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Exhaustible Resources at Dumping Prices
Affluence at the Expense of the South and of Future Generations
Oil – A Case Study *

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One of the "achievements" of the market economy is the "abundance" of scarce resources. The continuous fall in the prices of raw materials implies an excess of exhaustible resources. In reality it means a failure to take care of what is to form the life-basis for future generations. Theoreticians of all economic schools are endeavouring to present concepts for reduction of the consumption of environmental resources. Neo-classicists tend to favour the market instrument of environmental certificates, based on the Coase-Theorem (Coase, 1960) and the Property Rights Theory. The Keynesian School prefers the ecological tax-reform, in line with Arthur Pigou (Pigou, 1920). The common aim of these instruments is the internalisation of external costs, in other words, an increase in the price of resources.

Both concepts are based on the implicit admission that (a) the present-day price of raw-materials is too low and (b) until now, the market has also failed to regulate the price of resources in line with the ecology. It is their goal to reduce the consumption of resources in the North. However, this monodimensional view will most probably have a boomerang effect. Neither concept takes into consideration the cause of the sinking prices of exhaustible resources and thus the wasteful consumption of resources, nor their middle- and long-term economic and ecological effects. Nevertheless, the concepts in question – the environmental certificates and the ecological tax reform – are the understandable objects of increasing favour in the industrial countries of the North. They promise, on the one hand, to effect a decrease in the consumption of resources, while, on the other hand, maintaining existing affluence or even effecting economic growth.

However, both concepts will entail that resources, which are produced for the world market, will most probably lead to further expropriation of the resource-owners of the South and to a new form of redistribution of resource revenue from South to North. Whether they in fact really contribute to a middle- or long-term reduction in resource consumption is very doubtful. In this light, they can be perceived as an instrument of ecological imperialism, devoid of having any positive ecological effect on any part of the globe.

In this paper, the author wishes to warn against such an abortive development. He holds the global Dual System responsible for the paradoxical excess and falling of prices of exhaustible resources, which force the South to provide the North with exhaustible resources at dumping prices. This global system, which is economically, ecologically and politically unstable, is not a product of the market mechanism of global price regulation and allocation. This system is the result of a melting down of the market through power, in the special interests of social groups and the imperial interests of states. It follows from this analysis, that every ecological

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modernization concept, worthy of its name, is doomed to failure as long as the Dual System remains in existence. The author advocates the reconstruction of a complex market system with three production factors: labour, nature and capital; a system which existed initially and has however been turned upside down since the turn of the century by the development of the world market and as a result of political imperial intervention. He develops the Ricardo-Marx-Hotelling Theorem, which results from the attempt to modernize the Classical theory and politicize the Neo-classical theory.

Market Economy and a Sustainable Economy with Exhaustible Resources

Seventy Years of planned economy in the former Soviet Union and 40 years of bureaucratic steering of the economic processes in Eastern Europe have bequeathed their peoples shattered economies. Errors in the allocation of economic resources were the destructive "achievement" of this economic system. They lived off their economic and ecological reserves for decades. Bankruptcy was thus inevitable.

However, what does the allocation and use of resources in today's market economy look like, and has this economic system budgeted its resources wisely? If we consider the persistent fall in the prices of exhaustible economic resources within the market economy, we cannot, in the light of a detailed analysis, avoid drawing parallels with the subsidized goods and services of the planned economies. Who, however, subsidises the consumption of exhaustible resources in the markt economy? Is it not true that the people in this system are living off their economic resources, too? Are they not damaging the principle of sustainability, as was the case in the planned economy? These questions must unfortunately be answered in the affirmative. The market economy only too obviously disregards the preservation of the natural system. The unstable interrelation between the economy and nature is based on a global system of the marketing of resources at dumping prices. The following analysis provides us with the evidence.

Price Theory of Exhaustible Resources in a Complex Market Model with Three Factors of Production: Nature, Labour and Capital (Ricardo-Marx-Hotelling Theorem)

In the market economy, four factors determine the price-setting of renewable products: wages (price of labour), interest (price of the capital), the cost of materials and technology and technical progress. With regard to exhaustible products, the price is determined in a market model, in which nature acts as an economic factor of production, by two further factors, which arise from the nature of exhaustibility: natural productivity and the ability of resources to be monopolized. To allow an exact specification, such a model, implying the price setting effect of nature, will be defined in the following as a Complex Market Model.

The long-term price-effect of wages, capital interest, material- and technology costs as well as the rise in productivity generated by technical progress are similar in both sectors (renewable and exhaustible). The long-term price effect can be rising, constant or falling, depending on the relationship between the rises in costs and productivity. In the case of exhaustible products however, the extra two factors (natural productivity and the ability of resources to be monopolized) in the Complex Market Model, as distinct from renewable products, generate a price-rise, so that the market prices here, despite the price-depreciating effect of technical progress, do not in the long-term remain constant or drop, as is the case with renewable products rather, they rise exponentially.

The natural producibility of exhaustible resources, determined by their properties (chemical composition, degree of concentration of valuable materials, physical composition, etc.) and their location (distance from markets and depth of available energy of materials and minerals beneath the surface), varies greatly in different parts of the earth and thus generates varied costs. From this, we can recognize three tendencies:

First, and due to the fact that natural producibility cannot be reproduced at will, market prices, given demand, do not oscillate around the average production costs, but rather the area of marginal costs even if given perfect competition and at any given point in time. Second, differing marginal costs and marginal prices at any given period give rise to varying additional profits or differential rents. Third, in the long term, given a growing population and increased consumption and the resulting increase in exhaustibility, the marginal costs rise, as do the marginal prices, due to the fact that in this process natural producibility, notwithstanding chance increases which are only possible in the short term, tends to decline in the long term. The principle of optimization forces the supplier to usethe resource incurring the lowest costs, or the highest natural productivity. These relationships were recognized in 1777[1]. However, the systematic presentation of the concept of differential rent goes back to Ricardo's theory of work value (Ricardo 1972: 64 ff).

Natural productivity only determines prices in the area of exhaustible resources, not however in that of inexhaustible natural resources such as solar en-

ergy. Exhaustible natural resources have, as distinct from inexhaustible natural resources, a further characteristic which has considerable effect on price creation in the market economy. They can be monopolized and have thus always been the collective property of traditional communities, of modern states, or the private property of individuals. In the market economy, the owners of exhaustible resources have the power to sell the property rights to these resources and to participate in market activity merely by selling the legal title. Thus,the legal title and the included exhaustible resource become objects of bartering and commodities. The price of these commodities (municipal and agricultural property and land, forests, ore- and coal-deposits, oilwells, etc.) is in reality the price of the expected rent. The existence of the expected rent, made possible by the use of the resources is the prerequisite, for the transformation of the stock into a saleable legal title, an asset. On the other hand, the purchase of such a legal title is the prerequisite for its economic use. The industrialist wishing to use an exhaustible resource, invests capital not only in machinery and wages, but also in the purchase of the legal rights to the resource. And in fixing the retail price, he will have to estimate not only the costs of machinery and wages and his own profit, but also the capital costs of the resource. It is thus that a cost component is added to the retail price, which is caused by the ability of exhaustible resources to be monopolized, that has to be paid by the consumers and is received by the resource owner. The income of the latter is the interest on the capital, represented by the exhaustible marginal resource[2]. In other words, the price of the marginal resource is none other than the capitalized form of rents. The actual price of the exhaustible resources P_R will be regulated consequently, assuming functioning resource markets, in combination with the market interest rate r and the expected rental income R by:

$$P_R = \frac{R}{r} \qquad (1)$$

The discovery of the specific relationship between capital and nature, a factor which has been added to the market, between the market interest rate and the purchasing price of exhaustible resources goes back to Marx (Marx 1969: 636), who was the first to explain theoretically explain the social dimension of resource prices expressed in land ownership.

