially be traced back to a seemingly unfavourable distribution of property rights, with regard to inappropriate organizational forms of the firm.

One of several possible solutions to the problem, is direct control over managers. But one cannot safely assume that those who are interested in an efficient managerial performance (e.g., the entrepreneur or the capital owner) are optimally endowed with elaborate supervision mechanisms in the sense of close monitoring, not to speak of the fact that the rational capital owner, in pursuance of a reasonable portfolio decision most probably partitions his capital to different firms and thereby avoids an all to weighty dependence on a single firm's performance. The meaning is that for the most part 'an individual security holder generally has no specific interest in personally overseeing the detailed activities of any firm' (FAMA, E.F., 1980, p. 291).

A more promising solution is probably provided by granting the manager employee a partial interest in the firm's residual[1]. In this case the concept of X-efficiency and the theory of property rights are actually merged. The property rigths approach demands

1) See FURUBOTN, E.G. (1981, p. 704).

the most efficient distribution of property rights, while X-efficiency addresses itself to motivation-incentive structures. A payment-by-result scheme is just a case in point. The transfer of a right to a part of the residual demonstrates the superiority of a distribution of property rights which is essentially compatible with the interest-patterns underlying the system considered. However, the solution proposed is not so different from the concept of managerial reward, as delineated in a former section; in fact, the assertion is that it is implicitly involved. If one can assume the market for managers to be sufficiently competitive, then there is no reason why individually different performances should not be reflected in a variety of different wage claims of managers. In fact, the clue is that competition among managers must be considered to be the most reliable way of preventing deviations from contractual agreements.

This conclusion is also quite in accordance with the findings of E.F. FAMA (1980). He gives strong evidence for the following case: Where one can assume 'much internal monitoring of managers by managers themselves'(p. 293) - thus 'discipline of managers comes through managerial labour markets' (p. 295) - there is no need for the ultimate profit-claimant to engage in monitoring activity. In particular, it is noteworthy that although managers probably more than any other person within the process of production, cannot be exposed to direct performance measurement, they must take into account that current deviations from contractual agreements will consequently lead to a reevaluation of future wage claims (p. 299). A manager's marginal product probably cannot be evaluated with any degree of precision, and therefore adjustment processes will be incomplete. However, if those markets digest such information reasonably accurately, then at least an unbiased assessment can be expected, which in the course of time offers no incentive for deviant managerial beha-

viour from contractual stipulations[1].
Admittedly, the retreat to induced control-mechanisms may appear to be unsound. To meet this possible objection, however, one should recall that in an economy as stipulated here, where supply and demand capacities are determined by voluntary and individual decisions, the proper working of such a system heavily depends on the assumption that the market process works as a selection-mechanism. This beeing accepted, it is indeed difficult to escape the conclusion that if, once it is agreed that managers' performance must be assessed and observed as a prerequisite, it is only rational to assign this task to those who, through self-interest and specialized knowledge, are the best prepared, in other words: To managers themselves[2].

If this general line of argumentation is accepted, the apparent problem of lack of incentives due to the separation of income and control rights is hardly relevant any more. It is a measuring problem which, in LEIBENSTEIN's view, constitutes another potential source of X-efficiency. Its location is the conjunction of

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1) A more subtle argument, however, is developed by BAUMOL, W.J. (1959), MARRIS, R. (1964, 1972), and YARROW, G.K. (1973). A possible conflict of interests, which cannot be handled in this convenient way - since it is not a consequence of sub-efficient managerial performance - rests on the argument that managers, in contrast to the residual claimant might not be exclusively engaged in valuation-maximization strategies, but primarily exhibit a main interest in the firm's growth (e.g., in demonstrating power and prestige). A growth strategy may, for several reasons not be identical with the residual claimants' interests (because of different planning horizons). By that token a growth strategy might be pursued at the expense of reduced dividends. These nonprofit-maximization models, however, should not be confused with X-(in)efficiency, since the apparent inefficiency is the optimal solution of the manager's utility maximization, in connection with maximal productive efficiency (e.g., firms produce on their PPC).

2) For a similar argumentation, see ESCHENBURG, R. (1978, esp. pp. 23, 24).

labour performance and the technical process of production. This point will only be discussed in brevity, since the argumentation draws its validity to a large extent from the aboved-mentioned problem. The situation is also similar: Cost minimization cannot be carried out, because the production function is not completely specified, and not all inputs are marketed[1]. A deficiency of accountability then makes it rational not to contribute one's best performance, but to look out for free-rider positions.

The argument can be approached by referring to an example drawn from A.A. ALCHIAN/H. DEMSETZ (1972). Consider a production function $Y(L_1,L_2)$ with inputs L_1 and L_2 (L: human labour). The outcome Y is produced by a team (i.e., Y is the result of teamwork), if it is brought forth by a combination of L_1, L_2, $(L_1 * L_2)$, that means: $\partial^2 L_1 / \partial L_1 \partial L_2 > 0$ [2]. The result is comparable to a production function with inputs L_1, L_2 and L_3, L_3 itself being a composition of L_1 and L_2, which cannot be specified more accurately. As a consequence, the 'benefit' of production belongs to the team as such. Deficient individual internalization of above-average performance is then a straightforward consequence of the public good character of the 'benefit'. In the same vein, incentives to withhold are covered by team activity. For that reason, the usual method of wage determination does not work[3]. For the present purposes it is sufficient to note briefly that this

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1) See LEIBENSTEIN, H. (1966, p. 412).

2) In a strict sense, this expression only provides a condition for complementarity. But complementarity does not exhaust the notion of teamwork. Teamwork involves more then complementary inputs; on the other hand, one can have complementary inputs without teamwork. For teamwork it seems necessary to have a 'common interest', a 'common goal', which may only be approached by joint effort. A more promising solution may be approached using game theory. SHAPLEY, L.S./SHUBIK. M. (1967) analysed team production by the approach of game theory and by taking into account various property conditions.

3) See next page.

problem is conspicuously represented by the discussion carried out above. To detect possible shirking, or to assesss more accurately the contribution of each team member, it will be necessary to observe and to control the process of production more thoroughly. Accurate monitoring may be carried out by a specialist like the manager, which involves the above-mentioned problems, or it may be done by the residual claimant himself, or discipline may be set up by another form of organization. Whether each of these possible solutions prove to be robust enough depends to a large extent on the incentives offered to the individuals[1)]. The essence of the matter is that, starting from this kind of theoretical basis, one can reasonably be in doubt that these organisatorial patterns can actually survive, since such forms are often rendered non-viable by these invisible costs.

Correspondingly, an important change of viewpoint becomes evident here. While the concept of X-efficiency essentially is traced back to motivation patterns and preference constellations, the property rights approach concentrates on direction power and competence structures. Hence, a general conclusion which can be drawn from the property rights approach concerning the concept of X-efficiency asserts that a constellation where control rights and income rights are separated does not necessarily lead to less efficient results compared to those obtained by a configuration where both rights are attached to the same person. It cannot be overlooked, however, that the main problem, in its greater part,

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footnote 3) from the page before

The idea can be developed with the aid of an example used by ALCHIAN, A.A./DEMSETZ, H. (1972, p. 779): If a heavy cargo is lifted up by two men, it is almost impossible to determine their marginal productivity by means of total output. The mode of production impedes individual assessment of their achievement. Hence, team production tends to support the assumption of equivalent contribution.

1) In their paper ALCHIAN, A.A./DEMSETZ, H. (1972) investigate the relation of such T-costs with respect to different types of firms. For broader discussion see also LEIPOLD, H. (1978).

is a measuring problem: Human performance is not measurable in any desirable degree. But this interpretation shows the initial problem in a rather different light. Accordingly, the main objections raised with regard to the validity of neoclassical theory are renderred less weighty. On the contrary, it seems to be rather difficult to provide an opposing theory of X-efficiency with any degree of generality.

Evidently, it cannot be denied that X-efficiency with regard to motivation has some important effects. But it is precisely the nebulous nexus between cause, effect, and empirical evidence, that renders it a difficult proposition to agree upon or to refute. To state that LEIBENSTEIN's theory is wrong is not the point; but its operational appeal is, of course, minimal and, considered from a methodological standpoint, even unsatisfactory: Its central hypotheses do not lead to statements which can be directly tested[1], but are drawn from empirical evidence in a rather general manner[2]. By the same token, LEIBENSTEIN's concept is largely of an ad hoc character because, theoretically and analytically, it is only deficiently justified. The phenomenon he addresses is probably better explained by generalized neoclassical theory, and possible remedies are more accurately analysed with the help of the property rights approach. It can reasonably be argued that, first, X-efficiency is by no means left out of the usual treatment of efficiency, and second, that X-efficiency does not bring to light a novelty, which cannot be explained in conventional terms[3]. In the light of this reasoning LEIBENSTEIN seems to argue on rather unfavourable grounds, rejecting more

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1) For a similar view, see DeALESSI, L. (1983a, p. 70).

2) This point is intensively discussed in DeALESSI, L. (1983a, p. 75).

3) Strangely enough, H. LEIBENSTEIN argues in just the opposite way: 'under the latter (X-efficiency) the neoclassical model can be included as a special case', (1978, p. 203).

promising opportunities that lie close at hand: On 'taking transaction costs and the system of property rights into account is providing new insight into a broad range of previously unexplained phenomena, including those addressed by X-efficiency' (DeALESSI, L., 1983b, p. 844), however, 'in practice, LEIBENSTEIN and others seem to use X-efficiency simply as a catch phrase to denote ex post (in italics) deviations from idealized neoclassical equilibrium conditions' (DeALESSI, L., 1983a, p. 75).

1.2.3 The Process of Diffusion of Information

1.2.3.1 Profit Erosion as an Indication of Diffusion of Information

The working hypothesis of the previous section conjectured that activities in the information sphere may lead to information monopolies. The exploitation of such positions constitutes what is here referred to as entrepreneurial profit. Thus, as a matter of fact, entrepreneurial profit results from a situation where the dissemination of a particular piece of future relevant information has not yet come to an end. In this situation the owner of the information can demand a price which exceeds its pure cost without any direct reprisal. This activity, on the other side, attracts other entrepreneurial activity in form of imitation and adaptation. Although not intended, one cannot prevent this process to take place. Hence, knowledge is not profitably exploitable without conveying hints to others[1].

In the moment when successive discovery[2] of that piece of infor-

1) Discovery does not necessarily mean repetition of the inventive process as such, but in the first place a process of imitation and adaptation.

2) See LACHMANN, L.M. (1976a, p. 59).

mation is duplicated by another agent, these monopoly returns must somehow be dispersed into oligopoly returns. This process of dispersion continues as soon as new agents enter the market. The initial monopolistic position is thereby gradually transformed to an oligopolistic situation and finally approaches to a polypolistic market structure. Thus, we consider the economic process as to be relentlessly competitive; the rate of profit is constantly endangered and, in the end, all individuall profits are reduced to ziro.

If the description of this process is plausible enough, we can conclude that finally a situation is reached which asymptotically bears resemblence to the paradigm of an atomistic market result. The closer this constellation is approached, the more the competitive pressure diminishes any monopoly oligopoly returns. The final stage is characterized by market prices, which are pure cost-prices. This characterizes a situation where the economically relevant potential of a single piece of future relevant information is entirely exploited by virtue of competitive market forces. Thus, that particular piece of information ceases to include any incentive-attracting relevance at all. Its profit-attracting capability fades the more it bears a common knowledge property.

In this sense, the process of profit erosion may be comprehended as an expedient indication of the process of information diffusion. By that token the diminishing rate of entrepreneurial profit demonstrates the 'visible' result of the propagation of information in the market.

1.2.3.2 A Simple Model of Profit Erosion

Profit positions as a result of information monopolies must ne-

cessarily be transient if the market system works properly. Given the efficiency criteria of the PARETO-model as a benchmark, even the view must be endorsed that the more efficient a market system performs, the more ephemeral those profit positons prove to be. By that token, we return to our original concern of market efficiency. To put this intuitively acceptable but rather vaguely formulated reasoning into a more definte scheme, let P_t denote the periodic profit in period t, and assume that after the initial period (t=0) - the monopolistic situation - another agent enters the hitherto monopolistic market. Attracting customers may only be possible by lowering the price. Assuming this kind of diminishing returns, the process of profit decay after the period t of successive market entrance can be described by the following term:

$$(1) \qquad P_t = P_o \frac{1}{(1+\mu)^t} , \qquad t = 0,1,2,...$$

whereas μ is assumed to be nonnegative.
The total profit of the first entrepreneur is therefore the sum of all periodic profits

$$(2) \qquad P = P_o + P_1 + P_2 + ... ,$$

whereas P_o indicates the monopolistic profit earned in the initial period, while the accumulation over all remaining periods stands for the oligopolistic-polypolistic gross profit. With equ(2) rewritten as

$$(3) \qquad P = P_o [1 + (1+\mu)^{-1} + (1+\mu)^{-2} + ...] ,$$

and because of $0 < \frac{1}{1+\mu} < 1$, we are able to calculate P in a more convenient form, i.e.,

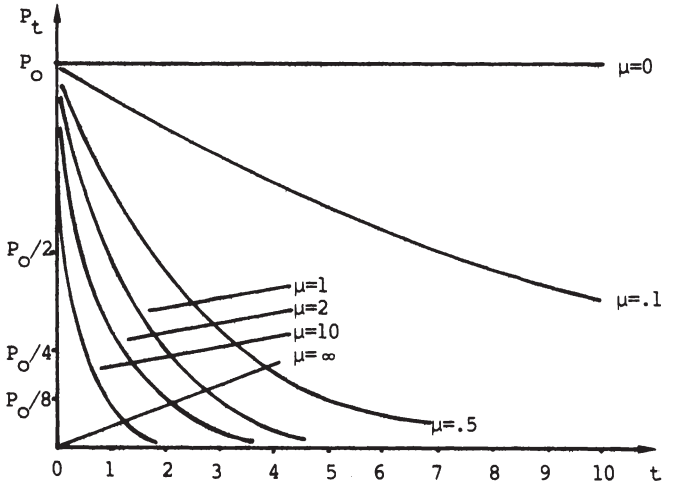
$$(4) \qquad P = P_o \frac{1}{1 - \frac{1}{1+\mu}}$$

$$= P_o \frac{1+\mu}{\mu}$$

By now, we can make some more detailed propositions about two pivotal issues with reference to the assumed process of exploitation of future relevant information.
One of them is the periodic profit $P_t = (1+\mu)^{-t}P_o$; the other the total amount of periodic profits, gross profits, dependent on the parameter μ; $P = ((1+\mu)/\mu)P_o$. Together with P_o, μ determines the amount of periodic profit. The higher the parameter μ, the smaller P_t will be. Parameter μ therefore determines the time-path of declining profits.

A more obvious presentation is provided by the following graph (Graph 1), which shows the time-path of profits for various values of μ .
As can be clearly seen, the initial profit P_o is always reached, and is independent of the actual value of μ. Considered under the paradigm of profit maximization, the prevailing amount of P_o is assumed to be determinded according to the COURNOT-solution. We may, therefore, speak of the COURNOT-profit, which is always earned in the initial period irrespective of the values of μ. The subsequent decay of the initial profit position then varies with different values of μ.

Graph 1: Periodic Profits



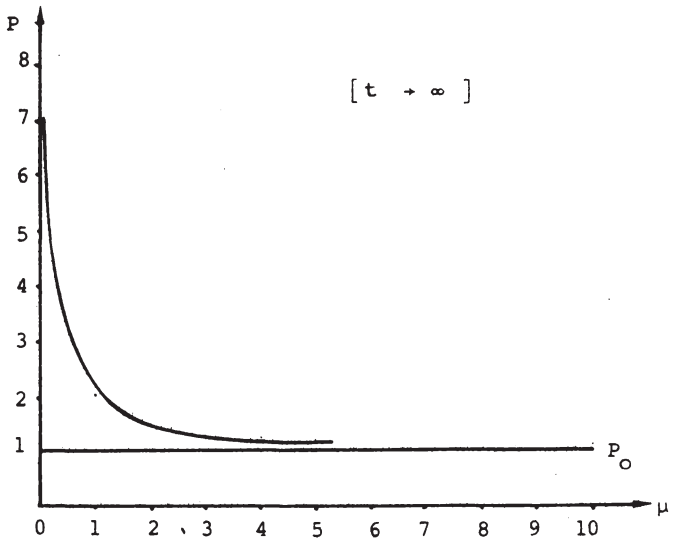
For $\mu = 0$ the original entrepreneur is able to realize his initial monopoly profit in each future period. Thus, as a matter of fact, no profit decay occurs, not only for analytical purposes[1]. For all positive values of μ, we obtain curves underneath the horizontal ($\mu = 0$) line; the steeper the curve, the higher the value of μ. These different curves thus indicate the different time-paths of profit decline for the different values of μ. At the other extreme let us consider the case in which μ approaches infinity. In the graph, the time-path for P_t then is identical with one single point: The origin. The economic interpretation is that after the first period an immediate and entire atomization of the monopolistic profit position into a polypolistic cost-only situation takes place. In this case, apart from the initial COURNOT-profit, all successive period profits are zero.

1) We will discuss this point later in more detail.

Let us now discuss the total profit which the prime entrepreneur is able to earn. Thus, we concentrate on the determination of P. By definition, gross profits correspond to a summation throughout all periods. In this actually means exhaustive exploitation of the initial information and is thus compatible with the long-run perfect knowledge situation.
To demonstrate the dependence between parameters μ and P, the following graph (Graph 2) in connection with equ(4) may be useful.

The gross profit as demonstrated in graph 2 implies the following conclusions: For $\mu = 0$ the total profit amount becomes infinite. The result is not surprising if we bear in mind that the gross profit in each period grows by a constant amount which is identical to P_o and this happens ad infinitum. Analytically, the result is obtained by using equ(4) with μ approaching zero.

Graph 2: Total Profits



$$(5) \qquad \lim_{\mu \to 0} \frac{1+\mu}{\mu} \; Po = \infty \; .$$

By the same token, considering the other extreme case where μ approaches infinity we get the following result:

$$(6) \qquad \lim_{\mu \to \infty} \frac{1}{1 - \frac{1}{1+\mu}} \; P_o = P_o \; ,$$

The gross profit only consists of the COURNOT-profit at the end of the first period, because of the total decay of the monopoly position within the initial period.

Thus, the range of possible values of gross profit runs from the lowest possible amount - P_o - up to infinity. All values in-between correspond to particular values of μ respectively, in a way that each $\mu \in [0, \infty)$ is mapped into $P \in (\infty, P_o]$.

1.2.4 Allocation versus Information Processes

The main purpose of the previous section was to provide a reasonable description of how to envisage the process of profit decay. The starting point was a position of informational advantage which led to an investigation of the I-system's capacity to assimilate informational distortion.

The way in which the problem was studied is apt to cause some misunderstandings. Our approach focused on the I-system's ability to disseminate future relevant information. We thus concentrated on a hypothetical process of profit erosion as a reliable indication of the unobservable process of information dispersion. But profits in termini of total revenues exceeding total costs were generated exclusively in the A-system via buying and

selling, i.e., the ultimate links in the economic chain of production and consumption.

However, we are not interested in the performance of the A-system. To put it differently, we are not concerned with the actual production and allocation of physical commodities, but with the process of information dissemination which forms the knowledge underlying the physical production structures. To redeem the concept as delineated here, an additional assumption is required. It must be taken for granted that the coordinative power of the A-system is large enough to ensure that its performance does not 'limp behind' the one of the I-system. Thereby, we mean that the A-system's intrinsic ability to generate movements toward a hypothetical point of equilibrium must be sufficiently strong so that the system itself does not create the internal temporal delay which causes the particular time-path of profit decay.

Although being somewhat distant from the previous problem, the following situation may provide an appropriate example. Let us assume that an alert entrepreneur builds up a restaurant on the top of a mountain with a unique view. Given the revealed demand of the visitors, he succeeds in ensuring a 'life-long' COURNOT-profit, although other potential 'restaurant suppliers' would also be prepared to invest their capital in order to earn above-average returns and thereby imitate the initial incumbent's strategy. Thus, the scene is comparable to the situation where a certain piece of future relevant information is obviously available but, due to lacking adaptation ability of the A-system, cannot be exploited by the various investors. The situation thus persists in a state of extreme allocational inefficiency.

The example, of course, is not particularly realistic: Evidently, one cannot 'construct' another 'Zugspitze' to establish restaurants on. In the example, the restriction of the A-system is a

sheer physical constraint.
However, the interpretation still holds: The physical impossibility of putting an imitation in juxtaposition to the original is just an illustrative example of prohibitively high adaptation costs, which - if appraised from an economic viewpoint - are considered as coordination costs.
One may, no doubt, question the usefulness of a conclusion stating a failure of coordination given such natural limitations. To put it in a more suggestive way: Does it make any sense at all to classify Greenland's A-system as less efficient compared to that of Italy, merely because the former cannot produce lemons, while the latter can? Does Austria have a more efficient A-system than Germany, because Austria owns a large part of the Alps and therefore possesses a few more 'Zugspitze'? Clearly, the idea that lemons exist in Greenland and that there is more than one Zugspitze in Germany is highly unrealistic. But it would be a mistake to dismiss this kind of analysis as altogether irrelevant. In the relevant sense elaborated above (i.e., in terms of the profit model), the comparison still holds some explanatory value. The symptoms, from the economic viewpoint, are conspicuous: Insufficient allocation patterns, despite superiour knowledge.
It is still more important to observe that, by the same token, those patterns are also generated by the various strategies of incumbents which deter or impede entry into the market. The result of such 'restrictions' may, however, lead to the situation where the deceleration of the adaptation capacity makes the A-system 'limp behind' the I-system.

Reaching this point of discussion, it may be useful to borrow from an idea suggested by C.C. von WEIZSÄCKER (1980) who considers a particular market where information is exchanged[1].

1) See von WEIZSÄCKER, C.C., (1980). For information as a tradable commodity see also HIRSHLEIFER, J. (1973, p. 32) and GROSSMAN, S.J. (1977, p. 431).

The purpose of those information markets is not to provide physical commodities - which may be directly used in production or consumption - but to provide information. Information markets are preparatory markets, not directly related to the final commodity. Thus they rather deal with the exchange of knowledge about the production markets. In this sense, the discussion is located on a higher degree of abstraction.
The particular feature of those markets is the extremely high manoeuvrability of the 'traded commodity'. It is plausible that this stands for a high degree of coordination virtue and by the same token for a low level of transaction costs. As a corollary, information markets exhibit a strong ability to converge instantaneously and smoothly towards PARETO-optimal market constellations.
The preceding analysis of the nature of information markets thus returns to our initial problem, i.e., different velocities of adaptation in the A-system and the I-system. This again constitutes the main analytical problem when we try to derive a 'measure of efficiency', in terms of an 'efficiency function'.

The existence of an efficient A-system momentarily taken for granted, this implies that we may exclude the possibility of 'slowly operating' market forces. Thus the parameter μ can be interpreted as a measure of the coordinative power of the I-system. By that, we mean a measure of the efficiency of information dispersion to approach and asymptotically reach the following state: Due to informational advantages, all individual profit positions are entirely dismantled. Under these circumstances only, complete profit erosion is equivalent to complete information dissemination. The corresponding values for $\mu \in [0,\infty)$ then are definitive for every occuring information-processing velocity of the system.
Again, as already mentioned, the two extreme cases are of particular interest. A completely static I-system is given for

$\mu = 0$. Hence, not even a minimal flow of information occurs which may lead to profitable market positions. The initial entrepreneur takes advantage of this particular case ad infinitum and thereby accumulates COURNOT-profits in each period. It is necessary to recognize that this result is totally independent of the coordinative power of the A-system: The rigidity of the I-system ensures the incumbent a quasi life-long constant revenue, quite unrelated to the market forces that drive the A-system.

In contrast to this, the case of $\mu = \infty$ will now be considered. The I-system is characterized by extremely low viscosity of information. The almost infinite velocity of information dispersion causes an immediate externalization of each informational advantage. In the analysis carried out above, the decay of a profit position therefore is already terminated after the initial period. The result of the present case bears a close resemblance to the classical approach of equilibrium analysis. It may suffice to illustrate this by pointing out that the classical approach also assumes that a market structure disperses all future relevant information equally and immediately, even if it is not explicitly in consideration. As a crucial difference from the model delineated here, it should be noted that in the classical paradigm there are no profits at all, while the present model allows at least a COURNOT-profit in the first period, which - due to the initial conditions - cannot be socialized immediately. After the first period, however, a state of total dispersion of information takes place. Thus, according to our model, even in information systems endowed with an extremely high power of coordination, a first-period monopoly profit can be internalized.

At a pertinent state in the course of further reasoning we will again meet the classical situation of infinite adaptative velocity and draw the conclusion that the impossibility of internalizing any kind of profit renders markets with such 'a high

degree of performance' nonviable. Obviously, this argument does not apply to market structures underlying the present model, although comparable problems will be involved, as in the classical case (patent right, licensing), which are discussed later.

All other values between these extremes stand for I-systems with varying information processing velocities. In all cases (except for $\mu = 0$) the system - throughout time - reaches a state of equal informational distribution. Then, the economic relevance of information is completely exploited.

1.2.5 Possession versus Property

A more or less rapid decline of periodic profit returns comes about in the final analysis by virtue of market coordination. Market coordination in the first instance is determined by reference to competitive forces. The particular nature of a functioning market thus becomes clear: The decline of the monopoly position throughout time demonstrates the operation of a process which increasingly deprives the incumbent of the possibility to exploit future relevant information. Competition may thus be seen as a special form of expropriation or theft, depending on how the process is characterized from a legal perspective.

However, from a legal point of view, the terms 'expropriation' or 'theft' are serious misnomers, because both legal concepts include property as a precondition. The sphere of information in this context is defined precisely by the characteristic that at most a possessory right but by no means a property right is attached to future relevant information. Possession is completely unprotected against imitation.

This becomes evident by comparison with the situation in the A-system. As previously mentioned, possession and property rights are specified so precisely, that a well-defined market exists for all relevant economic goods, and the corresponding property rights are traded in this market. Precisely these property rights, however, constitute a right of the owner to exclude all third parties from using his property. By contrast, it is characteristic for the I-system of this market model that no property rights are accorded at all, i.e., the right to prevent rival usage by others does not exist.

One point in connection with the preceding argument is apt to cause misunderstanding. The fact that no property rights exist for future relevant information means that such information is indeed a 'free good', but only in the legal and not in the economic sense. Thus, it undoubtedly exhibits the characteristics of scarcity and competing use. Such information is precisely a 'valuable' good in the sense of a positive future stream of returns.

On the other hand, it cannot be seen as a private good, for it lacks the attribute of exclusiveness associated with property rights. It must further be taken into account from an economic perspective that no signals of scarcity are indicated; no market exists in which prices are assigned to information as a tradable good.

Also, nothing is indicated about the cost of information acquisition in the broadest sense. There can be no doubt, however, that the production of information is resource-intensive. It is nevertheless conceivable that these costs could rise to prohibitively high levels and thus prevent all possible imitation activities. Despite this, costs cannot be interpreted as a form of compensation which is due to the initial owner of information. The incumbent rather remains uncompensated, and costs accrue to the potential receiver only in the form of time and money expenditures for aquisition, processing etc..

These costs could, at least theoretically, become infinitely high. This would mean that the information monopoly becomes completely protected and would be equivalent - in its effects - to an exclusive property right. This would be the case if $\mu = 0$. The other extreme case is an information sphere with zero costs. Although without great practical significance, there is ample reason to adopt this unrealistic assumption because it instantly endows competitive markets with PARETO-optimal characteristics. In effect, it resembles other comparable assumptions which have already appeared in the discussion of the classical allocation model.

The example of costless information demonstrates most clearly the consequences of 'unprotected ownership relationships'. So to speak in statu nascendi, the individual has monopolized knowledge and the initial positive monopoly profit is immediately eliminated by competition. This corresponds to the situation where the parameter μ gets infinitely high in the gross profit model.
The reason for this result partly lies in certain assumptions concerning the cost structure of the I-system, but also, and above of all, in the failure to assign property rights to future relevant information.

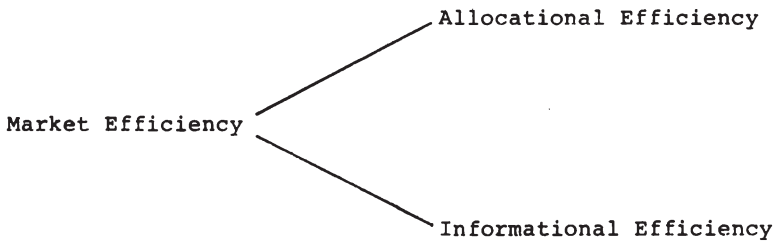
With regard to this failure to assign property rights, it is possible to speak of a law-neutral sphere. Nevertheless, this condition should not mean that rules or laws don't govern markets in the area of the information sphere[1]. At a theoretical level,

1) Of course, a law-neutral sphere does not mean that future relevant information can be extorted by force, for example. Thus, there is no HOBBESIAN 'natural state' in which the predator is not able to secure ownership of his prey for a single moment against the incursions of his competitors. The situation might better be compared to a state in which the predator - to maintain the metaphor - cannot prevent competitors to try to do the same as he did. Moreover, rules of an informal character tend to develop within market situations, which constitute a sort of professional ethos reflected in 'trade customs' and 'honorable behaviour'.

though, no codified rules exist which either prescribe or prohibit specific behaviour. In terms of the property rights theory, therefore, the market in question is thoroughly underdeveloped (if one can speak in such terms at all). Later it will become apparent that it is precisely the market's law-neutral character that provides very particular advantages in other respects.
For present purposes, it suffices to say that the faster the act of expropriation (imitation) takes place, the more rapidly the individual profit position is likely to decay as a result. In other words: The faster the process of profit socialization occurs, the more the market approaches competitive equilibrium (socialization function of competition, ARNDT, H., 1951, p. 47).

