

The Transition As A Catastrophe: From Theory To Policy, 1994

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1. THEORETICAL BACKGROUND

1.1. The Second Best Nature of the Transition

I.I.I. The General Equilibrium Approach

The application of the general equilibrium paradigm to the analysis of the transition from command to market economy is quite natural. By definition this process can be considered as a movement from a shortage, inventory burdened economy, to a balanced and efficient one.

The general equilibrium theory formulates and describes the possibility, uniqueness, behavioral foundation and stability of the simultaneous equilibria at all markets, given the specific utility functions and production sets (Takayama: 1985:169-74). The most part of the models do not take account of the cost of collecting information during tatonnement or non-tatonnement process. They also presuppose constant number of firms and exchanged goods, constant technologies and stable institutional structures. In other words, they exclude just the problems, which are of greatest interest from the transition point of view.

Although some attempts are done to adapt the general equilibrium framework to the realities of the post communist economies, including explicit introduction of rigidities, not permitting the prices to balance the supply and demand and thus leading to inventory strategies and shortages (Weitzman:1991:401-14), they cannot overcome the boundaries of the second best approach and create a stable basis for a comprehensive theory of transition. An other shortfall of the classical general equilibrium analysis is it's failure to take into account the existence of the complex mutating organizational and institutional structures. The "optimal ignorance" approach is to some extent the exception, that proves the rule in the sense, that by including the cost of adjustment one excludes the possibility of perfect equilibrium and thus reduces it's status to an inachievable goal (Davidson;Hall: 1991:244). On the other hand, the introduction of the utility non-linearity in information" implicitly implies uncertainty under the form of risk indifference (Christensen: 1983:408-9).

Nevertheless, the cost of information concept is extremely important in the context of transition learning process.

Finally we can conclude, that without reformulation of some of it's traditional assumptions, the usual specification of the general equilibrium optimization framework is not directly applicable to the transformation issues of the command economic systems. The problem is, that the transition presupposes an other type of equilibrium - in the typical neoclassical world resources

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are scarce, but the information abundant. The inverse should be expected in the mutating post-communist countries. Under transition the equilibrium is not a state, but a moving costly target.

1.1.2. The Modern Austrian School

The "market process" approach has many applications in the field of the comparative analysis of the command and market economic systems. The modern Austrians are interested in the economic development and the information role of disequilibrium prices.

The prices are knowledge "surrogates", they can also infer knowledge and provide profit opportunities for the entrepreneurial discovery process (Thomson: 1992:60-62).

Contrary to the general equilibrium conventional wisdom, Neo-Austrians see the main flaw of the command systems not in the absence of market clearing prices, but in the lack of entrepreneurial incentives and the impossibility to create rational hierarchical organizational structures. As to the latter, there is strong evidence supporting this conclusion, but the former is less convincing. In fact, incentives (not necessarily under the form of pecuniary incomes) and possibilities for entrepreneurial activities are present, even to a greater extent, than in market economies- the whole system of central planning is by definition subordinated to the entrepreneurial "discoveries" of the central planner. The problem is, that without neoclassical price environment, the society cannot distinguish between efficient and inefficient decisions.

In brief, the unreliability of the endogenous information makes the imitation of the market economies the only viable strategy for command economies. The evolution of such economies is an interplay between inefficient endogenous "discoveries" and market system imitation.

Clearly, the market process vision is extremely important from the transition point of view, emphasizing the role of disequilibrium prices, hierarchies and entrepreneurship.

1.1.3. The Monetarist Schemes

The role of the monetarism for reconstructing the former socialist economies is special both from theoretical and practical point of view. The concepts of shortage and money overhang, which are basic for the post-communist economies understanding, implicitly imply that under transition "money matters". On the other hand, the monetarist hypothesis about the stability of the function of the demand for money, based on the presumption of institutional stability of the economy, is too strong in the case of transition. As a consequence, such prescriptions of the orthodox monetarism, as the monetary targets and ceilings, positive real interest rates, nominal anchors and hard budget constraints, may be misleading, given the dynamic environment of the transition.

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The orthodox application of monetarism may lead to a huge accumulation of bad debts, prolonged depression, bank crisis and instability at emerging capital and foreign exchange markets. A non-orthodox monetary policy, based on the obligatory reserves, priority state budget deficit financing (McKinnon: 1991:55-66) and more short-term central bank regulations, seems more appropriate. To summarize, the importance of the monetarism relies

on the fact, that it emphasizes on the non-adaptive character of the velocity of money, and hence on the possibility and the importance of the stabilizing monetary policy (Friedman:1991:6-10). The limits are a consequence of the presupposed stability of the money velocity - under transition the income velocity of money should be expected to be a dynamic endogenous variable.

1.1.4. The Keynesian Activism

The high unemployment rate, the low level of capacity utilization and the existence of a relatively developed apparatus of state intervention into economy, may be serious arguments for demand oriented economic policies. The temptation is especially high after unsuccessful monetarist stabilization program in the beginning of the transition period. The credit squeeze and the inventories running down may really produce a typical Keynesian impasse (Calvo;Coricelli:1992:11).

