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# Can We Delineate Potential Output for an Economy in Transition? Search for a Benchmark

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# Working Paper

**Can We Delineate Potential Output  
for an Economy in Transition?  
Search for a Benchmark**

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WP-94-051

June 1994



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## Foreword

This paper was stimulated by a striking discrepancy which exists between the frequency with which the concept of potential output is dealt with in every basic macroeconomic textbook and nearly complete absence of any comprehension of what might have happened to potential output in economies in transition. Although the search for this macroeconomic pivotal point may look like solving an intellectual puzzle, the real challenge lies in implications of changes in potential output for effective policy-making during the transformation period. This paper points out some weaknesses of applying standard macroeconomic concepts (like Okun's law) and illuminates the necessity of using indirect and mezzo-economic approaches. Despite the difficulty of making a new definition of potential output operational, this paper suggests the usefulness of introducing a kind of transformation bridge which should methodologically facilitate understanding the concept of potential output when moving from a centrally planned economy to a market one.

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# Can We Delineate Potential Output for an Economy In Transition? Search for a Benchmark.<sup>1</sup>

*Motto:*

*Give me but one firm spot on which to stand, and I will move the earth.*

*Archimedes*

## 1. Introduction

According to a simplified mainstream macroeconomic textbook wisdom, the danger of inflation arises whenever an economy approaches or operates on (or even behind) its production possibility frontier (which corresponds to its potential output) and retreats whenever an economy records a noticeable GNP-gap, other things being equal. This regularity is usually *explained* by the rate of utilization and resulting availability of scarce production factors and *illustrated* by a relatively flat short-run supply curve in the region below the potential output and rather steep short-run supply curve in the region above the level of potential output. Aggregate demand management (with a temporarily fixed potential output and short-run aggregate supply) then results either in a substantial change of output and a small change in price level (or inflation) - when production capacities are under-utilized - or alternatively in unimportant output changes and considerable changes in price level (inflation) — when the economy uses its production resources "fully" or more than "fully". Potential output thus becomes a pivotal point of crucial macroeconomic importance.

The task of determining potential output is far from being simple, unequivocal and unbiased. There is no unique definition of potential output. The concept is defined in several alternative ways which reflect different methodological stand-points of individual authors, accumulated knowledge in this area, availability of statistical data, etc. Despite various shortcomings, limitations and arbitrariness of different definitions and methods the concept itself could still be considered as one of conceivable and useful benchmarks of macroeconomic performance both with respect to the short- and medium-run stabilization issues and with respect to the long-run economic growth. It serves as a valuable analytical tool for deeper insights into important underlying economic processes.<sup>2</sup>

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<sup>1</sup> I would like to thank János Gács for his valuable comments to the earlier draft of this paper and also to Mojmír Hájek and Vladimír Benáček for inspiring suggestions to certain points. Errors and omissions are my own.

<sup>2</sup> Potential output, as one of many useful indicators in macroeconomic analysis, can be used, for example, as a yardstick for the interpretation and formulation of fiscal policy. The concepts of "full employment surplus" or "cyclically adjusted deficits" are utilized in fiscal policy investigations.

The usefulness of the concept of potential output consists in the fact that the information on potential production possibilities provides a more precise identification of the gravitation trend for actual output oscillations during business cycles. This is because the concept enables to define a distinction between changes in the economy's capacity to produce and changes in the extent to which that capacity is used. By quantifying the potential output in relation to actual output we receive a more reliable picture of the current state of macroeconomic affairs which helps us to develop more accurate predictions of impacts of possible external or policy shocks. By the same token, policy makers should be in a better position to devise more appropriate policy responses to cure the unwanted excesses in macroeconomic performance. In other words, if steady growth of output and stable prices are the social and policy goals, the information of the production possibility of the country sheds light on the task of how the desirable combination of both can be attained effectively. The wider is the GNP-gap without being noticed, the more important is this kind of knowledge for good policy-making having more rewarding outcomes for the population. In this regard, potential output contains implicitly even certain normative features.

