

Resource-Constrained versus Demand-Constrained Systems

Author(s): J. Kornai

Source: *Econometrica*, Vol. 47, No. 4 (Jul., 1979), pp. 801-819

Published by: The Econometric Society

Stable URL: <http://www.jstor.org/stable/1914132>

Accessed: 21/06/2010 10:48

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## RESOURCE-CONSTRAINED VERSUS DEMAND-CONSTRAINED SYSTEMS<sup>1</sup>

BY J. KORNAI

In a socialist economy the shortage in consumer goods, housing shortage, disturbances in material supply, shortage in investment goods, and labor shortage are to be traced back to common main causes. Certain properties of the economic mechanism permanently reproduce shortage.

First we study the microanalytics of the producer firm. Efforts at increasing production may hit three different upper constraints: the constraints of physical resources, demand constraints, and the firm's budget constraint. The system can best be characterized according to which of these constraints is in effect. From this aspect resource-constrained and demand-constrained systems are discerned. In the former it is bottlenecks of production and not buyers' demand that delimit production; in the latter the case is the reverse. A socialist economy in its "classical" form belongs to the former type. This is connected with the question of whether the firm's budget constraint is "hard" or "soft". If it is hard, spending of the firm will be effectively delimited by its financial abilities. If it is soft, then because losses are almost automatically compensated by the state the firm's demand becomes almost insatiable.

The macroanalytical part of the paper demonstrates the mechanism of a chronic shortage economy with the aid of a hydraulic analogy. In it the sector of firms "pumps out" the slack of the system. This phenomenon is due primarily to the effect of "investment hunger" shown to be the result of an irresistible expansion drive.

Finally, the paper briefly touches on the interdependencies of shortage, inflation, and employment.

### INTRODUCTION

I WISH TO INVESTIGATE a few fundamental problems of the socialist economic system. Some of my colleagues and I, with the aid of mathematical models studied the questions to be analyzed in what follows; our results are in the process of publication. The present study is not concerned, however, with the description of any particular model, but tries to give a broader outline of the general economic issues underlying the various models. I will try to face the difficulties of a socialist economy no less frankly than would a Western economist discussing the deeper causes of recession, inflation, and unemployment.

I shall focus my attention on the problem of *shortage*. This is one of the central subjects in the economics of socialism. In understanding the problems of a socialist economy, the problem of shortage plays a role similar to the problem of unemployment in the description of capitalism.

The *consumer* constantly encounters shortage phenomena. Let me refer to Hungarian experiences. Although in past years the supply of consumer goods has much improved, "deficit goods" still keep disturbing smooth supply. Tens of thousands are waiting to get a telephone station, or to buy a car. The gravest

<sup>1</sup> Presidential address, presented at the North-American and at the European meeting of The Econometric Society, in Chicago, August 29, 1978 and Geneva, September 6, 1978. The author gratefully acknowledges the support of his research by the Institute of Economics, Hungarian Academy of Sciences, Budapest, and Institute for International Economic Studies, Stockholm University, Stockholm.

shortage phenomenon in consumption is a housing shortage which has grown into a pressing social problem.

We keep encountering shortage phenomena not only as consumers but also as producers. Hindrances are not rare in the supply of materials, semi-finished products, and parts. Shortage of construction and installation capacity is conspicuous in investment processes. In addition to all this, labor shortage increasingly retards the expansion of production.

Many economists and managers think that there are separate phenomena involved. Although symptoms are similar, the causation is different in each case. One kind of shortage results from the planner's fault, another one from the negligence of the factory supplying the product, and a third one may be the consequence of the price having been fixed too low, etc.

In my opinion all the above mentioned symptoms spring from the same root; in the final analysis they can be traced back to common main causes. We are faced with various concrete manifestations of the same *general* phenomenon.

It is not a temporary, or occasional problem, but a chronic one with which we are faced. Certain social conditions, and certain properties of the economic mechanism discussed herein constantly reproduce shortage.

The analysis of shortage is a widely diverging subject. Either as a cause, or as a consequence, it is interrelated with every important process of economic life. For a comprehensive analysis we ought to go through almost all chapters of economics. Of course, this short study cannot undertake to do this: it must rest content with only a fraction of the large sphere of problems. I have tried not arbitrarily to pick out matters of detail, but to analyze a few important interrelations. I must emphasize, however, that the following discussion does not claim to be either complete, or to be the full summary of a longer and more thorough train of thought.

Shortage can simultaneously be considered as *good* and *bad*. It is favorable that there is no unutilized capital which is unwanted by any firm for a productive use. There is full employment. (We shall later return to this.) Production is growing without recession. At the same time, achievements are necessarily accompanied by troubles. Shortages cause loss and inconvenience to consumers. They often have to wait for supply, to queue up, and frequently, are forced to be content with goods different from their original wish. Sometimes they cannot cover their particular demand at all. Shortage causes disturbances in production. A seller's market develops in which there is not enough incentive for improvement of quality of products and for innovation. All this is mentioned only as a preliminary: my study does not aim either at a normative evaluation, or at elaboration of suggestions. Its exclusive aim is *description* of the phenomenon and *explanation of its causes*.

The examination of shortage present in the socialist economy has numerous precedents in the history of economic thought. Limited space makes it impossible for me to describe them here in detail and to compare my viewpoint with that of others.

I shall carry on the analysis on a rather abstract plane; there will be no detailed

representation of economic reality. Basically I treat the "classical" form of a socialist economy, which preceded the economic management reforms of the 1960's and 1970's. I shall not discuss in detail to what extent the momentary state of Hungarian and other Eastern European economic mechanisms are identical with, and different from, the "classical" form. A further simplifying assumption I shall make is to disregard foreign trade. I begin my study with the microeconomic approach, and turn to the macroeconomic approach in the second part.