The problem here is that in a distorted market economy with asymmetric information, the increase of demand may lead, in spite of the resources underutilization, to raise of inflation. The injection of new sums of money into economy with high degree of uncertainty, may favor the unproductive behavior and contribute to the economic slump. To prevent such development, the state should introduce some kind of price and income policy, coupled with structural adjustment measures. In the same time, the demand oriented policy will probably create problems with foreign trade balance. The best solution to this issue - an export led growth, is inachievable in short run, given the low international competitiveness of production. So, only a return to a barter-based trade may permit non-inflationary economic growth. Finally, the state may be engaged into an economic policy, which would reproduce the inefficient economic structure of the past.

It is evident, that a pure keynesian type economic policy, as monetarism, may work only under the specific conditions in a mature market economy. This does not mean, that under transition the effective demand should not be considered as a possible constraint on the equilibrium convergence process (Artis:1990:17), but rather that the demand and demand oriented economic policy must be viewed in a broader context of an interaction with other constraining factors.

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1.1.5. The Systemic Perspective

The command segment of the world economy can be considered as a specific semi-peripheral structure, which appears not only as a result of some internal economic and political changes, but as a consequence of the evolution of the World-System. The presence of command economic structures may temporarily stabilize the world economy, given it's capabilities for a counter cyclical economic policy and disposition to force economic growth. As far as the central planning evidently cannot be as sophisticated as the world economy as a whole and the process of imitation is an imperfect by definition, the command economies are deemed to an inefficient functioning and final failure.

Nevertheless, the raise and fall of the command structures is a more complex issue than this. It is connected with the development of the international financial system. The transfer of resources from surplus to deficit economic agents at international scale, is highly dependent

on risk considerations. This worsens the economic conditions for the economically and politically most volatile countries and creates a vicious cycle. In such a situation, and given a low level of international cooperation, a state interventionist policy may be inevitable.

From political and economic point of view, the evolution of the core economies is of crucial importance. The change of the world leadership in the context of the hegemony cycles and long waves, creates situations of instability, economic crisis and lack of cooperation (Goldstein:1988), which facilitates the raise of economic and political radicalism (for historical description, see Appendix 1). Finally, the fact that the countries with middle level of economic development experience the higher level of vacillation between the authoritarian and democratic political systems (Arat:1987) explains the most probable space location of command economies. So, the World-System approach makes possible the theoretical explanation of the time and space coordinates of the emergence of the command economies.

As a consequence of this logic, the transition from command to market economy should also be a World-System led process, with historical (Gelb;Gray:1991:1-6) and geo-strategic factors playing an important role. The former centrally planned economies have three possibilities - to be integrated into the core; to be "peripherilized"; and to come back to a new variant of command system. The result, (not necessarily the same for different countries), will depend on the policy of the core, the level of international cooperation and the success of the transition strategies.

Finally we can conclude, that the systemic approach gives us an useful analytical tools. However, it fails to create a basis for pragmatic transition economic policy, especially at national level.

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1.1.6. The Principle-Agent Theory

The dominant state ownership is a typical feature of the most command economies. This permits to consider the transition as a change of ownership structure - a radical privatization will transform the whole modus operandi of the economy. Theoretically the privatization may be seen as a solution to the monetary overhang, as the best way to fight budget deficit and inflation, as an instrument of restructuring and creating competitive market structures and as mean for attracting foreign investments (Lipton;Sachs: 1990:293-94). The type of privatization the society chooses will also predetermine its future social and political foundations.

As far as from theoretical point of view the implications of the change of the ownership structure can be analyzed in the boundaries of the Principal-Agent approach, the latter can be used as some theoretical basis for transition economic policy. This theory can be successfully applied to the problems of the interdependence between the competitive (oligopolistic) market structures, ownership and economic efficiency. It is also an useful tool for the study of the role of the financial markets and the different techniques of privatization (Winiecki: 1992:271-77). The Principal - Agent approach is especially insightful for handling with disequilibrium situations and taking into account the role of the information at micro level. In the same time, the complexity of the problems of the systemic change of the post-communist economies is far beyond the boundaries of the Principal- Agent theory.

1.2. The Catastrophe as a Solution

1.2.1. The Special Concept of Meaning under Discontinuity Analysis

Some times the catastrophe approach to the economic and social problems is criticized (Sussman;Zahler:1978) on the basis of it's pretended lack of originality and uninformative character. In fact, the catastrophe theory implicitly implies a new, more narrow approach to the problem, which Samuelson (1983:5) formulated as a need for meaningful economic analysis. From Samuelson's point of view, given economic theory is meaningful when it suggest a hypothesis about empirical data, which can be refuted, if only under ideal conditions. One of the founders of the modern catastrophe theory, R. Thorn, put the supposition, that the topological complexity of the form should be considered as a scalar measure of the information. As far as the catastrophe theory is based on the circumstance, that any sudden radical shift in the way of functioning of the complex systems, given little change in conditions, can be described by variation of it's topological complexity, we can make the conclusion, that any catastrophic model, which really describes a qualitative reswitching, is by definition more informative, than a similar non-catastrophic one. This is a simple consequence

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of the fact, that the information itself is a measure of the complexity of a system and the catastrophe describes a transition from (through) one type (level) of complexity to another, a kind of shift which, also by definition, cannot be consistently interpreted without some discontinuity theoretical framework.