Considering the extent to which exhaustible reentation of the concept of sources can be monopolized, Ricardo's ideas on long term price increases must be amplified by the capital cost component of marginal resources. Accordingly, the market (equilibrium) price of exhaustible resources is composed of: (a) marginal costs MC and (b) rent R as costs of the resource capital.

$$P_R = MC + R \qquad (2)$$

So, a rent is generated, a differential rent, not only thanks to the varying natural productivities, but also due to the degree of exhaustibility and degree to which a resource can be monopolized, which as distinct from the last form will be termed an absolute ground rent. Thus it is also conclusive that exhaustible resource stocks, depending on natural productivity, represent different capital dimensions. Considering the expected higher rental income in the case of resources of higher quality or in a more favourable location, these represent a higher capital value than the marginal resource.

The effects of the ownership monopoly of exhaustible resources are thoroughly ambivalent. On the one hand, this monopoly leads to an income distribution from the consumers to the owners of exhaustible resources and to social inequalities; on the other hand it renders the exhaustible products more expensive, reduces the amount of their consumption, transforms the resources into capital, in other words renders them subject to a social surveillance which is relative, and prevents their unrestrained exploitation. The owners of exhaustible resources wish to prevent the bough being lopped, on which they themselves are sitting. To ensure their medium- and long-term rental income, they constantly strive to permanently keep supply tight and ensure that a balance between supply and demand is in principle impossible.

In fact the use of resource capital or the achievement of rent income respectively presupposes a structural imbalance between demand and supply due to a permanent deficiency in supply, as this is the only way that the relevant current market prices

1) The English agronomist James Anderson was the first to discover the distinctive features of price setting in agriculture and outlined them in his paper, *"An enquiry into the nature of the Corn Laws, with a view of the new Corn Bill proposed for Scotland"*, published in Edinburgh in 1777. Anderson's discovery was, according to Marx, to provide the theoretic basis for *Malthus*'s population law, published by the latter in 1915 in his paper *"Inquiry into the Nature and Progress of Rent"* (Marx, 1972: 170ff.)

2) In contrast to Neo-Classicism, the categories (of marginal utility or the theory of marginal productivity) marginal costs, marginal business, marginal resource, marginal price - are used in this paper principally in terms of macro-economics. The economy as a whole is under consideration – under the aspects of allocation and the maximization of utility. With this in mind, the marginal producer does not refer to the last worker employed in a company, rather to the marginal business within the complete (national or international) sector, within which the same commodities are produced.

can guarantee the generation of (absolute) rents beyond the marginal costs. Full competition amongst the owners of exhaustible resources will not reduce the supply gap and thus the rent income to zero, but rather to a degree regulated by the market. The structural supply gap and the rental incomes would then no longer apply, except in the case of the initial premiss of *ex*haustibility no longer being valid. In other words monopolization, the marketing of legal rights to nature, permanent supply gaps (monopolistic competition) and respective rental incomes are market economy expressions of the exhaustibility of natural resources and of the situation that these are factors of production in the economic calculation just as are capital and labour. Just as wages are the price of the work production factor , and profit is the price of the capital production factor , so are the capital costs of the resource or the rent, the price of the nature production factor .

If the exhaustibility of natural resources leads to their transformation into capital, then it follows that the value of this capital must in the long term rise exponentially, given the accumulation interest and compound interest. In the complex market economy, the owners of exhaustible resources are always faced with the optimization alternative, – either to exploit the resource at the present time and thus to achieve a rent R_0 and to invest this in the capital market at an interest rate r, or to leave the resource in the ground in the hopes of rising prices and to exploit it at the point in time t_1. In the long run, the prices of exhaustible resources would in fact rise at a growing rate as a result of increasing exhaustion.

The suppliers decide to extract the resource at a point in time t_1, when the expected rent R_1 is high or higher than $R_0 + R_0 \cdot r$. The maximizing of use stimulates the exhaustible resource supplier to maximise R_1 by limiting the supply (increase of the structural supply gap). On the other hand, competition amongst the suppliers leads to the reduction of R_1 to $R_0 + R_0 \cdot r$. Given a constant interest rate r, the rent rises in dependence on the time t (= period of years) according to the equation for exponential growth

$$R = R_0 \cdot e^{rt} \qquad (3)$$

where R_0 represents the rents at the point in time t_0 and e represents the natural constant.

From the Marxian discovery that exhaustible resources are represented in the capitalist economy as capital investment, only one small analytical step was necessary to draw the conclusion that the value of this capital investment must increase over a period of time due to compound interest. Marx, however, did not come to this conclusion, leaving it up to the neoclassic Harold Hotelling who, decades later, and independent of Marx, integrated the time dimension into the price development in the price theory of exhaustible resources (Hotelling 1931). Hotelling and all the other Neo-classicists, who followed his example, failed to make the connection to the fundamental knowledge gained by the Classicists and which had already been developed. Instead of using the category rent, as used by the classicists, Hotelling refers to "net price" as the difference between the market price and the marginal costs (Hotelling 1931: 141). Solow, who, with his remarkable contribution: "The Economics of Resources or the Resources of Economics" shortly after the "oil price shock" of 1974, emphasized the meaning and topicality of the nearly forgotten Hotelling Rule and gave it a new interpretation. Solow not only speaks of net price but also of "scarcity rent" (Solow 1974: 3). Since Solow's statement, the debate on the Hotelling Rule has become an established component of any treatise on the price theory of exhaustible resources, especially in the United States[3].

The fascinating dimensions of the Hotelling Rule for the present-day discussion on a sustainable resource economy are completely overlooked. The Hotelling Rule refers to the fact that the market rewards the careful handling of exhaustible resources, expressing as it does the fact that the owners profit not only from the production of resources at present, but also by postponing the exploitation of the resources until a future period. In this case, the interest adopts the function of a generation contract and the costs of the production factor, nature, are entirely reflected in the rising consumer prices, so that the production factor, nature, as resource capital, generates, in time, rising costs.

Despite the outstanding importance of the Hotelling Approach to the price theory of exhaustible resources, it carries with it one basic problem, symptomatic of all Neo-classicism, and which has led to false estimations in current debates, e.g. the oil price policy of OPEC. Hotelling discusses the cases of "free competition" and "monopoly"

3) As for example in Dasgupta/Heal 1979, Kemp/van Long 1980, Pindyk 1980, Griffin/Teece 1982, Siebert 1986 and 1987 and others, at the forefront of the debate two questions being of major importance: as to whether rises in the oil price of the 1970's are explicable in terms of the Hotelling Rule, and the question as to their relevance, given the real falling prices of exhaustible resources. The central question, however, (rendered even more apparent since the 1970's by the obvious ecological crisis) is how to explain the fundamental contradiction between falling market prices and the theoretically explicable long-term exponential rise in the prices of exhaustible resources.