#### MICROANALYSIS

##### *The Three Constraints of Increasing Production*

We shall center attention on the *producer firm*. For the sake of conceptual clarification the question of whether or not it is a capitalist or a socialist firm will be left open. We shall deal exclusively with the short-term behavior of the firm. It is presumed that the firm strives for increasing production, and we shall not question its motivation; i.e., whether its impetus comes from the command of superior authorities, or from its own voluntary decision (with a view to increased profit), or from bonuses promised to the managers, or at the urgings of customers, etc.

The question is the following: what are the *constraints* limiting efforts at increasing production? For illustration we can visualize a mathematical programming model of the firm, in which production variables are constrained by inequalities. Many thousands of constraints exist for every firm at any given moment, and, if we keep in mind the totality of firms, i.e. the whole of a national economy, many millions of upper constraints delimit production. Constraints are divided into three large groups:

1. *Resource constraints*: The use of real inputs by production activities cannot exceed the volume of available resources. These are constraints of a *physical* or technical nature: the stock of labor of different qualifications available momentarily for production, the quantity of materials, semifinished products, and parts lying on store, the capacity of machines and equipment ready for operation in factories, and so on.

2. *Demand constraints*: Sale of the product cannot exceed the buyer's demand at given prices.

3. *Budget constraints*: Financial expenses of the firm cannot exceed the amount of its initial money stock and of its proceeds from sales. (Credit will be treated later.)

Which of the three constraints is effective is a defining characteristic of the social system. The meaning of "effective constraint" is well known from the theory of mathematical programming. E.g., in the solution of a programming problem, equality holds for some of the constraints which are given originally in the form of inequalities. The constraints for which equality holds are *effective* because they have limited choice. Inequality holds for the rest of the constraints, which are *not effective* from the aspect of the momentary solution. They have no impact on choice: they are redundant. It is always the comparatively narrower constraints that are effective.

*Demand-Constrained and Resource-Constrained Systems*

Two “pure” types of systems are discerned from the point of view of effectiveness of constraints. One is the *demand-constrained system*. In it the effective constraint on production increase is the buyer’s demand. Demand constraints are narrower than physical resource constraints. The available quantity of resources would allow a further increase of production. Yet producer firms do not avail themselves of this possibility, since they do not see the excess as saleable.

*Capitalism is, in its “classical” form, a demand-constrained system.* This is the economy Marx treats in “Das Kapital” when he writes about the contradiction between the tendency of unlimited expansion of production and the limited purchasing potential of the market.<sup>2</sup>

Keynes’s attention was centered on this problem.<sup>3</sup> He analyzed the ways in which effective demand can be increased. Governmental and private investments, together with the indirect effects these have on employment and consumers’ demand, were among the possibilities which he considered.

Modern capitalism—mainly owing to the effect of active state interventions often undertaken in the name of Keynes—can no longer be qualified a “pure” demand-constrained system.

The other “pure” type of system is the *resource constrained system*. Here the effective constraints to an increase in production are the available physical resources. *A socialist economy is, in its “classical” form, a resource-constrained economy.*<sup>4</sup>

In order to avoid misunderstandings, it should be noted that if an economy is qualified as a resource-constrained system, this does not mean that in such an economy all resources are utilized at 100 per cent at every moment. In production, a more or less strict *complementarity* asserts itself in the short run. Technology is given; various inputs must be combined in fixed proportions. That is, if one of the resources proves to be a bottleneck momentarily, other resources remain partly or fully unutilized at the same time. A number of workers will be idle at the workshop if there is no material to process, or a part is missing for the installation, or there is a power cut; or, on the reverse side, there is material but it is not processed because the worker in charge of the task has not come to work. There is shortage of the resource presenting the bottleneck, and slack of the complementary resources. Therefore, shortage and slack are not mutually exclusive phenomena, considering the whole of production and a long period, but are necessarily concomitant.

<sup>2</sup> See, e.g., [10, Vol. III, Ch. 15, Section II].

<sup>3</sup> See [6].

<sup>4</sup> The idea arose already in the Soviet economic disputes of the 1920’s. In his study written in 1925, Kritsman [8] draws the following comparison: “. . . in capitalist-commodity economy there shows a general *excess*, and in the proletarian-natural economy a general *shortage*.” I found the quotation in Szamuely [12].

In his study written in 1970, Kalecki [5] stated it as an essential difference between capitalism and socialism that the utilization parameters of resources are determined with the former by the demand side, and with the latter by the supply side. Similar conclusions are reached by the Czechoslovak economists Goldmann and Kouba in their book [3].

### *On Measurement*

An important conclusion is drawn from the simultaneous presence of shortage and slack. The question, whether any economy is to be qualified demand-constrained or resource-constrained, cannot be answered by observing its slacks, or its unutilized resources only. It is possible, but by no means certain, that in comparing two economic systems—one resource-constrained and the other demand-constrained—it must be the former in which the average utilization of resources is higher. The exclusive criterion of distinction is: *what was the effective constraint in the elementary events of production?* If in the overwhelming majority of elementary events demand constraint was effective and physical resources constraint not effective, then we are dealing with a demand-constrained system. If, however, in the overwhelming majority of elementary events the situation was the reverse, i.e., production continually hit physical bottlenecks, the system is qualified as resource-constrained.