From catastrophic point of view any non- catastrophic theory should be non-informative, because it describes different states or different dynamic paths of the same system. On the contrary, meaningful is only an explicit hypothesis about empirical data, which implies a change of the topological complexity of an economic system, and can be refuted under strict conditions. It is not difficult to admit, that the continuous systems are only limit cases of the more general discontinuous development.

1.2.2. Catastrophe and Entropy

As far as the catastrophe theory is about the change of the regime of functioning of complex systems, the general rules operating the information in such structures should apply. It's well known, that the survival of a system (regime), depends on it's ability to generate as much variety within it's boundaries, as it exists in the form of threatening disturbances from the environment. The entropy, as a measure of the average amount of information, required for identifying of the observations by categories (Krippendorff:1986:19), is the variable, which reflects the system's ability to control the disorder. The increase or decrease of the entropy denotes some kind of structural development (negative or positive), which eventually may lead to systemic transformation. The relation between the entropy and the topological characteristics of the system is formulated by the Thorn's hypothesis, that the greater the topological complexity of a system, the lower it's entropy (Thorn: 1972:140).

From the point of view of the particularities the economic systems, the phenomenon of entropy implicitly implies the existence of non-price rigidities (Roy: 1990:16), in the case of market dominated economies, and of decentralized resource allocation, under central

planning. In other words, both market and command systems are supposed not to achieve an all-inclusive economic control. The economic entropy is generated by both the irreversible character of the natural processes, involved in production, and the human behavior.

In general, the risk averse economic agents may be supposed to contribute to the decrease of entropy, and risk takers - to its increase, given the multiplication of the number of low probability activities. In the case of prevailing market conditions the risk takers may be expected to engage into non-market information-based (entrepreneurial) operations, and under central planning - into market clearing ones.

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1.2.3. The Catastrophe Approach as a Complementarity. Theoretical Framework

As stated above, both the free market and the central planning cannot achieve in practice full control over economy - neither prices are sufficient statistic, nor the planning is possible without prices. So, in both the command and market economies uncertainty exists, every economic process is eliminating (ex ante and ex post) some entropy respectively. Given the fact, that the transition is a complex phenomenon, the final entropy flow, describing this process, would be a sum of different flows, produced by the change of multiple economic stock and flow variables. The rate of increase or decrease of individual flows will depend on the intensity and direction of given economic change, on the one hand, and on the variation (inclusive distribution shifts) of the associated probability, on the other.

The mutation may take place in different spheres (supply, demand, investment, foreign trade, money supply etc.), and may be subject of study of different theories, but the final result (the path of transition, if any) will be determined by the interplay of these various processes. As far as the transition may be achieved in fact only under some specific combination of different structural changes, measured by the dynamics of the respective entropy flows, and which cannot be interpreted in principle in any "metanarrative" framework, the catastrophe approach presupposes some coordination of the different theoretical lines of thinking on the basis of their relative importance, explicative capability and relevance under transition conditions, emphasizing their mutual complementarity and relativity, rather than alternativity.

The logical basis of this possible coherence is the fuzzy set theory (Murphy: 1991:146). If we can measure the plausibility of "membership" of given economy in the command and market states sets respectively, we can design a transformation model. Such transition premise would be not only an instrument for the interpretation of the real economic processes, but also a shift from one logic to another.

Having in mind, that we are interested in the predominant membership states, we can conclude, that any consistent transition theory (model), should be an explicit or implicit hypothesis about economic dynamics as an discontinuous image under a function on the basis a fuzzy set state variable, reflecting the deviation from the transition (50% membership) point and control (parametric) variables, measuring the entropy dynamics. This definition has "strong" structural discontinuity features (Vercelli: 1991:55) in the sense, that it presupposes, under the right choice of the state variable, both an alteration of the equilibrium properties of the system and change of the sign of the disequilibrium characteristics.

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1.2.4. Managed versus Forced Catastrophe

The sudden switch to another regime of functioning of the studied system is not something new in the economic theory or history. Different kinds of threshold effects are analyzed in many models, based on various theoretical considerations. The catastrophe approach as such is already applied to the problems of the technological progress, stagflation, space economics, monopolist behavior, business cycles (including long waves), financial crashes, exchange rates, Philips curve etc. Moreover, attempts are under progress to reformulate the foundations of economic analysis to explicitly include economic discontinuities (Rosser;Barkley:1991).

As far as the regime shifts are inevitable during the evolution process of any economic system, two types of change are possible - an unexpected crisis or aimed restructuring. In the first case the main intent of the theory and respective policy should be to avoid or to smooth and overcome the consequences the sudden disruption of the continuous path of the economy. In the second case however, the task is relatively more complicated. The theory should formulate under which conditions the change of the modus operandi of the respective system is possible, whether the new regime is stable, should the system go through a period chaotic behavior, are different sequences of policy measures possible, which is the socially optimal path of transition and whether the restoration of old structures is likely, given some inappropriate policy measures set.