(Hotelling 1931: 141, 146), as though "complete free competition" were possible in the case of exhaustible resources, as they are in the case of renewable products. However, this assumption is inconsistent with the rule he himself formulated. The "net price", or the "rent", results, as we saw above, in the case of exhaustible energies, from a structural gap in supply or a monopolistic balance. In the case of completely free competition, and the omission of the gap in supply, the net price is also not applicable, and with that the Hotelling Rule itself [4]. At this point, it can be more clearly demonstrated why it was that the extension of the Ricardo-Marxian Rent Theory, by the Neo-classical Hotelling Rule, or the reverse, provides the basis for a closed price-theory of exhaustible resources. Ricardo analyses the physical causes of rent, Marx goes beyond this component and integrates the social causes of rent generated by ownership and power relations, in the theoretical construction, providing a market economy reason for the natural resources as capital investment, but fails to follow the long-term effects on the value of the capital investment "nature", elicited by the dynamic market and depending on "time". On the contrary, although the time dimension and the effects of the dynamic market processes on price setting in the case of natural resources are at the centre of Hotelling's analysis, he excludes all the factors considered by Ricardo and Marx, such as natural productivity and the property functions of natural resources, which have a decisive effect in price setting in economic procedures. Ricardo, Marx and Hotelling follow completely different goals and argue in different theoretical milieus. Ricardo and Marx argue according to value theories, Hotelling owes his allegiance to the neo-classic theory of benefits and is concerned with optimisation options, which can be achieved in foreseeable periods, given the exploitation of exhaustible resources.

The combination of the single theoretical elements to a complete price theory of exhaustible resources arises from inner logic and the complementary functions of these elements themselves. Thus, on the one hand, the Marxian Theory of Rent approaches neo-classicism as a result of dynamifi-"cation, on the other hand the Hotelling Rule is embedded in the political economic reality of the market economy utilisation of exhaustible resources, which is characterised by complex property and exploitation laws. On the basis of the thus supported Ricardo-, Marx- and Hotelling Theorem, price setting in the case of exhaustible resources is further influenced by three further components, besides pure management costs: (a) by natural productivity (Ricardo), (b) as a result of non-reproduction, monopolisation (Marx) and (c) as a function of time (Hotelling).

According to this price-theoretic complete draft, the long-term price trend of exhaustible resources follows in a Complex Market Model taking account of equations 1–3 as:

$$P_R = MC + R_0 \cdot e^{rt} \qquad (4)$$

where MC expresses current marginal costs at any given time. In graphic form, the price trend can be temporally represented by the long-term price (and supply) curve S", which represents the sum of the current respective cost elements at any time (Figure 1). Here it is assumed that the production and consumption quantity of the resources increases in time, and natural production decreases, according to the Ricardo Rule.

The S- or MC-curve, represent the long-term course of marginal costs (MC), which rise disproportionately as a result of sinking natural productivity. The S'- curve symbolizes a price trend, to which is added the rent level which remains constant, resulting from the constant imbalance between supply and demand. Finally, the "S"- curve should portray the course of the price-trend in a Complex Market Model, in which the costs of the production factor nature are fully contained in the price formation, thus rendering the Hotelling Rule effective, so that the price of exhaustible resources rises exponentially as in equations 3 and 4. The equilibrium prices E_x result, in time, from the points of intersection of the demand curves D, moving along the supply curve, with supply curve S".

The concave shape of the curves demonstrates the effect of technological progress on the price. According to empirically supported hypotheses (Slade 1982), the dominant initial effect of technological progress on industrial consumption of resources is to sink the price. However, with consumption over time, natural productivity sinks, and this combined with the Hotelling Rule leads to compensatory price rise.

The above demonstrated Ricardo-Marx-Hotelling Theorem establishes that, in a Complex Market Model over the long term, prices of exhaustible resources will rise. The equilibrium prices P_1", P_2", P_3", and P_4" (at the corresponding time points t_1", t_2", t_3", and t_4") are actually much higher if, as represented in this model, the natural capital and production functions completely take the effect in economic reality and the costs of resources and capital are entirely reflected in the market prices. Thus, the production/reserves ratio falls and the

4) The error of not recognising that exhaustibility must lead to a monopolistic market form in a *Complex Market Model*, could be due to the fact that *Hotelling* does not question the causes of *net price* or *rent*, rather he takes these as given.

Figure 1: Increasing Prices due to sinking Natural Productivity

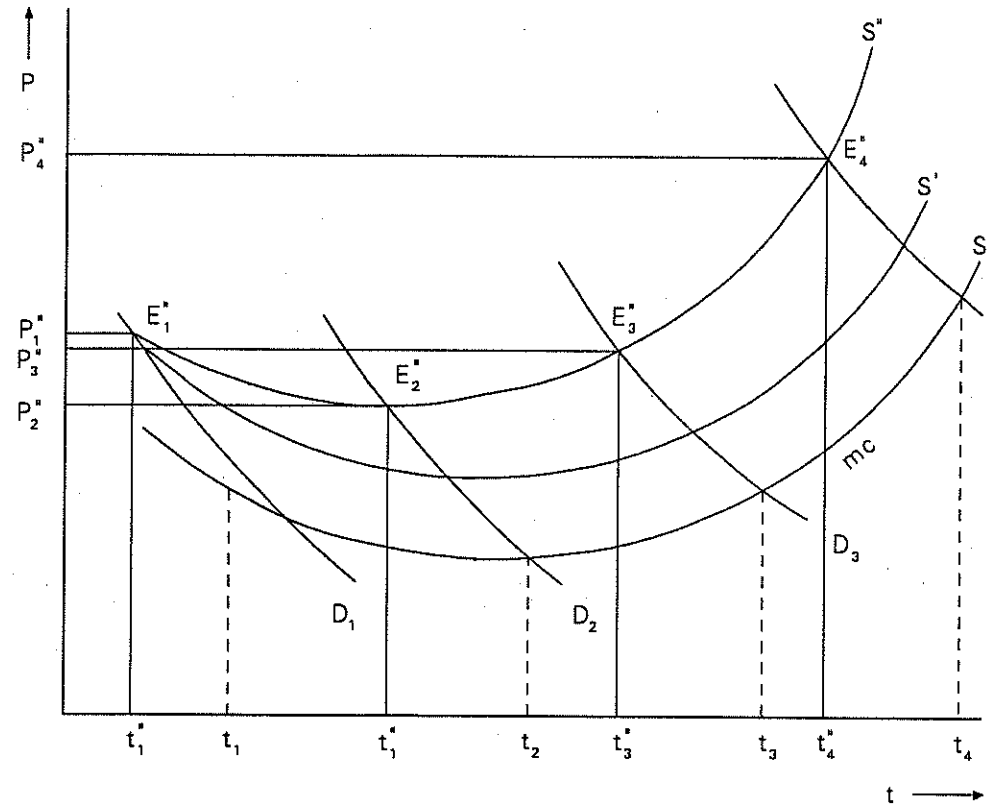
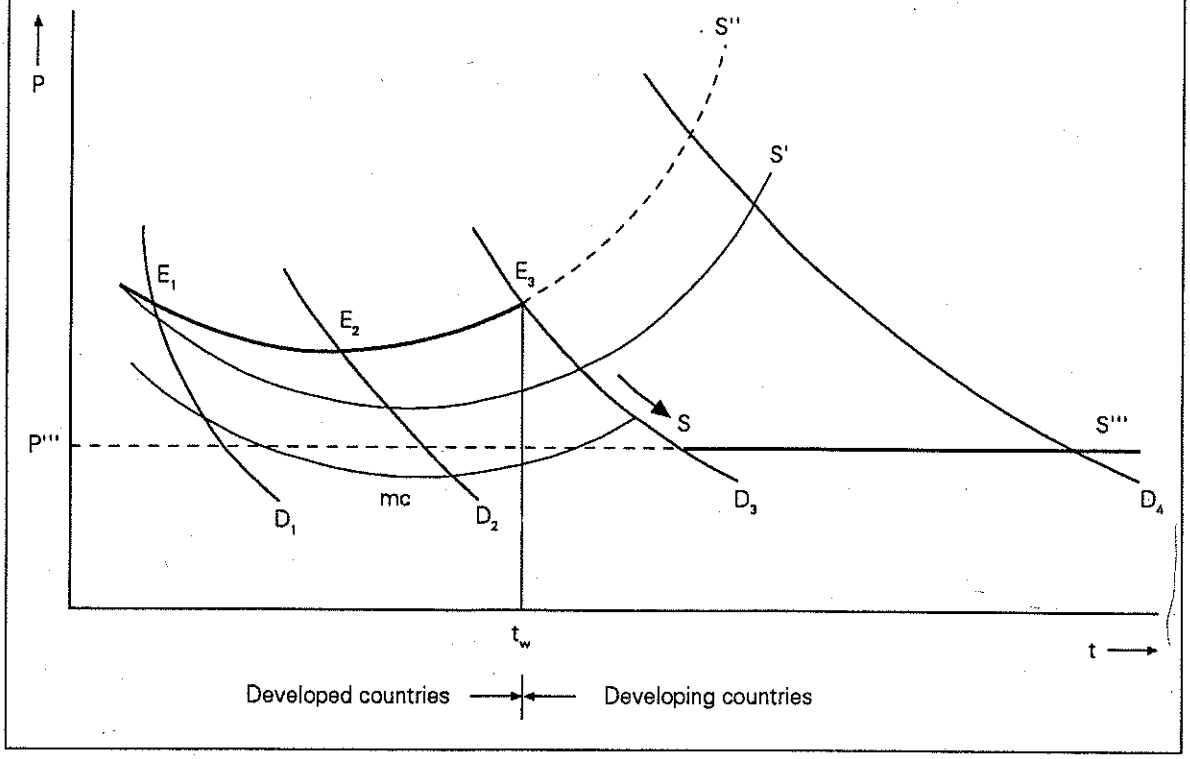