This leads us to the problems of *measurement*. Shortage cannot be described by any macro aggregate, and cannot be expressed by adding up the unspent or momentarily unspendable purchasing power of economic units. This is emphatically the case when, with shortage growing chronic, the behavior of economic units gets somewhat adjusted to the situation. It becomes customary that the product or service desired, but momentarily not available, is substituted for something else. In this case we say that there is *forced substitution*. Forced substitution and forced spending permanently absorb the purchasing power that its holder cannot spend in accordance with his original purchasing intention. That is why the aggregate “excess demand” measured in money terms is not an operational magnitude.<sup>5</sup>

“*Shortage*” is the collection of millions of submicro-level elementary shortage events. We shall present a few examples for them. (Here and now, for the sake of completeness, we shall mention non-profit institutions and households besides producer firms.)

(1) Somewhere, some product or service is not available, when the buyer firm, non-profit institution, or household wants to buy exactly that product or service exactly at that place.

(2) Some input is not available at the workshop or at the rooms of the non-profit institution, when the firm or non-profit institution would need exactly that input for its activities.

(3) The firm, the non-profit institution, or the household effectuates improvised forced adaptation in order to mitigate the consequences of momentary shortage. This may happen either in the course of the purchasing act, or in the course of utilization. For example, a substitution is made for the missing product or service with a product which is either inferior or more expensive.

In the case of a chronic shortage, thousands or hundreds of thousands of such or similar *elementary shortage events* take place. The intensity of shortage depends

<sup>5</sup> This is one (but not the only one) important way in which my train of thought on the shortage phenomena deviates from the analysis that is provided by the so-called “disequilibrium theory.” (See, e.g., Barro and Grossman [1], and Portes and Winter [11].)

on the frequency of those elementary shortage events, and also on whether it is only shortage events of comparatively easy consequences that occur frequently, or whether there are also elementary shortage events of grave consequences.

Since this is a stochastic mass phenomenon, it can be described statistically. Although each elementary shortage event can be well observed, it is obviously impossible to observe and register all of them without exception. Nevertheless, full measurement can be adequately replaced for practical purposes by observing representative samples and describing the distributions of the main types of characteristic shortage events. While the intensity of shortage cannot be measured on one summarizing scale, it has to be described by an ensemble of various shortage indicators.<sup>6</sup>

Reverting to production, based upon the above, we can use the following two statements as expressions of identical contents: “production often hits resource constraints, i.e. physical bottlenecks,” and “the intensity of shortage of inputs in production is high.”

### *Hard or Soft Budget Constraint*

After the detour concerned with measurement, let us now return to the constraints of production. In this connection we shall introduce a qualification not customary in microeconomics so far: we shall distinguish between *hard* and *soft* budget constraints.

A budget constraint is *hard* if it is asserted with iron discipline: the firm can spend only as much money as it has. It has to cover its expenses from its incomes from sales. It is entitled to take out credit, but the bank is prepared to grant credit only under “conservative” and “orthodox” conditions. This can be, therefore, only an advance for subsequent proceeds from sales.

The budget constraint is *soft*, if the above-mentioned principles do not get asserted consistently. The hardness or softness of the constraint can be stated indirectly, and through the observation of two phenomena.

First: *survival*. The budget constraint is hard if grave financial difficulties drive the firm to bankruptcy. It dies of its losses in the strict sense of the word, and without regard to whether or not it failed owing to its own negligence, or because of an unfortunate coincidence of external circumstances. The budget constraint is soft if the state helps the firm out of trouble. There are various means to do so: subsidies; individual exemption from the payment of taxes or other charges (their full or partial remission or postponement); allowance on the centrally fixed price of an input; open increase of the centrally fixed selling price or toleration of a hidden price increase; credit granted at soft conditions; prolongation of the due credit repayment; etc. The state is a universal insurance company which compensates the damaged sooner or later for every loss. The paternalistic state guarantees automatically the survival of the firm.

<sup>6</sup> I intended only to give some hints of what I call “the statistical description” of shortage, and how the category of “shortage intensity” can be rendered operational. Because of limited space, we cannot go into further details of the problems of measurement in this study.

The second phenomenon which allows one to draw an indirect conclusion with regard to hardness or softness of the budget constraint is the *growth* of the firm. The budget constraint is hard if the growth of the firm depends on its own financial position, i.e., on the one hand, on how much it could save and accumulate from its earlier profit, and on the other hand, on whether—under hard, “conservative” conditions—it is ready to take out credit and is able to get credit for investment purposes. This depends on the prospects of its financial situation and the expected profitability of the investment. If the investment proves to be a financial failure, it may lead to bankruptcy of the firm. The budget constraint is soft, if the growth of the firm is not tied to its present and future financial situation. In this case there is no failure; the firm survives even when investment entails grave losses.

What I call here the hardness of the budget constraint is not identical with what is called “profit incentive of the firm” in disputes about economic management reforms in socialist countries. Profit incentive—e.g., profit sharing of managers and workers—is compatible with a soft budget constraint. In such cases managers of the firm ask superior authorities for financial support exactly in order that workers (and maybe also the managers) can get their usual profit share even in the case of losses.

*Hard budget constraints are effective* in the sense we have explained. They constrain action and the freedom of choice. “We can spend only as much money as we have.” “If we invest badly, we shall die of it.”

*Soft budget constraints are not effective.* The financial situation of the firm does not constrain action. Money has only a passive role. “Let it cost what it may.” “The main thing is to acquire material and capacity, and money for it will be found in some way.” “Once we have a contractor, we shall not stop the investment just because we have no money.” “If there is a loss, the state budget will take it over.”