2. THE SELECTION OF THE RIGHT CATASTROPHE

2.1. Constructive and Destructive Catastrophes

R. Thom (1983:176-177) distinguishes two types of temporal interpretation of the "meaning" of the all seven elementary catastrophes - destructive and constructive. From the point of view of the transformation from a command economic system to a market one, this division is essential. The constructive catastrophe can be considered as some kind of process of diversification and sophistication of the old structures, which eventually leads to transition to another type of functioning of the system. A destructive catastrophe from this point of view is a procedure of dismantling of the old institutions in the context of some self-organizing process of an emergence of the new structures.

It is evident, that any variant of transition economic strategy should involve both type of processes. Nevertheless, constructive or destructive trends should prevail for any given point of time, at least in some subsets of the economy, if a shift is to take place. It is also possible to consider different periods with alternating constructive and destructive nature.

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Additionally, the fuzzy set theory permits some other inductive statements. The fuzzy logic framework (Schmucker:1984) presupposes two types of transition- through an average market economy set membership plausibility increase, or through a process of concentration (reduction of the degree of membership of the economic units, which are only partially market-oriented). The latter is evidently some kind of market selection process, which should eliminate the inefficient economic agents. The famous hard budget constraint is nothing, but one the rules of such selection.

The shock therapy can be classified as predominantly self-organizing, selection based catastrophe, and the gradualist approach - as a constructive and "average" one. It must be added, that the type of transition the society chooses, should be a function not only of the initial economic and political conditions, but also of the expectations about the results of the implementation of different approaches, in the sense, that these expectations are not trivial (some of the consequences of the transition are maybe unpredictable) and cannot be considered as fully rational. So, the path of transition should be expected to be always to some extent an arbitrary one.

2.2. Structural versus Global Approach

The transition from command to market economy is both some kind of internal evolution of a given national economy and a global process of interaction between different segments of the World-System. The first approach presupposes an explicit description of the internal economic organizational structures and the process of their mutation. The latter should include a concept of interdependence and co-evolution of the core, semi-periphery (the subsystem of command economies) and periphery (Third World), or should be based on some space economic model in a catastrophe inspired framework. Both lines of thinking are consistent and mutually supportive.

On the other hand, it is clear, that we can analyze the consequences of the COMECON dissolution for the world trade, financial flows, technology exchange and for the world economic order as a whole, mainly in global perspective. The same is true if we consider the failure of the command subsystem as a result of the evolution of the world economy. Nevertheless, for the purposes of the national economic policy, the World-System framework is neither sufficient, nor always directly applicable. The emphasize of this paper is on the national economic policy level, hence on the structural analysis.

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2.3. The Cusp Catastrophe as a Basic Model

The Cusp (or Riemann-Hugoniot) elementary catastrophe describes all the possible variants of the transition of given system from one locally optimal state to another. The main problem is the choice of the state variable, or the variable, which can reflect the relative importance (degree of membership in fuzzy terms) of market and non-market forces in the resources allocation of the respective economy. In the same time, this variable should be a Lebesgues measure in classical terms (probability), or plausibility in fuzzy language, and should reflect the mutations of the internal organizational and institutional structures of the economic system.

Such a variable maybe the average degree of "shortage" (excess demand) of the economy. This paper relies on a "fractal" interpretation of the Say's law, which means, that exchange take place between not perfectly informed economic agents and with prices for the identical products not necessarily the same between different sellers and buyers (the price is not a perfect market signal). In such a fractal, not fully integrated by market or central planning economic system, the average probability of "shortage" (impossibility to buy spontaneously a product at given price at fixed point of time and space) is supposed to equal the average probability of excess supply. It is evident, that under this formulation, the "shortage" (or more exactly the positive or negative excess of shortage over 50%) will reflect the relative importance of equilibrium (market) and disequilibrium (command) forces. It also permits the implementation of the strong discontinuity structural change conditions as far as it implicitly distinguishes between entropy and negaentropy flows. Another consequence is the possibility, that the economy can be in command regime even without central planning. This concept implies in the same time non-negligible cost of market information, finite endogenous time horizons and incomplete market structure.

The so described economic system is in equilibrium when the marginal productivity of information equals it's marginal cost. The quantity of information (entropy) the system produces, depends on the number of goods, buyers and producers, their relative distributions (relative parts), the average shortage and it's distribution, and on the time horizon, the economic agents are facing. The latter can be explained by the fact, that the quantity of simultaneous equations for present and future prices, which the economic system "resolves", depends linearly on the time perspective, the economic agents have. In this framework, the equilibrium growth rate of the economic system can be considered as a function of the rate of increase of it's entropy - as stated Hayek, the economic problem is not merely how to allocate "given" resources, but rather a question of the utilization of decentralized knowledge

(1976:77-8).