2 The Concept of Allocational Efficiency and Informational Efficiency

This section deals more precisely with the notion of efficiency as such. According to the separation of a market system into an allocation system and an information system, the expressions 'allocational efficiency' and 'informational efficiency' are defined. Thus 'market efficiency' must be considered as a generic notion of these two subconcepts. In accordance with the statement made above the following diagram may clarify the idea:



Before the details are discussed in greater depth, some general remarks about efficiency in economics are required.

2.1 Efficiency and Rationality in Economic Science

The following suggestion by H. LEIBENSTEIN (1966, p. 392) can hardly be considered to be uncommon: '...At the core of economics is the concept of efficiency'. Very plausibly and totally in agreement with the view of scholars such as those quoted above, one may even define economics as the science dealing with the efficient production and exchange of scarce goods. Indeed, by far the greater part of modern economics is concerned with expedient choice restricted by means, or with the discussion of assumptions which possibly allow a desired efficient performance. Thus, the efficient sphere of production (production efficiency), or of the efficient planning of households in making their consumption plans, etc. is considered.

Somehow, the notion of efficiency becomes the central idea, predetermined by the view of economics to be 'the mechanics of utility and self-interest'. Given this notion, the concept of efficiency can be compared to a lever used in mechanics to achieve a transmission which is as frictionless as possible. This is surely not an extravagant view. The metaphor clearly shows the way in which most economists view the problem: 'Efficiency', in a rather general sense, means assessment of a particular performance. A narrow perspective then stresses the paradigm of rational choice or rational usage of means. Thus, a common formulation postulates that an actor either maximizes the degree of goal-attainment subjected to given means, or minimizes the level of input in order to reach a given goal. From whatever angle one views the issue, - and we will meet quite a number of different definitions of efficiency - it will always circulate around this basic concept.

Apart from the ambiguity of the terminus technicus it is clear then that the causa finalis of efficiency must be sought in the principles of rationality.
Efficiency is definable only in a rational scheme and must be considered as a direct outcome of the postulates of rationality. Given this view, one need not say that rationality is acclaimed as the utmost norm to which human action is subjected: Only he, who acts rationally also acts efficiently, and each loss of rationality is inevitably reflected by a minor degree of efficiency.

But rationality as a normative procedure is as such not sacrosanct but rather subjected to different interpretations. The classical or CARTESian concept of rationality understands human behaviour as acting with complete knowledge, as if economic decisions were only a problem of rational choice restricted by a finite set of alternatives with given ends and with given knowledge about all events and circumstances at the time.
In short, this mode of behaviour outlines the familiar concept of the traditional 'homo oeconomicus' who, endowed with well-defined algorithms, ratiocinates 'perfectly suitable' solutions. It describes the paradigm of programmable decision, which connects means and ends logically in one of the inherently efficient ways.

Considerable time and effort was spent before the objections of those who incessantly raised serious criticism of such an idealization gained sufficient ground and finally brought about a reconsideration, which at its height of appreciation was even deemed worthy of the NOBEL Prize, awarded to one of the prominent proponents, H.A. SIMON[1)], in 1978. In his address of thanks[2)], he

1) Together with CYERT, R./MARCH, J.G. (1963), SIMON, H.A. can be regarded as one of the main actors of the CARNEGIE School.

2) See SIMON, H.A. (1979).

justifies the concept of bounded rationality by pointing to the fact that

> 'the classical model calls for knowledge of, or ability to compute, the consequences that will follow on each of the alternatives. It calls for certainty in the decision maker's present and future evaluation of these consequences. It calls for the ability to compare consequences, no matter how diverse and heterogeneous, in terms of some consistent measure of utility', (p. 500).

By that token

> 'the classical theory can be patched up sufficiently to handle a wide range of situations where uncertainty and outguessing phenomena do not play a central role - that is, to handle the behaviour of economies that are relatively stable and not too distant from a competitive equilibrium', (p. 497).

This is the junction where he demands for abandonment of the 'old paradigm' in favour of a concept with superiour power:

> 'however, a strong positive case for replacing the classical theory by a model of bounded rationality begins to emerge when we examine situations involving decision making under uncertainty and imperfect competition', (p. 497).

Thus, because bounded 'rationality is rationality when it falls short of omniscience' (p. 502) and, quite obviously, the fate of human knowledge is always to be incomplete, an applicable procedure 'is to look for satisfactory choices instead of optimal ones', (p. 501), or 'to replace abstract, global goals with tangible subgoals, whose achievement can be observed and measured', (p. 501). Hence, besides focussing on satisfying strategies, attention is drawn to the existence of multiple goals, resistance to change, organizational slack and other 'behavioural' characteristics (DAY,R.H., 1964).

By that token, the concept of bounded rationality is concerned with a situation where information is not abundant but must rather be sought and processed with a corresponding expense of

resources. Thus, it is necessary to incorporate a 'Theory of Search' (SIMON, H.A., 1979, p. 502).

This is quite different from the situation as it has been understood until now: While in the classical concept of rationality, the 'homo oeconomicus' is simultaneously a 'homo informaticus', acting under perfect-knowledge conditions, in the concept of bounded rationality this is not so. Then it is immediately conceded that 'perfect efficient' decisions are at best reached arbitrarily. Instead, the common case describes a situation where the objectively best solution is not applicable, thus human action always persists in a state of more or less subefficient performance.

At this point, however, one should not lapse into a common error: Judging revealed decisions as nonrational and therefore as subefficient may be the harsh result of stipulating an objectively complete and objectively correct decision tree. As soon as the aspiration to perfect knowledge is relinquished in favour of a situation where the typical decision maker has to strive and invest resources in order to obtain subjectively correct information, subefficient decisions could turn out to be perfectly rational because they were worked out in the light of objective knowledge. However, it is important to remember that the possibility of misinterpretation in natura can never be totally excluded. Surprisingly enough, this is even true in a comprehensive or objective sense: Individual behaviour is rationalized by transaction costs (in a general sense) and opportunity costs, or intangible cognitive costs. Thus, taking into consideration the particular situation in which the decision maker finds himself, his problem is solved when the enigma is fully elucidated: The matter is perfectly explainable under these conditions. If so, it is not actually correct, that maximization is more an exception than a rule.

The result of this epistemological position clearly aims in the direction of the fatalistic obsession according to which things are intelligible ipso facto, that reality is rationality, because things are as they are, and 'naught happens for nothing, but everything from a ground and of necessity'[1].

Here, we reach the point where the main conceptual intricacies of the idea of bounded rationality are brought to light: Actually any kind of behaviour and any kind of decision might be evaluated as rational under the stipulation of the inherent incompleteness and weakness of subjective information as an 'ad hoc rationalisation'. This is so, because rationality as comprehended in this context in the first instance means waste-free use of means under given ends'. Even then, it becomes difficult to answer the question of how much effort and resources are justified considering the fact that subjective information is always liable to be false. Starting from the wrong assumptions, we can never reach the right results, even and especially if we proceed by means of pure logic, the nearest relativ of rationality.
Then, however, it is a simple matter to recognize that any kind of action is an efficient action, because it is logically deducible from the particular, individual circumstances in which the action is virtually executed.

But, irrespective of this objection, it is perfectly obvious that under the banner of bounded rationality the pure act of deciding is also inherently a rational choice. What has changed are the completeness and determination of the initial conditions. Deci-

1) According to the Ancient Greek philosopher LEUCIPPUS, in: J. BURNET, 'Early Greek Philosophy' (4d. ed., London, 1930, p. 340) found in: GEORGESCU-ROEGEN, N. (1966, p. 10). The same idea is again expressed by the Ancient Roman writer LUCRETIUS: de nihilo nihil, which one finds again in D. HUME's principle according to which cause precedes effect: 'post hoc, ergo propter hoc'. We will meet this kind of reasoning once again in a following chapter.

sions are made under incomplete and uncertain knowledge but, despite these 'dubiousities', they are still governed by the principles of rationality: It may then be perfectly rational to stop short of being perfectly rational (P. STREETEN, in: CHARTER,C.F./FORD, J.L., 1972, p. 284).

It is, moreover, quite evident that this principle requires the weighing of marginal costs and benefits of each activity until they are balanced. Thus, we still live with the directive that man acts rationally and not intuitively. This dilemma of the rational approach of economic behaviour is most clearly expressed by L. MISES (1960, p. 35) who says: 'Action is by definition rational'.

By exactly that same token one may confidently give the very 'bottle' back to SIMON, that he would like to present STIGLER when he suggested that[1)]

> 'STIGLER poured the search theory back into the old bottle of classical utility maximization, the cost of search being equated with its marginal return'.

SIMON's concept again is not free of this fault. From whatever angle one looks at the issue the same inescapable conclusion looms: Rationality, whether under complete or incomplete conditions, requires an optimal balance of contrasting interests, quite in line with the dictum that it is only optimizing behaviour that carries any theoretical conviction in economics. Also, because optimalization is quite obviously a clear matter of measurement, number and calculation, the concept of bounded rationality does not convincingly shatter the reservations which may emerge when faced with the classical rationalist's tenet according to which 'knowledge proper only exists to the extent to which it is expressed in arithmomorphic concepts'[2)].

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1) SIMON, H.A., (1979, p. 503).

2) GEORGESCU-ROEGEN, N. (1966a, p. 22).

The great merit, however, of the concept of bounded rationality must presumably be sought elsewhere. Its main aim is to focus on the fact that information is not a self-evident matter but is rather a scarce good[1] which, like all other economic goods, must be subjected to a cost-benefit analysis[2]. By this, the classical assumption of perfect information is abandoned in favour of an analysis of information processes. The information processing capacity is limited to short-term memory capacity. 'This limited information processing capacity compels people to simplify even simple problems, and forces them to focus more on certain problem aspects than others' (SCHOEMAKER, P.J.H., 1982, p. 543). The essence of the matter is that the economic conditions of acquisition of future relevant information and their repercussions on allocation processes move into the field of theoretical interest. Thereby, 'the pursuit of profit has become the pursuit of knowledge'[3].

But the 'pursuit of knowledge' or, even better, the 'performance in the pursuit of knowledge', offers a full description of the main concern which is elaborated here. Thus, the Concept of Bounded Rationality must provide the central focus of the study. As a result, we necessarily refer to a 'concept of subjective performance' (subjective efficiency), a theory which concentrates on highly individual patterns of behaviour but, on the other hand, fulfills the requirements of a general theory of human action. In fact, one view expounded in this thesis deals almost exclusively with such an approach.

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1) The costs of acquiring the information and knowledge to maximize net benefit must be weighed against the extra benefits to be derived from them. See STREETEN, P., in: CARTER, C.F./FORD, J.L. (1982, p. 284).

2) As to decision-making according to the concept of bounded rationality analysis, see STREETEN, P., 'The maximization of the numerical exess of benefits over cost', in: CARTER, C.F./FORD, J.L. (1982, p. 283).

3) SHACKLE, G.L.S. (1970, p. 12).

In contrast, we also pursue a line of reasoning which has become dominant in contempory theoretical research. This approach, although again concerned with uncertain information and indetermined outcomes, is based on the assumption of complete and objective information and thus follows the lines of argumentation of the concept of rationality. Objective information in this context means that the results of the classical model are used to measure judgement.

The next two sections contain practical definitions of 'allocational' and 'informational' efficiency, referring to some kind of reference system, which in comparison allows to distinguish various degrees of efficiency.

2.2 The Concept of Allocational Efficiency

Allocational efficiency (A-efficiency) is the measure to assess the performance of the A-system (in short: the market), in order to allocate resources. For example, if a particular market is considered to be more efficient than another one, then this statement is the result of a comparison with regard to a reference system. The reference system itself should permit to make at least qualitative judgements about the performance of different markets. Thus, a system with clearly defined properties is required. To a great extent, this was already a concern when the A-system was introduced.

Starting from an economy with PARETO-properties, the model was then extended by relinquishing the requirements of this space- and time-free concept. This led to the introduction of transaction and coordination costs. T-costs were attached to an equilibrated state of the economy. The definition of both kinds of costs allows

- the stepwise abolition of the severe assumption of the pure PARETO-model in favour of a more expedient form according to the intended analysis,

- the demonstration of the interconnection between T-costs and C-costs, which opens the investigation to a dynamic development of a market.

According to these findings, therefore, as a first rough interpretation of A-efficiency, the PARETO-optimal market performance appears quite suitable. Axiomatic to PARETO-efficiency is the performance of a market which brings about the same allocational patterns as an A-system with the same set of assumptions as the classical allocation model'. The issue therefore has to be interpreted as the absolute norm of A-efficiency.

The next step to be considered must take into account both extensions, i.e., time and space. Accordingly, A-efficiency is understood to be the capability of the A-system to converge without delay to an equilibrated state, where a market-specific minimum of T-costs is reached. In this case, the system is an optimal developed system (in terms of fully assigned property rights), endowed with a system-specific optimal level of coordination power. Because this notion of A-efficiency is of worth only with respect to a particular market, it must be interpreted as the relative norm of A-efficiency.

No matter how the issue is actually tackled, the relative norm must be a composed measure assessing the market in equilibrium as well as in disequilibrium. But following this reasoning, another difficulty immediately emerges: The difficulty to reasonably differentiate between two A-systems, one having a relatively higher velocity to lead towards its internal equilibrium which once reached, persists in a state of a relatively higher level of

T-costs. It appears to be quite complicated to find an adequate and consistent evaluation of this situation. Although it raises some other interesting questions, we do not pursue this line of reasoning further[1]. Nevertheless, it should still be kept in mind that the outlined concept of A-efficiency necessarily has to take into account an assessment of both positions in which the A-system may be located.

There is good reason to believe that the change from the PARETO-model to the extended model bears features of a distinctly qualitative alteration, a view that may be totally justified by one's premise. In the context propounded here, however, it does not appear pertinent to view the issue as to be composed of two distinctly separate models without a common denominator. Rather, it is possible to consider the extended model as a prototype from which the PARETO-model is deducible as an extreme and particular case. This is not hard to imagine, because we just reverse the procedure by which the extended model was introduced. We assume that coordination power is almost infinitely high and transactions are costless, so that the A-system instantaneously moves to its equilibrium position. In other words, this process represents nothing more than the asymptotic extraction of time and space.

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1) However, two ways in which possible solutions might be traced should briefly be suggested: As a first approach, one may remember what was said about the interrelation between T-costs and C-costs (section 1.1.2.3), especially that T-costs may be transformed into C-costs, and may therefore change the internal structure of the A-system. According to our analysis, this must have an efficiency-increasing effect, because the transition of T-costs into C-costs (especially in the sense of newly assigned property rights) was said to be efficiency-enhancing in a dynamical perspective. Shifting to a more direct approach, we want to refer to an expedient application of the analysis which is explained in the next part, dealing with the 'Efficiency-Preference Function'.

As already mentioned, the classical model is a rather artificial case, but nevertheless bears the characterisics of 'absolute efficiency'. To use the PARETO-model as the proclaimed measure of efficiency, however, means to vest the extraordinary in the properties of normality, i.e., to take the impossible as an ideal norm. For that reason it hardly seems possible to extricate oneself from the common accusation of pursuing a 'Nirvana Approach', which, quite naturally, strengthens misleading conclusions of what is actually desirable and obtainable in a world where time and space are the most indispensable dimensions.

Although this pragmatic attitude receives widespread endorsement from an increasing number of scientists, it does not entirely debilitate a position which lays greater (or even too much) stress on the notional and asymptotic character of the PARETO-model. Any increase in coordination power and any decrease in the level of T-costs contribute to the enhancement of allocational efficieny, PARETO-efficiency merely marks the end of a line where enhancement is no longer possible form a purely theoretical point of view.

We now summarize the conclusions reached in this section. The criteria of A-efficiency are attributed to a time- and space-extended A-system. A-efficiency thus refers to both the level of coordination power and the level of T-costs. The higher the first are assumed to be (respectively, the lower the other), the more efficient is the A-system. Theoretically, a perfectly efficient state is conceivable which is described by the static and spaceless PARETO-model. Thus, for notional convenience PARETO-efficiency marks the upper end of the efficiency scale. The gradual deviation from this ideal norm leads to decreasing levels of efficiency, ending in the opposite extreme of a totally inefficient A-system where either no coordination power exists at all, or the level of T-costs is so high that the allocation patterns become utterly rigid.

2.3 The Concept of Informational Efficiency

The state of 'informational efficiency' (I-efficiency) cannot as easily be realized as the state of A-efficiency. This is partly due to the lack of such a well-defined reference system like the classical allocation model, which at least gives some guideline to judge the effectiveness of allocational patterns. Thus, as a question of pivotal importance one must ask how people gain information. Although the problem of production of knowledge in a market economy has been recognized for a long time, it has only received minor attention. This is probably due to the intrinsic difficulties of the subject: For quite obvious reasons, research has concentrated on allocation stuctures as the visible and single result of all those information processes which, by their very nature, evade direct observation. By that token, the Classical Allocation Model is based on 'perfect information'. The main and undeniable advantage of such an extraordinary assumption surely permits - according to SMITH's principle of the 'invisible hand' - vigorous engagement in the redistribution of purchasing power.

But this is not the main concern here. The emphasis is more closely set on the discovery of the extent to which competitive economies can be considered as efficient devices to reveal future relevant information, according to HAYEK's thesis of 'competition as a discovery procedure'. In more concrete terms, the issue revolves around the problem of to what extent competitive economies provide a sufficient information basis for efficient allocation decisions.
From an analytically expedient viewpoint, therefore, the term informational efficiency is treated in two dimensions, i.e., 'completeness' and ' exhaustion' of future relevant information.
To give an idea of what is to be understood by 'completeness of information', one may consider a cumulative set of information, a complete set of signals, which is available, let us say, at a

certain point in time t. The number of signals should not be thought of as to be necessarily fixed, but rather to be depending on the multitude of influences coming from special circumstances. Thus, if $\Omega_t = (\omega_1, \omega_2, \omega_3, \ldots)_t$ denotes the complete but unbounded set of signals available at t, one may consider ω_{it} as 'initial conditions' which, from a purely economic perspective, may consist of items like prices, quantities, profit- or splitting-announcements, crop forecasts, weather reports, etc., but also of political conditions, geographical particularities or whatever may have any informational content. Given a more general viewpoint, Ω_t stands for the exhaustive description of the past, and the difference denoted by $\Omega_t - \Omega_{t-1}$, merely indicates the increase of knowledge which is given by the accurate description of all events occuring in period t - (t-1).
A leading symptom therefore is that a decision based on Ω_t necessarily results in objectively correct conclusions, if one succeeds to interprete each ω_{it} correctly, i.e., if there are no shortcomings in the rational usage of information: Correctly inferred sequels based on correct and complete knowledge cannot be false[1].

At this point, however, the exceptional properties Ω_t is endowed with lead to an inextricable difficulty: If we know Ω_t, we are able to forecast correct what will happen at t+1, and thus we know Ω_{t+1}. By the very same token each Ω_i is predetermined by its predecessor back to $\Omega_{-\infty}$. Thus, the course of time becomes definite, exactly as the completenesss of initial conditions suggests. As appealing as it may appear at first glance, the

1) If the parts of a system are causally related, one can deduce the situation in the future from the actual situation in this system mathematically by use of HAMILTON's differentiation equation. For causality problems see MITTELSTEAD, P. (1981, pp. 148ff.).

LAPLACEian Principle of Sufficient Reason[1], which submits all actions under the rule of the Providential Authorities, hardly bears any palatable implications. It is beyond the dignity of humankind to accept the fallacy of 'librium arbitrium'[2].

At this point, the reasons to introduce randomness or probabilistic outcomes are plainly obvious: Reasoning in probabilistic terms - although we never know how to explain them[3] - extricates one from the destiny. In particular it allows one to interpret $_t$ not in a deterministic way, but rather to look at it in the light of HARTWIG's Aetialprinzip, according to which similar general causes entail the same stochastic form of distribution[4]. In this sense, completeness brings about the same distribution function from which the actual outcome were to be drawn.

It is not difficult, however, to recognize that HARTWIG's understanding of the matter in our context leads to obvious complications. 'Completeness of information' becomes a contradictio in adjectio, because by completeness we actually refer to a degree of completeness which by its probabilistic nature is defective: Incomplete completeness. Thus, nothing is wrong with POINCARÉ's position that random is only an outcome of the imperfection or

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1) See LAPLACE, P.S. (1814).

2) The dilemma involved is pointedly expressed by EDDINGTON, A. (1935, p. 282). 'It seems contrary to our feeling of the dignity of the mind to suppose that it merely registers a dictated sequence of thought and emotions; but it seems equally contrary to its dignity to put it at the mercy of impulses with no causal antecedents'.

3) As C.W. CHURCHMAN (1961, p. 139) pointedly remarks: 'Almost everyone knows what it means to say that an event is only probable - except those who have devoted their lives to thinking about the matter'.

4) See HARTWIG, H. (1956).

incompleteness of our knowledge[1]. There are no objective probabilities, only subjective ones. Psychological experiments show that people tend to overestimate the effects of high probabilities and underestimate low probabilities and their effects. The tendency to neglect low probabilities, however, is not confirmed when the decision situation involves a 'ruin problem'. Then it seems that a strict 'survival strategy' is preferred, which is presumably more adequately modelled by a lexicographic utility function than by the traditional expected utility model.

Quite apart from this more philosophical discussion, there are many different reasons suggesting that the 'normal' case is more adequately characterized by an incomplete set of information. As a pertinent example, one could simply refer to man's finite intellectual capacities as being due to the limited capacity to store and process knowledge, or the fact could be stressed that information is not considered to be costless, but is rather resource-intensive in terms of time and costs. Then, of course, it may be more convenient to define an actually available set which, compared to Ω_t, is bound and incomplete apart from the ambiguity of the random term. By that token, we consider H_t as a proper subset of Ω_t, with $H_t \subset \Omega_t$ containing a finite and specified collection of ω_i and $H_{n,t} = \{\omega_1, \omega_2, \omega_3, \ldots, \omega_n\}_t$.

Prima facie, we can define an infinite number of such subsets which are all identical in the relevant sense. The main task, therefore, consists of specifying the actual amount of information which can be used as an information basis. The determination

1) W. HEISENBERG writes (1955, p. 26): 'statistische Gesetzmaesigkeiten bedeuten in der Regel, dass man das betreffende 'physikalische System nur unvollstaendig kennt'. And even HEISENBERG's Indeterminacy Theorem - as has been argued by some physicists - can be thought of as the fact that one is not able to take sufficiently into account the historical development of the elementary particle in order to predict its future course.

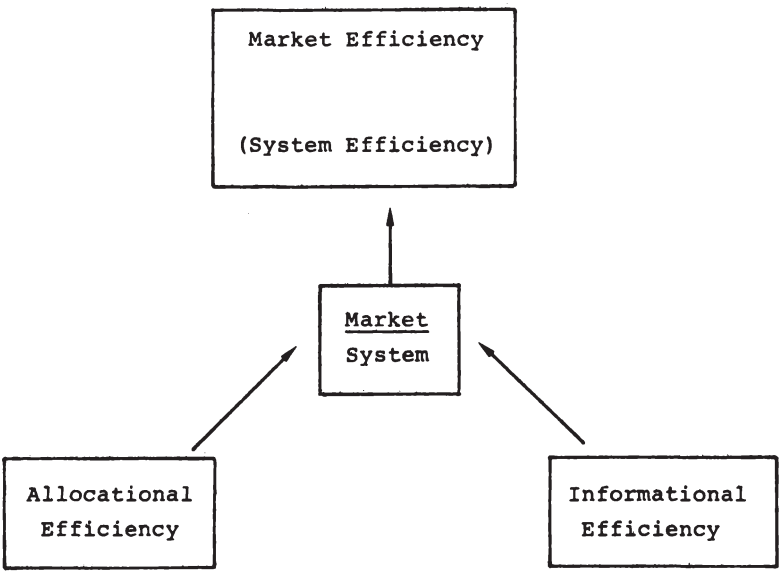
of $H_{n,t}$, as the relevant level of completeness then becomes the focus of information efficiency because decisions based on it will be more precise or less fallacious.

As another point deserving careful consideration, one may consider the fact that from the individual decision-bearer's viewpoint, final sucess is not guaranteed by information itself. The stipulation of a given set of information is by no means a passepartout to success, but rather a necessary precondition. Equally important, therefore, is the thesis that information must be interpreted correctly, a postulate which is usually referred to as the rational usage of information, i.e., the correct inference from signals to facts. Information is scarce and costly, it should not be wasted but rather exhaustively exploited if exploitation is free of costs. We call this the exhaustion thesis.

Information efficiency must incorporate both completeness and exhaustion of future relevant information, if it is to be an accurate measure of phenomenon. In a later chapter we deal with an approach precisely following this kind of interpretation, therefore we dispense with the more technical analysis of the issue here.

3 An Efficiency-Preference Function

The starting point of this investigation was the argument that an allocation system and an information system work together in what is usually called 'the market' (market system). As was pointed out in the preceding analysis, a market system's observable performance can be interpreted to be a composition of the productive performance of its two subsystems. The following diagram may illustrate the point:



The separation into A-efficiency and I-efficiency, however, is an entirely artificial one which, like all distinctions, can be criticized on many grounds. But it clearly serves the useful purpose to focus on our main concern: Informational efficiency.

One issue in this context has still not been tackled: The set of instruments and the way to measure 'market efficiency' reliably and accurately. Leaving aside the question of desirability, the problem connected with the question is whether it is possible at all to fit this rather abstract scheme into a concept which would allow to make quantitative statements about the qualitative concept of market efficiency.

The problem would be solved, if we could find a function F(.), describing all 'states of market efficiency', $(e_1,e_2,e_3,\ldots,e_k)$,

as real numbers: a 'lower state of efficiency' would correspond to a 'lower value of F(.)', or, in general:

$$F(e_i) \gtrless F(e_j)$$

if, and only if

$$e_i \gtrless e_j.$$

Then, assuming a comparison between two markets M^r and M^s due to their performance one could simply consider the numbers $F(e^r)$ and $F(e^s)$. M^r is therefore labelled more efficient than M^s in terms of market efficiency. $M^r \succ M^s$ if, and only if $F(e^r) > F(e^s)$.

In other terms, we are interested in a function F(.) for market efficiency which links a real number $n \in [0,1]$ to any e_i. Thus, F(.) maps all qualitative states into the set of real numbers between zero and one. Now, let us define a two-tuple (x,y), where X, $x \to X(x)$, is a function, mapping all qualitative states of A-efficiency into $x \in [0,1]$ and Y, $y \to Y(y)$ is a function, mapping all qualitative states of I-efficiency into $y \in [0,1]$.

In a next step, if we define F as

$$F = \min\{(x,y)\}, \tag{7}$$

we obtain an efficiency-preference function with the following properties:

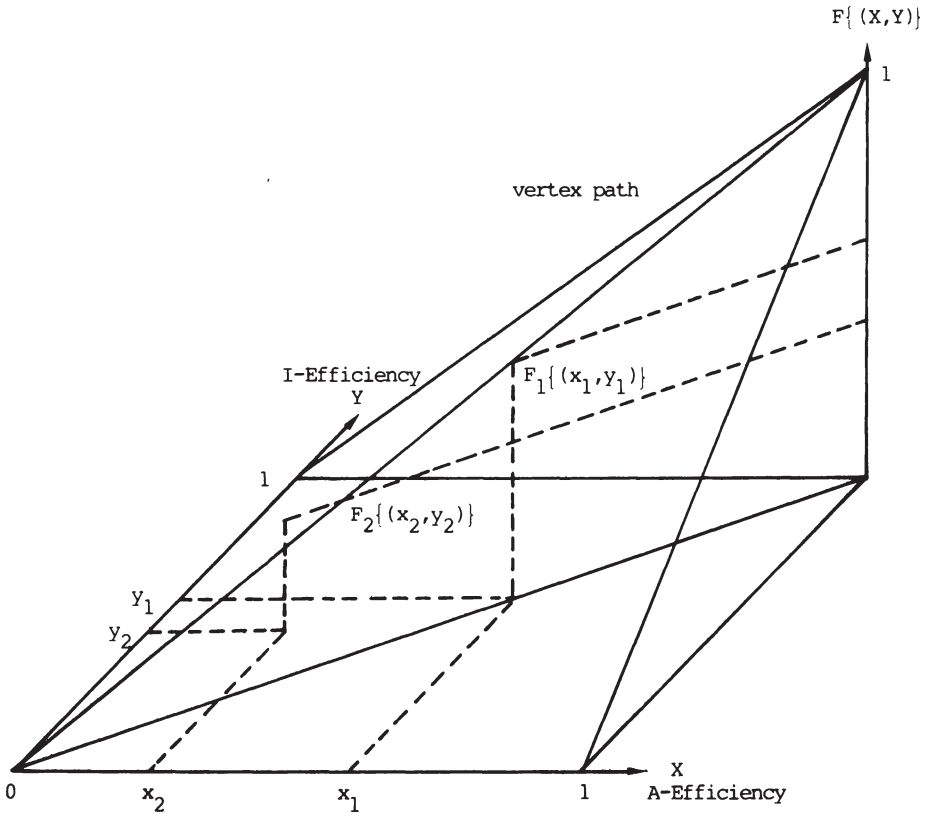
$$F\{(1,1)\} = 1$$
$$F\{(0,1)\} = 0$$
$$F\{(1,0)\} = 0$$
$$F\{(0,0)\} = 0$$

or, in general:

$$(8) \qquad F(x,y) = \begin{cases} x & x \leq y, \quad 0 \leq x, y \leq 1 \\ y & x \geq y, \quad 0 \leq x, y \leq 1 \\ 0 & \text{remainder} \end{cases}$$

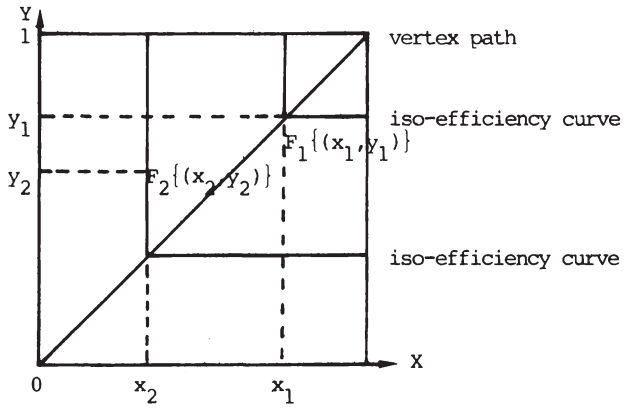
In the following figure, the efficiency-preference function (F-function) is depicted in a three-dimensional space. The values for A-efficiency are shown on the x-axis and the I-efficiency values are on the y-axis. Both scales run from 0 to 1. Above the X-Y-plane, F(.) is defined as described in equ.(8). The straight line going from the origin to the peak value of F(.) marks the vertex path of F(.). Thus, $F_1\{(x_1,y_1)\}$ indicates the case where $x_1=y_1=F_1\{(x_1,y_1)\}$, where the A-system and the I-system perform equally well. In contrast, point $F_2\{(x_2,y_2)\}$ lies on the left half of the surface of F(.). Hence, the situation is characterized by $x_2 < y_2$, the 'overall performance' is given by $F_2\{(x_2,y_2)\} = x_2$. Like all points on the left half of the figure, it describes a market system where development is restricted by the limitations of the A-system, although knowledge exists which would allow and entail a different and more efficient allocation pattern. Here, we consider the case where the A-system is limping behind the I-system. By the same token, the right half of the surface contains all combinations with $x > y$, thus, the A-system adapts faster to information impulses as they are emitted by the I-system. From an analytical point of view, only this position allows a definitive treatment of informational efficiency. Types of markets like those labelled information markets (1.2.4) are described by an (X,Y)-combination situated in this area and are hence pertinent examples for planned investigations focusing on information processing.