A specific importance of the concept of potential output arises when we try to identify the reasons of contemporary recessions in transforming countries. Many explanations ranging from external causes (collapse of CMEA trade, etc.) to reform-induced (temporary loss of coordination mechanisms, etc.) or self-inflicted causes (mistaken policies) seem to lack an anchor, which is the recognition of the ability of these economies to produce under altering conditions during economic reforms.<sup>3</sup> It is crucial to address the question whether this ability was changed at all during recent years and if so in what way and what factors stayed behind this change. It is unquestionable that the current performance (measured by GDP) of economies in transition is much lower than four years ago but we would like to discover to what extent is this decline a result of overall decreased ability of economies to produce and to what extent it is just the actual output deviation from their long run production trend. This issue is outlined in the *Figure 1*.

The stylized facts show that the economies during their transition periods shifted in the slumpflationary direction from the point *E* (year 1989) to *E'* (1992) displaying simultaneously output decline and price level increase. Disregarding the fact that the economies could had been in significant macroeconomic disequilibria in both (or even all) years and assuming that former socialist economies worked on (or near) their production possibility frontier<sup>4</sup> we would like to focus on the movement of the potential output line. Two extreme cases are portrayed. While on the left-hand panel the potential output did not change at all and the short-run equilibrium shifted far below the level of potential output (causing thus a substantial GNP-gap) on the right-hand panel potential output followed the path of actual output (and

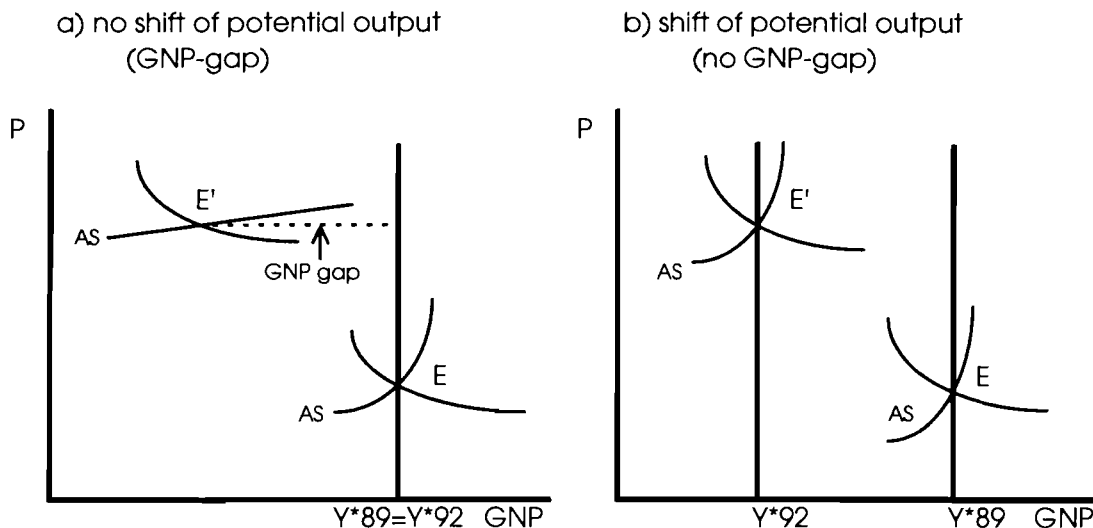
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<sup>3</sup> Similarly, wide-spread, politically-colored, and heated public discussions about "the necessity" (reformers) or alternatively "the excessiveness" (anti-reformers) of the production decline are frequently, alas, based on truly arbitrary statements. I am convinced that without knowledge of the potential output development the arguments of both camps are difficult either to prove or falsify. No loose judgments can therefore aspire to be real arguments in well-meant discussions and remain quite worthless personal views without any explanatory or convincing power.