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Now, if we separate three subsystems - "production", "supply" (marketing) and "demand", we can construct a Cusp catastrophe economic model with national income as a discontinuous function and average shortage as a state variable. The demand is supposed to depend on the probability for successful (more than fifty percent) spontaneous exchange of money against goods at given price, the supply is logistic activity with probability equaling the probability of two simultaneous exchange operations, and the production is a combination of two independent logistic activities. This implies, that the production and supply are less controlled by the market or central planning, than the demand is, hence the supply side is an endogenous flexible constraint to demand. Another consequence of these formulations is the different level of identification of macro and micro states. At the most aggregated level (demand) the economic agents are identified through their preferences, reflected by prices, at the supply level they appear as concrete buyers and sellers and finally as interdependent producers.

Only the interplay between these three subsystems can give us an informationally complete picture of the economy. Without discussing the details, we must only add, that the adopted information description presupposes both risk and uncertainty.

Finally, if for simplicity sake we consider the number of the goods, economic agents and respective distributions as constant, we can express the rate of increase of entropy by the rate

of advance of the average time horizons, the economic agents of the three different subsystems are facing. As far as these horizons can be relatively easily approximated on the basis of the available macroeconomic data (GDP, the volume of inventories and uncompleted construction, monetary aggregates), we have the possibility to measure the change of the Cusp equation constants and so to study the different variants of transition.

Technically, the model should represent the rate of growth of real national income as a function of production, supply and demand time horizons rate expectancies.

The model can be extended to take account not only of the change of "vertical" complexity of the economic system (time horizons), but also of the variety of goods, concentration of market power, the role of private sector, foreign trade and other variables.

3. PRELIMINARY THEORETICAL AND SIMULATION RESULTS

3.1. Conditions, Variants and Stages of the Cusp Catastrophe Transition

According to Zeeman (1977:5), there are five types of behavior of the Cusp catastrophe system - bimodality, inaccessibility, sudden jump, hysteresis and divergence. Any of these states cannot be excluded a priori from the analysis. For the purpose of this paper however, we should be most interested to determine the intensity and direction of entropy flows, reflecting

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the kind of internal restructuring of the economy, which makes possible the shift from command to market dominated resources allocation.

The catastrophe model of the transition is based on the idea, that the "shortage" is a quick variable, and the time horizons of the different types of economic agents are slow ones, in the sense, that they adapt to the changes of the former. We also suppose, that the first derivate of the potential function in respect of the state variable, reflects the marginal productivity of information. All the states of the economic system, for which the first derivate becomes zero, can be considered as locally optimal, given the respective values of the coefficients and control (slow) variables. They also form the manifold of catastrophe dynamics.

From institutional point of view, the transition from command to market economy can be only a process of replacement of the concrete common ends by common abstract rules (Hayek: 1989:63). Such shift makes sense if it enables a process of coordinated individual optimizing behavior, leading to higher efficiency. As far as the processes by definition a disequilibrium one, the prices are not supposed to be sufficient statistic, if socially optimal outcome is to be achieved.

Under non-neoclassical price environment, duality does not hold, hence the economic agents should be expected to maximize pecuniary incomes, given desired inventory and money stocks. This maximization does not imply cost minimization and optimal resource allocation. The transition adjustment should consist in sequence of unconstrained disequilibrium optimums. In other words, under transition it is not a priori clear whether the imposition of common abstract rules is more efficient, then the existence of concrete ends. The socially

optimal solution should be expected to be some dynamic "mixture" of the two regimes in fuzzy sense.

The start of the process of the liberalization of the economy should leave the economic agents with stocks higher, then optimal (if not, the central planning had been optimal, hence the transition does not make sense). The stock adjustment process triggers entropy flows (a downward shift of the time horizons), reflecting high information costs. As far as the former depends on some stock-flow ratios, the proportions between the rates of change of different variables gives the economic agents the necessary information about the frequency of reconsidering the desired stock levels. Finally, we have a disequilibrium, self-correcting transition adjustment process.

The transition strategy can be based on two approaches - radical economic reform (shock therapy), relying on the self-organizing forces of the economy, and gradual restructuring, presupposing the possibility of some kind of market institutions design, transition fine tuning and resource allocation decisions. These two strategies are not in fact mutually excluding. Both radical and gradual approach should include two main stages - first, dominated by destruction of command mechanisms and second, dominated by market based restructuring.

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3.2. The Shock Therapy as a Sudden Jump

The shock therapy is evidently a pure variant of destructive catastrophe, based on "big bang" type liberalization (dismantling of centralized state control of resources allocation and price formation). Our catastrophe model shows, that a necessary (but not sufficient) condition for such a jump is the following equation:

$$(1) T_s^3 / T_p T_b^2 = - 27 a_1 a_3^2 / 8 a_2^3$$

Where T_s is the rate of change of the time horizon of supply, and T_p and T_b are the rates of change of the time horizons of producers and demand, and a_1 , a_2 and a_3 are structural coefficients.

The time horizon of demand is supposed to equal the inverse of income velocity of money, the time horizon of supply equals income/inventory ratio, the time horizon of production is more complex, depending on income, money supply and inventory stock. As a consequence, T_b equals the difference between the rate of growth of money supply and current income, T_p is the difference between the rate of income and inventories, and T_s depends on the income, inventory and money rates, as well as on the absolute levels of inventories and money supply.

Given the initial conditions and the type of optimization behavior, we can find the initial values of t_b , t_s and t_p . We can also define the rates of the money supply, inventories and income.