Graph 3: Efficiency-Preference Function



The limitational character of the preference function is again and most obviously demonstrated by the fact that we deal with rectangular iso-efficiency curves as shown in the following graph, where F_1 and F_2 refer to the same positions as in the preceding graph.

Graph 4: Iso-Eficiency Curves



The obvious reasoning behind this proposed kind of preference function may easily be perceived by considering the metaphor that a chain cannot be stronger than its weakest link. In this sense, a market's overall performance is limited by the performance of its 'weakest' subsystem.
In addition, it is suggested that information efficiency and coordination efficiency are necessary prerequisites for market efficiency or, in a more accurate form, a market's overall performance cannot be better than its information (coordination) efficiency. But, of course, it is possible that a market's information (coordination) system may be highly efficient whereas its total performance may be on an extremely low level due to an inefficient system of coordination (information).

Two approaches will be presented in the following parts of this work. Both claim to provide a sufficient explanation of what is meant by market efficiency. They prefer quite different tools according to their distinct view of the phenomenon. Although they

can hardly be considered as antagonistic doctrines - in fact, they have some crucial points in common - their basic view of man's rationality differs considerably. The first approach considers man as a kind of 'homo informaticus', while the second conjectures man's position - according to J. MARCHAL (1949) - somewhere between 'homme de Descartes' and 'homme de Pavlov'. This position appears to be more in accordance with perceivable reality, while the first one clearly marks an extreme position which is not easily justifiable. The belief that people at least try to act rationally in their economic sphere may bridge the gap between real-world experience and theoretical assumption. If one accepts the hypothesis that man is a learning entity, then it seems reasonable to consider this extreme rationality assumption at least as a 'property likely to be (approximately) possessed by the outcome of this unspecified process of learning and adapting', (LUCAS, R.E., 1978).

An 'arithmomorphic approach' is to a great extent based on this assumption. Rationality understood as a norm of procedure is presented in an axiomatic form of positive knowledge. A 'causal-genetic approach' is more concerned with the bounded rationality of decision units which, in a world of ignorance and uncertainty make their choices under restricted and incomplete information.

Because the contribution of theory should not entirely be regarded separately from the empirical phenomenon, a brief presentation of the reference system 'futures markets' that provides elementary facts and some institutional properties from the point of view of a theoretical analysis is given below.

Chapter II The Empirical Reference System: Futures Markets

1 Definition and Institutional Setup

In futures markets, trading is carried out under special regulations and conventions which are more restictive than those applied to any other class of transactions. They serve primarily to facilitate hedging and speculation by promoting exceptional convenience and economy of transactions[1)].
Because futures trading deals in a particular manner with the 'future', the rationale for its existence can also be sought in the general uncertainty of future events. Uncertainty becomes a matter of economic relevance when rationally acting market participants make plans. Plans as a notional anticipation of future actions are indispensable if one takes into consideration that tomorrow's decisions are not independent of the ones made today, and vice versa. For those who participate therein futures markets serve as an instrument to make the future more transparent, by facilitating sales or purchases of goods whose corresponding contracts are to be fulfilled in the future. This concerns the sphere which is closely connected to the more general notion of 'intertemporal allocation'.

Futures trading requires two different but closely related markets. One is the actual market (spot or cash market) where contracting and actual fulfillment (trading) take place contemporaneously (virtually within a few days) by delivery of the physical goods at the actual price (spot or cash price). These contracts are usually adopted with respect to the special requirement of buyers and sellers and therefore often represent individual arrangements between the contracting parties. In general,

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1) This definition stems from H. WORKING (1953, p. 315), who exemplified the case of futures trading in commodities. Because of its general nature, the above definition also serves as a comprehensive description of futures trading.

these arrangements comprise items like quantity, quality, date and place of delivery. Individual arrangements are also characteristic for the activities on forward markets. But while in the cash market every buying or selling commitment is carried out immediately, forward market contracts are not fulfilled before their transmission time has passed. For example, this allows a producer to buy his required raw material for future delivery in advance.

In contrast to cash and forward markets in futures markets delivery is exceptional. E.g. in currency futures markets only about 1 % of all contracts are settled out by delivery. The subjects traded on futures markets are not commodities or financials themselves but contracts for their future delivery. Thus, a commitment to make (take) delivery of a real or financial good, stemming from the sale (purchase) of a contract, can be offset by an opposite transaction at the exchange. For example, the buyer of a June German Mark contract can offset his commitment to take delivery by selling a June German Mark contract on the exchange. An important precondition for trading the contracts at exchange is their standardization in several respects:[1)]

- Standardization in place: Trading of futures contracts is possible only at the exchange. The place of delivery is also standardized.

- Standardization in size: Each contract is restricted to a fixed amount, for example to 40 000 pounds of cattle, or 125 000 German Marks.

- Standardization in quality: In the case of commoditiy futures, certain kinds of physical standards of quality are required.

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1) For a description of these standardizations compared to those in forward markets see STREIT, M.E. (1981b, pp. 184 f.).

- Standardization in time: Time is standardized in two respects. There are only a few dates of maturity for the contracts, often only four maturity dates a year. Also, the last day to trade the contract is fixed. For long-time for currency futures contracts only March, June, September and December contracts are possible. Now there are also January, July and October contracts. Delivery date for all these contracts is the third Wednesday in the month of maturity. The last trading day, e.g., for German Mark contracts, is two working days before delivery date.

- Standardization in person: At the exchange, a clearing house is interposed between buyer and seller. This clearing house acts as the opposite party in every transaction and guarantees the fulfillment of all commitments. Traders, therefore, do not need to worry about their trading partners. A security deposit (margin) is paid to the clearing house when a position is taken as a guarantee of good faith. The exchange provides an additional safeguard by allowing only members of the exchange to trade on the trading floor. Individuals have access to the exchange through futures commission merchants and their floor brokers. A number of prerequisites must be fulfilled before a broker is allowed to act in trading. This and the fact that the clearing house itself guarantees the fulfillment of contracts dimineshes the risk that a contract will be broken to a minimal degree.

The decisive advantage for the trader is that he knows at the present time the price for buying and selling. These futures prices are the outcome of the coincidence of supply and demand and are presumably to a great extent determined by the speculative activities of market participants. This speculative component is due to the necessity to assess the future relation of scarcity of the goods under consideration. It seems safe to conclude that futures prices are based on informations gained at

the prenent time and reflect the expected value at the time of expiration.

Possible transactions which could facilitate futures trading will be briefly analysed and the major functions of futures markets will be shown.

2 Transaction Possibilities with Particular Reference to Conflicting Theories of Hedging

The possible transactions that can be carried out in futures markets are[1]: Arbitrage, hedging, speculation and spreading.

2.1 Arbitrage

Arbitrage means the simultaneous establishment of two opposite positions for the same 'good' in different markets. Because the buying and selling prices are known, this procedure is in general fairly risk free. The profit maximizing arbitrageur makes use of different prices for the same 'good' in various markets. The transaction is profitable if the resulting difference between these two prices at least covers the cost of transaction. The arbitrage transactions keep the prices between different contracts in line. Another form of arbitrage (temporary arbitrage) keeps the prices between cash and futures markets in line and interest rate arbitrageurs make use of sufficiently large interest rate differentials as the basis of simultaneous transactions in cash and futures markets.

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1) See, for example, DUSHEK, C.J./HARDING, C.J. (1979, pp. 22f.) who give a good explanation of the functioning of these transactions in currency futures markets, or GOSS, B.A./YAMEY, B.S. (1976) in the case of commoditiy futures.

2.2 Hedging

Hedging describes a simultaneous and contrary activity in the spot and the futures market.
A hedger contradicts his accepted position in the spot market by a reversal action in the futures market; for example, he sells in the spot market at the actual price S and cancels the delivery commitment by immediately buying a futures contract at the prevailing price F, so that the position held in one market offsets the position in the other. The difference (S-F) between the two prices S and F is called basis (B) and may be positive in the case of backwardation or spot premium negative in the case of contango or forward premium, or it may be zero. Several theories serve to explain why it may be rational to hedge - each of them stressing a distinct point of view.

The first theory, originally inaugurated by J.M KEYNES (1930, pp. 127 - 129) and refined by J. HICKS (1939), lays considerable emphasis on the argument that hedging allows for the transfer of the risk of price change from hedgers to speculators. This transfer is only possible if it is assumed that speculators are less risk averse than hedgers. In this sense, futures markets could be analysed with respect to two groups: On the one hand, there are hedgers, who are cautious in their handling of contracts and generally risk averse, and on the other hand, there are speculators, who can be seen as serious gamblers earning their money by professionally taking price risks. This is what M.E. STREIT (1982a, p. 1) calls '...the conventional dichotomy of market transaction ... (which) represents an inadequate abstraction ...', while L.H. EDERINGTON (1979, p. 157) interprets this 'inadequate abstraction' as 'the classic economic rationale for futures markets (which) is, of course, that they facilitate hedging - that they allow those who deal in a commoditiy to transfer the risk of price changes in that commodity to specu-

lators more willing to bear such risks'. The discussion about the motives of hedging still continues, last but not least because the various empirical consequences differ considerably.

2.2.1 Hedging for Risk Shifting

For a moment, let us follow the risk-shifting motive of KEYNES and HICKS. Even if the dichotomisation in hedgers and speculators was agreed on, a total risk shift only occurs if spot and futures prices move 'in concert' (parallel movement)[1], which is an extraordinary assumption and in general rejected from an empirical viewpoint. In all other possible cases, risk shifting in the sense of risk avoidance is incomplete and consequently the possibility of gain and loss in a hedged position still remains[2].
This argument necessitates a slightly different consideration. Axiomatic to hedging would then be the assumption that the likelihood of gains or losses in a hedged position is smaller than in an unhedged one.
To put it into a different perspective, in terms of price fluctuations the variance of the basis must necessarily be smaller than the variance of spot prices,

$$\text{var}(B) < \text{var}(S) \tag{9}$$

because of

$$\text{var}(B) = \text{var}(S) + \text{var}(F) - 2\text{cov}(S,F) \tag{10}$$

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1) This seems always to be implicitly admitted, although hardly consciously recognized, in discussions about the 'nature' of a hedge. See WORKING, H. (1953, pp. 321 f.).

2) The possible outcomes of hedging are clearly shown in YAMEY, B.S. (1951, p. 308) or in STREIT, M.E. (1980a, p. 539).

this is only true if

(11) $\quad var(F) < 2cov(S,F).$

The relationship between S and F in terms of cov(S,F) is a rough indicator of the functional dependence between spot and future prices[1]. In the case of futures trading a covariance above zero is expected and is usually given. This point is decisive for the futures prices' predictive power with respect to future spot prices. Obviously, in the case of a perfect hedge (parallel movement) var(B) will be zero. This means that the basis does not change but, of course, it does not necessarily mean that the prices themselves do not change. For var (B) = 0, equ.(10) can be rewritten as

(12) $\quad var(S) = 2cov(S,F) - var(F).$

If var(S) is expected to be positive, equ.(11) is valid as a general condition for the risk-reducing performance of a hedge.

Before the next step is made, it is probably useful to stop for a moment to illustrate this result with a more conspicuous example. For the time series for spot prices S and futures prices F of a certain futures market let us suppose a relationship like

(13) $\quad F = aS + b$

with a, b being real numbers. It may not seem very convincing to postulate such a functional relation between S and F.
To avoid possible objections it is necessary to note that the

1) An appropriate indicator is the coefficient of correlation. For the purpose of the argument, the covariance may be sufficient, however it is possible to rewrite the equations in terms of coefficients of correlation, of course.

function under consideration does not imply that spot prices or futures prices change in a linear way; empirical facts cannot confirm such linear price movements. Prices may throughout time develop in a highly complicated stochastic process. The nature of this process may be entirely unknown. The only stipulation made is that a linear relationship (in the above form) exists between the generating processes of the two time series. Furthermore, for the sake of the subsequent algebraic analysis, it is convenient to linearize the equations. This kind of presentation will turn out to be very useful with respect to efficiency and prediction tests which will later be considered in detail.
Therefore, in equ.(13) the coefficient a can be interpreted as a measure of distortion between spot and futures prices, which is assumed to be constant throughout time. Coefficient b is a constant shift parameter related to the absolute level of spot prices. If b is above zero, it stands for a forward premium or contango, if b is beneath zero, it may stand for the KEYNESian normal backwardation case. But it is necessary to note that this interpretation is not independent of the parameter a and is only true for particular values of this parameter.

The variance of the basis can be written in terms of σ^2 for the calculated variance of S. According to equ.(10), this leads to

$$(14) \qquad var(B) = (1 - a)^2 \sigma^2 ,$$

i.e., var(B) is a certain multiple of the variance of spot prices.

First, the case of a perfect hedge is considered: var (B) = 0 means that a perfect hedge is only possible if a = 1. In terms of the earlier interpretation, total risk avoidance presupposes that there is absolutely no distortion. This is a familiar result for the case of a perfect hedge. If b is supposed to be negative, it

may serve as a measure of payments which hedgers transfer to speculators for taking the risk of the price change indicating the case of normal backwardation.
Second, with the restriction of a perfect hedge now set aside, the basis is allowed to change throughout time with var(B) > 0. As a necessary condition for an advantageous hedge in the sense of reduced risk, inequ.(11) is developed which in our example provides the requirement

$$a^2 \sigma^2 < 2a\sigma^2 \quad \text{or}$$
$$a < 2.$$

The implications of this condition are the following: If parameter a exceeds 2 the distortion between spot and futures prices will become unfavourable to such a degree that an unhedged position is more risk reducing than a hedged one. In fact, this would mean a reversal of habitual positions. Hedgers would actually speculate because they 'hedge' and speculators would actually hedge their position because they 'speculate'. Whether this is in fact supported by any empirical evidence is a priori impossible to judge. But there are good reasons why this case is merely theoretical.
If the parameter a equals 2, market participants are indifferent with respect to hedging their positions. By not taking into account possible hedging costs from the point of view of risk reduction, a hedged position is as 'safe' as an unhedged one.
For all values $1 < a < 2$, a hedge facilitates risk reduction. The smaller the parameter a is, the better is the possibility for risk reduction, while $a = 1$ is the classic case of risk avoidance (the case of a perfect hedge). Even for values of a between zero and one, a reduction of risk avoidance is possible compared to the unhedged case, but although the measure of distortion becomes smaller, the risk connected with the hedged position increases. This is because each deviation of the actual a from its neutral

value $a^* = 1$ results in a higher risk which is nevertheless smaller than if no hedge was undertaken.

In the following statements, an attempt is made to put these considerations into a visual framework. To do this, it is first necessary to develop an 'objective measure' of what is meant by the term 'risk' or 'risk avoidance'. The parameter ρ denotes the ratio between the variance of the hedged position and the variance of the unhedged position.

$$(15) \qquad \rho = \frac{var(B)}{var(S)} .$$

The same kind of argumentation used above can again be applied. Therefore, if $\rho > 1$, the variance in the case of hedging is greater than in the case of non-hedging. This means that making a contract 'secure' by hedging is riskier than keeping clear of hedging.

For $\rho = 1$, both variances are equal; this indicates an indifferent solution, while for $\rho < 1$ and therefore (var(S) > var(B)), the usual argumentation concerning hedging performance hold true.

From equ.(10) and equ.(15) follows:

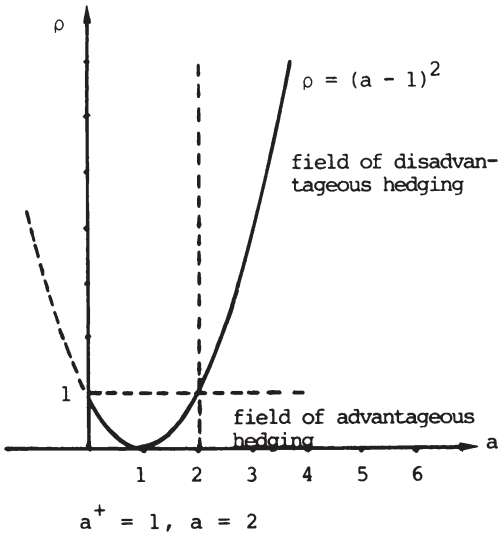
$$(16) \qquad \rho = 1 + \frac{var(F)}{var(S)} - 2\,\frac{cov(S,F)}{var(S)}$$

and, after considering equ.(13), we get

$$(17) \qquad \rho = 1 + a(a - 2).$$

Note that in equ.(17) ρ is independent of σ^2. This is immediately obvious if one keeps in mind the particular linear function between S and F shown in equ.(13) with a total coefficient of correlation cov(S,F)/var(S)var(F) = 1. Therefore, the risk measuring parameter ρ depends exclusively on the value of a (and not, for example, on that of b).
Now the dependence of the risk-measuring parameter ρ with respect to the measure of distortion between spot and futures prices (parameter a) can be depicted in a diagram.

Graph 5: Relationship Between Risk and Distortion
(Total Correlation ρ =1)



The starting point of this discussion was the risk-shifting motive for a hedge by KEYNES and HICKS. Hedgers try to avoid or, at least, to reduce the risk of future price changes by selling and buying contracts simultaneously in both (spot and futures) markets.

As a consequence, traditional hedgers would confine their actions to a field of advantageous hedging in the sense explained. In terms of the above model this would restrict the parameter a to $0 < a < 2$. In these cases, payments to speculators could be interpreted as a risk premium.

Adherents of alternative explanations of hedging do not accept this reasoning. They deny the basic assumptions made above, namely the division of risk and its transfer from hedgers to speculators. In their opinion, individualistic market behaviour is shown differently[1)]. They criticize the hedging performance as outlined by KEYNES on the grounds that it only allows a description in terms of routine hedging, i.e., stresses the analogy of an insurance contract between hedgers and speculators (corresponding to certain values of 'a' in the model) and therefore ignores two decisive objections (STREIT, M.E., 1982a, p. 4):

1. the fact, that the statistical proof of a significant and stable risk premium in general and in the long run has not yet

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1) See, for example, HIRSHLEIFER, J. (1977a, p. 975), who calls this traditional view of hedging the 'risk-transfer hypothesis' and the following explained theory the 'knowledgeable-forecasting hypothesis', while in this paper more emphasis is placed on the presence or nonpresence of expectations.

been shown apart from 'certain points in time'[1],

2. the possible variations in the different forms of hedging. Their utilization requires different motives.

2.2.2 Hedging for Profit Making

The second theory takes account of this multi-purpose concept of hedging[2], and is based mainly on the existence of the hedgers' expectations about price movements; a desideratum, which seemed to be redundant in the previous explanation. The particular consideration of expectations as a significant decisive factor with respect to hedging lays greater stress on the speculative motive than on the insurance motive: Optimal hedging decisions are at the same time optimal speculation decisions[3].

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1) For example, see the investigation of PAPADIA, F. (1979) who discovered a risk premium in the forward exchange market. However, his findings are not totally convincing, because they were exclusively based on a simple correlation analysis. Another article by CORNELL, B. (1977), presents estimates of different hypotheses of market efficiency by taking a risk premium explicitly into account. W. GAAB (1980a) found some statistical evidence of backwardation in currency forward trading, and recently O'BRIEN, T.J./SCHWARZ, P.M. (1982) discovered some strong significance for a risk premium (but see also WILSON, J.F. (1982)). C.A. BATLIN (1983) found that, given some plausible circumstances, a hedged position may even turn out to be riskier than the unhedged position. For a more general viewpoint of hedging practices, see WARDREP, B.N./BUCK, J.F. (1982).

2) H. WORKING (1962) lists the following: Carrying-charge hedging, operational hedging, selective hedging, and anticipatory hedging. The case of risk-avoiding hedging by KEYNES and HICKS is 'virtually nonexistent in modern business practice' (p. 442). As an empirical investigation which examines different hedging-strategies see ROLFO, J./SOSIN, B. (1983).

3) See GIDDY, I.H. (1976, p. 97).

In some of its aspects, this challenging view dates back to about 1946, e.g., the work of H.S. IRWIN[1] about the passive role of hedging. However, its main roots can be traced back to a series of articles by H. WORKING (1949a, 1953, 1958, 1962)[2]. The central ideas claim that it is hedging that forms the basis of futures trading, i.e., that hedging behaves like the driver, 'and speculation in futures like a companion going where hedging gives it opportunity to go' (WORKING, H., 1953, p. 318).
According to this theory, hedging is interpreted as speculation in relative price changes, in comparison to speculation in absolute price changes. Seen in this light, speculation in relative price changes involves 'trading the basis', expecting movements of spot and futures prices not to be parallel, so that the difference between them is likely to change. Corresponding to the hedger's initial commitment, these different price movements ultimately lead to profit or loss positions, and hedging may be more adequately described by '...the purchase or sale of futures in conjunction with other commitments, usually in the expectation of a favourable change in the relation between spot and futures prices' (H. WORKING, 1953, p. 326). This means that in contrast to routine hedging a hedge is only carried out if there is a prospect for profit. This attitude is therefore labelled selective hedging.

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1) See WORKING, H. (1961, p. 161 footnote).

2) In this context, the work of G.W., HOFFMANN (1932) is usually mentioned. He gives some hints as to which losses or profits of a hedge to a certain degree can be 'expected' (p. 45), and sees the business of hedgers to foresee gains accurately and take advantage of them, or to avoid losses as far as possible (p. 418). On the other hand, he explains as a principal reason for hedging the 'competitive advantage of shifting the market price hazard to others' (p. 381); see also his definition of hedgers confirmed in the following pages, where the speculator is introduced as the main adversary of the hedger. One can conclude that HOFFMANN was most probably not very interested in this particular aspect of futures trading. For a detailed discussion of the subject, see YAMEY, B.S. (1983).

To return to the model introduced above: According to this, a hedger's decision would only have led to 'the expectation of a favourable change in the relation between spot and futures prices' if, in terms of the variance, the probability of such a favourable change had already become sufficiently high in the hedger's personal view. WORKING's definition abstracts from this kind of uncertainty in a particular manner. It assumes that the hedger, when he wants to take a position, trusts in his expectations without taking into account the degree of vacillation in the market prices[1)].

In other words, even if a hedger is certain about a future price change which would make a hedge profitable, he would not be prepared to hedge in the case in which the vacillation of the basis 'exceeds that of spot prices'. Otherwise, his chances would be no better than through the toss of a coin or even worse.

If this interpretation is to be meaningful, price fluctuations must surely enter the calculation, and hedging against this risk again becomes reasonable in the KEYNESian sense. This argument is clearly pointed out by B.S. YAMEY (1982, p. 15): 'price volatility ... explain(s) the traditional and still common association of hedging in futures with the avoidance or reduction of price risk ... (and) there are no good grounds for de-emphasizing price risks in the discussion and analysis of hedging'[2)].

A third interesting way to explain hedging lies in the application of portfolio theory which allows to combine risk and returns in an appropriate approach. This theory is widely developed in an

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1) WORKING clearly recognizes this point when he (in a slightly different context) writes: 'many people will state expectations with great confidence, but evidence no confidence at all when faced with a challenge to act on their stated opinion', (WORKING, H., 1949a, p. 151).

2) An article which deals with this problem by introducing 'volatility tests' was written by SHILLER, R.J. (1981). He uses a parametric test over mean and variance, although more in the context of the 'efficient-market hypothesis'.

article by J.L. STEIN (1961) and is applied by L.H. EDERINGTON (1979). Because a detailed discussion of all transactions is beyond the scope of this paper, attention is only briefly drawn to the above-mentioned ones[1].

2.3 Speculation

Contrary to hedging and arbitrage, speculation is not immediately counterbalanced by an inverse act. Therefore, speculators 'trade the absolute prices' of contracts by taking a position, that is expected to be profitable by liquidation. The interim period may be within a day (scalping), within a couple of days (day trading) or it may occur at the maturity of the contracts (position trading)[2].

The main motive for speculation is assumed to be profit maximization. In terms of the KEYNESian routine hedger, a speculator is regarded to be his 'natural' counterpart, whose risk avoidance correlates to the speculator's risk acceptance. The empirical fact of a missing risk premium - which is usually expected to appear in the form of spot prices that exceed futures prices - is often regarded as a striking piece of evidence against the KEYNESian interpretation.

But this is not a totally convincing argument, and there are many reasons that a basis which is zero or even negative does not necessarily tell against routine hedging.

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1) For example, the obvious distinction between commodity futures markets and interest and currency futures markets as their neighbours is neglected due to the storability of those commodities and the resulting costs, therefore the more complex variations of hedging such as 'carrying-charge hedging' and its fine distinction to 'temporary arbitrage' are disregarding. See STREIT, M.E./QUICK, R. (1982, pp. 314 ff.).

2) See STREIT, M.E./QUICK, R. (1982, p. 316).

This can be shown by considering the life of a certain contract from time $t = t_o$ to $t = t_1$. Time t_o indicates the day of delivery and t_1 the day of maturity. It assumes that hedgers in the conventional KEYNESian sense are:

- uninformed,
- without expectations,
- interested in a short hedge for the purpose of risk avoidance or at least risk reduction.

Therefore, this market has already fulfilled the conditions elaborated above in the 'variance-model'. Furthermore the existence of speculators seeking profit by professional risk-taking can be characterized to be

- building expectations,
- calculating their risk rationally,
- seeking and processing information.

A possible constellation describing a contract in t_1 may be the following (see graph 6):
The futures price F_o can be regarded as an estimation in t_o for the future spot price S_1 in t_1.
This estimation is assumed to be based on the speculators' set of informations available in t_o. Of course, they are not entirely sure about the actual price S_1, and therefore F_o stands for the expected value S_1^+ of S_1 which means that speculators have a certain probability density function in their mind which gives them an 'idea' of S_1.

A possible presentation is shown in graph 7 by curve a. Speculators use S_1^+ as a reliable value in their estimation. It may also be possible that they calculate in terms of a 2σ-interval[1)] as a security range covering 95 % of all possible cases, which is not decisive for the argument, but should be kept in mind.

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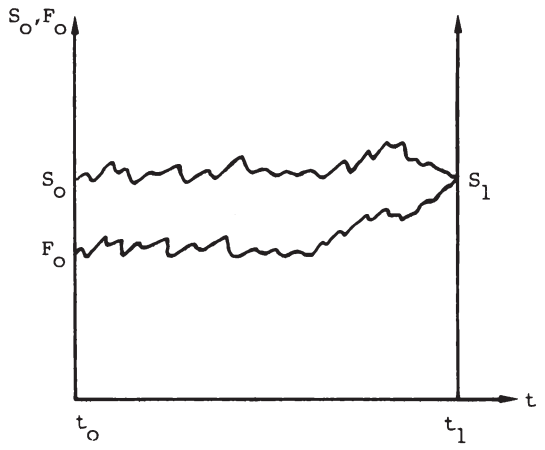
1) σ indicates the standard deviation.

Graph 6: An Example for a Contract's Life



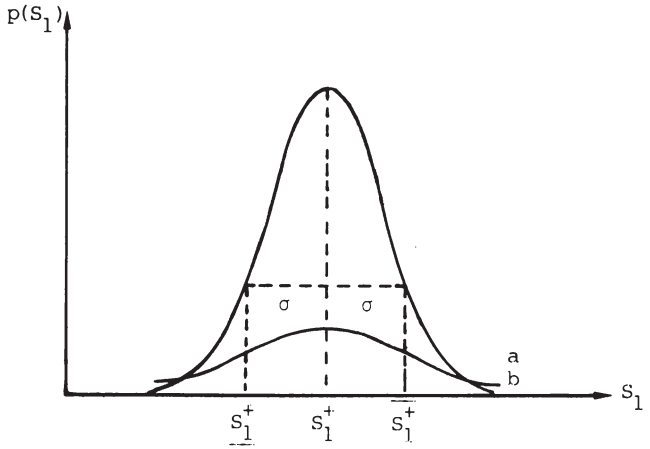
Curve b in graph 7, stands for a hedger's 'picture' of future spot prices. Because this curve is extremely flat, almost all values of S_1 seem to be possible with the same 'degree of confidence'. These circumstances make sense for him to buy the speculators' 'service' to bear the risk of wrong estimations more accurately.

Without explicitly introducing a speculators' utility function, it is plausible that to take this risk
- all costs of his particular information activity
- all general costs of his activity and
- an appropriate profit span

must be born and paid by the hedger.
These charges are usually included in the risk primium; therefore, the basis is greater than zero. Graph 6 illustrates such a

situation which represents the KEYNESian case of normal backwardation.