Figure 2: Price Formation of ExhaustibleResources in the Dual System



statistical life span of resources increases. The model illustrates that a market-guided, sober approach towards a relatively sustained use of limited natural resources is not only possible, but absolutely necessary.

The price of resources in the complex market system P_R (Figure 2) derived above factors in the capital cost of resources or rent R and thus expresses the economically correct market price. However, this price does not yet take into account external costs created by restoring the environment as a consequence of resource consumption. The economically correct price of resources P_R must be expanded to take environmental costs E into account. We shall call the resulting price category the complete market price P_C.

$$P_C = P_R + E \qquad (5)$$

However, is this theory an academic dream model (wishful thinking) which is contradicted by the reality of sinking global market prices for nearly all raw materials? Can this theory be supported by concrete examples derived empirically? These are legitimate objections to our theory that must be answered in full.

The best example that supports the theorem is the long-term price development for urban land and real estate, the natural factor of production for the global urban and development economy. The real price of this limited resource has experienced global rise over the long term both in the Northern and Southern regions. Urban land and property is a highly sought after commodity throughout the world. Property owners face the optimization alternative either to dispose of their resource capital today, and to invest the profit in the capital markets, or to postpone the sale in anticipation of rising property prices, or strictly speaking: in anticipation of a higher interest rate for his resource capital. Due to their monopoly (ownership of land) and under the conditions of perfect competition, i.e. that a cartel of owners is not even necessary, they create a sustained structural imbalance between supply and demand (a lasting supply gap) by orientating themselves, as participants in the market economy, exclusively at the optimization criteria of the market. The exhaustible resource "urban ground" seems to function according to the laws of the Complex Market Model. Thus, the exhaustibility of this resource manifests itself in an insurmountable way also by the owners' behaviour in the market and by rising real prices.

In the South, where the urban population continues to grow, the clearest sign of resource exhaustion is the emergence of slums and consequent social catastrophe. And in the North, the corresponding sign is the widespread emergence of multi-occupied residential properties.

Exhaustible Resources at Dumping Prices: The Dual System Theorem

Why does the price of all other exhaustible resources sink instead of rising as the complex Three-Production Factor Model predicts? In contrast to urban property, the price of farmland has declined and sunk in some instances almost to nothing. The decisive factor which differentiates an exhaustible resource like urban real estate from all other exhaustible resources is the fact that urban property cannot be transported, whereas all other exhaustible resources are globally transportable.

Rising urban real estate prices admittedly increase the incentives to move into thinly populated regions. However, these incentives are tempered by cultural limitations and occur only in a limited number of cases. The mobility of the populace doesn't solve the land problem over the short term, but rather, channels it into other regions. The mobility of the remaining exhaustible resources enables a region to overcome its limited resource problem, and the tendency for prices of this resource to rise over the long term, through massive imports.

An essential precondition for massive movement of raw materials from one region to another, from one continent to another, is an efficient transportation system. When one part of the world exploits the limited resources of other regions for its own needs without heeding their own long-term needs, this works against the market for a few decades (keeps the price low), and produces overflow of resources which doesn't correspond to reality. It is in this "fortunate" state which Europe found itself in relation to the rest of the world in the 19th century and in which the North currently finds itself in relation to the South. The ability of a region to base its consumption and future consumption of natural resources on its resource potential is an essential principle for developing a sustainable economy. The transportation revolution and consequent ability of the North to import excessive amounts of raw materials, creating a false abundance, has resulted in the permanent violation of this principle of a sustainable economy.

The Europe of the 19th century overcame the exhaustion of agricultural land and the problem of increasing agricultural prices through the massive importation of agricultural products (resulting in a horizontal expansion of global arable land). Advances in chemistry and technology (vertical expansion or increase of intensity in agriculture) presented a second exhaustion of resources. Agricultural land apparently does not play a major role

as a factor of production any more. Global markets suffer today from overproduction of agricultural products and sinking prices, to the point where it seems that agricultural land is inexhaustible[5].