The differences between rates reflect rates of change of time horizons, and ratios, as mentioned, should give the economic agents the information about the necessary frequency of reconsidering the level of shortages, taking into account the new levels of money and inventory stocks. We have now two main possibilities - coordinated and disjoint adjustment. If we consider that all economic agents have access to the same macroeconomic data (money

supply, inflation, growth) we can suppose, that they have the same frequencies of adjustment (probably, the ratio between the rates of income in current prices and the rate of money supply), hence the adjustment process should be coherent. We also can suppose, that the quickest (the slowest) adapting subsystem dictates the general speed of (or supplies the information for) adjustment.

Nevertheless, the coherence is not highly probable, given the fact, that macroeconomic information in post-communist countries is usually not easily available and completely reliable, the difference between the aggregate and decentralized information and the necessity of some kind of preliminary agreement between the agents. If coordinated, the process can converge to the condition (1). Even in this case, the transition is highly improbable, because it implies inacheavably low levels of shortages. It is important to emphasize, that without the introduction

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of different subsystem's time horizons, any transition is impossible or must be a painful selection process.

The coordinated shock therapy transition should go through three main stages. The first stage is dominated by the demand adjustment and is characterized by income velocity of money acceleration. The higher the inflation at this stage, the deeper the economic collapse. It should be noted however, that the slump is not immediate, but depends on the reactions of the slower subsystems. At the second stage the fastest subsystem is supposed to be the supply, given the decrease of inflation and the reduction of inventories. This can be interpreted as an adjustment of the marketing strategies under the new conditions. The last stage should be the adjustment of production subsystem. This process is the most complicated and depends simultaneously on the monetary, inventory, inflation and income adjustment. As far as the transition is hardly achievable after the first attempt, we should expect several cycles of this market - oriented adaptation, hence quick and slow adjusting subsystems will alternate.

It should be mentioned, that the rate of price increase is an endogenous variable in this model. The inflation is also the cheapest way to change the time horizons from individual economic agents' point of view. In the same time, it is the most expensive from social standpoint, raising the marginal cost of information. At the optimum the two tendencies are balanced.

At figure 1 are presented some results of the computer simulation of Bulgarian economy. They are based on time series regression coefficient estimates and different hypothesis about the transition. Y is the national income at constant prices, and d is a measure of the average shortage. The instable point A, styled by high inflation and velocity of money dynamics, is a point of possible jump from non-market to market state of economy. As far as such shift is in practice impossible, the adjustment process can continue only if point A will move towards the transition point 0. It means that, after high initial negative growth rates the economy will gradually achieve zero rate and next perform the transition, stabilizing in predominantly market economy membership state with positive growth rate.

If the adjustment process is disjoint, the different subsystems (production, supply and demand) will rely on different degrees of precision of information and slow (production) and fast (supply, demand) adapting subsystems will appear. In such a case, the system is simultaneously at three different levels of shortages. This means, that periodically the fast

adjusting subsystems should come back and realign with the slow one(s). An other possibility is to consider that the quick subsystems are supplying the slow ones with more accurate information, but the periods of reconsidering the current adjustment behavior remain different. The organizing center in catastrophic terms, or production subsystem, will finally dictate the rate of transition. The system as a whole should experience chaotic dynamics with prevailing negative growth.

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In this theoretical framework the dynamics of the transition will depend on initial conditions (money and inventory stocks), structural properties of the concrete economic system and the way the economic policy influences the agents' behavior. Of course, the economic policy can influence the dynamic path of transition through initial conditions also - if an Erhard type monetary reform precedes the price liberalization, the transition adjustment process can be radically facilitated. This conclusion coincides with the findings of other authors (Edwards: 1992:135-8). On the other hand, if the initial conditions problem is ignored by the policy maker, it will reappear under bad debt accumulation phenomenon after the first stage of the shock therapy.

As admitted Stiglitz (1985:28-9), under equilibrium with supply not equaling demand, the adverse selection and credit rationing are the most probable outcome. The bad debt problem reflects the simple fact, that the stock adjustment process is asymmetric in the sense, that it affects economic agents in different way- the relatively more short term based economic activities are favored at the expense of the more technologically sophisticated and long term oriented ones. After an Erhard type monetary reform, the transition adjustment should be expected to be more symmetric and less adverse selective.

The other important topic is the economic policy impact. As far as the common concrete aims are rejected under shock therapy by definition, the only important thing is the rules of the game formulation. In Eastern Europe, the hard budget constraint paradigm is the theoretical basis for all market oriented reforms. The hard budget constraint is usually understood in purely financial terms (nominal anchors, tight orthodox monetary policy and state budget deficit control), ignoring the price environment. Nevertheless, the hard budget constraint have different meanings under market and command economic regimes. It is not accurate to state, that the command economic system is incompatible in principle with a hard budget constraint. The problem is, that under central planning, the hard budget constraint presupposes not only financial, but also centralized price and income control. Only such complex discipline may induce cost reducing behavior and avoid the transfer of the firm specific inefficiencies on the consumer under command framework.