Graph 7: A Probability Density Function of S_1



Two problems, however, arise immediately:

1. For an external observer, F_o is no longer a reliable predictor for S_1, because F_o constantly underestimates S_1. This bias is probably not fixed, but variable, depending on the steepness of the conjectures probability function.

2. It will be extremely difficult to settle with any degree of confidence the difference between the spot and futures prices, $(S_o - F_o) = B_o$, as an appropriate indicator of a risk premium. This is because speculators in the above sense calculate their risk premium in terms of the expected spot price and futures price, $(S_1^+ - F_o) = B_1^+$.

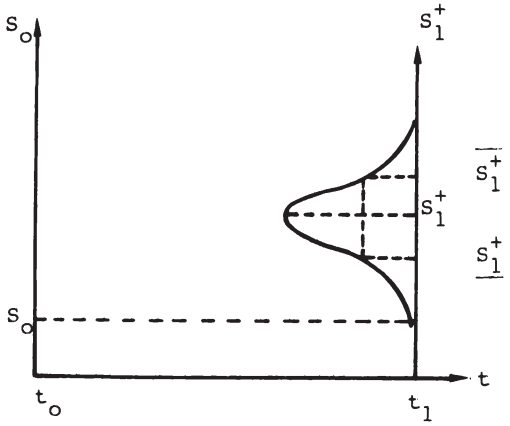
For the sake of argument, if one assumes the speculators' forecast to be correct, i.e., $S_1 = S_1^+$, then $B_1 = B_1^+$, as the expected payments from hedgers to speculators, as based on the speculators' rational calculus.
$S_1 \neq S_1^+$ implies $B_1 \neq B_1^+$, so that a speculator will earn additional profits or, if costs exceed receipts, he will experience losses. The existence of this transitory component will be the normal state of affairs, although its range is restricted by a certain degree of probability, which is characterized as a more or less steep conjectured density function.

Because point 1 is not of interest here, attention is drawn to point 2 with some additional reflections. If speculators expect S_1 to be greater than S_o (i.e., $S_1^+ > S_o$), graph 8 is applicable.

Given this situation, a short hedge is normally unfavourable, but again the routine hedger is completely indifferent to futures prices although, as will later be shown, this assumption does not upset the argument.

Now, how should the futures price F_o be settled? Competition among speculators will not allow the business to be run at 'any price'. Therefore, if B_1^+ is assumed, just for clearity of insight, to be x % of S_1^+, it may well be plausible that F_o exceeds S_o. This usually indicates a spot premium, $S_o - F_o < 0$,

Graph 8: A Probability Density Function in the Case of $S_1^+ > S_o$

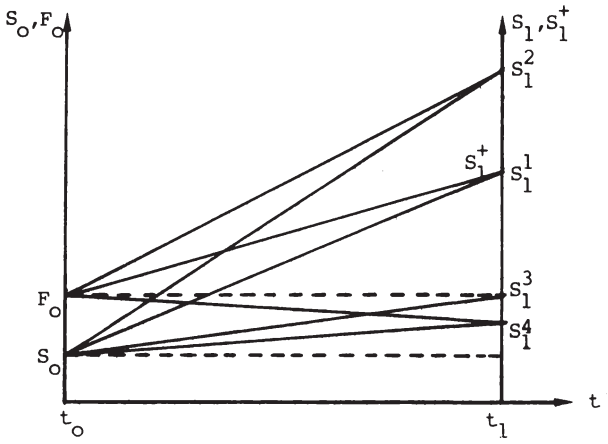


and, at first glance, tells against the existence of the KEYNESian notion of a 'normal backwardation' which, at a closer look, still exists ($S_1^+ - F_o > 0$).

Graph 9 depicts possible outcomes of the speculation, marked as S_1^1 to S_1^4.

S_1^+ marks the case $S_1 = S_1^+$, where speculators' expectations are totally fulfilled. This and the case of $S_1^2 = S_1$ are profitable

Graph 9: Possible Outcomes of Speculation



for speculators, and also for hedgers, although an unhedged position would lead to a greater amount of surplus.
If $S_1^3 = S_1$, there is no receipt for speculators, leaving them (due to costs) in the red, while for $S_1^4 = S_1$, i.e., when a hedge becomes profitable, speculation becomes unfavourable.

The net result of a hedge in S_1^3 is zero, while in S_1^4 a surplus emerges compared to an unhedged position. As graph 9 shows, speculation turns out to be profitable if the futures price F approaches the spot price S_1 in t_1, but only if F approaches from beneath ($F_o < S_1$).
Therefore a speculators' dilemma could be characterized by finding a price F_o, which, compared with his expected future spot price according to the laws of probability, promises him a profit

and ensures that he can take a position when he enters into competition with his rivals[1].

Ad rem: It is possible that the KEYNESian risk premium is partially compensated, or even overcompensated by, a 'reverse' bias. This means that there is no statistical evidence supporting this interpretation if one has the notion of a 'backwardation' defined in the usual sense.
Why, however, should such a 'reverse' bias occur? Does something like 'a priori'-knowledge exist which generally shifts expectations in one direction, i.e., that $S_1^+ > S_o$?
A possible explanation - in terms of an observable empirical phenomenon - could be inflated prices. If tomorrow's price is higher than today's due to a general underlying inflationary process, then indeed a reverse bias occurs, counterforcing a potential backwardation, and the final spot prices cannot be explained sufficiently without taking into consideration inflation expectations. If, however, this reasoning makes sense, then it will be difficult to deduce adequate conclusions, and therefore the empirical findings do not allow any particular results to be drawn concerning the relative plausibility of the theories, both of which are compatible with the data.

2.4 Spreading

Spreading aims to take advantage of conjectured changes of price differences either of contracts with different dates of maturity

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1) As a 'general trading rule', he could fix F_o as the 'lower' limit of the 2σ-band, ($F_o = S_1^+$).

(intra-spread), or of contracts with different commodities[1] with the same or with different dates of maturity (inter-spread).
If those beliefs in changes of price differences are correct they may result in profit-making. A characteristic of spreading is the fact, that open positions are counter-balanced in reversal positions either in a different market (inter-spread) or in the same market in a different (longer or shorter) contract.
Such activities correspond - according to the underlying motives - with more emphasis on risk reduction, to a hedge or with more emphasis of profit-making, to arbitrage.
And again, elements of speculation are involved, namely if the case of an intra-spreading is considered where, due to the different dates of maturity of the contracts an 'open position' will occur for a short time, so that the conditions of speculation are fulfilled. Therefore, spreading may embrace the whole range of stimulating motives, except the pure risk avoidance motive of a routine hedger, although it has to be admitted that the bulk of these motives probably lies more between the two ranges of motives of arbitrage and pure speculation[2].

The risk connected with spreading transactions is smaller than the one connected with speculation, because open positions are not held and, because of transactions like arbitrage and carrying-charge hedging there is a tendency to "normal" price differences between the two contracts. Lower risk reduces the deposit that has to be paid for the establishment of a spreading position in comparison to the establishment of two speculative positions[3].

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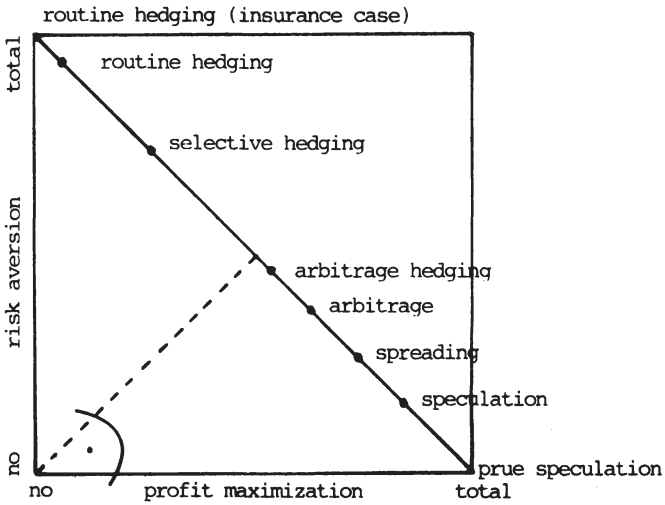
1) M.E. STREIT (1980a, p. 545) restricts an intra-commodity-spread exclusively to the case of substitutional goods.

2) See STREIT, M.E. (1980a, p. 545).

3) See KROLL. St./SHISHKO, J. (1973, p. 126).

As was shown earlier when other possible transactions were discussed, it is rather difficult to speculate about the motives for these activities. For reasons of simplification, if routine hedging is put aside[1)], it seems rather arbitrary to attach certain motives to certain transactions. Nevertheless, for purposes of clearness, graph 10 attempts to integrate risk aversion and profit maximization.

Graph 10: Possible Transactions in the Light of Risk Aversion and Profit Maximization



The arbitrary nature of graph 10 may focus the attention on whether or not it is desirable at all to classify transactions in this respect.

1) Routine hedging interpreted as the classical insurance case.

It may, on the other hand, be more useful to view them from their efficiency standpoint in respect to disturbance and adaptation within the framework of a market-oriented system.
In view of this possibility, more stress should be laid on the 'price levelling' ability of arbitrage and spreading as well as on speculation and the different profit-oriented kinds of hedging. This does not imply that prices should be levelled. Of interest, however, is the capacity to produce prices according to a permanently changing information situation, i.e., prices which are able to indicate relative scarcity as accurately and immediately as possible.

3 Economic Functions of Futures Markets

3.1 Microeconomic Functions

Possible microeconomic functions of futures markets are:[1)]

- Risk reduction (because futures markets provide hedging possibilities);
- Credit facilitation: It is easier to acquire credits for traders who hedge their positions.
- Capital investment especially for speculators, because only about 10 % of the contract value is to be paid in advance. Furthermore, it is easier to activate, e.g., in currency futures markets than in interbank foreign exchange markets.
- Collection and dissemination of information: There are many participants in futures markets and all of them send signals to the exchange. The results of all transactions, i.e., the futures prices, are publicly available; futures prices for example appear in the financial section of major newspapers. Another advantage of futures markets comes from the fact that partici-

1) See, for example, STREIT, M.E. (1980b, 1981b).

pants do not need as much information as traders on spot or forward markets. For example, a seller of futures contracts does not need to search for a trading partner who wants to buy his contracts, nor does he have to care about the integrity of his partner because his vis-a-vis is always the clearing house of the exchange.

3.2 Macroeconomic Functions

Macroeconomic functions of futures markets are, for example:

- Improvement of intertemporal allocation[1]. If the differences between spot and futures prices are greater or smaller than the cost of storage arbitrage becomes profitable. The deviation signals the expected future market conditions. The induced arbitrage reduces intertemporal differences in scarcity.
- Stabilization of prices: 'Futures trading can be considered to have a stabilizing influence on commodity (or fincancial) spot prices if fluctuations of these prices in terms of frequency and/or amplitude are smaller when a parallel futures market exists'[2]. It is difficult to test the hypothesis of price stabilization empirically, because the test period with futures trading is not the same as the period without futures trading. But some 'a priori'-reasons for a stabilizing effect can be specified[3]. For example, futures markets are like clearing centres for information. 'With the introduction of a futures market information, once widely dispersed among the participants of a heterogenous product market is now collected at a central market place'[4]. Futures markets can accelerate the

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1) See WORKING, H. (1949).

2) STREIT, M.E. (1980c, p. 495).

3) See STREIT, M.E. (1980c, pp. 496 ff.).

4) STREIT, M.E. (1980c, p. 496).

speed of information usage and diffusion, and therefore the range of price changes can be reduced.

4 Institutional Properties of Futures Markets as an Aid to Theoretical Analysis

The main thrust of this section will be to examine to what extent institutional properties of futures markets may be described in terms of a certain reference model of market performance. Even if the risk of injuring the fundamental rules of adequate abstraction is run, this could be valid. The above-mentioned considerations will turn out to be very useful in assessing the understanding of those theories, which claim to provide sufficient explanation of the empirical phenomena 'futures markets' from a theoretical and therefore abstract point of view. In this regard, one may construct the image of a 'perfect market'.

This perfect market can be described in terms of the following constituent elements or properties[1)]:

1. All goods are homogeneous.
2. Supply and demand are independent of space (no differentiation in space).
3. Supply and demand are independent of time (no differentiation in time).
4. The market is completely transparent.
5. The market's structure is atomistic.
6. Access to markets is free.
7. Prices are adjusted immediately.

It is understood that demand and supply for all goods are banlan-

1) See for example OTT, A.E. (1978, p. 105).

ced in perfect equilibrium at every moment throughout time. Referring to prices, the 'law of indifference' is valid and the price indicates the equilibrium price.

Taking these seven assumptions as a benchmark, it is evident that no single existing market system will completely correspond to theory. A relevant question, i.e., whether serious deviations in certain assumptions exist, remains tentative or must at least be considered with extreme scepticism. Here, a serious deviation refers to any attempt to explain a real market phenomenon which deviates in such a serious manner in terms of this reference model that it fails. In what follows, an attempt is made to discover which of the 'perfect-market conditions' are gravely affected due to the institutional properties of futures markets per se.

ad 1

Trading with currencies may be the easiest way to reveal the homogeneity of goods, although the problem of inflation, which can be regarded as a source of inhomogeneity, still remains. But this kind of diversity may be the particular reason why currencies are traded at all. Therefore inflation, among other factors, will play a dominant role in the process of price determination itself. On the other hand, the very fact that goods are to a certain extent homogeneous permits trading. This is why in the case of commodity futures - as mentioned earlier - standards of qualification are undoubtedly required. However, if those standards are assumed to be given, homogeneity may be accepted.

ad 2, ad 3

These two requirements result from the notion of a zero-dimensional market where costs of transactions due to space and time cannot occur. Together with homogeneity, these assumptions ensure coincidence of demand and supply without any frictional expenditure. However, there is no denying that futures markets do not

work without any maintenance costs, although they facilitate this coincidence with a high grist-to grain-ratio. As will be shown later, these transaction costs will be handled with different degrees of abstraction in different theories.

ad 4

If complete transparency means that everyone (trader, broker) knows the prevailing price at any time, then futures markets surely fulfill this requirement. It is one of the constituent elements of those markets that the authorized dealers are permanently informed about the price and quantity of supply and demand.

Whether the price at which trading actually takes place can be interpreted as an 'equilibrium price' or just as a more or less haphazardly established constellation between selling and buying parties again remains a matter of abstraction and a controversal point between proponents of different theories.

But one could even go further by asking a more sophisticated question: Does complete transparency also mean a general and complete recognition of the motives and causes which activate individuals 'running a business'? At least with respect to 'causes', theories claim to provide 'plausible grounds for reasoning'[1)], but their size and breadth again differ considerably. This question concerns the problem of 'perfect information', which will be studied with particular emphasis, again because here again differnt levels of recognition come to light.

ad 5, ad 6

Both assumptions are certainly not fulfilled in real futures markets. Their general meaning is that the more numerous the

1) For example, a 'plausible ground for reasoning' could be the expectation of increasing scarcity of certain goods, if continuing purchases despite increasing prices of that goods are assumed.

market participants are, the less possible it will be for an individual to build up and exploit a monopolistic position.
Free access to the market will, naturally, support this tendency. But it is not useful to waste time here arguing that serious security requirements must be setup against this. Despite this, a certain minimum of breadth[1] must be reached anyway. Otherwise, market processes will not start or will lead to undesired positions of economic power. Indeed, at the beginning, currency futures suffered from weakness and the Italian Lira was cancelled for those reasons[2]. Today's futures markets are most likely to fulfill this condition.

ad 7

In the last part in this chapter, the instantaneous adjustment of prices is discussed. The classical theory argues in terms of an infinitely high velocity of price adjustment, an assumption which must not be in accordance with reality[3]. The problem of the appropriateness of this assumption is one of the hardcore questions to be dealt with, and it will be shown that theories again abstract in a distinct way from price adjustment.

One reason for choosing the above-mentioned reference system is because the performance and the results of the system are already known. This should enable to make critical reflections about other systems (e.g., futures markets) which deviate to a greater

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1) The term 'breadth' denotes that there are enough market participants as well as enough tradable goods.

2) See BROWN, B. (1978, p. 82).

3) Of course, homogeneity of goods or atomistic market structure are far from being realistic assumptions. But between the acceptance of the one and the rejection of the other lies the borderline of what is sometimes called adequacy of abstraction. Therefore, the pretension of adequacy itself has the property of a normative value judgement or at least results in a serious epistemological problem.

or lesser degree in certain aspects from the theoretical reference model - depending on the chosen level of abstraction - and to assess these differences in terms of this model. Of course, the proposed perfect-market model may be questioned in some or all aspects, and therefore the possibility of finding a more appropriate system should not be excluded 'a priori'.

However, a preliminary justification for choosing it may serve the fact that 'a well-functioning futures market is perhaps the closest real-world counterpart to the abstract model of a perfectly competitive market'[1)].
The benchmark, used to measure the functioning of these systems will be 'efficiency'.

1) See GOSS, B.A./YAMEY, B.S. (1976, p. 9).

Chapter III The 'Neoclassical' Perspective of Informational Efficiency

1 Introductory Notes

In the broad research field of 'market efficiency', a great amount of theoretical and empirical work is concerned with the generation and the properties of prices entailing efficient market performance.

Because coordination efficiency is relatively high in the empirical reference system of futures markets, further attention is drawn mainly, but not exclusively, to their information efficiency. Futures prices can be regarded as a market-coordinated aggregation of individual assessments about future scarcity relations. The hypothetical character of all these prices is due to the fact that planning decision units are exposed to fields of action governed by uncertainty. In this connection, planning as an anticipation of future action means that each single market participant acquires future information which is possibly relevant and makes a speculative evaluation with regard to his individual needs and interests. Because of the coordinative power of the market, the quantity of executed market actions finally results in the acceptance of one market price. This market price can be considered under two different aspects:

- As a market-clearing device, if at this price all desired transactions can be carried out.
- As an instrument to disseminate or diffuse information, if every initially collected and processed information is reflected by this price.

Futures markets are especially responsible for collecting and disseminating information. They are centres of rational price formation. Many types of tests have been developed to prove that markets exercise this function efficiently. Most of these tests refer to an appropriate form of PARETO-optimality. They define

efficiency in terms of the balance of marginal rates of substitution concerning production and utilization of information in the usual frame of microeconomic analysis[1]. It is assumed that people at least try to act rationally in their economic sphere. This approach called 'arithmomorphic approach' is presented in the following parts of this chapter.

2 The Arithmomorphic Approach

The following presentation of the arithmomorphic approach is divided into two interrelated steps.
First, the general idea is introduced by the illustration of a popular example. From this point, the central proposition of the so-called 'Efficient-Market Theory' is derived; (FAMA-approach). Afterwards, the statistical properties of this theory and some statistical implications - necessary for subsequent analysis - are elaborated on. A proper statistical background will prove to be advantageous for the understanding and for the criticism of the approach.
The theoretical foundations of the approach will be assessed. Its limitation or appropriateness will be discussed from a microeconomic viewpoint. This will be mainly carried out with reference to risk averse behaviour and will finally lead to additional and broader criticism. A last section will provide a brief conclusion and an appraisal of the approach.

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1) Efficiency tests in futures markets referring to the arithmomorphic approach are presented for example by HANSEN, L.P./HODRICK, R.J. (1980); KOFI, T.A. (1973); LEUTHOLD, R.M./HARTMAN, P.A. (1979); PANTON, D.B./JOY, O.M. (1978); STEVENSON, R.A./BEAR, R.M. (1970).

2.1 Presentation of the Basic Idea

The basic idea supporting this approach will be clarified in the following example:
Consider an automobile company with a great number of shareholders who try to make a profit on their assets. Consider also a smoothly-functioning stock market where, among others, these certificates are traded. Now, assume the development department of this firm constructs an Otto-motor (engine) with outstanding technical features. The first finished car is due to be available one year from now. Because it is likely to have the qualities of a bestseller, the company reckons with a high demand for their product and expects a significantly better profit situation. The information about this new construction is spread around by technical automobile magazines as well as by newspapers, so that virtually everyone knows about the event. In this context, the question of present interest is relevant for the price development of the shares in this company.
If shareholders also believe that the company's return situation will improve, they too reckon with higher dividends and/or an increase in undistributed profits. Ceteris paribus, this leads to a higher demand for shares due to a portfolio revision of the asset holders, which increases the price of the particular asset and brings down the price of all others, which have been sold according to the restructuring of portfolios. Every investor makes his own calculation about what he expects in terms of dividends and chooses a buying and selling strategy with respect to actual and expected market prices.
If he assumes the actual price to be higher than in the future, he will sell today to avoid losses. On the other hand, if he assumes the actual price to be lower than in future, he will buy today.

The aggregation of all these individual calculations is done in the market, where demand and supply are brought together under

the regime of the market price. Thereby, nothing changes essentially if futures markets are introduced. It seems safe to conclude that futures prices of such contracts, based on the information in time t, reflect the expected value at the time of expiration. This is characterized by the predictive capability of futures prices referring to future cash prices.
With regard to information-processing capacity, there will essentially be no difference whether spot prices or futures prices are referred to. This becomes immediately obvious if one accepts the central proposition of the 'Efficient-Market Theory' (EMT) which states that if markets perform accurately, they will not waste information throughout the process of price determination. Or, to say it differently, if only one bit of information exists which could be used for any favourable buying or selling strategy (i.e., announcements similar to those in the above example) then EMT claims, that this will be entirely used by the market participants so that in the end the price moves to a positon where it totally reflects the aggregated assessment of all information available at the actual moment of consideration.
Thus, efficiency in terms of EMT is defined as the performance of a market ...

> '... in which prices provide accurate signals for resource allocation: that is a market in which firms can make production-investment decisions, and investors can choose among the securities that represent ownership of firms' activities, under the assumption that security prices at any time "fully reflect" all available information. A market in which prices always "fully reflect" available information is called "efficient".[1)]

Leaving aside for the moment what is meant by 'available information', 'fully information-reflecting prices' build the cornerstone of this definition. 'Reflecting' means predictions, which, given all previously available information, are the best in terms

1) FAMA, E.F. (1970, p. 383).

of accuracy[1]. But by which mechanism are those prices generated? What kind of steering mechanism warrents efficient market performace?

2.2 Expected Return Models

If markets coordinate accurately in the above-mentioned sense, market forces will drive prices to positions where they fully reflect a particular set of information. The existence of such positions is based on the notion of a representative market mechanism and an information activity in terms of marginal adaptation processes claiming to be at a reasonably approximative state of equilibrium:

> 'the theory only has empirical content, however, within the context of a more specific model of market equilibrium, that is a model that specifies the nature of market equilibrium when prices "fully reflect" available information'[2].

According to this, models could be agreed upon which, for example, state that in equilibrium market efficiency can be described by the following equation[3] derived for a particular security's price p_t,

$$(18) \qquad p_t = E(\tilde{p}_{t+1}/H_t)(1 + E(\tilde{r}_{t+1}/H_t)^{-1} \ ,$$

where $\tilde{p}_{t+1}$ is a random variable indicating the next period's price, $\tilde{r}_{t+1}$ is the percentage return per period which is again a random variable and is defined as $\tilde{r}_{t+1} = (\tilde{p}_{t+1} - p_t)p_t^{-1}$ or, generally, $r_t = (p_t - p_{t-1})p_{t-1}^{-1}$, where E denotes the mathema-

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1) The terminology is inaccurate, therefore preliminary. Later on, precision will be provided.

2) FAMA, E.F. (1970, p. 413f.).

3) See ibid., p. 384.

tical expectation operator and H_t stands for a set of information available at time t. The expected return conditional on the set of information is defined as $E(\tilde{r}_{t+1}/H_t) = (E(\tilde{p}_{t+1}/H_t) - p_t)p_t^{-1}$. This definition makes clear that $\tilde{r}_{t+1}$ is a funciton of $\tilde{p}_{t+1}$, therefore at the moment it is sufficient to point out the properties of $\tilde{p}_{t+1}$ or, in more general terms, the sequence of prices (p_t).

2.3 Statistical Backround

The complete incorporation of information in the expected prices leads to the 'fair game' quality of price changes. Given $x_t = p_t - p_{t-1}$ the sequence (X_t) is called 'absolutely fair' if

$$E(\tilde{x}_1) = 0 \tag{19}$$

$$E(\tilde{x}_{t+1}/x_t, x_{t-1}, \ldots, x_1) = 0 , \qquad t = 1,2,3,\ldots$$

From

$$\tilde{p}_t = \sum_{i=1}^{t} x_i + c , \qquad c: \text{constant} \tag{20}$$

follows the sequence of prices (P_t) is a martingale

$$E(\tilde{p}_{t+1}/p_o,p_1,p_2,\ldots,p_t) = p_t , \qquad t = 1,2,3,\ldots \tag{21}$$

which is equivalent to

$$E(\tilde{p}_{t+1}/x_1,x_2,x_3,\ldots,x_t,c) = p_t . \qquad t = 1,2,3,\ldots \tag{22}$$

It follows

$$(23) \qquad E(\tilde{p}_{t+1}/p_o,p_1,p_2,\ldots,p_t) = c + \sum_{i=1}^{t} E(\tilde{x}_i/x_{i-1},x_{i-2},\ldots)$$

$$= c \; . \qquad t = 1,2,3,\ldots$$

The actual price will consist of this equilibrium price c plus a sum of random numbers, with properties as defined in equ. (19).

Equ.(21) can be generalized if the sequence (P_t) is considered as a sequence of random functions in a probability space[1], and if a σ -algebra H_t[2] is defined which is generated by $(P_o, P_1, P_2, \ldots P_t)$, so that equ.(21) can be rewritten as

$$(24) \qquad E(\tilde{p}_{t+1}/H_t) = p_t \; . \qquad t = 1,2,3,\ldots$$

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1) In this context, a random function is considered as a function f(w,t) of the two variables w and t. The variable t refers to time and will only take real values. Fixing the value of the argument w in f(w,t) results in a real function $f(w,t) = f_w(t)$ of the variable t, depending on the parameter w. Thus, to each outcome w of the experiment, corresponds a definite real function of the variable t. This function is called a realization (or a sample function) of the random function. According to this, a random function f(w,t) can be regarded either as a family of random variables $f_t(w)$, depending on the parameter t, or as a family of realization $f_w(t)$, depending on the parameter w.
Throughout this work the latter meaning is valid for a random function in general. See for further treatment KOLMOGOROV, A.N. (1956), or YAGLOM, A.M. (1962).

2) A σ -algebra is a family A of subsets of a given set Q with the following properties:
- If a set A is incorporated in Q, so is its complement $\bar{A}=Q-A$.
- If (A_n) is any countable collection of sets in A, then their union $\cup A_n$ and intersection $\cap A_n$ also belong to A.
Given any family B of sets in Q, the smallest σ -algebra containing all sets in B is called the σ -algebra generated by B.

In this case, the σ -algebra H_t contains the set of random price functions $(P_o, P_1, P_2, \ldots P_t)$.
For the purpose here, the σ -algebra H_t is extended in favour of a σ-algebra I_t, which is generated by $(P_o, P_1, P_2, \ldots P_t)$ and also by other random functions. Therefore, any random variable which depends on the past must be measurable with respect to I_t. This refers in particular to H_t, which is a subset of I_t, $H_t \subset I_t$.
This extension has a far reaching conclusion for, as shown later on, it does not restrict the price generating process to the sequence of the random variable (P_t), but also to any other sequence of random variables. Therefore, the informational content of I_t is greater than the one of H_t. Only if the price p_{t+1} is entirely determined by the sequence of random variables (P_t), the relation $H_t \subseteq I_t$ is valid.

Given I_t, equ.(15) is rewritten in the more general form of

$$E(\tilde{p}_{t+1}/I_t) = p_t. \tag{25}$$

Equ.(26) entails a stronger relation. By induction it can be shown that

$$E(\tilde{p}_{t+1}/I_{t-s}) = p_{t-s}\ , \tag{26}$$

$$t \geq s\ ; \quad t,s = 0,1,2,\ldots$$

so that the expected value or price in t+1 based on all information available s time-units ago would be the price at time t-s. Thus, the content of information bounded in I_{t-s} contains the history of the process up to time t-s. In other words, as time passes by, information increases, so that I_t is increasing, i.e.,

$$I_o \subset I_1 \subset I_2 \subset \ldots \subset I_{t-s} \subset \ldots \subset I_t. \tag{27}$$

Although each subsequence of (P_t) again constitutes a martingale,

the informational content grows throughout time. This implies that a σ -algebra as a measure of the informational content is an increasing function of time.
If in equ.(25) the equity sign is replaced by $\geq$ we get a sequence of (P_t) which is a submartingale

$$(28) \qquad E(\tilde{p}_{t+1}/I_t) \geq p_t \ .$$

Thus, given the information sequence (I_t), the expected price is equal to or greater than p_t. According to equ.(28), expected prices are not allowed to drop.

If equ.(28) is transformed in terms of expected returns, we get

$$(29) \qquad E(\tilde{r}_{t+1}/I_t) \geq 0,$$

stating that expected returns are non-negative.

But one should be aware of the following: Because the submartingale property states $E(\tilde{p}_{t+1}/I_t) \geq p_t$, the equivalent transformation for the expected returns is $E(\tilde{r}_{t+1}/I_t) \geq 0$. If expected returns are positive, the sequence (r_t) does not constitute a fair game as defined in equ.(19).

Another characteristic should also be noted:
Although x_t and r_t are not equally defined[1)], the following proposition remains valid: If the sequence of prices is assumed to obey a martingale, i.e., $E(p_{t+1}/I_t) = p_t$, the sequence of rates of returns is also an absolutely fair sequence as defined above. In other words: $E(r_{t+1}/I_t) = 0$ is a 'fair game'.

To be in line with the literature considered here, we follow E.F.

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1) The first case simply refers to first differences while the other considers the rate of growth.