<sup>4</sup> Later on we release this assumption.



short-run equilibrium) which led to a zero GNP-gap.<sup>5</sup>



**Figure 1** Did Economies in Transition Experience a Shift of Potential Output?

It is obvious from *Figure 1* that both cases have crucial and quite opposite consequences for understanding the nature of current economic decline and for effective macroeconomic remedies as well. Indeed, much depends on the shape of and the location on the aggregate supply curve. If the left-hand situation is the case, then the economies do not lose the production potential inherited from the past and their task consists in its better utilization. Any economic policy designed to stimulate growth and overcome the current economic depression should be effective (in terms of output) and could be launched without any fears of generating inflationary pressures. If the right-hand side story is true, a part of former production capacities is lost (at least in the short-run), the existing capacities are utilized (more or less) fully, and policy makers cannot expect any substantial gains in terms of output from the implementation of expansionary policies: they should be very careful and to avoid any temptation to stimulate the economy unless they want to ignite the inflationary spiral. Under such conditions, long term economic growth of production possibilities depends more on factors like high rate of savings, positive inducement to investment, reasonably focused microeconomic policies, etc.

This paper attempts to apply the concept of potential output on a highly turbulent and burdensome object — post-socialist economy in transition to a market economy — using the example of the Czech Republic. Section 2 reviews basic or accepted definitions of potential output. Section 3 outlines possible ways of applying two methods of estimating potential output. Section 4 deals with technological measures of potential output. Section 5 develops a methodology which takes into account specific conditions of former socialist economies and the transition period as well. While the former are characterized for example by non-parametric economic environment, systemic-conditioned wasting of production factors or distorted system of economic incentives, for the latter is typically the weak markets, high

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<sup>5</sup> I think that we can reasonably assume that the potential output did not increase during three years of transition.

degree of economic uncertainty, still non-standard behavior of the whole groups of economic agents, lack of reliable statistical data, etc. Concepts of technical potential output, systemic-conditioned potential output, and economic potential output are introduced and several hypotheses about the movement of potential output are suggested. Section 6 presents some available statistical evidence which serves for the examination of the above mentioned hypotheses. Section 7 attempts to estimate potential output in industry. Section 8 discusses the implication of the potential output analysis for economic policy. The results of the study are summarized in the conclusion.

## 2. Basic Concepts and Some Approaches

Estimating the level of potential output<sup>6</sup> of a certain country is an intricate task. There are many approaches to this issue ranging from simple intuitive guesses to highly sophisticated computations using advanced econometric tools.

The most simple definition of potential product indicates, that this is the level of output that would be reached if the economy were using its production resources fully.<sup>7</sup> A number of questions immediately arises when we start considering the condition "fully". It usually refers to a full or normal capital utilization and full, high, or desirable level of labor employment. Because these criteria are rather vague and moreover not comprehensive, another supplementary condition(s) is (are) usually needed. Most frequently it is the non-inflationary utilization of supply capacities. With regard to the introduction of price criterion, the potential output is the largest output that could be obtained without inflation.

Understandably, along with all additional conditions, the necessity of further specification emerges: how much inflation could be contemplated as a price stability? What is, in fact, the full utilization of capital and labor, and so on. Neither unemployment nor inflation rate were precisely formulated in numerous studies and if they were, their designation was later on subjected to changes enforced by developing circumstances. As far as the utilization of labor is concerned, some researchers suggested that full employment should consist of such types of employment (seasonal, structural, frictional) that would not be increased much by higher demand — at least not rapidly and not without generating the upward pressures on wages and prices. Others identified the unemployment rate corresponding to potential conditions as simply one, which is low enough to be generally acceptable. In the USA during the 1960s the view prevailed that full employment (very often expressed later on in terms of a natural rate of unemployment) is consistent with four percent of unemployment.

This level of unemployment served *Arthur Okun* as the target rate of labor utilization underlying his computation of potential GNP. Okun (1983, p. 148) made an assumption that, "whatever the influence of slack economic activity on average hours, labor force participation, and man-hour productivity, the magnitudes of all these effects are related to the unemployment rate. ... the unemployment rate can be viewed as a proxy variable for all the ways in which output is affected by idle resources. The measurement of potential output then is simplified into an estimate of how much output is depressed by unemployment in excess of

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<sup>6</sup> This term was invented and introduced by Arthur Okun in 1962 (Okun, 1983).