The preceding stereotypes of common thought in business circles suggest that the hardness or softness of the budget constraint reflects an *attitude*. It must not be mistaken for the book keeping category of the balance sheet of the firm. The latter is an *ex post* identity. It is a relationship which holds all the time: the difference of the terminal and the initial money stock is identical with the difference of incomes and of expenses. As opposed to this, the budget constraint—if hard and thereby effective—is an *ex ante* behavioral regularity, which exerts an influence on the firm’s decision.

Exactly because it is an *ex ante* constraint, it is related to the firm manager’s expectations. These are not formed upon the basis of one single event, and develop not only from the manager’s experience at his own firm but in the course of a long period, and as a result of generalization of overall experiences. If no firm is ever helped out, or only very rarely rescued from financial failure, the manager will expect the same thing for his own case. He will consider the budget constraint hard and act accordingly. If compensation of losses becomes more frequent, if the growth of the firm starts to break away from its financial situation more often and at more places, the manager of the firm may feel that the probability has grown that his firm would also survive despite exceeding the budget constraint or a financial failure caused by a wrong investment. The budget constraint is not quite

hard, but softening. And, beyond a certain limit, the manager can expect almost with a 100 per cent certainty that the survival of his firm is guaranteed; it can stand every loss and investment financial failure. If the overwhelming majority of firm managers have this expectation for the future, it can be said that the budget constraint is soft.<sup>7</sup>

*In the "classic" form of socialist economy the budget constraint is soft.* It seems that economic management reforms—although profit sharing has been introduced in several socialist countries, Hungary among them—have not led to significant hardening of the budget constraint and have not turned it into an effective constraint.

### *Demand of the Firm*

There is a close causal relationship between the hardness or softness of the budget constraint and the two groups of constraints discussed earlier: the effectiveness of the resource constraints and of the demand constraints.

Let us take first the case of the *hard* budget constraint.<sup>8</sup> The demand of the firm for inputs depends on the price and the buyer's financial situation. The statements that we know well from standard demand theory are valid if the buyer's budget constraint is hard (and is valid only in that case).

The firm as buyer is prepared *voluntarily* to refrain from purchasing and accumulating too much material, from engaging too many workers, and from starting too large investments—"too many" and "too large" in the sense that in its seller's role the firm may hit a demand constraint, and then the expenses will not be justified posteriorly; the firm may suffer losses that may lead to failure in the end. Therefore, the firm must be cautious in determining its demand, because "running away" involves risk and may endanger existence of the firm.

All this has its multiple effects on interfirm relationships. Every firm is a seller and a buyer at the same time. Demand of the *buyer* firm is constrained by the hard budget constraint. Sales of the *seller* firm, and thereby also its production, are delimited by the buyers' demand constraint. We have arrived at the demand-constrained system.

Aggregate demand can be increased by Keynesian economic policy. Yet as long as the budget constraint remains hard, demand will be *finite*. Even at the Keynesian expansion of demand the investor's risk-aversion is maintained. The system does not expand up to the limits drawn by the bottlenecks of resource constraints.

<sup>7</sup> By this short description we wished to show that (a) the formation of expectations is based on the observation and subjective evaluation of the stochastic properties of recurrent events and (b) the degree of hardness and softness ought to be measured in fact on a continuous scale, since it is not only the two extreme cases that exist. It is only with a view to simplification of the exposition that my study used the dichotomy "hard" and "soft".

<sup>8</sup> The analysis is not complete either here or in the case of the soft budget constraint. For the time being it is limited to inter-firm relationships, and the demand of households and non-profit institutions will be disregarded. They will be briefly treated in the second part of the study.

Let us now turn to the case of the *soft* budget constraint. In that case there is no voluntary constraint on the demand side. Demand is not simply too large, but as a first approximation can be formulated as infinite.

The firm's demand for inputs is price-inelastic. Demand for the firm does not depend on its financial income. Accordingly, the shape of the firm's demand function differs completely from the way it appears in standard microeconomics.

If anything keeps the firm from revealing an "infinite" demand, it is mostly the following two factors: (1) Although it would like to hoard as much material, semi-finished products, and parts as possible, capacity of its storerooms is limited. (2) Public opinion and superior authorities condemn "hoarding", including, in addition to the above-mentioned, the "reservation" of labor. It gives a better impression and is therefore better tactics to show some self-restraint in determining demands.

We keep these restraining factors in mind, when we make the following formulation: *the demand of firms for inputs is almost insatiable*. It goes by all means up to the supply limits of inputs. Therefore, in the sphere of inter-firm input-output relationships, the system becomes resource-constrained.

*If the budget constraint is soft,<sup>9</sup> Say's principle is not valid, and together with it, Walras law is not valid either. In the final result, the fundamental axioms of standard microeconomics are not valid. Therein lies the key to understanding the microfoundations of a shortage economy.*

At that point we must conclude the microanalysis. Our discussion contained an extreme amount of simplification; we have no room here for a more thorough and more complete description. In any case, the micro apparatus is sufficient for examination of a few macro relations.

## MACROANALYSIS

### *Simplifying Assumptions*

The most important assumptions of our simple model are these: 1. We shall discuss the "classical" form of socialist economy. 2. A short-term analysis will be made. 3. A stationary economy will be described. 4. Only storable goods will be treated; services will be disregarded. 5. The economy will be divided into two sectors: the sector of firms and that of households. We shall disregard the sector of non-profit institutions (although at certain points we shall refer to its role). 6. As we said in the introduction of the talk, we shall not treat foreign trade. 7. Production will be divided into two classes known from Marxian reproduction theory: Class I, production of producer's goods, and Class II, production of consumer's goods. We assume that the exclusive buyer of consumer goods is the households sector which buys every commodity for money. Thus we disregard consumption allotted in kind to the population. The sector of firms buys the producer's goods, both of Class I and Class II.