FAMA, (1970, p. 385) and define the fair game according to

$$(30) \qquad \tilde{y}_{t+1} = \tilde{p}_{t+1} - E(\tilde{p}_{t+1}/I_t),$$

from which we derive the fair game characteristics[1], with respect to the information sequence (I_t).

$$(31) \qquad E(\tilde{y}_{t+1}/I_t) = 0,$$

or, in the case of expected returns

$$(32) \qquad \tilde{z}_{t+1} = \tilde{r}_{t+1} - E(\tilde{r}_{t+1}/I_t),$$

thus leading to

$$(33) \qquad E(\tilde{z}_{t+1}/I_t) = 0.$$

These definitions do not contradict equs. (19-22). Essentially, the content is the same. FAMA's definition although not clearly stated in his work, refers to the basic fair game proposition given in footnote 1 below.

In the development of the theory, only the statistical concept of the mathematical expectation was used until now. The presupposed

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1) A fair game may also be defined as follows: Let $P_n = X_1 + X_2 + \ldots + X_n$, $n=1,2,3,\ldots$ be the finite sum of n independent trails. Provided $E(X_n)=u$ exists, a fair game necessitates setting the stake s, so that the net gain $(P_n - sn)$ converges to zero by the laws of probability with n increasing. This is

$$\lim_{n \to \infty} \{|P_n - sn| \leq \varepsilon\} = 1|_{s=u}, \quad \varepsilon \geq 0$$

which is an analogon to the law of large numbers. Now, by choosing an ε which is smaller than the expected return $E(r_{t+1}/I_t)$, $\varepsilon < E(r_{t+1}/I_t)$, the non-fair game property of a submartingale is proved. See LAMPERTI, J. (1977) and KALLIANPUR, G. (1980).

condition was the existence of a finite expected value. In particular, no information was given on a special probability distribution behind the mathematical expectation values. So, in equ.(19) as the basic definition of the fair game quality, it is assumed that $E(x_1)=0$ and $E(x_{t+1}/x_t,x_{t-1},\ldots,x_1)=0$. Thus each single price change $x_t = p_t - p_{t-1}$ could have been drawn by different probability functions as long as they result in the stated values of their mathematical expectations. Another strange phenomenon occurs therein, although the martingale quality may be associated with an intuitive imagination of independence or at least unbiasedness, this is a premature conclusion. B. MANDELBROT (1966, p. 244) correctly pointed out that it is only the expectation which is unaffected and the probability distributions of x_{t+1}, or $x_t,x_{t-1},\ldots$ are not assumed to be independent of the distribution of x_1. Thus, there may well be a degree of dependence as long as the mathematical expectations are not concerned. These difficulties are easily resolved by introducing the 'random walk', or 'BROWNian walk' model. To give a more picturesque description of what is meant by a sequence of prices following a random walk, KENDALL, M.G. (1953, p. 87) has conjectured:

> 'The series looks like a "wandering" one, almost as if once a week the Demon of Chance drew a random number from a symmetrical population of fixed dispersion and added it to the current price to determine the next week's price'.

A less demonic definition of the statistical random walk consists of two properties:

A sequence of prices (P_t) constitutes a random walk, if and only if price changes, $x_t = p_t - p_{t-1}$; $t = 1,2,3,\ldots$, are mutually independent and identically distributed.

From this definition it follows immediately

(34) $$f(\tilde{x}_{t+1}/x_t, x_{t-1}, \ldots, x_1) = f(\tilde{x}_{t+1}),$$

i.e., the conditional density function is identical to the unconditional density function.
The model can be formalized, as was essentially done in equ.(20):

(35) $$\tilde{p}_t = \tilde{p}_{t-1} + x_t.$$

Given the independence and distribution assumption, the error term x_t, is specified by

(36) $$E(\tilde{x}_i) = 0$$

$$E(\tilde{x}_i \tilde{x}_j) = \begin{cases} \sigma^2 & i = j \\ 0 & i \neq j \end{cases} \qquad i,j = 1,2,3,\ldots$$

The mathematical expectation equals zero. This is obvious if the parameter c in equ.(22) is allowed to be any real number, offsetting the trend in the more general case where $E(\tilde{x}_i) = 0$. Therefore, if c not equal zero, a random walk with a trend is valid.
In the special case where $c > 0$, the sequence of prices coincides with the weaker relation of the submartingale property whereas, if $c = 0$, the martingale property is valid. There is no specific assumption about the shape of the underlying probability distribution. It is only necessary that expectation and variance are finite and constant. Then all serial covariances equal zero because of the independence assumption. However, all features derived for the martingale of fair game models are correct if the random walk model is valid. The reverse case, unfortunately, does not hold. Given the bounded knowledge in (H_t), the martingale property only rules out linear dependencies among $(\tilde{x}_i)$, while the statistical indepencence of the random walk model does not allow

any kind of dependence[1]. The only case in which noncorrelation entails independence concerns the normal or GAUSSian distribution. Provided all $(\tilde{x}_i)$ are identically normal distributed, a test of the martingale property would simultaneously be a test of the random walk model.

Thus, given the particular distribution assumption $(x_i) \sim n(0, \sigma^2)$, the 'white noise' process as defined in equs. (34-36) entails two remarkable points for random walk of prices, as stated in equ.(37). First, the variance of $(\tilde{p}_t)$ is easily calculable by rewriting equ.(35) as

$$\tilde{p}_t = \sum_{i=1}^{t} \tilde{x}_i . \tag{37}$$

This is equivalent to equ.(20) for c = 0. Note that the general rule is not jeopardized. Therefore,

$$E(\tilde{p}_t^2) = E(\sum_{i=1}^{t} \tilde{x}_i^2) \tag{38}$$

$$= t\sigma^2$$

indicates a time-dependent variance, which essentially means that the longer the process, the greater the variability of prices. In fact, with t increasing, the prices' variance rises above all limits:

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1) In literature, the random walk model is not always consistently defined. See, for example, GRANGER, C.W.J./MORGENSTERN, O. (1970, p. 71) or CONRAD, K./JÜTTNER, D.J. (1973, p. 578). The latter define the random walk only in terms of zero-correlation and therefore do 'not rule out the profitable application of more sophisticated trading rules, which are based on detected non-linear dependence of price changes'. Throughout this work, we stick to the definition given in the text.

$$(39) \qquad \lim_{t \to \infty} E(\tilde{p}_t^{\,2}) = \infty \quad .$$

Second, the mutual dependence of two successive prices, $\tilde{p}_{t-1}$, $\tilde{p}_t$, is denoted by

$$(40) \qquad E(\tilde{p}_{t-1}\tilde{p}_t) = (t-1)\sigma^2 , \qquad t = 2,3,4,...$$

respectively, for a distance of j periods, $\tilde{p}_{t-j}$, $\tilde{p}_t$,

$$(41) \qquad E(\tilde{p}_{t-j}\tilde{p}_t) = (t-j)\sigma^2 , \qquad 0 \leq j \leq t,$$

so that, in general, prices are correlated. The higher the correlation, the longer the process, the less distance between them. Throughout the analysis of price series in speculative markets, the random walk model became more and more the cornerstone of theoretical reasoning, and essentially all empirical research concerning efficient market performance refers more or less explicitely to the characteristics of a BROWNian motion when price developments are explained. One could even agree on the verdict as stated by M.D. GODFREY et al (1964, pp. 22 f.), that the random walk model is the only price-determining mechanism which is consistent with the unrestrained pursuit of profit motive by the market participants.

Basic research in this field was done in a pioneering work of BACHELIER, L. (1900), OSBORNE, M.F.M. (1959), WORKING, H. (1949a, 1974), KENDALL, M.G. (1953) and SAMUELSON, P.A. (1965a,b).

The brief introduction given here may suffice for subsequent analysis.

2.4 A FAMA-Model of an Informational Efficient Market System

The following section concentrates on the application of statistical price formation models in the field of the efficient market theory as presented in the previous section after outlining some technical details .
Thereby, an overwhelming part of recent empirical research is essentially based on FAMA's theoretical work about efficient market performance; for the case of forward markets, see GAAB, W. (1980a,b, 1983) and LEVICH, R.M. (1979); for the case of futures markets, see TAYLOR, St. (1982)[1].

2.4.1 Presentation of a FAMA-Model of an Informational Efficient Market System

FAMA's original contribution mainly consists in an extension of the existing research on the field of price formation in speculative markets. He was the first to connect the conditions of efficient information processing with market equilibrium. The developed partial models of markets can be transformed in hypotheses that can be tested. These models differ essentially with respect to the theoretical assumptions about the returns of capital[2]. For the first time, however, the purely descriptive investigation of price series which dominates in the earlier works of P.A. SAMUELSON (1965a) or H. WORKING (1974) was extended

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1) See also footnote 2 p. 100.

2) See E.F. FAMA (1976a, capt. 5).
The four models have the following properties:
1. Expected returns are positive (partly discussed in this work under the topic of submartingales).
2. Expected returns are constant.
3. Returns conform to a market model (i.e., follow a (non-linear) path of equilibrium).
4. Returns conform to a risk-return relationship.

and the martingale property of prices was derived in a broader frame of economic theory.

Unfortunately, besides a few rather general indications, E.F. FAMA (1970, 1976a) does not provide a clear and comprehensive presentation of EMT. To achieve better insight into the mechanism this theory implicitely makes use of, I will develop a complete FAMA-model of an information-efficient market system, consisting of two interrelated sub-models: A market equilibrium model and an information model.

The following discussion will shed some light on the limitations of these information models as well as provide some fundamental criticism about the appropriateness concerning the intended issue.

The model basically consists of five equations:

$$(42) \qquad p_t^* = E^*(\tilde{p}_{t+1}/H_t^*) \cdot (1 + E^*(\tilde{r}_{t+1}/H_t^*))^{-1}$$

$$(43) \qquad E^*(\tilde{r}_{t+1}/H_t^*) = (E^*(\tilde{p}_{t+1}/H_t^*) - p_t)p_t^{-1} > 0$$

$$(44) \qquad E^*(\tilde{p}_{t+1}/H_t^*) = \sum_i ({}_i\tilde{p}_{t+1} \cdot f^*({}_i\tilde{p}_{t+1}/H_t^*))$$

$$(45) \qquad f^*(\tilde{p}_{t+1}/H_t^*) = f(\tilde{p}_{t+1}/H_t)$$

$$(46) \qquad p_t = E(\tilde{p}_{t+1}/H_t) \cdot (1 + E(\tilde{r}_{t+1}/H_t))^{-1}$$

Equ.(42) indicates that at each point throughout time a security's price equals the next period's expected price, discounted by the expected rate of growth. Whatever the content of H_t^* turns out to be, prices are always generated with respect to the set of information, so that all implications of the informations are 'well built-in'. In this sense, prices are conditional on avai-

lable information. Because in this market model the equilibrium position is determined by the expected rate of return, the complete class of models is called 'Expected Return Theory' (ERT). Thus, equ.(42) is the market clearing condition as stated by ERT[1].

The left side of equ.(43) contains the mathematical expectation of a security's one-period return from time t to t+1. The expected return may be considered as strictly positive, as positive and constant, or follow a time-dependent equilibrium path[2].
In this context, however, it is not so important to specify exactly the value or range which the expected return is supposed to adopt. Here, the general structure of the system underlying the analysis is of interest. The right side of equ.(43) simply defines the expected return as the expected rate of growth of prices[3].
Equ.(44) defines the conditional mathematical expectation on the basis of a given probability distribution conditional on the set of information H_t^*.
The asterisk indicates 'market assessment', i.e., an assessment on a market level of aggregation. Therefore, $E^*(\tilde{p}_{t+1}/H_t^*)$ is constructed on the basis of the market's assessed conditional price distribution $f^*(\tilde{p}_{t+1}/H_t^*)$. Accordingly, $E^*(\tilde{r}_{t+1}/H_t^*)$ indicates the expected next-period return, assessed by the market on grounds of the processed information capacity at time t (H_t^*).
So far, the theory argues in terms of a certain grade of aggregation. Informational content and distribution function are supposed to exist on an aggregated level, in the market.

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1) For interpretation, see equ.(18).

2) Cf. FAMA, E.F. (1976a, p. 142).

3) For some methodological critism to this basic equation see LeROY, St.F. (1976, pp. 141 f.), and E.F. FAMA's reply (1976b, pp. 143ff.).

The formal completion of the system is provided by equ.(45), supposing that the market assessed, subjective probability function is identical to the objective probability function. This clearly marks the concept of MUTH's rational expectations, particularly if the metaphorical 'market' is just considered as a 'convenient way of summarizing the decisions of individual investors and the way to describe those decisions interact to determine prices'[1]. By this assumption, the system becomes logically consistent. Successive inserting instantly leads to the testable hypothesis of equ.(46) as the reduced form of FAMA's model.

Following this line of reasoning, it can be concluded that MUTH's rational-expectation scheme is behind FAMA's deliberations. In this case, equ.(45) serves as a link between subjective reality and objective meta-world in the rationale of the model.

The proof of FAMA's efficiency concept consists two separate hypotheses which are skillfully interwoven. For the sake of argument, they are referred to as:
1. Market-efficiency hypothesis
2. Information-efficiency hypothesis.

The market-efficiency hypothesis basically consists of equs.(42) and (43). Equ.(42) may be considered as a reduced form of a more explicit market-clearing model. Such a model possibly contains any conceivable demand and supply pattern. The only constraint to be considered is that the conditions of market equilibrium can be stated in terms of the mathematical expectation of the distribution of returns. This is a rather general equilibrium characteristic. But as already pointed out, this is entirely due to the

1) FAMA, E.F. (1976a, p. 135).

specification of the market model. Thus, for example, an appropriate market model may lead to expected returns which are constant throughout time, or returns which follow a non-linear equilibrium path of other variables in the model.
The information model consists of the hypotheses represented by equs.(44) and (45). Equ.(44) in addition to the character of purely definition the expectation contains also a behavioural hypothesis. It refers to the fact that all information activities finally result in the generation of a single future-oriented characteristic number. For a single investor, the advantage of the expectation as a leading decision variable results from the property of balanced experienced gains and losses, counting on the Law of Large Numbers. On the average and in the long run, this should prove to be a 'fair' strategy. Therefore, it is quite in accordance with the theory that market transactions lead to surpluses or deficits. The possible advantage following the expectation rule consists in the long term compensation of derivations. Equ.(45) contains informational efficiency as the core of the whole theory. It states the equivalence of objective and subjective accuracy. 'Objective correctness' denotes the only correct possible representation of prices in terms of a probability distribution under perfect processing of a given set of information. 'Correct possible representation of prices' denotes that the real information model creates prices which are appropriately described in terms of a joint density function.

FAMA states that if the set of information underlying price distributions is represented by I_t, this bias of information

> '...includes what might be called the "state of the world" ... : e.g., current and past values of any relevant variables, like the earnings of firms, GNP, the "political climate", the taste of consumers and investors, etc. ... In addition to current and past values of relevant variables, ...(I_t) is also assumed to include whatever is knowable about relationships among past values of the same or different variables, and

> also whatever can be predicted about future states of the world from the current state. In short, ...(I_t), the information available at ... (t), but also whatever is knowable about the process that describes the evolution of the state of the world through time'. FAMA, E.F. (1976a, p. 135).

Following this line, I_t as set of information by definition includes knowledge in any conceivable form. Because of the all-embracing informational content, the information model leads to an empty statement, and merely provides a tautological definition from which information efficiency immediately follows. Therefore, it makes any further explanation of information performance redundant.

To avoid jumping to conclusions, and to help the theory to retrieve its explanatory power, the information hypothesis must be considered from a slightly different angle.

For clarity of insight, the information model is broken down into two separate but interrelated sub-hypotheses.

First, the model contains the statement of equality of the subjective and objective probability distribution of prices, based on a certain set of information, e.g., I_t. In other words, if another bulk of information, e.g., H_t, initially entailed a different distribution of prices, the first sub-hypothesis claims that the market's assessment would lead to an identical probability distribution. It is stated that because the objective model by definition does not waste scarce information, neither will an information-efficient market (if one exists). This will later be called consistency hypothesis.

The second step concerns assumption about the bulk of information. With respect to I_t this proves to be a pure empty statement because the set of information is defined without exclusions, or by the creation of something like an omniscient information-provider. This would obviously be an untenable assumption, inaccessable to any kind of empirical research whatsoever.

2.4.2 Tests of Informational Efficiency

To avoid this 'extreme null hypothesis', several different subsets of I_t, i.e., H_t^i are defined. These obey the following rule

$$(47) \qquad H_t^1 \subset H_t^2 \subset H_t^3 \subset \ldots \subset H_t^i \subset I_t \,, \qquad t = \text{constant}.$$

For each subset, H_t^i fulfills what was earlier derived with regard to the properties of a σ -algebra, especially

$$(48) \qquad H_1^j \subset H_2^j \subset H_3^j \subset \ldots \subset H_t^j \,, \qquad j = \text{constant}.$$

The point now is to define H^j in a way that it pinpoints the level at which the market under consideration fails to be efficient in information utilization.
The strongest test of information efficiency would be to find out whether the market uses all information bounded in I_t. If one assumes that I_t is objectively observable, then mere comparisons of price distributions, namely those conditional on I_t and I_t^*, would be a test of the consistence hypothesis. If the actual market failed to stand the test, appropriate subsets of I_t, H_t^j could be examined step by step, until the market's assessment provides the same price distribution.
Given the acceptance of the consistence hypothesis, the market under consideration could be named efficient with respect to that particular set of information. Because this second hypothesis determines the 'level' of processed information, it is called level hypothesis.
In the field of empirical research, the level hypothesis has been reduced to definable size by a threefold partitioning of the set of information, and accordingly to three testable propositions[1]:

1) Cf. FAMA, E.F. (1970, p. 388).

1. The weak form test confines the bulk of information just to the sequence of historical prices (H_t^1).

2. The semi-strong form test is used to check wether current prices 'fully reflect' all publicly availabe information (H_t^2). This means that the test investigates the adjustment of security prices to one kind of information-generating event, (e.g., stock splits, announcements of new security issues, etc.)[1].

3. The strong form test examines the effect of potentially monopolistic access to information (H_t^3), investigating whether all available information is fully reflected by prices, in the sense that no investor earns higher profits than the average because of monopolistic access to some information.

The appreciation of the consistency hypothesis is essentially constrained by the acceptance of the rational-expectation paradigm. The problem of handling the level hypothesis empirically results from the difficulty (if not impossibility) to distinguish between the available information sets in a reliably accurate manner. While the idea may be clear cut on a theoretical level, it turns out to be hard to handle in connection with the formulation of the testable hypothesis, because in principle those tests are based on unobservable components[2].

Following FAMA's idea, both hypotheses finally lead to the proposition of equ.(46), whereby the systems efficiency comprises two interrelated spheres of determination.

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1) See, for example, the work of FAMA, E.F. et al, (1969).

2) A slightly different way to separate between sets of information is proposed by NEUMANN, M.J.M. and KLEIN, M. (1982). Their proposal is based on the fact, that informations can be distinguished due to their different marginal costs of acquisition.

First, the market creates a price distribution for the set of information which is accurate in terms of efficient information processing. From this the conditional expectation value is deduced. The information sphere is only dealing with price distribution in terms of expectated prices.
Second, this 'information' is the basis for the market-clearing model, by determining concrete prices and quantities, so that equilibrium conditions are fulfilled by optimal resource allocation, i.e., by efficient market processing. In this sense, an optimal market 'overall-performance' will occur - in the sphere of information processing as well as in the sphere of market transaction.
Note that the model is recursive, starting from efficient information processing and ending in efficient market transactions. This reasoning is clearly confirmed by FAMA, who writes that

> '...on the basis of the information ...(H_t), the market assesses a joint distribution of security prices for time ... (t+1). From this assessment of the distribution of prices at ... (t+1), the market then determines appropriate current prices ... for individual securities. The appropriate current prices are determined by some model of market equilibrium that is, by a model that determines what equilibrium current prices should be on the basis of characteristics of the joint distribution of prices at ... (t+1). In other words, a market equilibrium implies a market-clearing set of prices for individual securities'. FAMA, E.F. (1976a, p. 135), underlining by myself.

So far, most economists seem to agree to this description but, unfortunately, an inaccuracy has slipped in which may give rise to misunderstandings. The objection is raised against the statement that the market 'determines appropriate' current prices. To draw the correct conclusions from the theory, the issue should be interpreted in the following terms:

First, with regard to the market model, it must be a stochastic market-clearing model, i.e., an exogenous random process (white

noise) is superimposed on the deterministic structure of the model.
Second, because the realizations of this process are not known in advance, the market sets prices according to the mathematical expectation of their density function[1)], counting on the Law of Great Numbers, saying that on an average and in the long run, this will prove to be a 'fair' strategy. If those expected prices were equal to actual prices, the system could be solved without any remainder. The mathematical expectation values of prices fit the case perfectly. This is ensured by the appropriateness of the market model, as well as primarily by efficient information processing of the information model. It is obvious that actual prices, however, are not determined by the market, but - to remain in the metaphorical language - are drawn out of the given price range. Therefore, current prices will generally fail to reach equilibrium values; this may well result in repercussions on market-clearing conditions. Therefore, current prices fluctuate randomly around their expectation values in those models - a glance at equs.(19,22) can confirm this. Otherwise, if they were always exactly on the target, the model would explain a kind of causality which, per definition, is excluded by the randomness assumption of equ.(35).

In either case, the division of a system efficiency into a sphere of efficient information processing and a sphere of efficient market clearing allows to explain a market's capacity from two points of view. Considered from a theoretical point of view, it might be possible for a market to process information correctly but to fail in transforming the correctly assessed information into corresponding market transactions. This finally results in suboptimal allocation, even in a state of equilibrium. This case

1) By assuming this, one must bear in mind that investors are supposed to be risk neutral and/or without any time preference.

corresponds to the left side of the efficiency-preference function (p. 86) and is characterized by $x < y$.
This means that a market-inefficient system may very well be information efficient. Or, to argue in terms of the model, the information hypothesis would not apply due to an incorrect market model. Empirically, this could represent the case of natural or artificial impediments of substitution causing high costs of adaptation. On the other hand, it is also possible that the market model is correct, while the information model fails to process information efficiently and therefore provides the market with incorrect information signals[1)].

Although the final result is inefficient allocation in the previous case as well as in the case where the information model fails to function, the decisive emphasis of EMT predominantly lies on the second case.
The theoretical properties of markets with perfect information providing necessary and sufficient conditions for optimal (i.e., efficient) resource allocation have already been worked out. It is necessary to prove scientifically that markets are able to provide an informational basis which is not only unreachable by any other social form of social organization but also retains a close resemblance to the ideal of perfect information. Therefore, it is not all that surprising that FAMA founds the information hypothesis on the following set of assumptions, (FAMA, E.F., 1970, p. 387):

1. There are no transaction costs in trading securities.
2. There is free access to all available information without charge to all market participants.

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1) See page 86f. for the interpretation of the iso-efficiency curves.

3. All participants draw the same conclusions from current information with respect to the current price and the distribution of future prices of each security.

Using this as a benchmark, it is almost trivial to arrive at efficient information processing. If people acts as a homo oeconomicus, then of course, not a single piece of information will be wasted. However, the interpretation of information as a scarce good in those models can only be done with extreme caution. It seems to be more in accordance with the set of assumptions to consider information as a free good simply because its price is zero. Therefore, it may be rather difficult to imagine economically efficient use of those publicly available goods. Could be that things turn upside down, if deviations occur from those assumptions, e.g., if information must be paid for. Here, this is regarded as a potential source of inefficient processing, (FAMA, E.F., 1970, p. 388). While it may be reasonable that positive transaction costs for example entail inaccurate information signals, this sounds strange in the case of information considered as a private good. Usually, it is argued that the unhindered exchange of private property rights in a free enterprise system ascertains efficient (even PARETO-efficient) allocation of private goods. Here, the opposite case surprisingly occurs. Information as a private good is considered as a potential source of inefficiency.

2.4.3 The Problem of Joint Tests

However, the proof of informational (in)efficiency cannot be furnished because of an empirical testing dilemma: Unfortunately, two hypotheses are to be tested at once. Basically, the statistical test of FAMA's theory consists in checking whether equ.(46) is valid. As already pointed out, this equation can be considered as the reduced form of the market model of equs.(42,43) and the

information model of equs.(44,45). Equ.(46) constitutes the testable implication of both theories.

Given the acceptance of falsifying factors, a rejection of the null-hypothesis (H_o: system A is informationally efficient with respect to the information set H_t^i) does not necessarily imply an informationally inefficient market system, because it may well be that only the informational-efficiency hypothesis is valid, but not the tested market-efficiency hypothesis.

In fact, to prove informational efficiency, equs.(44,45) deserve the main attention. Because the implication of these hypotheses leads to unobservable components, the detour through the market model must be made. Hence, a salient deficiency of FAMA's theory is that it lacks a reasonable explanation for the link between $f(\tilde{p}_{t+1}/H_t)$ and $\tilde{r}_{t+1}$.

As already mentioned, a possible detailed specification might be provided by an equilibrium model which states that in equilibrium expected returns are positive ($E(\tilde{r}_{t+1}/H_t) > 0$), (Test 1), or positive and constant ($E(\tilde{r}_{t+1}/H_t)) = c;\ c > 0$), (Test 2). But without jeopardizing the general rule, it is also conceivable that the expected return in equilibrium follows a long wavy path on which the information hypothesis holds true, that is: $E^*(\tilde{r}_{t+1}/H_t^*) = E(\tilde{r}_{t+1}/H_t)$.

If all actual values of r_t on the wavy equilibrium path are greater than zero ($r_t > 0$), Test 1 is an appropriate but nevertheless not the best approximation of the real state of affairs[1]. However, the hypothese of informational efficiency would not be rejected. Now assume that Test 2 is applied. Then the efficiency analysis will in this case suggest inefficient information processing while in fact the tested market model is inappropriate.

The following graph (adopted from FAMA, E.F., 1977, p. 149) may be suitable to illustrate the argumet:

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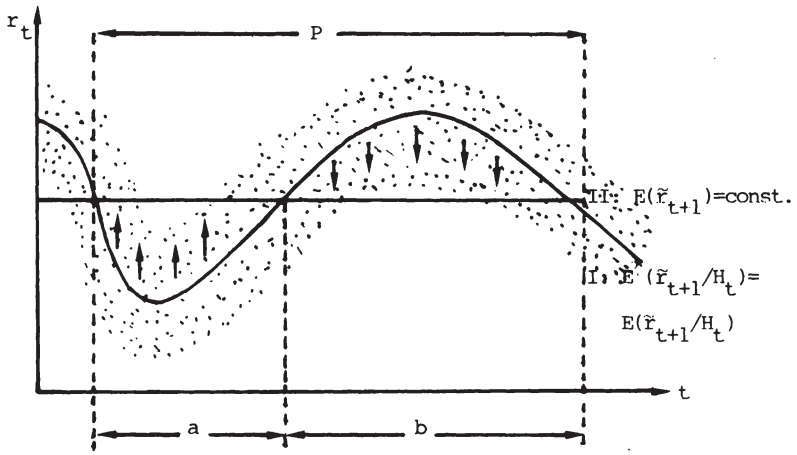
1) It is an appropriate description, because the model only requires positive rates of returns. It is not the best description, because rates of returns follow a describable time path.

Given the above reasoning, the wavy line (line I) represents the equilibrium time path where information is efficiently processed. The straight line (line II) shows the tested market model based on constant rates of returns throughout time.

Graph 11: Hypothetical Development of Returns in an Efficient Market



Although the empirical data suggest the outcome of an informationally efficient market, the hypothesis of informational efficiency will be rejected because the model is misspecified. In fact, the market performs efficiently, as indicated by the wavy line.

This is the usual way of arguing with respect to the problem of

testing joint hypotheses. Following this line of reasoning, however, another more sophisticated objection could be raised. If it is confirmed that line I adequately represents the model's equilibrium path throughout time given efficient information processing: Can such a model even stand the weak form test of informational efficiency, i.e., restricting H_t just to H_t^1, the bounded information of past returns (or prices)? Can returns follow a cyclical pattern without market participants being able to detect and exploit such a pattern?

Even in the case of the most simple set of information (H_t^1), the market will use information efficiently. For example, assume that there are additional demand in subperiod 'a' (where prices are relatively low) and that these commitments are to be sold in subperiod 'b' (where prices are assumed to be higher). This results in an overall net gain (transaction costs neglected). In fact, FAMA's example may stand for the case where the market-clearing conditions are fulfilled, but the hypothesis of informational efficiency does not apply. Things will not improve, if the market is allowed to use 'all available' information correctly. In consequence of the profitable buying and selling transactions during the subperiods 'a' and 'b', supply and demand forces will drive the returns away from their initial equilibrium path, as indicated by the arrows in the graph. The implication is obvious: In such a model, fully utilized information will lead to transactions destabilizing the market, driving it from equilibrium to disequilibrium. If, just for the sake of argument, this process is assumed to come to an end on the straight line II where $E(\tilde{r}_{t+1}/H_t)$ is constant, then a situation is reached were all information is accurately processed. But then, the market-clearing condition - as illustrated by the wavy equilibrium path - would be violated. Whether such a situation can be reached and tested is a pure matter of conjecture. This would be entirely dependent on the concrete specification of the model.

One way to escape the dilemma could be the special assumption that the time horizon of the market is shorter than one period of the cycle (P). This would underline the argument that people do not realize the whole periodic pattern and therefore are not able to take it into account. The period of time that they are supposed to take into consideration in decision-making is too small to reveal such profit possibilities.

If this is true, a periodic equilibrium path of an informational efficient market could be explained. The assumption of time-restricted information periods is, by the way, a widely accepted working hypothesis in economic theory. Most of the frequently used adaptation or expectation mechanisms are founded on special autoregressive patterns which, according to the psychological Law of Exponential Forgetfulness, weight the informative past with increasing installments of neglect. The agreement to such an adaptation mechanism could reasonably lead to the argument that all the weights lying beyond the time-horizon are too small to contribute to the assessment of information.
But it can easily be shown that such auxiliary constructions are not pertinent to the basic theoretical structure of EMT. What leads to the rejection of such deliberations is the fact that prices (which fully reflect information) and rates of returns form a 'martingale' with respect to the set of information on which they are conditional. The key analytical device is that, in contradistinction to 'autoregressive' market structures, markets producing martingale properties of prices or returns never 'forget' the content of an information set. As time goes by, these processes include more and more information and use all information with the same intensity, independent of time. This lead to a controversy and finally to the rejection of FAMA's argument of a wandering equilibrium path. Periodic patterns that can be adopted are not compatible with the martingale property of prices.
It is assumed that new information come in randomly and are imme-

diately processed and signalled via prices (price changes); thus a random pattern of price changes is produced. Fully utilized information then lead to price-configurations, the knowledge of which can no longer provide the informational basis for any profitable business strategy. To say it differently: If certain types of information do not arrive randomly, the time series of prices show particular patterns.
This is usually regarded as a striking example for unutilized information, i.e., for 'market inefficiency'. Thus, when prices develop purely at random, so that price changes are totally unpredictable, such a market is called informationally efficient (at least in the weak form).