In the case of perfect market conditions, the firm is supposed to be a price taker, so a hard financial constraint is a sufficient condition for a cost minimizing behavior. It is evident however, that under disequilibrium dynamics, the tough financial restraint is not by itself satisfactory tool for cost reduction. Price control in monopolized sectors and productivity-oriented income policy are the other necessary components if a "real" hard budget constraints are to be introduced. The tight monetary policy can be in fact "softer" restraint, than the centralized control. The empirical evidence of the productivity fall in Eastern Europe confirms this conclusion. On the other hand, a more gradual price liberalization and subsidies reduction process maybe appropriate (Calvo;Coricelli:1992:14).

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In fuzzy set terms a hard budget constraint shock therapy must be an "intensification" process, which is supposed to eliminate the inefficient economic units and increase the ratio of market oriented ones. Once again, the non-neoclassical price environment makes such selection procedure contradictory. The policy maker have three choices - to postpone all exit and entry decisions in the state sector until a stable transition in shortage terms is achieved; to base the decisions on broader than profitability, considerations; and to accept an "intensification" at different speeds for the various sectors of the economy on the basis of their relative market performance. The best framework for all of the three types of policy is some structural adjustment program. Nevertheless, we should agree, that the shock therapy is not the best way to resolve the "intensification" problem, the latter must be analyzed in some long term evolutionary perspective (Murrell: 1992:35-53).

From Neo-Austrian point of view, the shock therapy is an implicit entrepreneurial revolution. In other words, under the bounded rationality price environment of the transition, economic agents are expected to rely more on intuition, than on precise calculations. Given the fact, that under some circumstances the catastrophe equation may not have real solutions and, as a consequence operations like $<$ and $>$ are not defined, an optimizing behavior may not be possible for some periods, hence the entrepreneurship is really important. On the other hand, if the most part of economic agents behaves like entrepreneurs, the cost of information should remain high and transition will stop.

The leading transition figure should be not the entrepreneur, but the rational professional manager. It must also be mentioned, that the welfare effects of entrepreneurial-led transition process should be negative too in terms of both output and Pareto-optimal income distribution.

The shock therapy can be analyzed under the angle of the accumulation of information-storing structures (Ayes:1988). As far as this is a costly process, the information becomes important externality, reflecting both the uncompleteness and the imperfect nature of markets. The process of creation of new structures can even induce vicious circle(Krueger: 1992:222). In such a situation, as argued Arrow, the economic agents have to rely on rational expectations, based on information other than prices, so the free market information advantages disappear (19X7:210). This means, in Hayek terms, that the optimal transition should not ignore the common concrete aims, on the one hand, and should actively support the elaboration of the system of common abstract rules, on the other.

3.3. Alternative Transition Policies

There are two alternatives to the shock therapy- some kind of managed shock transition and purely gradual restructuring.

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The main shock therapy transition shortcomings are it's high social cost and high probability of chaotic hysteresis. The latter, from the point of view of the assumed theoretical framework, means that periods of increasing inventories and production are followed by

periods of decreasing shortage and negative growth. To avoid this, the policy makers may try to manage the shock.

The Cusp catastrophe equation have two control variables. These variables depend on the rates of change of the subsystems' time horizons. The time horizons desaggregates in two flow rates (inflation and real income) and two stock rates (money and inventories). If the "concrete aims" are forbidden, the policy maker can influence only the market environment through monetary, tax and eventually demand policy.

It can also support the establishment of market institutions. The essential role of monetary policy is evident. If the policy maker adopt an orthodox monetary policy, relying heavily on the positive real interest rates, the shock is hardly manageable because of the lack of degrees of freedom. In order to increase the number of instruments, the central bank should introduce credit ceilings to control inflation and interest rate policy to influence the income and inventories. The system still should not be manageable as far as the credit ceilings under disequilibrium conditions may influence the money growth and inflation in different directions, on the one hand, and the interest rate evidently have mutually excluding impacts on income and inventories, on the other. The system also does not have a "point of reference", the usual money targets and nominal anchors being too arbitrary. In such a situation we can introduce the exchange rate, the price control in the monopolized sectors and the income policy as an inflation gearing instruments. In order to separate the income and the inventories we need a demand management.

The only unresolved problem is the targeting of the policy. The most natural aim and point of reference for the success of the market stabilization program, is the decrease of the shortage. A suitable measure of the level of the average disequilibrium can be the relation R / M , where R is the value of inventories in current prices and M is the money stock. Given the initial conditions and expected agents behavior, reasonable shortage targets can be established. A set of subtargets for money supply, interest rate, exchange rate, budget deficit and other variables can be introduced. Finally we can receive a dynamic transition policy framework.

In addition to this, as already mentioned, the policy maker may influence the initial conditions through monetary reform. Another option is to support the process of market institution and organization emergence. The imperfect information and the uncompleteness of the markets being the main flaws of the looming structures, the emphasize should be put on capital markets, stock and foreign exchanges as well as on the future markets. An other important topic are the property rights. A non-orthodox monetary policy, based on obligatory reserves maybe more preferable, then the credit ceilings or be combined with them. Such approach may permit

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separate treatment of the problems of high credit risk under disequilibrium conditions, and money supply. It also should facilitate the demand oriented policy through the greater possibilities for privileged state budget financing.