<sup>9</sup> The detailed analysis of the capitalist system does not belong to the subject of the present study. I only call it to attention that also in modern capitalist economy signs of a slight (or not so slight) softening of the budget constraint are showing.

It can be proved that the observations following below would be true under less restrictive assumptions.

I do not present the model in mathematical, but rather in a “pictorial,” form. We shall use a *hydraulic analogy*: the flow of products will be represented by the flow of a liquid, e.g. water, and their storing by the storing of a liquid. The analogy is not new. At the London School of Economics the *Phillips machine* was shown several decades ago. This was a physical analog model, in which the interdependencies of the stock and flow variables of Keynesian macroeconomy, were represented through real liquid flows.<sup>10</sup> Here we shall use diagrams to replace both the physical analog model, and the mathematical description of the processes.

### *Reservoir of Class II*

We shall begin description of the system by presenting the *second reservoir* storing the output of Class II. (See Figure 1.) This is to be interpreted in a way such that all products of the firms in Class II flow in there after production but before being transferred to households. It is as if, in accordance with our macro approach, the total finished product inventories of consumer goods producing firms and the stocks accumulated in trade were collected into one huge store.

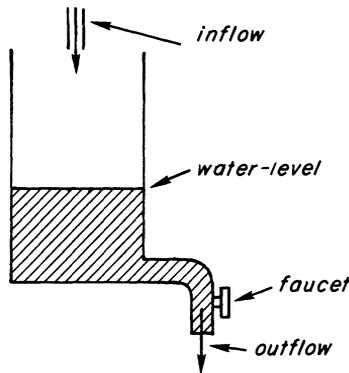


FIGURE 1

For the moment assume that the second reservoir is perfectly isolated from the reservoir of Class I. What determines where the water level of the reservoir will be (i.e., of what size the stock of consumers' finished goods will be)? It depends obviously on the proportions of inflow and outflow. Let us consider as given the inflow rate. In that case the water level depends on what outflow is allowed by the

<sup>10</sup> The model was constructed as a visual aid by the same A. W. Phillips whose name became later known as a result of the “Phillips curve.” While the Phillips machine demonstrates the flow of liquid under *pressure*, the present study is concerned with flow induced by *suction*. For explanation of the two expressions, see [7].

The idea of demonstrating interdependencies of shortage economy with the aid of a hydraulic analogy was inspired by J. Weibull.

*faucet* fixed on the reservoir. The faucet can be regulated by changing the consumer price level and the nominal income of the household. Well known elementary macroeconomic interdependences assert themselves here, so that there is no need for a more detailed discussion. The outflow grows wider if, at a given consumer price level, nominal income grows, or if at a given nominal income the consumer price level is reduced. In such cases the water level begins to sink and, if outflow is faster than inflow through a long period, the stock will be finally exhausted. From that time on only as many goods can reach the customer at every moment as have just been produced. And, conversely, the outflow will narrow down, if at a given consumer price level the nominal income of households goes down or, if at a given nominal income the consumer price level rises. The water level will rise in the reservoir, i.e., the stock of consumer goods will increase.

The faucet can work because the budget constraint of the household is hard. The consumer can purchase only as much as his money allows (after deduction of intended savings).

Let us stop here for a moment, because we must talk about the importance of the water level of the reservoir. There is a close negative relationship—*ceteris paribus*, at a given organization of the system, and given adaptive properties of production and trade—between inventories on the one side, and intensity of shortage on the other side, or—in more general terms—between the slack in production and trade on the one hand, and shortage on the other hand. The relationship can be rigorously proved theoretically, and is also empirically verifiable. But now all we can do is to refer to intuition. Let us think of our everyday experience as buyers. If we set out on our purchasing route, and the shelves and stores of shops are full of goods, we can expect with high probability that we shall find what we want already at the first place, or at least after only a short search. If, however, shelves and stores are rather empty, it may easily happen that we shall be told not only at one but at several places that what we are looking for is a “deficit good.” This is only a stochastic relationship. A larger stock cannot guarantee, either, the exact and immediate fulfilment of every purchasing intention, but it can reduce the probability of shortage phenomena appearing.

Given these assumptions, the consumer price level and nominal income (the “faucet”) regulate the volume of the inventories of consumer goods (the “water level”), and thereby the intensity of shortage on the consumer market.

### *Reservoir of Class I*

We present the *first reservoir* in Figure 2. In accordance with our macro approach this can also be interpreted as a huge transitory store. Into it flow all producers' goods that any of the firms in Class I produced; from there they can reach the firms of Class I and Class II that will use them for inputs.

As we have mentioned, it is assumed for the moment that this reservoir is perfectly isolated from the second reservoir.

In comparing the two reservoirs, it becomes apparent that there is no faucet on the first reservoir. The budget constraint of the sector of firms is soft. Out of this

reservoir the liquid flows freely: demand of the buyers (i.e., of firms in Class I and Class II) is not limited by their financial position. Moreover, it is not enough to emphasize that there is no faucet. We can see *pumps* on the figure which pump the liquid out of the reservoir. The reservoir is empty: there are no inventories of producers' goods, and at the same time intensive shortage phenomena show in production. It is the first emptied reservoir that corresponds (at the macro level, and in the framework of the hydraulic analogy) to the system which we called "resource constrained" in the first part of the study.