Since the beginning of this century, during the colonial and post-colonial periods, the North and the South have found themselves in varying positions, in that although both are similarly richly supplied with exhaustible resources, the South has been almost completely deficient in the technological and sociological requisites for the utilisation of these resources. The economies in the South are still, to a great extent, traditional and not market economies. The market relationships are limited to urban regions, so that urban land has long become a capital investment. Prices in this area follow the rules of the Complex Market Model. This does not apply to the area of mineral and fossil resources, these being merely scantily utilised for own needs. They fail to constitute capital investment as in the Complex Market Model and the private or group owners of these resources are not far enough advanced in the development of their market economy rationality principles and criteria for optimal exploitation necessary to realise their own interests via a market exchange with the North. Along with the difference in the pace of development and consumption niveau between the North and South, there is the inequality of political and military power. In a global system, made up of a dualistic coexistence of North and South, the latter being ruled by a traditional, stagnating economy, its political and military powers being far weaker than the highly developed North, the stronger pole in this Dual System (Dual System Theorem) actually succeeds in employing the weaker pole to work for its own support using its exhaustible resources. This occurs almost across the line against and even to the exclusion of the laws of the market economy. Archaic rulers and owners of exhaustible resources of the South are induced or forced to enter long-term right-of-use contracts with Northern raw material companies, without right-of-use limits at reliable concessional rates for the term of the contract, and with no reference being made to the quantity of resources exploited.

Given this structural framework, the raw material companies of the North, follow what from their point of view is the consequential principle of optimization: that is to say to exploit the exhaustible resources as quickly and as extensively as possible in the contract period even to the point of complete resource exhaustion to sell them on the world market and to invest the returns in the investment market or in other sectors in the North. Investment is made in the extraction of the resources instead of in the resources themselves. In the sealed user-contracts, the economic sovereignty of the owners over their resources is considerably restricted. According to their contracts, they have transferred their rights to optimise their own profits by limiting supplies to the raw material companies of the North. In other words, the decisive regulatory instrument of the Complex Market Model is in effect eliminated.

Although the resources of the South are exhaustible, there is no sign of a tendency towards monopolization or shortage. They do not represent a capital investment, and are treated as inexhaustible material sources, which can be unrestrictedly used by the raw material companies of the North. As the resources do not function as capital, the Hotelling Rule loses its price-creative function. The market model of perfect competition succeeds on a global scale, as if the resources were not exhaustible but renewable. Under these conditions, it is impossible create awareness of the real signs of exhaustion by means of market regulation and rising prices of raw materials. Instead of scarcity and a gap in the structural supply, the mono-dimensional possibility for the raw material companies of optimizing their profits leads to a speedy exploitation of the resources and thus to permanent overproduction. The movement and creation of world market prices for exhaustible resources does not follow the rules of the Complex Market Model; rather, they are governed as depicted in Figure 2, by the political framework of the Dual System.

Given total competition and structural overproduction, the long-term supply- and price curve S'' in Figure 1 moves to the point in time t_w along the demand curve D_3 to the inelastic supply- and price curve S''' (Figure 2), following on the beginning of the extensive exploitation of exhaustible resources in the South (this has been the case since the beginning of the century). According to the terms of perfect elastic supply, every possible demand can be satisfied by the world market, without incurring a rise in world market prices. The price niveau P''' follows relatively low marginal costs, as marginal resources fall victim to high extraction costs in both sections of the Dual System. The inelastic resource price in the Dual System either completely fails to contain the economic meaningful and real price component, the Resource Capital Costs or the Rent, or it contains only a fraction of these costs. Thus, it

5) Considering the ecological crisis also very apparent in agriculture, which has been generated by the excessive use of technology and chemicals, it becomes quite obvious that the idea of overcoming natural land exhaustion is an artificially created illusion, the latter being a product of the flagrant abuse of the principle of sustainability. In the face of the necessity of ecological restoration, the question arises as to whether the land is not already completely exhausted.

is obvious that the successful world market prices are dumping prices. They are a product of the fact that in the Dual System the production factor nature and its real costs are eliminated from economic reality. Thus, the resource dumping price P_d is lower than the resource price P_R the difference being the resource capital cost R or a fraction of same in the complex market system.

$$P_d < P_R = MC + R \qquad (6)$$

For a fuller understanding of the economic process and its consequences, we can compare price formation in the field of exhaustible resources in the Dual System with price formation in a normal business in the Market economy, where the real capital costs are not taken into consideration in the price calculation, so that the price of the commodity is lowered artificially.

Just as a business lives off the available capital stocks and is unable, due to falling income, to repair wear and tear, thus rendering bankruptcy inevitable, the South and in fact the whole human race is in the midst of a process which must end in the bankruptcy of resources. The dumping prices, which have held for decades, are proof that the principle of sustainability, which is at least relatively attainable, has been grossly violated in this sector for a considerable time. They also indicate that circa 1/5 of the world's population in the North is capable of artificially raising its present standard of living to the detriment of 4/5 of the world's population in the South and the future generations. At any rate, the massive import of exhaustible resources at dumping prices in the North considerably accelerated the economic growth process, allowing this section of the earth to live according to an industrialisation and consumption model beyond their means, and leading to an escalation in the inequalities and conflicts between North and South. The results of the Dual System are disastrous for the South too, the inordinate exploitation of raw material sources literally bringing about the erosion of the substantial base beneath the feet of 4/5 of the world's population, while the North is privy to the most modern technology, which enables them to relativize the only too obvious trend towards natural resource exhaustion.

To paraphrase the above analysis, the effect of the combination of the Dual System with the irreversible detrimental and interventional realizable endeavour, to enable the technical transport of the most fruitful agricultural land, forests, oil wells and ore deposits from other regions to a few affluent islands, thereby crossing continents and seas, is that the prices of these resources drop, in contrast to the rising prices of urban land. It has also become clear that the Complex (three factors of production) Market Model is not a fabrication, rather it represents a normal economic regulatory model in the case of exhaustible resources, which, however, thanks to external economic compulsions of the Dual System (political and military intervention in the special interest of groups and the imperialistic interest of states), is replaced by the two production factor model of perfect competition.

Oil: A Case Study

Oil Dumping Prices in the Dual System

Since the "Oil Crisis" of 1974, a very lively debate about oil prices has evolved [6]. Many of the theoretical positions in this debate share the same weakness namely, they focus exclusively on the rise in oil price from 197980 and ignore the fact that oil prices before 1974 fall almost continuously. Moreover, these theories do not sufficiently explore the connection between the long-term decline before 1974 and the sudden rise in prices since then. This weakness is not surprising. It is primarily the result of the fundamental failing of Neo-classical economies, namely, taking full competition for limited resources as empirically implicit. In the case of oil and fossil fuel prices in this century, full competition and falling prices have been more the result of intervention policies than of market-dictated logic. Long-term oil prices (with 1989 price levels serving as the base) reveal clearly different price trends.

At first (18601915), the United States was the leading oil producer. During this time, technical advances in exploration, boring technology, and transportation as well as the discovery of new sources of oil, all led to a price-lowering effect. On the other hand, another effect factored into oil prices. American oil producers, following the results predicted by the user-optimization principle according to the Hotelling Rule and by market regulation in a Complex Market Model, fight the price-sinking effect. The price curves take on a cyclically concave form.