2.5 Limitations and Criticism of the Arithmomorphic Approach

In the following, the validity of the efficiency concept with respect to the topics of 'risk aversion', 'non-linearities', and 'distribution assumption' will briefly be examined.

The first point is that the indeterminability of actual prices exposes decision-makers to risk. Thus, risk and risk aversion, both seem to bear an economically relevant dimension (e.g., a hedging activity), which is not negligible 'a priori'. If we agree to a statement from H. DEMSETZ[1], 'that the task of risk reduction must be incorporated into the concept of efficiency', we must ask whether the above concept of prices which fully reflect information and obeying a martingale, is compatible with a risk averse economic structure. Referring to statistics, the dispersion of a random variable around the expectation value (variance) is usually considered as an adequate measure of risk. The intuitive reason is that the higher the variance is the more are realizations likely to deviate significantly from their expected value.

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1) DEMSETZ, H. (1969, pp. 1-22).

As shown, FAMA's model makes no explicit use of the concept of risk measurement. The only decision basis (the information model) is supposed to provide a forecast of the next period's price, presented as the mathematical expectation under the restriction of fully utilized available information. This price expectation is incorporated into the market model to determine market-clearing quantities, but the way in which the dispersion of prices is linked to the prediction is not explained. The point is that, although rational expectations are assumed, in a risk averse economy equilibrium prices may occur, which do not follow a martingale. Thus, even if the market forms rational expectations in terms of expected values of the true probability function, the expectation values are not taken as a reliable forecast, because of risk, but rather as a biased value on the security side. Therefore, even in the case of rational expectations, only under the stipulation of a risk neutral utility function, the mathematical expectation equals the realized value determined by the market[1]. In this sense, individuals are risk neutral if and only if they 'are indifferent between a random prospect and its expectation with certainty'[2]. Usually, this will occur if the price determination process is governed by a linear utility function[3]. In general, non-linearities in these models result in biased predictions of future prices.

In economic theory, the assumption of risk aversion leads to the well-known portfolio selection model on a microeconomic level in the tradition of H.M. MARKOWITZ (1952, 1959) and J. TOBIN (1958) or, on a macroeconomic level to the capital-asset-pricing models (CAP) developed by W.F. SHARPE (1964) and J. LINTNER (1965). Intuitively these models include risk aversion in terms of a trade-off between the first and second moment of the price

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1) This is frequently overlooked in rational expectation models.

2) LeROY, St.F. (1982, p. 194).

3) Cf. MANDELBROT, B. (1966, p. 244), especially footnote 2.

generating process. Thus, the level of volatility - the variance - becomes a part of the expectation value as a second decision variable. Clearly, the property of prices to fully reflect information , as defined by martingales, can be violated.
However, it is apparent that, if price changes obey a fair game process, it is only the expectation of future prices which is independent of the past[1]. Moments of order greater than one therefore are not excluded from being determinable by past knowledge[2]. The explicit description of martingale processes under risk neutrality has been carried out by P.A. SAMUELSON, who emphasizes the redundance of the second moment[3]. The more important question in this context is whether martingale prices are still valid if the second moment is explcitly taken into account.

A way to avoid these difficulties is offered by the submartingale model. If the influence of risk averse market actors exceeds that of risk seekers, prices would ceteris paribus steadily increase because of the net-fear of risk. Then the martingale process could be replaced by a submartingale. In this case, those who seek more risk than the average could 'ride the trend', and profit from other people's caution by virtue of their own boldness[4].

1) Cf. MANDELBROT, B. (1966, p. 249), see also p. 132.

2) In general, this is also the problem of non-linear relationships.

3) See his salient and pioneering papers: "Proof that properly anticipated prices fluctuate randomly" (1965a, pp. 41-49), and "Proof that properly discounted Present Values of Assets vibrate randomly" (1973, pp. 369-374).

4) This is the general idea of the 'older hedging-theory', which is quite in accordance with a risk averse market structure. Hedgers who are more risk fearing than speculators, pay the latter for guaranteeing fixed future prices. Expected future prices should therefore exceed spot prices at least in the amount of risk premium. This is known as the 'Keynesian normal backwardation case'. Besides some methodological objections, the theory still cannot be confirmed by definite empirical evidence; see STREIT, M.E. (1982a) but also, for the contrary view, LeROY, St.F. (1981).

Besides the objection that this kind of explanation seems to be a bit arbitrary and theoretically unsound - one would like to speak of an ad hoc or exogenous risk explanation. It is obvious that the criterion required for efficiency - namely absolutely fair price changes - is not fulfilled. The set of prices from the past or, more general, the whole set of information from the past contains unexploited profit opportunities - namely information about the trend.

The requirement for an endogenous risk explanation first leads to the μ-σ-approach or to CAP-models. Unfortunately, CAP-models of the SHARPE-LINTNER type are not able to deal with the martingale property of prices. The reason for this failure is that those models are confined to a one-period analysis, where key-variables like the next period's variance and expectation value are given. Therefore, the price structure is predetermined which otherwise - in the case of martingale prices - would be generated by an intertemporal probability distribution.

It was shown for the first time by St.F. LeROY[1] that endogenous risk explanation under special conditions leads to price series which are not generated by a martingale process. The model includes investors who maximize their utility from wealth. The utility function itself includes the next period's wealth as an argument variable in terms of expectation value and variance. Besides the usual trade-off relation between the two utility arguments, the assumption of constant absolute risk aversion ensures that the marginal utility relation of expectation value and variance is not a function of wealth. This means that the required risk premium is independent of the initial capital endowment and that

1) LeROY, St.F. (1973, pp. 436 ff.).

total risk remains constant over time[1]. The model finally shows a highly complicated pattern of autocorrelation in prices. Thus, the idea to connect efficient market performance with martingale prices was disproved.
Interestingly enough, in a later paper J.A. OHLSON[2] succeeded to demonstrate that under a slightly different set of assumptions the same model will in fact yield martingale prices, even in the case of risk aversion. Instead of constant absolute risk aversion, OHLSON consideres the case of constant relative risk aversion. Provided that - besides a few other slight modifications - the next period's expected prices are indeed only a function of structural parameters and not of the state of the economy in terms of past dividends, they will mould a martingale series.

These results emphasize the sensitivity of the martingale property with respect to model assumptions. Thus, it can be concluded that the incorporation of risk aversion into informationally efficient martingale models can finally be reduced to a problem of adequate assumptions, and that martingale prices can hardly be viewed as a 'natural' or 'self-evident' characteristic of efficient informational performance. Risk aversion is the most common example of non-linearities, but it is rarely recognized as such.

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1) Consider an investor's utility function U() with the variables expected next period wealth E() and variance V(), conditional to the state of the economy (#), so that
$U=(E(\tilde{w}(t+1)/\#), V(\tilde{w}(t+1)/\#)$ with $U_1 > 0$, $U_2 < 0$. Then constant absolute risk aversion requires that U_1/U_2 = constant. The rationale behind this risky asset is independent of the initial wealth. On the other hand, constant relative risk aversion requires $w(t)U_2/U_1$ = constant, meaning that a risk premium of a given risk is not independent of wealth and therefore a function of wealth (for similar results see LeROY, St.F., 1973, p. 438).

2) OHLSON, J.A. (1977, pp. 229 ff.).

There have been many attempts to secure the linear efficiency concept under the paradigm of risk aversion.

A frequently used method to evade the difficulties is simple to consider other aspects which should fulfill the criteria of efficiency. For example, M.J.M. NEUMANN and M. KLEIN[1)], faced with the problem of non-efficient price setting in a risk averse economy, simply state that

> 'die Theorie effizienter Märkte davon nicht berührt (wird), weil auch bei Risikoscheu die allgemeine Martingaleigenschaft der Differenzen von realisierten und zugehörigen erwarteten Ertragsraten erhalten bleibt' (underlining by myself).

In this context, the series of rates of return obey to the martingale law, so that the differences between actual and expected rates are a fair game. In fact these models often yield in martingale properties of rates of return. The decisive point is that the research carried out so far has, for obvious reasons, been concentrated on martingale prices and therefore on fair game rates of return. FAMA particularly advocates the principle that efficient market performance should entail prices which fully reflect available information; therefore, prices moulding a martingale and rates of return represent a fair game.
Unfortunately, it is not irrelevant whether rates of return are a martingale or a fair game process. This is because rates of return are defined in terms of prices. This logical flaw was introduced by FAMA himself[1)]. So, if a risk averse market brings out martingale returns, it may be called efficient in terms of returns but not in terms of prices. Prices will be generated by a highly complicated non-linear stochastic process, which by no

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1) NEUMANN, M.J.M./KLEIN, M. (1982, p. 179).

2) Cf. FAMA, E.F. (1970, p. 384 f.); see e.g. equs.(32,33).

means will exhibit the desired characteristics[1].
This is not a minor academic qualification. It reveals a deeper characteristic namely that efficiency, if measured in martingale properties, is not at all independent of the kind and degree of transformation the variable is to undergo. As the above example indicates, the development of returns throughout time could well be called an efficient process; however, this can by no means apply to the corresponding prices.

For instance, it is a frequent practice - for good reasons - to analyze log-prices. However, if the market performs efficiently with respect to log-prices, it must not necessarily be efficient for prices themselves. The point is that the arithmetic fair game model then is transformed in a geometric fair game model in which the usual arithmetic mean is replaced by the non-linear notation of the geometric mean $((\prod_{i}^{n} p_i)^{\cdot}\exp(1/n))$[2], so that in general, and also in this case unbiasedness is not independent of the choice of scale the variable is transformed to.
A remedy in so-called 'Consumption-CAP-models' is to assume log-linear utility functions[3]. But it is doubtful that people think and feel in terms of logarithms, although a strong support of the view is provided (e.g., by the Weber-Fechner-Law) in favour of a constant relative risk aversion (equally constant precentage-changes of wealth create corresponding changes in utility). Besides that, the martingale property of prices as a first approximation remains only valid in the case of linear utility functions,

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1) This is easy to prove; recall the definition of rates of returns $r(t) = (p(t)/p(t-1)) - 1$ and the martingale property defined in terms of returns $z(t+1) = r(t+1) - E(r(t+1)/H(t))$. Now, after setting $E(r(t+1)/H(t)) = r(t)$ and after substituting and rearranging, one obtains a non-linear stochastic price equation $p(t) = p^2(t-1)/p(t-2) + p(t-1)z(t)$ with $z(t)$ being a white noise process.

2) See SAMUELSON, P.A. (1965b).

3) See, e.g., FITOUSSI, J.-P. (1982, p. 28).

where the criteria of 'expected utility' coincides with the criteria of 'expected value'.
The deeper methodological problem is that economic theory is still pretty much in the dark about the variables which 'in concreto' should carry a martingale or fair game property. To prove efficiency, a rigorous treatment for the microeconomic utility structure is undoubtedly required, and as long as research is unable to provide a satisfying theory and is almost mute about the problem, it remains more or less arbitrary which variable and what kind of transformation is to be used in order to finally witness efficiency[1)].
Martingale prices only provide accurate predictions in terms of expectation values. Nothing is said about moments of higher order, like the variance as a well accepted approximation of risk. The incorporation of risk into the already existing frame is feasible without further difficulties only if price changes follow the random walk model, thus by the assumption of statistical independence all possible conjunctions of higher order between prices are cut of.
But the random walk model is not easily justifiable, and there are some serious objections against the stability of a GAUSSian distribution in long price series.

At first glance in the case of long time series the validity of an appropriate application of the Central Limit Theorem seems to be plausible. This is the case when the total amount of transactions is considered as a sum of independent actions, each of them conforming to a certain probability distribution with a total

1) This line of reasoning was also supported by A.A. ALCHIAN (1974, p. 10) who conjectured that because there always exist predictable profits if prices are not martingale processes, even prices of labour, services and perishables should be martingales, and that even income explained via the permanent-income concept of the life-cycle hypothesis should be considered as a martingale series. See also the comment by MYHRMAN, J. (1974).

variance which is proportional to the respective time interval. But the plots of the empirical distributions of price changes are much too leptokurtic, i.e., an above average concentration around the mean and the tails.
Research has shown that a 'LÉVY-PARETO distribution' with a characteristic exponent $1 < \alpha < 2$ will probably serve the purpose better[1]. Unfortunately, those general distributions have no finite second moment, so that the variance as an economically interpretable variable becomes at least questionable. Of course, in empirical work it is always manageable to calculate the variance of the sample considered, the point is that if the true process follows such a stable PARETian distribution, the fundamental requirements of stationarity are transgressed. Martingale as well as random walk processes, however, only remain a sufficient statistic as long as some pivotal stationarity assumptions about the generating process are valid. Current research rather strengthens the suspicion that these preconditions are rarely given.

But risk is not the only determining variable; each non-linearity either in the model itself or in the data can distort the martingale property of prices. Tightly connected with this problem is the surprising possibility that in empirical work stochastic processes may be identified as zero-correlation processes - indicating market efficiency - while in fact non-linear dependencies are valid which, when recognized, could be used for non-trivial forecasts. Therefore, not only errors of the first kind (according to the joint-hypothesis problem) are involved, but

1) See the important paper of B. MANDELBROT (1963, pp. 349-419); or the empirical studies of E.F. FAMA (1965, pp. 34-105). A more recent investigation in this field is done by G. RONNING (1974, pp. 272-302),or J.W. McFARLAND et al. (1982, pp. 693-715). They calculate the characteristic exponent $\alpha = 1.4$ and thus heavily support the conjeture of a non-normal distribution.

also errors of the second kind (for example, that the false hypothesis is accepted) are possible.
In either case, it is rather difficult to draw convincing results out of empirical efficiency tests:

> 'Cautiousness is thus in order when interpreting the numeros zero autocorrelations in return tests ... it appears indeed that they are simultaneous tests of market efficiency, perfect competition, risk neutrality, constant returns to scale and the impossibility of corner optima' (J.- P. DANTHINE, 1977, p. 15).

Finally, it is even doubtful that zero-correlation tests are at all proper tests of market efficiency.
On the other hand, empirical work always has to cope with 'imperfect data', simply because an isolated observation of phenomena is normally not possible.
To sharpen this vague suspicion somewhat, it can be questioned wether there is any 'intrinsic' connection between market efficiency and martingale prices. To clarify this point, one must always consider the very structure of the model that brings out efficient performance.

The theoretical environment of the model is build up in such a way that the past price as a sufficient statistic guarantees a reliable forecast about further development of prices. The connection between the market sphere and the price-generating process is such that the current price correctly and unequivocally reflects all market settings. In the language of the model, this means random fluctuations around an equilibrium path of a competitive economy which is subjected to 'stationary conditions'. The assumption of stationarity must be considered as the crucial cornerstone and is the decisive hint that the current price is the best predictor of future development. Strictly speaking, one deals with an unchangeable economic framework of a 'stationary' society.

Nevertheless, the great advantage of FAMA's theory lies in the striking austerity of the basic idea, which allows to argue in terms of an economic theory, whose

> 'equilibrium is described by one or two functions rather than by the multiplicity of (frequently uninterpretable) marginal equalities of state-preference analysis' (St.F. LeROY, 1982, p. 190).

Consider an equilibrium price not fully reflecting all available information. This stands for a non-rational utilization of scarce goods. In this case, the market's coordinative power would be too low to cope with its fundamental task of optimal allocation. Or, if this is wrong, there is at least one market participant who had specific information. If he starts to act, he initiates a process of adaptation. Obviously, in this case the initial price cannot have been an equilibrium price. On the other hand, a constellation can be imagined in which an informationally efficient price prevails in a disequilibrium situation.
This failure could be due to the fact that the market mechanism generally fails, even in an economy of free enterprise. This could give rise to demands for a 'wise dictatorship' in terms of a strong public sector bearing the responsibility to keep the economy on the 'right' path. But it is also possible that an ill-conceived legislation and the corresponding regulation activities truncate or impair the initial adaptive capacity of markets. Both aspects are of decisive importance. Finally, it is of interest to ask whether markets as a social phenomenon are capable to ensure not only optimal allocation of resources but whether they are also able to build up an accurately functioning information system, outperforming coordinating individual decisions. One way to test the efficiency of markets is the arithmomorphic approach and, as long as there is no a-priori knowledge to fundamentally demonstrate the inappropriateness of this approach, it should still be considered as a second-best solution to the problem. To be valid a theoretical disproof must show that there is no

relationship whatsoever between market efficiency and martingale prices. This seems to end up in a Sisyphean work as I have already tried to show. A more promising way may be to work out in detail and criticise the assumptions made about problems like risk aversion, non-linearities etc.. Such limitations have already been discussed but did not yet lead to a complete rejection. For each theory, however, the ultimate test-stand is the empirical probation which must always be noticed.
As long as such a theoretical or empirical disproof has not been presented, there is no reason why this approach should not be regarded as a sufficient approximation of reality.

The second approach, the so-called 'causal-genetic' approach, is not as easy to handle as the arithmomorphic approach. It was mainly developed by the 'Austrian School' and provides a view of economic reasoning which objects to the treatment of the problem as it is tackled by the arithmomorphic approach.

Chapter IV An 'Austrian' Perspective of Informational Efficiency

1 Introductory Notes

Based on a viewpoint that could roughly be labelled as an 'Austrian perspective of speculative trading' in this chapter I present a concept of speculative trading in futures markets with respect to informational efficiency. The adjective 'Austrian' is a catchword for a sideway on the map of economic thoughts, which was mainly shaped by the work of its founders C. MENGER and L. MISES[1)]. Although today's 'Austrian' scholars are not (intellectually) bound to a standard unit of academic architecture, they nevertheless have contributed to a body of ideas, which can be considered as an alternative programme to the well-established agenda of 'Neoclassics'. Today's neoclassical theory still rides the waves of popularity, but can hardly conceal the emerging inconsistencies which are inherent in its structure. Neoclassical theory is often accused - to use a phrase by R.J. GORDON (1976) - to proceed with 'impeccable logic from unrealistic assumptions to conclusions that contradict the historical record'.
On its macro-level, neoclassical economics has already lost some of its sparkling polish since the days of L. WALRAS and A. MARSHALL; and today there is widespread agreement on the fact, that modern macro-economics faces three major unsolved problems: aggregation, expectation, and optimization, if macro-economics is based on so-called micro-foundations.

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1) It is difficult to provide an exhaustive enumeration of all thinkers who form the hardcore of the Austrian theory. An attempt could go as follows: MENGER, C., WIESER, F.v., MISES, L., MAYER, H., HAYEK, F.A.v., LACHMANN, L., ROTHBART, M.N., KIRZNER, I.M.. Problems arise with scholars like E. BÖHM-BAWERK and J.A. SCHUMPETER, and even C. MENGER himself is occasionally denounced as being a Non-Austrian (see LACHMANN, L.M., 1977, p. 48). An excellent discussion of this point is in HUTCHINSON, T.W. (1981).

This criticism, however, has been mainly articulated by 'Neo-classicists' themselves; hence, these perceived difficulties 'are largely due to the work of mainstream theorists, and not to any successful assault from outside' (F. HAHN)[1]. To be sure, there is no denial that the triple problem has also been recognized by 'outside-scholars', although perhaps with shifted emphasis and with different conclusions.

Ever since its appearance, the various writers of the Austrian School have repeatedly emphasized that neoclassics are severely trapped in[2]

1. an excessive preoccupation with the state of equilibrium;
2. an unfortunate perspective on the nature and role of competition in markets;
3. grossly insufficient attention to the role (and subjective character) of knowledge, expectations, beliefs, and learning in market processes;
4. a normative approach heavily dependent on questionable aggregational concepts and thus is insensitive to the idea of plan coordination among market participants.

To search for possible explanations why these arguments had hardly any radical effect on the traditional science is beyond the scope of this chapter. Neither is it my intention to recapitulate the Austrian theory in full length and detail. The main focus is to provide a line of criticism to the neoclassical theory of informational efficiency as it is reflected in the FAMA-approach and its variations. Correspondingly, the Austrian theory is used mainly where it may render some support to the understanding of speculative trading, and where the traditional

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1) HAHN, F. (1981, p. 127).

2) See KIRZNER, I.M. (1981, p. 115).

view only provides insufficient explanation, or even encounters inconsistencies.
The four above-mentioned objections raised against neoclassical theory may serve as an intellectual guide through the following sections, though the Austrian ideas will not appear in such a clear-cut manner. The chapter itself is organized in the following way:

In section 1 (Hedging versus Speculation) the traditional meaning of hedging is briefly reviewed and then contrasted with a more sophisticated version, which stresses in the first place the informational aspect of this particular transaction. The course of argumentation loosely corresponds to chapters III and IV.
The interpretation provided in section 1 stresses the necessity to inquire more thoroughly into Information Processes (section 2). Information processes are most likely the central mechanism of market-economies. Their performance largely determines the functioning and efficiency of a market. Section 2 refers to its main extent to chapter III.
Section 3 contains a discussion about beliefs and expectations held by individual decision-makers, and especially their influence on price fixing in speculative trading and vice versa. Section 3 is mainly related to chapter IV.
The last section (Monopoly and Profit) corresponds to chapters I and III. These twins, not as bedevilled as in Marxist Theory, largely evaded or mishandled in Neoclassical Theory, turn out to be the 'sine qua non' in a market. There is ample reason to believe that any attempt to regulate the size or duration of profit or monopoly is an intrusion which cuts into the market's vitality. Efficient markets, however, have their own procedures to keep an all too powerful twin is 'under control'.

2 An 'Austrian' Perspective

2.1 Hedging versus Speculation

As a pertinent starting point, one may recall the basic possible transactions involved in futures trading as already set out earlier. There, hedging was essentially described as two simultaneous and opposed buying-selling activities, in both the spot market and the futures market. Two theories are described which explain why it may be rational to make a hedge.
The first theory placed considerable emphasis on the argument that hedging allows the transfer of the risk of price change from hedgers to speculators:

> 'Consequently the ordinary business man only enters into a forward contract if by so doing he can "hedge" - that is to say, if the forward transaction lessens the riskiness of his position' (HICKS, J.R., 1946, p. 137).

Correspondingly '...the speculator puts himself into a more risky position as a result of his forward trading' (ibid. p. 138), and earns a risk premium[1] in the amount of the positive difference between the current spot price and the currently fixed futures price[2]. This case of 'normal backwardation' then 'measures the amount, which hedgers have to hand over to speculators in order to persuade the speculators to take over the risks of the price fluctuations in question' (HICKS, J.R., 1946, p. 138), a price,

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1) For similar arguments see ARROW, K.J. (1977, p. 5). KEYNES, J.M. (1930, p. 143) has conjectured the risk premium in a magnitude of about 10 % p.a..

2) According to the traditional theory it is the (typical) producer who is engaged in a hedge by selling for future delivery ('short' position). The tendency for a relative weakness on the demand side ('long' position) is then compensated by the speculators' activities. For a more detailed presentation of this theory see GRAY, R.W./ RUTLEDGE, D.J.S. (1971).

which is included in the futures price, whereas the latter is 'nearly always made partly by speculators' (HICKS, J.R., 1946,p. 138).
In the second theory 'the important or central feature of hedging was not the reduction of risk, as in the traditional approach: Rather, it was the pursuit of profit through the exploitation of changes or expected changes in the basis, that is, the exploitation of opportunities of profit presented by the prospective movement of prices in the futures market relatively to the movement of prices in the cash (or physical or actuals) market.'[1] According to this theory, hedging is interpreted as a form of speculation.

One may wonder about the epistemological fruitfulness of discussions about the relative strength or relative weight of such trading motives, however, the germ of all such contest is presumably more accurately dismantled if one inquires into the corresponding market structures which are compatible with them. Then, the KEYNES-HICKS-position offers a rather simplified explanation of such markets: In an all too schematic way the division into two dominating groups of traders, personified as hedgers and speculators, allows to characterize those markets as institutions, where apparently only the revealed attitude towards risk decides between affiliation to the 'long' or the 'short' side[2]. A striking feature of this approach then consits in the fact that, even if one assumes identical informational conditions among

1) YAMEY, B.S. (1983, p. 28).

2) Even an eminent contemporary representative of the Austrian School as L.M. LACHMANN at a certain point stresses that the 'fundamental division is in optimism or pessimism of expectations' in speculative markets, (LACHMANN, L.M., 1976b, p. 155). But he most likely has to be understood in a sense that optimism or pessimism is not the characteristic of a constant cohorte of traders, hence, as he goes on arguing, the same person may be 'at once a buyer of one kind of security and a seller of another' (opt. cit., p. 155).

hedgers and speculators, futures trading would start. And trading will start only because for a few it is more normal to look forward to the future hopefully rather than dreadfully[1]. However, on the other hand, there is no dispute that different perceptions of risk bear some important impacts on the explanation of futures trading, but as a sole argument its particular overemphasis shifts the main focus away from the aspect that those markets are tools of informational exchange. The adoption of such a point of view, on the other hand, does not relegate the perception of risk as an insignificant momentum, but treats it as a possible explanatory variable. This indeed corresponds to the opinion that if the view of regarding risk as an exogenous 'primum mobile' embedded in one's personality is abandoned risk behaviour will become explicable in theoretical terms focusing on the informational situation that underlies the decision-making process. At this point the nexus between risk and information is plainly conspicious: The more dense information about an event is, the less risky it proves to bet on it. Perfect knowledge bears no risk, whereas ignorance bears a maximum of risk. By the same token, striving for information is contemporaneously an effort to reduce the possibility of misjudgement, i.e., to reduce risk. This is the usual unsatisfactory treatment in economic analysis as to merely investigate the input-output relation between the quantity of information and its effect to decrease

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1) 'Man', to quote Adam SMITH, 'is an anxious animal'. This is not hard to understand. One must not have studied Darwinism to understand one of nature's principles, namely that life unconditionally maximizes its chance of survival. And although Fortuna favours the brave, caution or more technical 'risk aversion' as one of those survival patterns, has proved more advantageous in man's history: cowardice is probably more a virtue than a vice. In this sense it seems not to be quite convincing to assume the existence of speculators as a 'natural condition'. The existence of Las Vegas or similar gambling centres should not tempt to confuse 'le plaisir de jeu' with 'le plaisir de risque'. (SMITH, A., Lectures on Justice, Police, Revenue, and Arms; ed. by CANNAN, E., Oxford, 1896; found in LEKACHMAN, R., 1959, p. 75).

risk. On the other hand, as will soon be shown, risk reduction is not the only gain of such informational activities. Hence, to understand hedging as a pure risk-shifting concept, which, as with regard to its pivotal variables, exclusively relies on exogenous risk parameters, does not only mark a rather unsatisfactory position from an epistemological viewpoint, but also leaves a wide range of behavioural patterns largely untouched[1)]. In contrast, a more broadly entrenched theory of hedging, aiming at the role of information in the process of decision-making, provides more probably a basis for explanations, which is in

1) As will be seen in the following part, the inquiry into information processes opens the way to interpret entrepreneurial activity with no special and explicit reference to risk perception. This kind of genuine (imaginable) entrepreneuship - as I.M. KIRZNER (1973, pp. 78ff.) maintains - 'depends on no specific attitude toward uncertainty-bearing on the part of decision-makers. Even if decision-makers displayed neither aversion nor preference toward uncertainty as such, even if they failed altogether to recognize the relatively precarious character of all perceived profit opportunities, we would yet have to find a place within our theory of the market process for entrepreneurial alertness ... It is remarkable to what a large extent this view contrasts to the well-established theories of decision-making as for example encapsulated the portfolio approach or in capital-asset-pricing models. In both these types the pivotal variable is 'risk' as to explain the choice between the amount of expected return and its degree of probability respectively to explain the strategy of diversification among several assets as to reach an acceptable combination among differently conditioned papers. In both these tentative explanations KIRZNER would not find any hint for entrepreneurial activity. These models would just describe a money-lender's effort to get something back for his lended property. And even the fact that in empirical work there have been deduced some 'β -values', which are of correct sign and of statistical significance may not defuse the objection. It merely means that there is some statistical correlation between an hypothetical perception of risk and some real economic constellation. It would certainly not signify more than a correlation between a straight line and a cube would: Although there may be some sort of significant dependence a line can never explain a cube. In this sense these models pretend an explanatory power, which they actually fail to achieve for 'some few dimensions'.

accordance to the observable variety of different trading possibilities.

2.2 Information Processes

If hedging is more than just a protection against risk, i.e., as evidence suggests, speculation for profit, then as a subsequent question one should ask for the concommitant conditions which allow such an interpretation.

One such an explanation resides in the apprehension of markets being - broadly speaking - networks of information channels. This view of markets as information-clearing devices borrows its vindication from the notion, that markets are discribable as highly complex information systems. Following this line of reasoning, markets can be seen as being settled by a large number of decision-makers linked to each other by a dense network of communication. Correspondingly, the system 'market' is not a 'closed system' but is embedded in and dependent on the political, cultural, and social environment. With respect to the problems pursued here, the impact of such a conceptualization can be summarized in two propositions.

First, markets allow a 'division of knowledge in the SMITHian sense of a specialization of labour[1)], in a sense, that the individual is specialized in certain activities, without (the individual) having necessarily to relinquish all the other specialists' achievements.
Second, markets need to be analysed in terms of a theory of 'complex phenomena'[2)], hence the transformation from 'masses of

1) See HAYEK, F.A. v. (1937).