The sketched dynamic transition policy should permit to coordinate the transition adjustment and to avoid the danger of chaotic hysteresis. It is also expected to accelerate the transition and to decrease it's social cost. The main idea of the managed shock is to combine the

positive sides of the shock therapy (emphasize on the self-organizing forces of the economy) and the gradualism (manageability).

The rational basis for a pure gradual approach from the catastrophe theory point of view is the fact, that to achieve a transition, the economy does not need in principle to go through critical situations. In this case however we should drop the ban on the common concrete aims. Only with some kind of centralized control on the resources allocation the gradual transition is a feasible solution. In the Cusp catastrophe framework, the gradual transition should have two stages. At the first stage the time horizons of production (organizing center) and supply (the normal factor in catastrophic terms) subsystems should increase or remain constant. The demand time horizon (splitting factor) should decrease (income velocity of money increases). This can be interpreted in the sense, that a gradual price liberalization is combined with demand management and investment supporting policy measures, in order to avoid a production collapse. Export-led growth policy measure should also be appropriate.

The next stage presupposes positive time horizons growth rates for the all three subsystems. This means a gradual state allocation policy substitution for efficient capital and future markets. Such type of transition probably presupposes a stable, South Korean- Japanese kind of political system. We can make also the conclusion, that a more realistic description of the transition process should be based on two dimensional (economic and political) framework.

An important weakness of the gradualist type transition strategy is it's complexity and the need for a relatively long preparation period, as well as it's implicit dependence on the scarce foreign capital and insufficient internal savings.

To resume we can add, that, contrary to the usual conclusions, the higher the initial distortions of the economy, the higher the need for urgent measures, but simultaneously, the stronger is the economic consistency of a gradual transition. So, the policy makers should choose between the relatively easy to start shock therapy and the more complex to implement gradual approach. Fortunately, a shock therapy start do not exclude a gradualist oriented completion. A managed shock therapy variant seems also possible.

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3.4. Further Research and Extensions

At this stage, only general theoretical background and some computer simulation, based on data of Bulgarian economy are performed.

Further research should be concentrated on the problems of stability and optimal growth paths of transition. Some issues can be interpreted more rigorously in a Bayesian games equilibrium (Laffont: 1991:51-68) framework. Another important topic is the specification of the different variants of transition strategy in the context of instrument-target interplay. The theoretical background of this paper permits more complex approach to the restructuring of post-communist economies. The introduction of the foreign trade, for example, is not a trivial extension, as far as the export is a supply, and the import a demand type activity, hence the exchange with the rest of the World (where, in addition, a different level of shortage prevails) alters the whole modus operandi of the economy. The role of the emerging private sector and the privatization also can be incorporated into the model.

Another interesting field is the analyses of the problem of transition from a more pronounced evolutionary point of view. In this paper only some macroeconomic aspects (different reactions of the subsystems) are studied. If we drop the hypothesis about the constant distribution of shortages between agents and sectors, we can describe a selection process under catastrophic framework.

One of the aims of this work was to avoid the strongly criticized in the literature ad hoc character of the most part of the economic catastrophe theory applications. As a result, the implemented joint entropy-catastrophe-fuzzy set approach could be useful not only for the transition models. All kind of economic policy regime shifts or Schumpeterian technological "Historical Reswitchings", can be interpreted in this framework. The contingency for implicit institutional mutations handling, makes possible it's application for the study of the long term structural evolution processes of the economic systems.

4. OTHER CATASTROPHES

This paper emphasizes on the cusp catastrophe as the most appropriate model of the process of transition from command to market economy. The choice of this model relies on the hypothesis, that the studied economic system really can function both under command and market regime, and that it's economic weight is insignificant from the point of view of the World-System. When these conditions do not hold, other elementary catastrophes can be actuated.

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The Fold type catastrophe may describe a transition with full destruction of the old regime and new beginning. The East Germany unification is an example of such process. The Swallowtail equation, including three control variables, may model an unsuccessful transition- probably the perestroika in the former USSR.

The Butterfly catastrophe is associated, according to R. Thom, with the system Source-Message-Receiver. This four control variables function can be applied in the World-System context. The source of innovations (the core) interacts with the message (the command segment, which main strategy is the imitation of core technologies under non-market economic conditions in order to become independent of the industrial center), and receiver (the Third World), which plays a passive role, imitating both the center and the command economies.

The Umbilic type catastrophes (Hyperbolic, Elliptic and Parabolic) are of more complex type, including interplay between causes and consequences (the equations contain two state variables). This kind of behavior can be interpreted at the World-System level as a complex state of cooperation and competition, involving international institutions (Hyperbolic Umbilic), common targets (Elliptic Umbilic) and common instruments (Parabolic Umbilic). The Umbilic catastrophe models would be the most appropriate tool for the study of the process of transition as some kind of reintegration of the command subsystem into the world

market economy. These kind of theoretical metaphors can be applied also for the description of the transition as a two dimensional evolution- economic and political, economic and environmental or other combinations.

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