In the second phase (1915–74), the market share taken up by oil producers from the South and Middle East increased exponentially and by the early 1970's, they accounted for 58 % of the world's oil production. In the same time period, the real

6) On the whole, this theoretical debate comprises three different lines: the *Cartel Theory* (Pindyck 1978; Adelman 1982), the *Property Rights Theory* (Johany 1978; Mead 1979) and theoretical contributions following the *Hotelling Rule* (Solow 1974; Roumasset/Isaak/Fesharaki 1983; Fisher 1987). The substance of the theoretical approach described herein, represents a criticism of the mentioned approaches, on the other hand, it implies reflections which are part of these theoretical approaches.

global market price for oil generally fell, despite the over-proportionate increase in global demand for oil (particularly after the Second World War). This sinking price trend was admittedly the result of the discovery of extension stocks of oil with especially high productivity in the Middle East. Despite the abundance of oil in the South, the North consumed and consumes the lion's share of global oil and this imbalance between consumption and production in both regions is caused by the Dual System. In this system, the oil-producing states cede their right to decide over how much oil to produce to the oil companies of the wealthy North. Thus, the end result is a loss of sovereignty by the oil-producing states, as they can no longer decide how to optimize their own consumption needs[7].

While the possibility of increasing their income as usual mainly by new user contracts was left to the first, the latter followed their own short-term profit maximization principle of exploiting the oil wells of the South as quick as possible within the utilization term fixed by contract. This special condition created by the Dual System is the cause of the perfect competition in the global oil market and the trend to lower market oil prices. The monopoly power of oil-producing states over their oil sources and their ability to respond to the natural tendency towards exhaustion of their resources is taken away and there is no other social instance that is able to take on this function. The consequence of these conditions is that oil sources cease to function as a real factor of production or capital investment. Oil sources are exploited as if they are inexhaustible. The real existing costs (rent) of resource capital for exhaustible oil sources thus do not suppress the artificial competition created in the global oil market. As a result, oil is sold far below its equilibrium value at dumping prices.

The year 1974 marked the temporary end of dumping prices for oil and led to the third phase (1974–85) in the history of oil prices. From 1974 to 1980, the market oil price shot from US$2 to $11 to $40 a barrel, thanks in large part to the founding of OPEC (1960) and the efforts of member states to overcome the Dual System and achieve economic sovereignty over their own soil resources. In fact, during the 1970s, the long-term contracts of the multinational oil companies were almost completely annulled and these oil concerns found themselves pushed out of the production area of OPEC. OPEC embarked on a strategy of testing a long-term maximization of utility for the member states, in the sense of the Hotelling Rule, through the regulation of production quantities and the optimal combination of controlling production and oil price. All signs pointed to the end of perfect competition and its effect on global market prices and the transition from the Dual System to a Complex Market Model with monopolistic equilibrium prices[8]. This transition stalled, however, and since 1985, OPEC has lacked the strength to continue its strategy of raising revenues and stabilizing prices through restricting production. On the global oil market there is once again an overabundance of oil and fossil fuels. Once more, perfect competition reigns and since 1985, oil prices have fallen to $15–18 a barrel, which, adjusted for inflation, corresponds to the global oil price level of the second phase (1915–74). As a result, oil revenues from the OPEC states have sunk drastically from $284 billion (1980) to roughly $93 billion (1987).

Thus seems apparent that, in the current fourth phase (1985 onwards), the production-consumption relationships for the energy sector have returned to those characteristic of the Dual System. Oil is offered at dumping prices, mainly as a result of political intervention. In the following some of them are mentioned in brief:

(a) First, rapid increases in oil prices reduced demand and led to a salutary energy conservation which absolutely corresponded to the OPEC strategy of oil scarcity. However, this also led to an increased oil supply by non-OPEC members and to a higher profitableness of nuclear power. The industrial countries, on their part, additionally forced the weakening of the OPEC position, reducing their world market share by large-scale credits to non-OPEC energy suppliers in order to counteract the policy of reduced supply by OPEC.

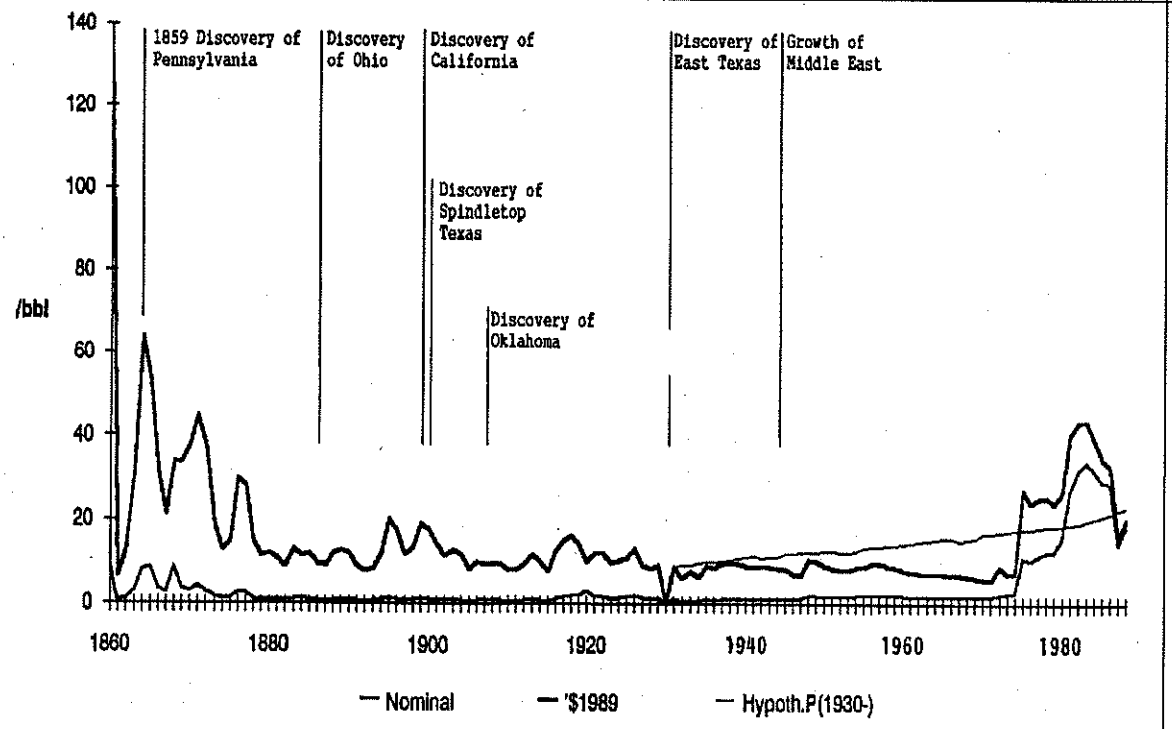
(b) The high interest rates in the United States have globally led to a detectable rise in extraction rates, affecting production quantities and leading to falling raw materials prices (Interest Rate-Raw Materials-Price Mechanism, see Massarrat 1993).

(c) There are also important issues which need to be dealt with by the producing states. First, the

7) Meanwhile, the historical circumstances leading to the discovery of abounding oil wells in the Middle East and to the acquisition of user contracts by multi-national oil combines, have been documented in detail, so that only the relevant sources are mentioned here (see Denny 1930; Mejcher 1980 and 1990; Yergin 1991).

8) In this respect, the importance of the OPEC as an oil cartel regarding monopolistic price regulation has been by far overestimated in particular by the representatives of the *Cartel Theory*. They disregarded that the OPEC oil suppliers in competition to the non-OPEC oil suppliers, to the suppliers of other fossil energies (gas, coal, oil schist and oil sand), to the suppliers of nuclear power and potentially also to those of renewable energies and therefore have not been and will never be in a position to raise the oil price (which is normal for exhaustible resources) above the monopolistic equilibrium price.