2) See HAYEK, F.A.v. for a series of articles related to the problem of complex phenomena; (1964; 1967, p. 8; 1975, pp. 14f.).

isolated, irreducible data'[1] to the observable and aggregated result is a 'catallytic process'[2], which is not a function of some few measurable variables, but emerges from the interaction of a large amount of conditional factors and particular circumstances:

> '...catallaxy is a network of many economies, firms, households etc., but it has no specific common purpose itself; and it is not a deliberately made organisation but a product of spontaneous growth' (BARRY, N.P., 1979, p. 45).

In this sense, markets are seen as devices to coordinate and to integrate scattered and incomplete items of information, which finally mould a coherent result of price and quantity patterns, whose concrete realization no single person could have known in advance[3]. Consequently, as a social engineering mechanism 'market-induced' implementation is particularly advantageous where, instead of uni-directional ones, search processes encompassing an 'array of feasible actions' are involved, whose practicableness not only depend on their potential degree of realization, but also on their (variable) attached aims; in essence, this is a situation, where the concommitant circumstances, which determine an individual's decision, remain concealed[4]. The terminus tech-

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1) This is I.M. KIRZNER's (1973, p. 1) succinct expression.

2) The Greek expression 'catallactic' means to barter, to balance. It has been suggested by R. WHATELY (1855, p. 4) as early as 1831: 'the name I should have preferred as the most descriptive, and on the whole least objectionable, is that of Catallactics, or Science of Exchange'.

3) Cf.: 'Der Ursprung der Überlegenheit des Marktsystems... besteht nämlich darin, daß es bei der sich ergebenden Verwendung der Produktionsmittel mehr von dem unter unzähligen Personen nur verstreut existierenden Wissen über einzelne Tatsachen genutzt wird, als irgend eine einzelne Person besitzen kann' (HAYEK, F.A.v.,1975, p. 15).

4) See HAYEK, F.A.v. (1969, p. 249).

nicus in general use for such a kind of mechanism is 'competition', and correspondingly competition is regarded as a modus of discovering hitherto unknown, or at least unused facts[1].

In its main features, this mode of action is a mechanism which is based on price signals, and according to this view '... the market system is an information device which transmits knowledge automatically through the signals sent out by prices', in other words, '... the function of the price mechanism is to integrate these dispersed fragments of information (knowledge of time and place) to produce an overall order...' (BARRY,N.P., 1979, p. 47).
Yet it is the combination of high efficiency by which dispersed information is gathered, and low 'costs of maintenance', which support the traditional testimony of having at one's disposal a system of superior performance[2].

The preceding argument, however, also bears some interesting implications of reversed significance.
The way by which scattered pieces of information are finally brought together to bring forth a coherent overall order is mainly an attractive query restricted to intellectual mind, which is puzzled about the determinants of the aggregated and visible outcome of such competitive processes. The argument gains most of its attractiveness from the unpleasant, but not at all uncommon fact, that an inherently unstructured system is able to produce a result, which apparently is of a far higher degree of order. This is an observation, which is independent of the dispute whether the system is an array in an objective sense, or merely appears to be chaotic to one's mind. The decisive clue has its roots in

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1) HAYEK,F.A.v. (1969, p. 249).

2) G.P. O'DRISCOLL (1977, p. 27) emphazises: 'The price system is a means of economically transmitting information among transactors: it produces information about changing market conditions'.

another unpleasant association: In a competitive market system, man entrusts to a large extent his social existence to a mechanism, which he not only understands rather insufficiently, but which as a common feature from time to time may run counter to his own (economic) interests[1].

This last remark may require additional explanation. One has to be aware of an essential characteristic of competitive processes, namely that by virtue of each single transaction carried out, a certain influence of its informational basis on the prevailing price cannot be prevented. In other words: Informations enabling voluntarily conducted acts of trading are, with regard to their economic relevance, at least incorporated to some minimal extent in the agreed price[2]. This is L.M. LACHMANN's (1976a, p. 59) concern, who argues that 'nobody can profitably exploit his knowledge without conveying hints to others'.
This conveyance of information can be compared to the work of a map maker. The mapping-out of information in the price, however, is nevertheless a rather crude but reliable procedure: Even the most intricate informational content is only appraised with regard to its price-changing capacity. Hence, an external observer only by haphazard might infer from visible price-constellations the underlying structures of information. He probably will never be able to decipher the information's entire message. This appears quite obvious, because in his mind there exists an infinite set of information which could compel prices to raise, and another infinite set, which could make them fall; in short, the mapping-out is not a one-to-one relation.
And still in another respect the mapping-out is incomplete. When-

1) Quite in line with this reasoning does J.W.N. WATKINS (1967, p. 10) argue 'that decisions shape events, not that decision-makers control events'.

2) For the sake of accuracy, however, one must presuppose that prices are not entirely inflexible with regard to demand or supply.

ever one asserts that information is sufficiently and accurately reflected in prevailing prices, one has to add that this is only valid if considered from the trader's individual point of view. As a pertinent example one may consider the case where a trader is only informed of the 'price-changing power' of some future relevant information (e.g., 'information A raises the price for commodity X by 5.6 dollars). Then a large possibility still remains that he, aware of the full content of this information (e.g., 'there will be a three month drought this year') and in the light of his personal evaluation and consideration (e.g., ' a new drought-resistent wheat-plant has been introduced') will get to a different interpretation (e.g., 'wheat-prices won't move more than 4.5 Dollars'). The meaning of this simplified example is that the assessment of information is almost always a partial assessment, subjected to its bearer's informational conditions and his hierarchy of personal values. As is noted by L.M. LACHMANN (1977) in this context :

> 'whether a given price change ... will at different times give rise to identical expectations, will largely depend on the way in which people interpret it' (p. 75) and although this interpretation is based on expectations, which are 'largely a response to events experienced in the past, ... the modus operandi is not the same in all cases even of the same experience' (p. 67).

Quite obviously, this notion of the price mechanism as a special dissemination device cannot imply that prices actually convey an entrepreneur's future relevant information in a form conceivable to any observer[1)]. The point to be made here, is that the price indicates potential opportunities of entrepreneurial activity, e.g., the prevailing price movement may indicate shifting scarcity relations.

It is this very context that also characterizes the price mechanism as an incentive mechanism: The attending observer may

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1) This is quite at odds with the standard FAMA-approach.

be activated to a similar engagement or, at least, may find the situation worthwhile to be explored in greater detail. Therefore, the price mechanism turns out to be rather a 'fire-alarm' than a 'telex'.

To refer more closely to futures trading practice, the explanation here corresponds to the demonstration of those processes informational divulgence, as outlined earlier. The understanding of this kind of process, considered from this revised point of view, is alleviated by pointing to the fact that the gradual decay of monopolistic information positions coincides with the process of infiltrating information in the I-system and, in essence, is the same. In this sense each 'profitable' transaction carried out, which is based on relevant knowledge about the future, signals to its observer a potential source of entrepreneurial activity[1].

This view is in fact the MISESian idea[2] of the entrepreneur as an alert arbitrageur, relentlessly looking out for new price-cost differences to be exploited. And, although threatened by the 'fear of losses', he is driven by the 'lure of profits', to search for those opportunities, that have been left unused by others.

From the point of view of the (initial) information-holder, however, this process - as already noted - involves the undesired circumstance that by virtue of himself on trading activity, and through the particular functioning of the price mechanism, part

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1) It is not granted at all, however, that this possibility of entrepreneurial activity is actually used by an observer. To suppose this would require that this sort of activity consisted only in the initiation of uncreative copying or imitation processes. Although this is important, it does not exhaust the idea of the entrepreneur.

2) For L. MISES' main contribution in this field and as a constituent work for the Austrian School one should mention 'Human Action' (1949), but also his 'Epistemologic Problems of Economics' (1960).

of his future relevant information gets revealed and initiates - generally speaking - further entrepreneurial activity (e.g., imitation and adaptation). Hence, as a most natural thing, according to the obsolescence of the entrepreneur's superior knowledge his (monopolistic) profit-position also dwindles. And, even worse, he finally cannot even be confident that his engagement may not turn to his disadvantage (e.g., in the case where his trading position is based on information that is opposed to the actual development). In his view, these possibilities mark competition as a process which is of questionable desirability. It is this very context, however, which labels the price mechanism as a propagation mechanism or, even more accurately, a dissemination mechanism.

In recognition of this fact it paradoxically appears, that information processes by means of the price mechanism bear their own antithesis. On the one hand information is collected, while contemporaneously - on the other hand - it is dispersed[1]. However, as is often the case, the paradox is more ostensible than real. The HAYEKian argument of 'catallaxy' provides an exposition of information processes to explain a well-arranged outcome (a well-arranged entiteness), i.e., information processes are mainly investigated in respect of 'the use of knowledge in society'[2]. This perspective then can quite easily be paralleled with KIRZNER's entrepreneur-argument, i.e., information processes with respect to 'the individual production of knowledge'. While HAYEK's concern resides more on the integration function of competition, KIRZNER's position focuses more - according to H. ARNDT's trenchant expression - on the socialization function of competition[3].

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1) 'We must look at the price system as ... a mechanism for communicating information if we want to understand its real function' (HAYEK, F.A.v., 1945, p. 86).

2) See HAYEK, F.A.v. (1945).

3) See ARNDT, H. (1951).

2.3 Divergent Expectations and Speculative Prices

2.3.1 The Idea of Expectations

The above-mentioned argument that by means of the price mechanism agents only receive little stimulating indication which might be worth to be explored in greater depth, emphasizes the necessity to look more closely at the way projections about the future are formed. These projections have always been man's favourite game, his 'true hybris', as I. WALLERSTEIN (1974, p. 414) somewhat poignantely notes. In the same vein L.M. LACHMANN (1976a, p. 59) states:

> 'The future is unknowable, though not unimaginable. Future knowledge cannot be had now, but it can cast its shadow ahead. In each mind, however, the shadow assumes a different shape, hence the divergence of expectations'.

Until J.M. KEYNES' (1930) pioneering work in which 'expectations' explicitly entered the range of economic thinking, this field had been an almost virginal area on the economist's globe. Nowadays the research into expectations rides the waves of popularity since it has turned out to be the very pivotal issue in getting a deeper understanding of market processes - particularly in the field of speculative trading.

However, although speculative trading in futures markets or similar institutions covers only a rather insignificant part of the whole range of economic activities, the notion of speculation has a far broader interpretation in economics: All markets for goods, which are to any degree durable or storable, are essentially speculative, since a given day's price is influenced by expectations concerning the unknown price of the following week or following year[1].

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1) Similarly expressed by G.L.S. SHACKLE (1982, p. 232). L. MISES (1960, p. 252) is even more rigorous: '...the outcome of action is always uncertain', he maintains; 'Action is always speculation'.

According to this line of reasoning, the idea of markets as devices of information processes specialized in labour has to be seen in connection with the idea of markets being a device for settling individually held prospects. It has often been argued that the aggregation of individually held prospects is a performance of the market system, which is hardly a 'modus procedendi' depictable in a schematic form. This is mainly because there is no good reason to believe that the formation of individual expectations can be traced back to some generally stable patterns of behaviour. Taking this point of view, the particular merit of a market system, nevertheless, resides precisely in the fact that, by virtue of a widely unknown mechanism, it is capable to produce a coherent result. And to a dominant extent it is based not only on contesting, but also widely on - in a sense - incommensurable beliefs. Such a treatment of expectations undeniably comes closer to reality, but inevitably at the expense of some 'positive knowledge' otherwise to be gained. As L. MISES (1960, p. 11) maintains:

> 'The same situation has a different effect on different men. The attempt to arrange men in classes, whose members all react in the same way has not been successful, because even the same men react differently at different times, and there is no means of ascribing unequivocally definite modes of reaction to different ages or other objectively distinguishable periods or conditions of life'.

MISES' remark adds a new dimension to the interpretation of human behaviour - a remark, which in its general significance aims in the direction of a philosophical attitude that occasionally is labelled as second degree of indeterminism. The Aetial-Principle, (or first degree of indeterminism) attributes to each realization of a set of initial conditions a probability number. The interpretation of these numbers in the light of KOLMOGOROFF's axioms then gives opportunity to derive optimal strategies under uncertainty. In this case expectations are, so to speak, 'uniformly

held beliefs'. They correspond to the mathematical concept of expectations, for example in its special form as expected utility. This kind of formalization provides a procedure, which - although attractive in its logic and 'provocative' simplicity - truncates the speculative outlook into the future to a simple mathematical algorithm by means of - as G.L.S. SHACKLE (1949, p. 112) notes - 'an unappealing, unexciting abstraction such as the mathematical expectation'.

G.L.S. SHACKLE (1949, 1969, 1970, 1972) in particular (among others) from a subjectivist's point of view devoted a great part of his writings to point out the fruitless collage consisting of a theory of expectations and the traditional theory of probability[1)]. In his opinion, shared by all scholars pursuing this line of reasoning, the tricky outcome of such a hybridization

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1) 'In the first place, SHACKLE has extended the scope of subjectivism from tastes to expectations' (LACHMANN, L.M., 1976a, p. 58), and - this should be added - deliberated the idea of human expectations from the iron claws of the classical probability calculus.
It would take a much more extensive review than is provided here to account for all the different branches in the field of probability theory established so far to meet these problems. For the sake of completeness but without going into details, at least four schools of probability can be distinguished, which are often somewhat spontaneously mixed up under the heading of 'classical probability'.
(i) The quotient approach of P. LAPLACE (1812). This 'classical' definition of probability refers to the quotient of favourable outcomes to some event and the total number of all possible elementary outcomes.
(ii) The frequency approach of J. BERNOULLI (1713), mainly axiomatisized by J. VENN (1866), H. REICHENBACH (1935) and R. MISES (1936), treats probability as the limit of objective frequency: $prob(x_i)=lim(x_i/x_n)$.
(iii) The logical school of probability (Representatives: J.M. KEYNES (1921) and, especially R. CARNAP (1962)) measures probability as a logical objective relation of a set of evidence to the objective truth of some hypothesis.
(iv) The subjective school of probability, in which probabilities are treated as 'degrees of beliefs', applicable to repe-

(continued)

is a theory of certainty 'in suitable disguise', i.e., a risk-less-choice approach. This holds true, since bundling of events and their infinite repetition produce 'stable numbers' that 'turn ignorance into knowledge, or doubt or fear into assurance' (SHACKLE, G.L.S., 1979, p. 7).

The second degree of indeterminism claims the impossibility to weight the different and unknown outcomes of some kinds of experiments[1]. The occurence of an event is not considered as the

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footnote continued

titive and not unique events. This school has mainly been inaugurated by F.P. RAMSEY (1931), B. deFINETTI (1937, 1949), L. SAVAGE (1954), and J.W. PRATT, H.RAIFFA and R. SCHLAIFER (1965). Most of these different approaches are finally manageable in terms of A.N. KOLMOGOROFF's (1933) axioms (e.g., probabilities add up to one, the addition-rule and multiplication-rule are valid). However, there has been a tendency in the subjective school to loosen these axioms, which for a series of reasons are considered as too restrictive and too severe as to provide acceptable decision criteria for typical human situations of decision-making. For an authoritative discussion of this point see CHURCHMAN, C.W. (1961) or SCHOEMAKER, P.J.H. (1982).
G.L.S. SHACKLE has the particular merit of having attempted to eliminate these perceived deficiencies of conventional probabilism (as some of the more recent authors one should mention KAHNEMAN, D. and TVERSKY, A. (1972)). His concept of potential surprise deals 'not with measurable risk and the application, in circumstances which give it meaning, of actuarial probability, but with the totally different problem of what are the human reactions to uncertainty, that is, the irreducible core of ignorance concerning the outcome of a virtually isolated act' (SHACKLE, G.L.S., 1949, p. 118).

1) In economics the various degrees of indeterminacy are more commonly referred to as the KNIGHTian distinction between risk and uncertainty (KNIGHT, F.H., 1921), picked up by GEORGESCU-ROEGEN, N. (1966b, p. 63): 'risk describes a situation, where the exact outcome is not known, but the outcome does not represent a novelty. Uncertainty applies to cases where the reason why we cannot predict the outcome is that the same event has never been observed in the past and, hence, it may involve a novelty'. It is due to this fundamental difference that only 'in the case of risk, but not in the case of uncertainty, we can define the probability of the outcome' (GEORGESCU-ROEGEN, N., 1954, p. 524). In traditional treatment,

(continued)

result of a specific set of initial conditions, but as the outcome of a conglomerate of all preceding events, whose collective configuration bring forth its particular realization (uniqueness of events).

2.3.2 Consensus Expectations versus Divergent Expectations

The decisive significance of the postulate of uniqueness of events for the treatment of expectations is that ignorance puts the decision-maker in the 'normal' position, where he - as noted by G.L.S. SHACKLE 1979, p. 53)

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footnote continued
however, this distinction is payed little attention. Classical probabilism enjoyes widespread acceptance, and even - as already indicated - the character of randomness, that 'all aspects of risk are melted into a single criterion, that of "expected utility"', vanishes (ibid., p. 525). It may also be noted, by way of digression, that the mapping-out of expectation into the real numbers only covers a special class of expectations (criterion of comparability), a fact that has again been emphazised by the same author (GEORGESCU-ROEGEN, N., 1966c, esp. pp. 263-269).
H. SHUBIK (1954) has drawn attention to the circumstance that the transition from certainty about risk to ignorance ('uncertainty' in KNIGHT's terminology) may not procede in distinctly ordered steps, but may form a continuous scale, mainly due to a missing delimitation of the notions. He writes that 'the amount of information regarding the future states of many factors influencing business drops off monotonically as the time period becomes more distant', and he continues that then 'for example the probability distribution ... becomes more and more tenuous with time until it ceases to have much meaning for the purpose of planning' (p. 634). It is important to recognize that the point stressed by SHUBIK still allows the issue to be handled in traditional terms, i.e., in terms of conventional probabilism. Then, however, those opposing scholars, as cited above, were no less than victims of what R.G. COLLINGWOOD (1933, p. 48) labels the 'fallacy of precarious margins': One tries to draw precise boundaries where no precise boundaries exist. Hence, the KNIGHTian classification would be a 'distinction without a difference'.

> '... is conscious that even the foreground of the field of action in time-to-come is a shifting mist and that all beyond melts into a void'.

Although SHACKLE's words sound somewhat mysterious, they characterize a common persuasion which I.M. KIRZNER (1976a, p. 42) paraphrases as 'an indeterminacy and unpredictability inherent in human preferences, human expectations, and human knowledge'.

This distinctive way of approaching expectations mainly deprives the issue of its formal accessability. As a result of this one may conclude that - as the most normal state - decision-bearers differ in the evaluation of their prospects about the future. Hence expectations cannot be regarded as to be forming identical prospects but must be envisaged as changing from one instance to the other, and from one person to the other; in essence: Individual expectations are individually different expectations.

Although at the first glance this conjecture is hardly a point of contention, it receives special emphasis when one turns to speculative trading practices. Here one should carefully distinguish between 'individualistic' and 'aggregative' economic expectation. H. WORKING (1949a), who mainly established this set of ideas, views 'market expectations' as 'aggregative expectation' (p. 152), in the sense that some economic variables (e.g., futures prices) reflect a sort of 'consensus expectations' (p. 151). The point is that on the aggregated market level speculative prices can be envisaged as the outcome or realization of those consenting prospective expectations. It is WORKING's suggestion that recorded speculative prices (e.g., the time-series of futures prices) may be similar to random guesses which, for example, are involved in a simple WIENER-process. Apart from their inherent randomness (variance), however, these series may in a sense be

defective as to exhibit a sort of biased development[1]. In order to maintain their special random character, these biases must either be insignificantly small in their influence[2], or must tend to diminish progressively after their occurrence[3].

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1) H. WORKING (1949a) mentions four different kinds of biases: (i) the general bias, in the sense of a KEYNESian normal backwardation (p. 153), (ii) the conservative bias due to a tendency inherent in market expectations to lag behind in adjusting fully to new substantive information (p. 154), (iii) the informational bias, 'arising form inadequacy of information (p. 155), and (iv) the exaggerate bias as 'a supposed tendency for market expectations to respond excessively to day-to-day news and rumors and to generate unwarranted price-fluctuations' (p. 156).

2) As in the KEYNES-case.

3) See WORKING, H. (1949a, p. 158). As a point of interest one should notice that the statement 'tend to diminish progressively after their occurence' is in its result not conform to a WIENER-process. Following his reasoning, it is no surprise that a correlation test exhibits some form of price-dependencies. This objection has not been left unnoticed. In a case-study about cycles in speculative prices, WORKING takes account of this fact and analyses the movement of wheat prices as 'random, or nearly random , change during most of the time, and a sort of true cyclical movement in isolated occasions' (WORKING, H., 1974, p. 51). He continues to offer an economic interpretation: '... wheat prices usually behave in a manner approximating the theoretical ideal, ... but occasionally something happens to throw prices out of proper adjustment, whereupon readjustment occurs gradually' (see also WORKING, H., 1958, p. 195). This may even go so far that 'the expert who studies the course of price relations in a futures market over a period of a few weeks or months may often gain thereby valuable clues to the influences operating in the market' (WORKING, H., 1942, p. 50). Most probably the expert WORKING has in mind is one of those vivid arbitrageurs called 'scalpers' who, according to his opinion, do not aggravate (e.g., ride short-term price movements) but diminish price fluctuations, i.e., stabilize the market. Thus H. WORKING advocates the opinion that speculation is conbucive to smooth market performance. On the other hand, N. KALDOR (1939/40a, p. 10) conjectures that 'in every market there is a certain range of price-oscillation within which speculation works in a destabilizing direction while outside that range it has a stabilizing effect'.

Given this kind of consensus-belief assumption, it became customary in mainstream economics to view markets as mainly used by socalled representative traders, i.e., traders who are powerful enough to form expectations, which are consistent to the final evaluation of the market[1]. This suits the notion that markets are instruments of selection: Inept traders are (if they really exist) sooner or later driven out and after a (short) period of transition the market finally is exclusively managed by traders having not only superior information, but some kind of perfect foresight (see FIGLEWSKI, St., 1978). The situation seems to be appealing. It means an utilization of information which in any respect is perfect: There is no kind of aberration that would require any kind of correction - the system performs 'without waste'.

But it is difficult to find an adequate theoretical exposition of this extreme situation. Perfect foresight includes all relevant information about alternatives and preferences as well as knowledge about all planned actions of all other transactors[2]. It requires a kind of 'Cartesian esprit géométrique[3], able to fill in all blanks in a PARETian-system of equations to be solved simultaneously, in order to drive a 'pertium mathematicum' and its corresponding quantity[4].

No further argument is necessary to demonstrate the inappropriateness of such a view. Being aware of the severe implications

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1) With regard to futures trading the adequacy of this simplification has already been discussed by N. KALDOR (1939/40b) and R.G. HAWTREY (1939/40). HAWTREY rejects KALDOR's 'representative trader' by pointing out that there is no 'one' expected price common to all traders (p. 203).

2) See O'DRISCOLL, G.P. (1977, p. 23).

3) This is F.A.v. HAYEK's succinct expression.

4) See HAYEK, F.A.v. (1975, p. 16).

involved in such assumptions, there is probably no way to evade the suspicion that the subject might be mishandled. But this scepticism is often only superficial and it is matched by a naive overconfidence in one particular approved line: To present a coherent explanation of market processes that would consist of '"algebraic" theories describing only the general character of higher-level generalities' (HAYEK, F.A.v., 1964, p. 29), in order to arrive at a maximal degree of reduction in complexity[1].

These special problems associated with the production of knowledge in a market economy, however, have been recognized long ago, and there has always been a widespread consensus that the private agent has an incentive to try to predict prices correctly or, in T.W. HUTCHINSON's words (1977, pp. 86 ff.):

> 'the case for relying (mainly or entirely) on the price system can be reasonably and coherently formulated ... in terms of superior foresight of profit motivated private individuals'.

But, quite evidently, 'superior foresight' does not mean 'perfect foresight', not even knowledge of 'all relevant facts', quite apart from all shades of omniscience. It means 'superior foresight' compared to the achievemetns of all other social information systems known so far.

There have been many attempts to prove the absurdity of the perfect-foresight assumption. They usually concentrate on the point that such a reference system is by all means the most incongruous one to explain individual decision-making under perceived informational constraints. Perfect foresight makes the formation of expectations virtually redundant: A procedure

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1) HAYEK refers to this procedure as the 'Pure Logic of Coice'. HAYEK, F.A.v. (1937, p. 35).

without any epistemological gain[1].

2.3.3 The 'Unquiet Market'

The consensus-belief assumption is also rendered obsolet by a much more subtle argument, which in the case of futures trading has recently been put forward by M.E. STREIT (1983a). The controversy rests on the fact that market-conform, e.g., perfect-foresight expectations not only neglect the traders' limited information processing capacity but, even with this limitation taken into account, give ample reason for an immediate break-down of the market mechanism itself.

Assuming that markets are mainly managed by traders whose trading motives can reasonably be subsumed under a profit-seeking strategy (as opposed to the hypothetical insurance-motive), one has to be aware of one important particularity: The technique of speculation shows considerable congeniality to betting. However, constituent to betting is to set one's conjecture against another's; in short, opinions involved in a bet must necessarily dissent[2].

Although being an admittedly primitive illustration, it lends some explanatory power to the issue discussed here. As STREIT has shown in great detail, speculative trading only starts if the traders engaged expect some advantageous result - each of them according to his own informational background. This must be true for the seller as well as for the buyer. Both of them believe that they are looking after their interests in the best possible

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1) Cf.: 'Die Entdeckung, Verarbeitung und Nutzung von Wissen... macht ... das Definitionskriterium von Marktprozessen überhaupt aus. Von diesem Aspekt abstrahieren heißt also, das Problem der wissenschaftlichen Behandlung von Marktprozessen auf definitorischem Wege umgehen'. (GRAF, H.-G., 1978, p. 32).

2) A wellknown saying is: 'It takes differences of opinions to make horse races'.

way. The seller, because he has evidence that prices will go down, the buyer, because he conjectures that prices will move up, hence their expectations are opposed as far as the development of prices is concerned. However, the position of prices on the day of maturity is determined by the correctness of their expectations, and those traders, whose expectations are more in accordance with the actual situation will be able to offset their market position in their interest. Their profits are equivalent to the losses, that comparatively worse traders are going to suffer due to the cancelling of their commitments. In other words: One side exactly gains in the amount of the other side's loss. The essence of this simplified delineation can be summarized in a single remark: In speculative markets, sellers speculate against buyers or, in more conventional terms, 'there must be bears and bulls'.

The preceding argument has some important implications for the traditional assumption that traders are endowed with 'concordant beliefs'. According to J. HIRSHLEIFER (1977a, p. 979) concordant beliefs (with some slight modifications they are also labelled as 'representative beliefs' or, in M.E. RUBINSTEIN's (1975) terminology, as 'consensus beliefs') mean:

> 'that essentially all the market weight in price determination will be contributed by traders who share identical prior probability beliefs about which state of the world will obtain. This does not mean that belief-deviant traders are rare or unimportant, but only that they cancel one another out so far as effects on prices are concerned'.

A theory based on such an assumption pursues a methodological route that may be expected to lead to a dead end since, as already indicated above, there is strong evidence that speculative trading never comes into existence under such idealized conditions: Speculators endowed with the same (correct) infor-

mation[1] will generate identical prospects. The new price, already common to all, will instantaneously move to its conjectured position and will remain there until new evidence requires another change. The crucial effect is the non-occurence of transactions which in fact have to be carried out, as early as the intention to sell or to buy under these conditions causes a corresponding change in prices. Not one single contract will necessarily be transferred in anticipation of this new price: The market comes to halt.

It is this very context, which under these conditions renders speculative trading obsolete. This conclusion is also demonstrated in a passage of G.L.S. SHACKLE (1982, p. 232), where he asks:

> 'What like is a speculative market? It is inherently restless, it is the unquiet market. All dealers want it to move in opposite ways, but they cannot make a worthwhile gain unless it moves. Any impact which has suggestive power enough to stir the excitement of dealers will be greedily exploited to make the market move'.

Again, SHACKLE's remark runs counter to a large number of writings, trying to explain speculative trading in connection with consensus expectations; a body of literature dealing with the factors that explain the phenomenon within the traditional scope, so as to construct an axiomatically consistent, generally applicable, as well as numerically computable measure of expectations. This formulation, as already noted, runs also counter to the orthodox version of perfect-foresight models.

Even if one accepts its more refined versions (e.g., that either perfect foresight should only be understood as an asymptotic property or as a pertinent 'as-if-assumption'), perfect foresight cannot defuse the main objection raised above; it leads to the

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1) With similar ease one could also use a term which is more en vogue: 'Rational Expectations'. However, it is the adjective 'same' rather than 'correct', that is really important here.

same 'sui-generis'-error. While both of those auxiliar assumptions mainly serve as 'men of straw' destined to alleviate the acceptance of their exceptional conclusions (in other words, provide some help to understand something that cannot be), the main insight derived from above is: It is not necessarily so. This is a rejection, which essentially is founded on logical reasons, and not on grounds of plausibility[1].

2.3.4 The Principle of False-Price-Trading

At this junction we briefly place the above mentioned apprehension of expectations in the context of an additional emerging difficulty, which will reveal some other important implications. If the interpretation of divergent expectations is to be meaningful, then both the buyer and the seller surely must consider the prevailing price to be incorrect with respect to their own informational background. In particular, this gives evidence for the case that both of them, in their own views, contract at a 'false price'[2]. Thereby, it does not matter, whose anticipation finally turns out to be correct, or who showed a higher degree of correctness; those engaged in a newly fixed contract believe the ruling price to be 'incorrect'.

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1) Things are becoming even more complicated if one assumes perfect foresight and the predictor's own action to be a (predictable) variable in all others predictors' calculuses, thus a situation where the predictor's behaviour is part of the predicted system. This leads to such logical paradoxes as the one, for example, mentioned by O. MORGENSTERN (1935, p. 343) where (under the paradigm of perfect foresight) Sherlock Holmes, facing his enemy's perfect-foresight capacity, would have to commit himself to Moriarty already at Victoria Station. MORGENSTERN shows that under the stipulation of perfect foresight there is no convergence to the PARETian competition-solution if CHAMBERLIN's monopoly-solution is adopted to an ever increasing number of traders.