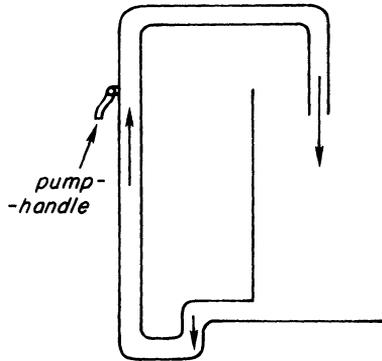


FIGURE 2

Before talking about pumps, we must make a remark. Let us not forget one important lesson of the microanalysis: shortage and slack are usually present simultaneously. Remaining within the hydraulic analogy we could say that the bottom of the reservoir is not entirely smooth. If we took a closer look at it, we could see that it is full of hollows in which liquid is held up. What is more, it is not water that is flowing in the reservoir, but a less fluid material which sticks on the walls and bottom of the reservoir. Turning now to economic reality: processes of the system take place with *frictions*. Adaptation goes on with delays and is accompanied by mistaken decisions. Therefore, the siphoning-off effects notwithstanding, unsold stocks may decay, resources may rest unutilized.

Yet now, for simplicity's sake, let us disregard consequences of frictions and revert to the rougher macro-picture. We were saying that pumps siphon off more or less the reserves of the system; shortage is highly intensive.

#### *Forces Operating the Pump*

Two of the driving forces operating the pump handles must be mentioned. *Quantity drive* in production may be induced by taut central plans. In this case firms are instructed to fulfil high production targets. It is well known that in the "classical" form of a socialist economy where firms received detailed instructions from the central authorities, managers were encouraged primarily to increase the

volume of production. This phenomenon is, however, not necessarily tied to the system of instructions (which is only one of many possible types of signal from the center to the firm). A similar effect may be asserted if the superior organ does not give instruction, but very emphatically declares its requests. Whether the form of signal from center to firm is the former or the latter, tautness of the plan means, in any case, that somewhat more output is required from the firm than can be actually produced from the resources at the given organization and adaptive ability. Under such circumstances the phenomenon of “hitting the resource constraint,” which we mentioned in the first part of the study, must come about.

It would not be correct, however, to trace back the quantity drive solely to the tautness of central plans. It may appear also if the central plan is more reasonable and moderate. There exists also a *decentralized, autonomous mechanism of shortage*. This has always added to the centrally generated shortage, and may become prevalent even if the central economic policy does not induce shortage (or only slightly induces shortage).

In this matter I recall the microanalysis in the first part of the study. As a consequence of the soft budget constraint the firm as a *buyer* raises an almost insatiable demand. Whatever the momentary supply of resources and inputs, the firm always feels that it is not enough. It is impatient; it urges the producer itself or asks for the intervention of superior organs.

And now let us think of the other role: the firm in its function as a seller. Really, or symbolically, the buyers queue up before the firm; they are impatient, they press the firm. Even if it is not instructed to do so, the firm will start by its own will to hasten the drive for more production, so that it can satisfy impatient customers as soon as possible. For that, however, it needs more input itself, and this plunges us into the *self-generating vicious circle of shortage*.

Furthermore, chronic shortage, and constant hitting of resource constraints, i.e. physical bottlenecks, create uncertainty in the supply of materials. This generates a *hoarding* tendency. While output stocks shrink everywhere, each producer tries to pile up its own input stocks. Hoarding further amplifies the self-generation of shortage. We can say therefore: *shortage breeds shortage*.

The other important driving force of pumping is the *expansion drive*. This may develop, similarly to the case of short-term decisions, as a consequence of taut central investment plans. If economic policy wishes to extend production at a forced rate, it will usually determine ambitious investment targets with input requirements which exceed the available supply of investment goods. Investment actions keep hitting the physical resource constraints of investment.

Just as before, expansion drive does not need to be forced by central instructions upon the medium-level authorities of economic management and upon the firms. There is an *inner* force which promotes expansion drive. *Every firm without exception wants to grow*, and their “representative”, the superior authorities, also wish the sector in their charge to grow. *Investment hunger* is general, and rises again and again, even if at some places it may be stilled momentarily.<sup>11</sup>

<sup>11</sup> For description of the regulation mechanism of investments, I made use of T. Bauer's research work [2].

There are a number of motivations for the inner expansion drive, and together with it, investment hunger. The most important of these is *identification* with the firm or, in the case of a superior organ, with the sector under its control. Every leader is thoroughly convinced that the activity of the unit in his charge is socially important. He perceives that there is shortage in its output. Therefore, he considers expansion justified and urgent. We can see again the self-generating mechanism of shortage, but now in the sphere of long term decision-making. The perception of shortage intensifies the expansion drive and investment hunger; expansion drive and investment hunger intensify shortage.

It is, however, not enough to recognize the positive motive that stimulates expansion and investment. It may be even more important to understand that, in the case of the soft budget constraint, *nothing keeps the firm from investment*. Investment risk has ceased; financial failure is impossible. There is no existing firm who, once offered an investment possibility, would voluntarily refuse it. This is the most important difference between the two social situations with which we are now concerned, and which Keynes treated at his time. His problem was how the cautious investors, afraid of failure, could be encouraged, and in which way insufficient private investments could be completed, at least partly, by state investments. But we are faced with a firm whose "investment appetite" is unrestrainable.

A particular *investment money illusion* develops. It appears as if financial investment quotas, i.e. money, were distributed by central organs: by the planning office, by financial authorities, and by banks. In fact they allocate *permission to start* the physical actions of investment. And, if action has begun, it cannot stop, not even if it costs much more money than has been planned. Money supply passively adjusts to the money demand generated by the physical inputs of the investment actions. The budget constraint of investment is also soft and ineffective.