Figure 3: Long-Term Trend of Oil Prices: Real, Nominal and Hypothetical
Oil Prices: 1860–1899 Pennsylvania, USA; 1900–1944 Average Prices USA; Since 1945 Arabian Light
Source: Real and Nominal Prices, British Petrolium



Gulf War between Iran and Iraq revolutionized the OPEC Strategy of maximizing use. The war on the battlefield gave rise to a battle within OPEC over production quotas and revenues. Both states continually violated OPEC agreements, delivering cheap oil to the global market. The oil policies of three states, Saudi Arabia, Kuwait, and the United Arab Emirates (UAE), have proved to be even more crucial to the current oil dumping prices than the Gulf War. These three states control over 45 % of the world's oil reserves and more than 58 % of the total oil reserves of OPEC. Thus, Saudi Arabia, Kuwait, and the UAE have the power to block any OPEC decision. The exceptional wealth in oil reserves and the quasi-definitional power within the OPEC of these states is not only a strength but a weakness. They can be put under enormous pressure by their military stronger neighbours, as the occupation of Kuwait by Iraq so amply demonstrated.

For these states, the only guarantee of their political integrity and physical security is a political-military alliance with the North, and particularly, the United States. The price which these states must naturally pay for this security guarantee, is an oil policy which does not hurt the energy price structure of the United States. The especially low energy prices in the United States can be maintained as long as OPEC continues to flood the oil market with oil at dumping prices. Saudi Arabia, Kuwait and the UAE can afford to pay this price for their security, because, unlike the other OPEC members, they do not run the risk of exhausting their oil reserves by aggressive production policies. The three states supported OPEC's maximizing strategies only half-heartedly and since the mid-1980's, they have in effect, taken over the role once played by the multinational oil concerns, essentially pumping out oil from the ground as quickly as possible and investing the surplus income on the financial world markets. Thus, the short-term interests of the most powerful industrial state of the North coincide with those of the richest oil-producing states of the South, all coming at the expense of the medium and long-term interests of humanity[9].

In Figure 3 the real existing long-term oil dumping

9) In this context, the object of the second Gulf War becomes distinct as well as the resoluteness of the United States to accept not on any account a weakening of the position of just the three gulf states *Saudi Arabia, Kuwait and UAE* within the OPEC in the case of Kuwait falling away (see Massarrat 1991). On the background of common interests - and absolutely not accidentally - this peculiar alliance of North and South became apparent as the most important obstacle at the UNCED Conference in Rio de Janeiro not to undertake essential alterations to the present market and price structure for fossil energies in spite of the greenhouse problem.

price is set against the hypothetical (equilibrium) price path, which under a Complex Market Model would have prevailed. This price path was traced, using a complicated method according to equation 4 and taking into consideration the long-term market interest rates of the United States and the marginal costs C as well as the rent R_0 for oil in 1930 for the period 1930–85 (see Massarrat 1993). The comparison of both price paths illustrates the difference between the hypothetical slow-rising exhaustion tendencies, and future exhaustion tendencies projected into the present time equilibrium, leading to oil dumping prices the product of an instable price system, which, with or without OPEC, must and will be continuously torn apart by sudden price rises.

The Results of Oil Dumping Prices for the Present and the Future

Dumping prices for oil have several important economic and ecological consequences:

a) Dumping prices for oil in the Dual System led to the concentration of oil and fossil fuel production in the South rather than the North. While the North remained the chief consumer of all energy forms, the South became the main supplier of oil for the North.

b) Dumping prices for oil reinforce the latent transfer of income from the suppliers to the consumers. In order to stabilize and increase revenues, suppliers in the Dual System increase production and thus set the stage for overproduction and subsequent price decreases. Thus begins the vicious cycle of dumping prices and overproduction (Dual System Effect).

c) Thus, dumping prices for oil lead to higher rates of extraction and shorten the lifetime of oil wells, at the same time provoking the wasteful use of energy which increases the CO_2-emission and aggravates the greenhouse effect.

d) Dumping prices for oil sanction an industrial model in the North which is not sustainable or capable of being extended fairly across the globe because this model feeds on the resources of the South and of future generations, both of whom must pay in the future for our current overexploitation of nature.

e) Dumping prices for oil lead to a decoupling of the fossil fuel markets and distort the global supply structure. Because of the decoupling of fuel markets, the oil price is based not on the marginal costs (the most expensive category) of the energy sector, as in the rule generally for exhaustible resources, but rather on the marginal cost of the oil (for example, North Sea oil). The production of other fossil fuels such as coal either collapses or can be maintained only through heavy subsidies from the state. The low marginal cost for abundantly-flowing oil from the South hurts the profitability of meaningful renewable energies such as solar energy. Low marginal costs also lead to an artificial devaluation of the capital value of the aggregate oil supply. The accelerated concentration of oil production from the North into the South and decoupling of the fossil fuel market causes not only an unequal regional use of resources unfavourable to the South but also an unequal stock of fossil fuel sources. As the especially valuable oil sources in the South are exhausted in the near future, the oil-producing states of the South will lose the most important source of their income and will become themselves increasingly, dependent on external sources for their energy needs. Thus, as demonstrated by Figure 4 (next page), the North must be prepared to support fossil fuel prices and further dismantle the huge income gap between North and South.

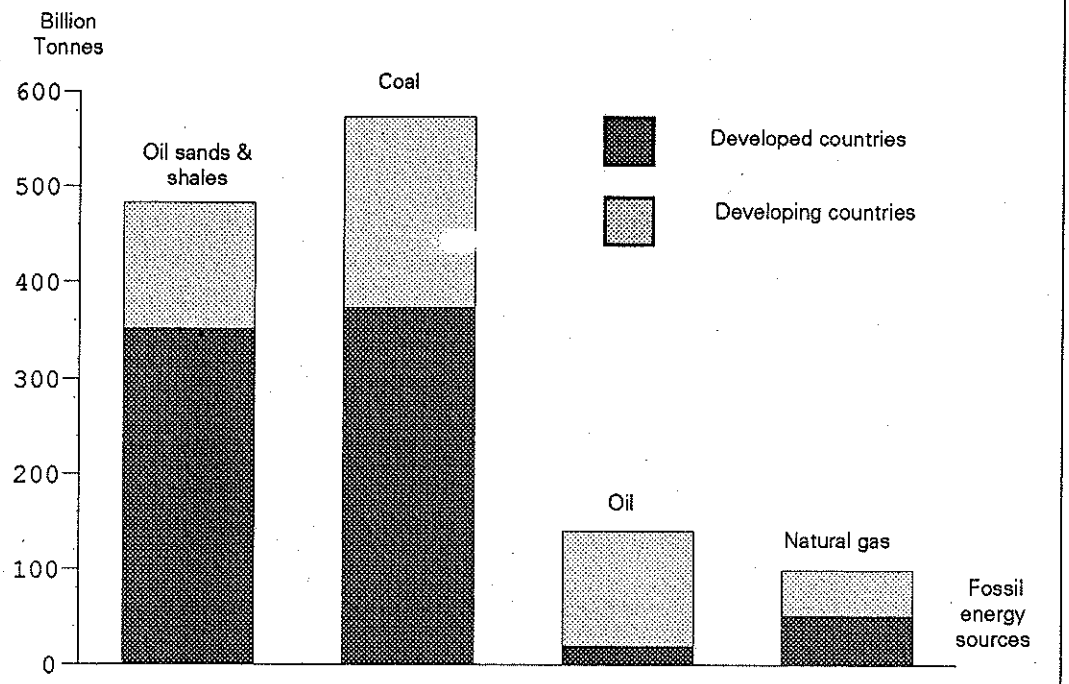
Oil dumping prices are responsible for the structural distortion of global energy prices, consequential dislocations and imbalances between individual energy sectors, dangerous instabilities in the North-South relationship and finally, for the most important global environmental crisis in the present. If the lessons learned about false allocation through false prices hold, then the long-term consequences of false energy prices are graver than false prices ever could have been in planned economies.