2) See STREIT, M.E. (1983a, p. 71).

As an analytically expedient example for this unfamiliar idea one may consider J. HIRSHLEIFER's (1975, p. 529; 1977a, p. 978) differentiation a "prior-round trading" and a "posterior-round trading". In the first round traders attempt to establish trading positions in the market aiming at prices, which they expect to be changing to their advantage in the (near) future. Hence, they expect events to occur, that would induce a favourable price-change, in a way that the subsequent removal of their commitment would lead to a net profit position. This second trading activity is conducted during the posterior-round. The pivotal point, however, is the correct anticipation and interpretation of those emergent phenomena, which at least partially diminish the uncertainty, that is inherently involved in such forms of trading.

Generally, this scheme of trading and its corresponding interpretation is meaningful for almost all trading situations. As M.E. STREIT (1983a, pp. 72 ff.) has shown, there are some expectations, which nevertheless mainly arise in the emergency-situation where 'missettled' trading positions have to be corrected (e.g., this could require selling at an unfavourable price to prevent (increasing) losses). This is most likely to occur at the date of maturity, or the period shortly before, when a consensus is 'imposed upon traders by the facts of the spot market' (STREIT, M.E., 1983b, p. 8).

As far as the actual changes in prices are concerned, this process, however, occurs when in a rather general sense, one trading group gains preponderance. But in spite of all concomitants characterizing such a situation, its principle still remains valid: the incentive for trading arises from the fact that traders consider the prevailing price to be false. In this context it may be worth to quote A. SHERRARD's[1] analysis of such a

1) See WORKING, H. (1958, p. 204). The quotation is part of the discussion which immediately follows the article. See also WORKING, H. (1958, p. 193).

price-change in some length:

> 'The trader will respond to this in the light of his own independent information. If he feels that the new price is not "appropriate", he has an opportunity to profit by either buying or selling - backing his own judgement against the composite judgement of other traders, as represented in the prevailing price. His action will then contribute to a further price movement. The essence of the matter is that the information and understanding of the different traders, insofar as they are not in agreement, can be made effective, in a social sense, only through buying and selling'.

This view again gives strong evidence to the notion that to their greater part trading activities are carried out in accordance to the principle of false-price-trading[2], although this interpretation widely conflicts with the common analysis of speculative trading.

2.3.5 Speculative Prices versus Forecast Prices

If one accepts the kind of process described in SHERRARD's quotation, an additional problem emerges, which points at a further inconsistency of the orthodox theory: Corresponding to a well-established conceptualization, efficiency-oriented research seeks to prove futures prices as at least to be an unbiased predictor of future spot prices. This common formulation asserts that in informationally efficient markets these futures prices (i.e., anticipated future spot prices) must be considered as correct conditional forecasts for the actual emerging price. The justification for this kind of predictive power again rests on the stipulation that the conditioning individually perceived factors are not only identical for all market participants, but are also identically interpreted among them.

However, all these tentative explanations transcend the basic

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1) Similarly see STREIT, M.E. (1983a, p. 71)

question to what extent under these conditions profit-oriented hedging or speculation strategies are of any sense. From the perspective of the principle of false-price-trading this theoretical line analogously conflicts with observabel behaviour, as already demonstrated in the previous case. If correctly inferred prices are common to all traders, they do not leave any profit opportunities to the single investor worth to pursue. The best he can hope for is that the Goddess of Fortune from time to time presents to him a 'windfall-profit'. But he probably can never hope to convert his engagement from an outcome of pure chance and adventure to a steady business.

The reason for this peculiar situation must mainly be located in the circumstance that although the major entrepreneurial challenge of this kind of business consists in the search for future-relevant information, this activity becomes entirely futile under these conditions.
The crucial analytical indication rests on the idea that the alleged efficiency-attesting property shows itself in fully informational prices, i.e., in prices, which already include all available information accumulated so far, that are relevant for the future. By the same token the past and, more important, the future, is no longer a heavy burden, and the main characteristic of such efficient markets is the possibility of unpredictable price changes. The property of unpredictability indicates that all available information is entirely utilized by market participants; and if new information randomly enters the scene, its relevance - via general equilibrium forces - is instantaneously incorporated into the prevailing price.

Although attractive in its formal construction, this kind of explanation, when taken to its logical conclusion, leads to a succession of inextricable inconsistencies, which finally doom any attempt to elucidate this sort of profit-oriented, individual trading acitvity. In the same vein, one should like to paraphrase

HIRSHLEIFER's aforementioned statement: It is in fact the belief-deviant trader, who he assumes to play a neutral, in a sense also redundant role, who actually forms the market price. Individuals endowed with representative expectations will not hedge or speculate to achieve profit - in short: They will not trade at all[1].

2.4 Monopoly and Profit

2.4.1 The Notion of Friction

A major point of disagreement between Austrian theory and neoclassical theory - although seldomly discussed in detail - is found in the different opinions of efficient market performance. A common method is to equal efficient performance to 'absence of friction'. Behind this opinion the conviction can be found that friction is some kind of inaccuracy or waste.

In neoclassical theory market inefficiency becomes apparent particularly in the existence of monopolies. The polypolistic reference model disperses market power to an infinite number of participants, attributing to each of them only an infinitesimally small amount of influence. The execution of monopolistic power is only imaginable under circumstances rendering the competitive forces of the market hindered, thus causing their performance to be imperfect. The reason why a concentration of economic power is regarded as an undesired configuration lies in the SMITHian apprehension that monopolies only yield a higher rate of profit, but it is competition that increases opulence. Almost all economists in the tradition of SMITH bedevilled monopoly as the visible result of subefficient market performance. In the

1) This unorthodox conclusion, however, is also recognized by HIRSHLEIFER himself (see HIRSHLEIFER, J., 1975, p. 539).

same vein the notion of profit is a disliked conception.

As far as profit is concerned, it is quite in line with this reasoning to consider profit as the 'spoil of monopolistic power'[1]. Hence profit can only occur in situations where there is some kind of 'incomplete adaptation', i.e., in situations of imperfect performance. Especially in Austrian theory this kind of reasoning has been rejected with vehemence. It is argued that without the prospect of profit the main incentive for entrepreneurial actitvity is lacking. There must be a reasonable chance to reach a revenue level that exeeds pure costs. This coincides with the idea already set out in chapter I (1.2.2.2), where the entrepreneurial profit was delineated as a sort of entrepreneur's wage. Along this line it is argued that 'the entrepreneurial element can only come to existence in situations where "imperfect" knowledge and market failure are granted an untidy presence' (KILBY, P., 1983, p. 107).
In this respect 'hampering frictions', for example incomplete information or suboptimal behaviour are effects which in orthodox theory have often been underrated; and if these frictions have played a role, it is the role of dissipation of energy (effects to be overcome) so that the resulting motion may be as regular as possible. According to this view, these frictions prevent the market from becomming fully adjusted at once; they prevent the apparently desirable state of the economy, in which all expectations are correct expectations from becoming real. This particular state of fulfilled expectations is then compatible with the 'equilibrium position' of the market: 'It appears that the concept of equilibirium merely means that the foresight of the different members of the society is in some special sense correct' (HAYEK, F.A.v., 1937, p. 41).
As already pointed out in the previous sections, however, the equilibrium position as a state where all incentives for change

1) See LAMPERTON, D.M. (1972, p. 196).

are eliminated can hardly offer a meaningful explanation of speculative trading. This does not mean that the notion of equilibrium has no significance at all. It seems to be less irritating, however, to speak of a tendency or movement towards equilibrium, viz., market processes which do not exhibit a tendency toward equilibrium act as to diminish excess capacity by rapidly synchronizating prices. Such a view then shifts the focus of interest from equilibrium itself to the process of approaching the equilibrium.

The market process is explained as a converging movement towards a point of tranquility. Thereby, the notion of tranquility is not further elaborated - for example, it could mean equality of demand and supply or, more generally '... daß die verschiedenen Pläne, welche die sie zusammensetzenden Individuen für Handlungen der Zukunft gemacht haben, miteinander verträglich sind', (HAYEK, F.A.v., 1970, p. 59). The crucial argument in this approach is not to view the problem in terms of points of tranquility, but in terms of unadapted, unexpected events, which permanently disturb and therefore impede a smooth and finite movement to a certain point of tranquility. Even the thought of one relevant point is denied in favour of a multitude of ever changing ones. Therefore thinking in these terms is rejected at all.
The causal-genetic approach urges the focus of attention to more or less dynamically changing situations of non-equilibrium instead of considering theoretical equilibrium situations where all adaptation processes have come to an end.
In a more overlapping reflection SCHUMPETER points a vivid picture of what could be meant by this and by the adjective 'causal-genetic': 'Der Kapitalismus ist von Natur aus eine Form oder Methode der ökonomischen Veränderung und ist nicht nur nie stationär, sondern kann es auch nie sein. Dieser evolutionäre Charakter kapitalistischen Prozesses ist nicht einfach der Tatsache zuzuschreiben, daß das Wirtschaftsleben in einem gesellschaftlichen und natürlichen Milieu vor sich geht, das sich

verändert und durch seine Veränderungen die Daten der wirschaftlichen Tätigkeit ändert, ... (sondern) der fundamentale Antrieb, der die kapitalistische Maschine in Bewegung setzt und hält kommt von den neuen Märkten, den neuen Formen der industriellen Organisation, welche die kapitalistische Unternehmung schafft' (SCHUMPETER, J.A., 1950, pp. 136 f.).
Just as HAYEK, who reflects to a greater extent the above context as the view of market processes as information processes: '... that if the tendency towards equilibrium, which we have reason to believe to exist on empirical grounds, is only towards an equilibrium relative to that knowledge which people will aquire in the course of their economic activity ...' (HAYEK, F.A.v., 1937, p. 53).
HAYEK's quotation is clearly related to what is meant in this work by the term "information efficiency". It is the ability of a social system to generate a certain state of knowledge in a permanently changing environment, which would not differ decisively from the state of knowledge, that would occur, if the relevant information about the changing environment would have been transmitted to everybody right from the beginning.

This being accepted, the question crystallizes around the point '... how much knowledge and what sort of knowledge the different individuals must possess in order that we may be able to speak of equilibrium', (HAYEK, F.A.v., 1937, p. 48). However, the above definition seems to be torpedoed, because '... it is clear that if the concept is to have any empirical significance it cannot presuppose that everybody knows everything', (HAYEK, F.A.v., 1937, p. 48). The request may be best described by HAYEK himself when he aims '... to show that in this sense the spontaneous actions of individuals will ... bring about a distribution of resources which can be understood as if it were made according to a single plan, although nobody has planned it ...', (HAYEK, F. A.v., 1937, p. 52).

It is not difficult to explain why traditional economics has focused its attention to the theory of equilibrium, relatively neglecting the theory of the approach to equilibrium. The explanation lies mainly but not exclusively in the incongruity of the symbolization of catalytic processes by a proper arrangement of typical dynamic equations. Specific numerical relationships fail to come to grip with the complexity of market processes and their inherent lack of constants[1]. A further reason arises from the common apprehension of efficiency, paraphrased by the term 'the faster the better'. Then, however, it is only too reasonable to concentrate on the hypothetical and final limiting state of these prices. The process itself can hardly be of any decisive interest, since it marks only a state of transition, which - if possible - should be omitted. Correspondingly the divergence of expectations, an indispensable part of any meaningful interpretation of speculative trading - besides being a major source of disequilibrium - is in the first instance a source of inefficiency. As J.R. HICKS (1979, p. 133) goes on to argue 'whenever such a divergence occurs, it means (retrospectively) that there has been malinvestment and consequent waste. Resources have been used in a way in which they had been foreseen, will not be satisfied or will be satisfied imperfectly. Thus disequilibrium is a mark of waste, and imperfect efficiency of production'. Placed in such a general context, this is certainly not an adequate description of speculative trading. HICKS' statement may be correct from a single trader's viewpoint, whose expectations went astray, but only in the trivial sense that he was somehow mistaken. False expectations are always undesirable not taking into account, whether expectations are divergent or identical. The question is: Are they evitable? HICKS' argument is drawn from a reference system, which in no respect is concerned with the problem of a

1) This is not only a specific 'Austrian' viewpoint, but also shared by numerous other economists. Representative for them see KEYNES, J.M. (1936, p. 297).

choice between uncertain alternatives but with the allocation of productive means when knowledge is equally available for all. Quite evidently, in such an arrangement any divergence from the factual truth must be considered as a waste. Because it is not known what like the facts will be, there is no use in pointing out that some agents waste time and means because they have false prospects. The point is that for some others investment has not been in vain, precisely because they had different (and superior) foresight. Unless one can safely assume that there is no reason why people will make mistakes, divergence of expectations then can rarely be regarded as a sort of waste. The discrepancy between an ideal norm and real life cannot lend itself to a sound justification. In contrary, under uncertain conditions, divergent expectations in combination with divergent action can be considered as a powerful and rational strategy to increase the likelihood that at least some may be correct in their anticipation.

In such a situation the notion of friction also receives a different meaning: Superior knowledge can only be advantageous when some form of (chronological) delay hampers an instantaneous adjustment and gives way to the possibility of corresponding actions. Quite naturally, the successful entrepreneur unwillingly contributes to a better adaptation to future scarcity of the economy as a whole, and at the same time accelerates this process toward the hypothetical situation, which would be fully compatible with that particular set of data. The point, however, is to recognize that this describes a market situation which is characterized by divergent expectations among traders. It is a disequilibrated state of the economy in connection with a process of partial adjustment towards the final equilibrium. Only the succession of such situations gives the entrepreneur's activity any meaningful sense. Correspondingly, friction becomes one of the constituent factors of the viability of entrepreneurial activity.

2.4.2 Monopoly

The previous section's analysis was based on the thesis that entrepreneurial activity in monopolistic practice always appears to exploit the difference between all revenues and all contractual stipulations[1]. If this interpretation is of significance then surely monopoly stands for market-disequilibrium which is of central interest. This situation must be clearly separated from well-established theories like those in the tradition of COURNOT, CHAMBERLIN or STACKELBERG, who, although dealing with monopolies, only succeeded in deriving an analytic formulation of the special case where markets in some sense are in equilibrium. Most of the rejection of monopoly stems precisely from this myoptic view, which particularly fails to focus on the position monopoly receives in the market process. The analytically obvious welfare losses induced by monopolistic power in equilibrated markets as compared to the polypolistic reference-model have supported this opinion. In fact, any deviation from PARETO-optimality is considered as a conclusive indication of market failure.

J.A. SCHUMPETER is one of those prominent advocates, who formed the contrasting position, namely that monopolistic practice must not only be seen as a pathological aberration of the classical market model. He argues that especially in the short-run monopolistic postitions are a common practice, and, as a natural consequence, entrepreneurial profit is conveyed by the monopo-

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1) Entrepreneurship itself has nothing to do with ownership of productive means (cf. footnote p. 43). However, the monetarization of the preceived difference requires in some form the use of productive means. This is the junction where the entrepreneur has to collaborate with the manager. The latter then acts as an efficient administrator who hires or acquires all nessecary inputs.

listic surplus[1]. The emergence of profit finally results from a 'process of creative destruction' indicated by the launching of new processes of production that handle new products or existing products in a more economical way[2]. Given this modus operandi the SCHUMPETERian entrepreneur in the first instance captures a position to create his own profit opportunities and henceforth always acts to disturb the steady flow of the economy, i.e., hinders the internal market forces from bringing about an equilibrium. Adaptation processes are incessantly exposed to new shocks which disturb a straight approach to equilibrium. These impulses of entrepreneurial activity may not occur in a totally arbitrary way, but affect markets coming in like waves, causing the economy to fluctuate around its long-term equilibrium trend. In this sense the SCHUMPETERian entrepreneur is a disrupting and disequilibrating agent, who from time to time destroys the existing structures of the otherwise smoothly functioning economy.

Although SCHUMPETER attempted to draw attention to the inherent dynamic character of economic processes, he was not unreservedly backed even by scholars who shared this fundamental view. Particularly KIRZNER - and in a similar vein MISES, who could be regarded as the intellectual precursor of this kind of thinking - distinctly opposed against this delineation. According to their conception profit is not created by the entrepreneur but is a result of his acute alertness to look out for already existing opportunities, which have been overlooked by others. In contrast to the image of the entrepreneur forcing a transitory gap between the prices of inputs and the prices of outputs, KIRZNER's entrepreneur cannot precisely be viewed as 'shifiting the curves of cost or of revenues which face him, but of noticing that they have in fact shifted' (KIRZNER, I.M., 1973, p. 81). In this sense the entrepreneur predominantly acts as an arbitrageur, who

1) See SCHUMPETER, J.A. (1975, pp. 167 f.).

2) Ibd. chapter 7, and SCHUMPETER, J.A. (1934).

watches two different prices in two different markets for essentially the same thing: The bundle of inputs, which besides physical goods includes all sorts of required (technical and managerial) knowledge, has a lower exchange value than the bundle of outputs. This difference in prices yields an arbitrage-profit[1)] which can be gained by those who notice it. Accordingly, the entrepreneur in the first instance acts to balance diverging demand and supply, and initiates or accelerates a process which finally leads to equilibrium. For SCHUMPETER, the economy is stable in itself. Equilibrium is maintained by internal forces. The entrepreneur, however, steadily disrupts this process, whereupon new adjustment will occur.
For KIRZNER, the entrepreneur has the ability 'to see unexploited opportunities whose prior existence meant that the initial evenness of the circular flow was illusory - that far from being a state of equilibrium it represented a situation of disequilibrium inevitably destined to be disrupted ... (thus) the entrepreneur is the equilibrating force whose activity responds to the existing tensions and provides those corrections for which the unexploited opportunities have been crying out ' (KIRZNER, I.M., 1973, p. 127, emphasis added).

2.4.3 Market Efficiency

Market efficiency gets a slightly different meaning when interpreted from the Austrian perspective. This view, while concentrating on market processes as competitive processes, emphasises the absence of obstacles to competition. Tightly connected to the argument of coordination costs is the view of futures markets as a conglomeration of informational monopolies. The notion concentrates on the fact that the possession of future relevant information constitutes a monopolistic position that out-

1) See KIRZNER, I.M. (1973, p. 85).

distances rivals. The exploration of informational advantages can be envisaged without any difficulty in a strictly robbinsian fashion - as a pure profit-maximizing strategy.
On the other hand, the pure entrepreneurial act, which must be predated, contains the creative search for unperceived opportunities, which may be 'lurking around the corner'. The entrepreneur, always guided by the striving for profits and the fear of losses acts according to his judgegment on potential profit-chances that have been left unexploited by others.
In this context it might be helpful to view the evaluation of futures markets as a perpetual repetition of construction and destruction of informational monopolies. This approach resembles to the SCHUMPETERian view of market processes as a 'process of creative destruction'. Entrepreneurial activity disrupts the continuing circular flow. The entrepreneur is understood to initiate changes and to generate new opportunities. But is this situation compatible with a high degree of informational efficiency? If we conceive I-efficiency as the use of (available) information, we must assume that the monopolist's activity attracts other alert entrepreneurs who try to find their advantage in copying or imitating the original. I suggest that this kind of derivative innovation activity should be attributed to the entrepreneurial task. This means that imitators are also entrepreneurs in the original sense. The reason for that lies in the fact that as long as the use of the speculative idea is not transferred to a marketable good, the good must be acquired like all other inputs. The successive user of this kind of information although it is not his own idea, acts as if he were the originator. He makes 'something out of nothing'. This is because the market (via price processes) signals to him some profitable action. And this signal is a free good. However, each user of the signal contributes something to the decay of the oligopolistic positions of all his predecessors. And with the entrance of every new entrepreneur who, by chance or whatever, interpreted and

dispersed the signal correctly, the oligopolistic price behaviour crumbles down and approaches the full-competition solution. Because in this process the derivative entrepreneurs make use of a non marketable good (free-rider information) - a behaviour which is strictly against the interests of those already possessing it - one may even assert that competition is a form of theft. This point was already in chapter I part 1.2.5 (possession versus property). But precisely these characteristics lead to a widespread use of information and is therefore constituent for I-efficiency. Because of their copying and imitation activities, the derivative entrepreneurs contribute to a situation, where an informational equilibrium exists. In this equilibrium, free rider information ceases to have any profit-attracting power. This coincides with the notion of an equilibrium state of an economy, because in the classical paradigm it would mean that profit does not exist any longer. In our extended model even in this case some profit may occur. This profit, however, is limited as to the extent to which transaction costs do matter. T-costs are costs that matter in the equilibrium. Thus, even the prospective that certain persons make substantial amounts of money on the market, is not necessarily incompatible with the existence of T-costs, which play the role of sheltering walls around the monopolist. This explanation, however, is against the paradigm of Neoclassical Theory, which nevertheless works without any exchange costs. This state of equilibrium becomes the more allocationally efficient the lower the level of T-costs is.

Most profits, however, are substantiated in the state of disequilibrium, where the new market is only sparsely populated by derivative entrepreneurs and are, correspondigly, the main attraction for the entrepreneurs following them. The prospect of this kind of situation encourages entrepreneurial activity. However, regarding informational efficiency, it is desirable to converge to the state where this free rider information is available

to everyone. This is NORDHAUS' suggestion who advocates the opinion, that the entrepreneur should get revenue for all his costs and that his information should be made publicly available. This idea precisely demonstrates the opinion which was discussed in the section dealing with the decay of the monopolistic position. The quicker this process is, the better the performance was assumed to be.This is surely correct from the aggregate point of view. But if we turn back to the entrepreneur as the initiator of this process, it will be difficult to see any reason for him to get into activity. From his viewpoint, he has no incentive to take on any risk, because he could at best recover his expenses. The 'Produktionsumweg' (WICKSELL) doesn't pay for him. At least, he must be indifferent between consumption and investment. NORDHAUS' suggestion only focuses on the final allocational pattern, which one should approach as quickly as possible. But, as revealed by the active entrepreneurs action, there is no room for him to crop his profit. Thus the changes are brought about in response to the existing pattern of false decisions, a pattern of missed opportunities. In this regard, he brings into mutual adjustment those discordant elements, resulting from former ignorance of market performance.

KIRZNER's line of reasoning is also basically followed here. To view entrepreneurial activity as an endogenous variable of market processes (i.e., the entrepreneur reacts to some external changes of conditions) as opposed to the exogenous factor he plays in SCHUMPETER's opinion is more appropriate to explain tendencies of market processes that erase monopolistic profits and thereby give way to reach a state of equilibrium.

However, there are also common features which are of essential significance. It is important to recognize that both types of entrepreneurs attract resources from alternate uses which were before used in other branches of the economy. Both types in a similar vein attract consumers, who up to now have been content

with similar or other goods. By fulfilling this task, the entrepreneur contemporaneously occupies the position of an incumbent of a monopolistic or quasi-monopolistic position. This situation, however, is fully compatible with the notion of allocational efficiency. Resources are driven into most efficient directions and expenditures of consumers are spent for the most preferable commodities. The question is, whether this situation is compatible with informational efficiency. This is roughly the case, if informational efficiency is understood as the best possible use of all available information.

The question of durability of such monopolies remains of crucial importance. The exemplification of futures markets as public goods[1)] allows access to this problem. Established positions indicate to each spectator by means of price signals an expected change of future relations of scarcity. Their interpretation in terms of their own sphere of information may lead to additional market activities. In SCHUMPETERian perspective this accelerating procedure of imitation initiates a progressive process of profit erosion for those who enter the market later and try to establish their position and thereby make the price change in a way to reduce profits. This process will not reach a deadlock until all informations once exclusively held by monopolists are common property. The ongoing destruction of informational monopolies and therefore profit-monopolies has its roots in the externalities of the price system. The act of information processing is a pure private matter but there is in general the very moment that a market position is established, and although no-one has to decode the 'causa finalis' of such a position, the price-signal remains some cheap 'causa efficiens' to the observer, by which he cannot be excluded via the market process itself.
The diffusion of information, therefore, must be regarded as

1) The idea is evaluated in more detail in STREIT, M.E. (1981a).

inseparably connected to the market as an institution carrying the properties of a public good. The velocity of diffusion (besides the digestion or viscosity of information) is also a sensitive attribute of the coordinative power of the market, reflected in the amount of transaction costs. Thus, the higher the first and the lower the second is assumed, the quicker a successful market position may be established.

With regard to the extreme case of an infinitely high velocity of diffusion, we consider the paradigm of traditional equilibrium theory as a state of maximum disarray. Unfortunately, this steady-state property involves some stifling consequences.
The notion of equilibrium combined with a non-sequential analysis brings about the peculiar situation where prices as the only source of information decay to an informationally meaningless state. This is at least the finding of S.J. GROSSMAN and J.E. STIGLITZ[1], who via the choice of analytical instruments implicitly assume an infinitely high velocity of information diffusion (literally, they assume an infinitely high capacity of adaptation, which in our context de facto has the same effect as an infinitely high velocity of diffusion). The essence of their analysis can be resumed in the proposition, that an informational efficient system necessarily must break down, because on the one hand prices cannot be assumed to fulfill the requirements of an efficient steering system, while on the other hand they turn out to be lacking 'content'. Informationally meaningless prices are the logical consequence of an infinitely high diffusion process, because we hardly can imagine entrepreneurial activity without

1) GROSSMAN, S.J./STIGLITZ, J.E. (1976, pp. 246 ff.). In fact, there is a whole series of papers from the author(s); see for further literature STREIT, M.E. (1981a).
The analysis carried out in these articles can well be paraphrased by the paradoxical situation where, following some successful search the entrepreneur immediately transmits the results of his endeavour to (an infinite number of) competitors for the sake of common profit.

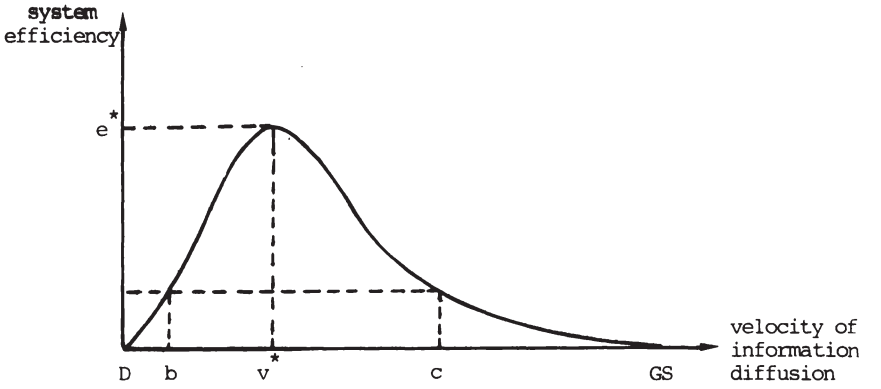
the prospect of future receipts. So by the fact of their sheer existence, we may witness inferior information processing.

The GROSSMAN-STIGLITZ system of 'one and for all'-adjustment, however, marks only one end of the scale. We may also consider a market system in which the velocity of diffusion is extremely low, or even zero. This represents systems with (infinitely) high amounts of coordination costs, which can be traced back to 'natural' or 'artificial' impediments like the so-called 'thinness of a market' or, for example, a certain kind of protectionism. Those systems, although in all probability also populated by individuals and firms relentlessly seeking to maximize profits, fail in their main purpose to efficiently allocate resources. One could characterize them by (almost) inflexible, highly resistant monopolistic patterns, which are excessively exploitable without processes of repercussion like imitation or adaptation, that finally lead to an equalization of economic power. Markets described by such low self-adjustment abilities are later referred to as 'dinosaur-systems'.

Between these two extreme views one might expect a broad range of more realistic cases. Thus, given the above analysis, one can reasonably argue in favour of something like an 'optimal state of efficiency' related to system efficiency and erosion of power in terms of the velocity of information diffusion. This is perhaps not a pure technical function and presumably dependent on a whole set of variables. To illustrate the issue, the following graph may be appropriate.

Point D characterizes the 'dinosaur-case' of a zero-adaptation system, while on the right side GS represents the GROSSMAN/STIGLITZ-case of informationally dead systems. It is particularly interesting that the two market systems, shown as "b" and "c", are compatible with entirely different market structures.

Graph 12: Velocity of Information Diffusion



Although both of them have the same degree of system efficiency, "c" characterizes a system, where in general investors are not prepared to venture particularly risky or high-cost investments. A high degree of externalization hampers a desired minimal rate of returns. To say it differently, the ability of adaptation is so high that possible gains due to exploitable informational monopolies are eroded before all initial costs are covered. Here the extraordinarily big range of free-rider possibilities hampers a higher level of market efficiency. We must assume the opposite for market "b", which more or less consists of a rigid pattern of almost invariable monopolistic positions which surpress a more efficient market performance in terms of allocative efficiency.

Another interesting fact revealed by the graph is the relation between system efficiency and velocity of diffusion, which disintegrates to two separate scopes. Before the optimal state "v^*" is reached, a complementary relation connects the two variables,

i.e., if one succeeds to increase information diffusion, the efficiency of the system rises simultaneously. In this case, the usual theoretical analysis of market efficiency must be presupposed. Because the optimal state the relation changes to a trade-off. The more the diffusion processes are speeded up, the lower the system performance finally turns out to be. Thus, to stay alive, market processes need a certain degree of 'blurredness'. This result may appear to be surprising, but in the very end it is founded on the microeconomic view of individual behaviour, as it is interpreted in the light of this theory. The causal-genetic approach advocates the opinion that a certain part of (in-)efficiency must not be considered as 'sand', but indeed as 'oil in the gear-box'. Or, to say it in other words, for the efficiency of the whole system, some degree of inefficiency is necessary; and, moreover not every increase in coordination efficiency automatically leads to an increase in system efficiency.

It is, however, important to note that this is not what the upholders of the 'traditional' efficiency definition usually advocate. Their hallmark is the undistorted reflection of information in prices in terms of a maximum of efficient information performance. In a causal-genetic view we would assume a state of relative optimality 'somewhere beneath' the FAMA-definition. This leaves the price process covered by a vail of speculative vagueness.

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