Summarily, it can be stated that *quantity drive creates an almost insatiable demand for inputs of current production, and expansion drive creates an almost insatiable demand for investment goods*.

For a short detour I shall mention that the role of *non-profit institutions* is similar to that of firms from the point of view of processes examined here. They also know the symptoms of quantity and of expansion drive.<sup>12</sup> Thus they are also "pumping."

We have already touched upon the question of who in fact handles the pumps. If, as I have pointed out, it is the central economic policy that is at the head of quantity drive and forced-rate expansion, this fact reinforces greatly the effect of pumping. Yet even if central economic policy is more restrained, there are still hundreds of medium-level administrative authorities, and thousands of firms and of non-profit institutions who hold the pump in their hands. It is difficult to remind

<sup>12</sup> Here belongs the part of consumption that the population received free, or almost free, at a nominal price (e.g., health service, education, etc.). These services reach the citizens through non-profit institutions. For a considerable part of them, demand is almost insatiable; intensive shortage phenomena appear. It is understandable that these non-profit institutions also take part in pumping.

them of self-restraint. If anybody pumped less, others would pump away what he could have gotten. While not one manager of firm, non-profit institution, or superior organ is pleased with the consequences of shortage, he still feels that he cannot stop, he feels compelled to pump.

### *Leaks and Filtration*

The next step in our analysis is to do away with the assumption that the two reservoirs are perfectly isolated from each other. Let us have a look at Figure 3 which shows the two reservoirs side by side. There are *leaks* on their common sidewall, through which the liquid filters. Turning from the analogy to economic reality: there are no two separate markets hermetically closed from each other, one used exclusively by the households, and the other used exclusively by the firms. These two types of buyers compete with each other for the same supply.<sup>13</sup>

Through the leak, water can flow in either direction, and this can in fact happen in the economy. (Private car owners buy up parts before firm-owned cars can get them, or the other way round.) Yet even if the possibility of symmetry exists, in practice the actual direction of the flow is usually asymmetrical: it is the sector of firms that effectuates *siphoning-off* for itself.

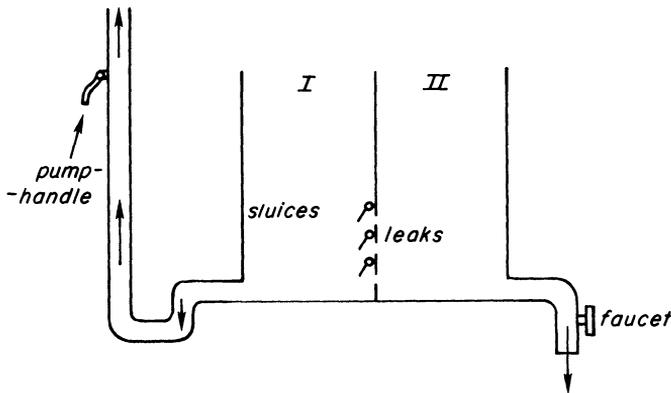


FIGURE 3

Let us not forget that there is a faucet on the right side, i.e. at the outlet of the second reservoir, while on the left side there is no faucet. Let us assume that, while the rate of flow into the second reservoir remains unchanged, the outlet of the

<sup>13</sup> According to Figure 3 competition takes place for the products which the producers have already put into the "reservoir." In reality, of course, "competition" begins already at earlier stages of the vertical process of production: which sector can suck up production inputs. This, however, cannot be discussed in the framework of the analogy that serves for a general framework of the macroanalysis expounded here.

In "filtration" an important role is played by foreign trade whose analysis is disregarded in this study.

faucet is narrowed (e.g., the consumer price level rises). For a time the water level will be rising. This will be, however, *ceteris paribus* only transitory. The law of communicating vessels asserts itself. If one vessel is full, while the other one is empty, and there is communication between them, the water level will even up. In the present case also, the level in the second reservoir sinks to the level of the first reservoir.

The economic interpretation of the analogy is the following. *Unequal competition takes place between the two types of buyers. "Household" has a hard budget constraint and is therefore sensitive to costs. "Firm" has a soft budget constraint, and is therefore hardly or not at all sensitive to costs. Hence, in the competition of buyers the firm has an advantage over household; it can draw away part of the supply intended for the household.* It can absorb the slack (inventories, reserve capacities, etc.) accumulated in Class II, which would otherwise make the service of the household smoother.

Let us examine one or two examples. Taxi fares go up. "Household" reacts to it as it has to according to manuals of microeconomics: its demand is reduced. For the firm, however, taxi fares represent a slight expense; if it uses taxis at all, it will continue to do so also at higher fares. What is more, it may even use the service more than before, since now it is more easily available, with less waiting time. Or let us examine a more serious example. Let us assume that the rents of publicly owned flats are suddenly raised. This would induce a lot of families to voluntarily move into smaller and cheaper flats. If the rise in rents is high enough, there would even be empty flats after all the removals have taken place. These vacancies would be absorbed immediately by firms for the purpose of office rooms. The excess rent that would weigh heavily on the budget of the household would be easily paid by firms.

There are, however, several reasons why not all the inventories filter through from the second reservoir to the first reservoir according to the law of communicating vessels. We shall indicate only two factors here. One is "friction," which has been mentioned already. Purchase agents of firms do not pounce fast enough on goods; perhaps they do not need the concrete products that are offered to the consumer. The other reason would be that administrative sanctions forbid the firms to buy up products and services intended for households (e.g., it is forbidden to use rooms intended for flats for the purpose of office premises). It is such sanctions that are symbolized by the *sluices* closing or narrowing part of the leaks in Figure 3. Of course, it is difficult to enforce consistently such administrative constraints, and particularly difficult to extend them to cover all products and services ready to filter through.