Conclusions for a Strategy for Sustainable Economics with Exhaustible Resources

Pursuing a sustainable economy respecting the inherent exhaustibility of natural resources remains at present a utopian goal. In terms of its implementation, the sustainable economy must seek to preserve the supply of natural resources as long as possible for future generations. To achieve this goal in the area of fossil fuels, the current dumping prices for oil must be abolished and higher oil and energy prices instituted. At present, two market instruments are under consideration which would attempt to internalize the external costs of energy consumption: (a) introducing environmental certificates; and (b) an energy-CO_2 tax. Both concepts accept as implicit that current energy prices are too low, although they do not address the fundamental source of the energy problem. The author doubts that these instruments are actually designed to reduce energy consumption and achieve lasting ecological reform.

Figure 4: Estimated Fossil Energy Sources in the World (Billion Tonnes Oil Equivalent)

Source: For natural gas, oil and coal see British Petrolium Statistical Review of World Energy, 1990, London; For oil sands and oil shales see M. King Hubbert, Energy Resources, in: Resources and Man 1969, San Francisco



Environmental Certificates

Environmental certificates and licenses are traditional Neo-classical instruments designed to internalize external costs, because they open up those elements of the market, which neglect environmental costs, and save interventionist measures. The Coase Theorem (Coase 1960) along with the Property Rights Theory is the basis for this concept. The central idea is of user rights for legal titles, created and sold by the state and which permit the use of environmental resources. The concept thus endows the consumer's right to environmental resources with a significant allocational function. Consumers have the opportunity to be rewarded in the future for refraining from exploiting a resource today.

The question of allocation is of similar importance in the case of environmental certificates for consumers to that of the rights of resource owners in the complex market system in the Dual System, however, environmental certificates remain ineffective, the resource owner in the South being prohibited from maximizing his usage by opting for alternatives. The initiation of environmental certificates for consumers would thus sanction the existing Dual System, transferring the maximum utility function from the supplier (mainly the South) to the consumer (mainly the North), thus leaving the resource owners in their current role of supplying the industrial countries with resources at dumping prices, and enabling the latter to be the sole profit-makers in the internalization of external costs.

In other words, this method hinders the South from capitalising on their own exhaustible resources and following a maximum utility strategy, while at the same time the North, by creating and selling fictitious legal titles has opened up new and lucrative sources of income. This Neo-classical concept could in all possibility become a modern market instrument for the further distribution of wealth from the South to the North, whether or not this is, in fact, strategically planned.

CO_2 Energy Tax

This Keynsian tax concept places more importance on state regulation and is shortly to be introduced into the European Community. Like the system of environmental certificates, this system is consumer-oriented. It fails both in theory and in model calculations to take any account of the behaviour of the suppliers of fossil energy sources in the world market and fails, in particular, to consider the

complex interdependencies of oil price formation and fossil energy sources on the world market. However, it tacitly assumes, for example, that the OPEC states would reduce their oil supply as a result of a reduction in oil consumption brought about by an energy tax.

It is, however, to be expected that a fall in oil consumption would bring about a drop in the price of oil, incurring revenue losses in OPEC states. For this reason, we can assume that they would increase, rather than decrease, the oil supply, despite falling consumption, in order to stabilise their revenue. The supply surplus thus created causes falling world market prices for oil, consequently decreasing energy prices and finally a renewed increase in the demand for oil and other fossil energies.

The energy tax, which in the short run brings about a decline in consumption, would now be counteracted by a rise in consumption, induced by the declining oil market prices. The final result would thus involve a redistribution of income from the OPEC states to the oil-consuming states, without achieving a reduction in use of energy and in CO_2-emissions. Theoretical proof for this result can be found in the market theory, empirical proof being provided by the previous mineral oil tax policy of the European Community (Massarrat 1993).

Radical Alternatives

As outlined above, environmental certificates and energy taxes are the modern instruments of an ecological imperialism, however of questionable ecological significance, in both cases the South implicitly playing the role of delivery man for resources at dumping prices. In contrast to this, the conquest of the Dual System would not only render them superfluous, it would also precipitate a politically and ecologically more effective reaction.

The reduction of energy consumption by means of an energy tax could, for example, be successful if the redistribution of income to the detriment of the OPEC states were precluded This is, however, guaranteed if the reduction of energy use is accompanied by higher oil prices. The latter, however, assumes a reduction in the oil supply. Thus, the main deficit in the demand-orientated energy-tax concept refers to a concept of quantity reduction and price rise on the part of the supplier, which should, according to all probability, be more consistent and successful with respect to a reduction in CO_2 emissions.

The concepts of quantity reduction and price increases of fossil fuels on the supplier's side render the energy tax redundant, not, however, the CO_2 tax, the latter acting as an ecological corrector of the market prices of fossil energy sources of varying CO_2 content. In terms of environmental politics and social balance, the supply price regulation concept could, in the long run, be the most effective, if a global not merely a regional consensus could be achieved.

In accordance with socially balanced criteria, which are ecologically and politically effective (compare with Massarrat 1993, a global concept is suggested based on three complementary components :

a) Prescription of upper limits for the total production-levels of fossil energy sources, taking into account the long-term CO_2 budget (certificate system on the supply-side). The price formation of single energy sources (oil, coal, gas) is then left to the market.
b) The taxation of the CO_2 content to effect an ecological correction of the market price of the various fossil energy sources. It is important here to restrict inequalities in the utilization of regional resources (oil in the South and coal in the North).
c) Taxing natural productivity (the differential rents) on the supply side. The resulting income and that incurred through the CO_2 tax should secure the energy supply of the developing countries, which are deficient in resources and are undeniably need to of catch up with the others.

It is clear that a global consensus is necessary for the long-term success of the suggested concept. However, unilateral and regional (EC) measures in this direction can, independently of a global consensus, have a positive effect, and should be furthered for the following two reasons: (a) The measures initially lead to higher production costs and can restrict international economic competition; however, they can initiate innovative processes with medium- and long-term competitive advantages for innovative products and technologies (such as in the use of renewable energies). (b) The measures have a pioneer function, their practical results stimulating other countries and regions to follow suit, thus speeding the process of political and ecological unification in the energy sector. These measures could be implemented immediately, based on the long term proportion of the CO_2 budget appropriated to them, to set an upper limit to annual consumption according to the energy source, leaving the market to carry out the allocation regulation function.

Germany, the European Community and other industrialized countries do not have to wait for a global consensus on the limiting of production and consumption levels of fossil fuels. They can take a leadership role in the process of the reconstruction of the global ecological energy market.

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