Our conclusion is as follows: *shortage intensity on the consumer market does not depend solely on standard regulators such as supply of consumer goods, consumer price, and nominal income. It depends also on the strength of the siphoning-off effect of the sector of firms or non-profit institutions.*

Emptying of the reservoirs, i.e. intensifying of shortage occurs with particular force if, *ceteris paribus*, the faucet of the second reservoir is opened wider. (E.g., rise in nominal income at given prices accelerates, and the growth of supply of

consumer goods and services cannot keep pace.) But reservoirs may empty, or sink to a very low level also if that does not happen, and even with a restriction of household demand, given the assertion of the siphoning-off effect of the almost insatiable demand of firms not limited by budget constraint. This is the final reference to the hydraulic analogy. We can see in a pictorial form, the flow system with its reservoirs, faucet, pumps, leaks and sluices, which I called *suction* in my book *Anti-Equilibrium*.<sup>14</sup>

#### ECONOMIC POLICY IMPLICATIONS

In spite of the abstract character of our analysis, some practical economic policy conclusions may be drawn. Here are but two examples: the questions of inflation and employment.

#### *Inflation*

In Hungarian economic disputes the idea has arisen that an effective antidote to shortage is inflation. At fixed prices shortage is intensive; at a rising price level this intensity would lessen. According to this, there is a “trade-off” between shortage and inflation. The stronger the one, the weaker the other. The existence of a kind of “socialist Phillips curve” is presumed. In my opinion this view is wrong. It is a view based on inaccurate assumptions which do not take into account the existing institutional conditions.

The trade-off “shortage-inflation” may in fact prevail in a *fully monetarized* economy, in which the budget constraint for both household and firm is hard. In such an economy, if inflationary processes begin on the side of wages while the rise in prices is artificially restrained (“repressed inflation”), the expanding excess demand will obviously lead to an even more intensive shortage.<sup>15</sup> Under such conditions the release of the “repression” of inflation, i.e., opening the way to price increase, may drain the swollen excess demand. Demand constraint becomes effective again, and shortage may be more or less eliminated.

Yet all this does not hold for an economy which is only *half-monetarized*. In the institutional conditions that were discussed in the earlier part of the study, the sector held under the hard budget constraint is monetarized, while the sector under the soft budget constraint is only seemingly monetarized. The sector functioning under a soft budget constraint does not react to price increase by reducing demand. The firm is able to pass on any increase in prices of inputs sooner or later to the buyer or to the state budget. Therefore, its demand remains—also within any inflationary process—almost insatiable. What is more, this sector is able to engage in the siphoning-off process to the detriment of the

<sup>14</sup> See [7, Chapters 17–22]. I have described here the same *phenomenon* as I did in the book, but *causal* analysis differs from the previous one at several important points. The explanatory factors that I considered the main cause of suction in *Anti-Equilibrium* stayed a role also in the present analysis, but only secondarily. “Weighting” of the causes has been rearranged. I consider now the *main* cause of suction the institutional background, concretely: softness of the budget constraint.

<sup>15</sup> For the theory of “repressed inflation” see B. Hansen [4], Barro-Grossman [1], and Malinvaud [9].

sector that is yet held under a hard budget constraint, which would, in fact, react to a rise in prices by reducing demand.

As a consequence of the chain of cause and effect briefly summarized here, there is no trade-off between inflation and shortage. Shortage is reproduced, at a stable as well as at falling or rising price level, as long as the institutional conditions for its chronic reproduction exist.

### *Employment*

In a resource-constrained economy, after the transitory historical period of absorption of labor, full employment becomes permanent. This is one of the most important achievements of the socialist economy. At the same time chronic labor shortage appears as one of the manifestations of resource shortage.

Full employment is not brought about by specific economic policy measures aimed at increasing employment, and not even by planning envisaging labor-absorbing input-output combinations. Explanation of the phenomenon must be found in the institutional conditions. It is a consequence of the soft budget constraint that demand for resources grows almost insatiably. Demand for resources, including demand for labor, necessarily has to grow as long as it does not hit the supply constraint.

This event appears in a "fixed package" accompanied by the other effects of a soft budget constraint: permanent full employment is concomitant with permanent labor shortage and other shortage phenomena. The reverse is also true: a genuine hard budget constraint usually keeps reproducing unemployment, together with the other negative and positive consequences of the hard budget constraint.

The great question arises: is it possible to develop a kind of in-between situation, i.e., a "convex combination" of the two different institutional set-ups and, together with it, such a situation in which there would be neither labor shortage nor unemployment? Or, do powerful social forces drive the economic system to either one or the other corner solution? The author has to confess that he does not know the answer to the question.

Finally, one more remark seems to be necessary. I have not made concrete proposals. I have not tried to elaborate a normative theory determining the method of overcoming shortage. I have strictly limited myself to the development of a descriptive-explanatory theory. The group of phenomena in question is extremely complex and complicated. Quite a few suggestions have already been made, which have turned out one by one to provide only symptomatic treatment without eliminating the deeper-lying causes that reproduce chronic shortage. It is my conviction that efforts at a thorough analysis of the situation and at a better clarification of cause-effect relationships may promote the practical solution of problems.

*Institute of Economics, Hungarian Academy of Sciences, Budapest*

*Manuscript received October, 1978; revision received January, 1979.*

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