<sup>7</sup> As a synonym the term "output at high employment" is sometimes used.

four percent." Using the post-war quarterly data and three different methods relating output to the unemployment rate, Okun developed a kind of transformation between both variables which became famous as Okun's law. It states that on average every extra percentage point in excess of four percent unemployment decreases the real GNP by 3.2 percentage points within the range of 3 to 7.5 percent of the unemployment rate. The relation between potential and actual output is then expressed in the equation

$$P = A[1 + 0.032(U - 4)] \quad \text{if } 3 \leq U \leq 7.5 \quad [1]$$

which states that when the unemployment rate (U) is four percent, potential output (P) is estimated as equal to actual (A) and when, for example, the unemployment rate is five percent, the estimated GNP gap is 3.2 percent of GNP.

Two remarks deserve attention:

1) Potential output, not only in Okun's understanding but in general, is a static concept. Factors like technological knowledge, capital stock, natural resources, the skill and education of the labor force are fixed in the short-run. In the study of the relation between potential and actual output in each single individual year they are treated as other things being equal. The difference between both variables comes from the movement of aggregate demand. When the demand is lower than the level that would lead to four percent of unemployment rate, part of the production potential will not be produced.

2) A two-way street between potential and actual output exists. While the potential output, indeed, demarcates the basic space for oscillations of actual output in a given period, the extent of resource utilization in a current period determines the development of potential output in the next period (Coen, Hickman, 1980). Recessionary periods with unused resources in a large scale retard the growth of potential GNP via low profits and personal incomes; low investment into plants, equipment, research, and education, etc. Because "today's actual output influences tomorrow's productive capacity, success in the stabilization objective promotes more rapid economic growth" (Okun, 1983, p. 147). Thus, in contrast with the above paragraph, in the medium- and long-run, potential output is a dynamic concept par excellence.

Four percent of the unemployment rate and 3.2 : 1 "transformation ratio" were modified at the end of 1960s. Wide consensus was reached that during 1970s the natural rate of unemployment in the US economy increased to five percent and during 1980s even to 6-7 percent.<sup>8</sup> This upward shift of the full employment target was also reflected in regular Presidential Reports. While during 1960s and most of 1970s the Council of Economic Advisers considered potential output to be the output that would be obtained if four percent of the civilian labor force were unemployed, in the 1979 Economic Report of the President

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<sup>8</sup> The long-run upward shift of the natural rate of unemployment is being associated with many factors: increased labor-force participation of teenagers, minorities and women; secular growth of humanitarian government policies (unemployment insurance, welfare programs, minimum wage legislation, etc.); increase of structural unemployment and some other factors.

the CEA used 5.1 percent unemployment rate in each of the years from 1975 through 1978.<sup>9</sup>

The turbulent 1970s and 1980s brought into the research of potential output a good deal of confusion, disturbing irregularities, and inconsistencies. These were caused by supply shocks of different kinds, wild fluctuations of basic macroeconomic variables, changes in policy priorities and modifications of broad institutional settings. As a consequence, the attitudes of authors diverged and their understanding of the concept became even more arbitrary (Denison, 1985).

In the last 15 years the consensus emerged, that after 1973 an unemployment rate of four or five percent would not have been consistent with price stability. Therefore, some researchers retain price behavior as a criterion for potential output and refuse the criterion of low unemployment. Nevertheless, no attempts seem to be made to measure potential output as the largest output reachable under the condition of stable prices. Taken strictly, such a figure would be probably very small and would imply such a rate of unemployment which would be, because of its excessiveness, of doubtful value either as a policy goal or as an analytical tool.

Because of this inconvenience, a new criterion was introduced at the end of 1970s. It regards potential unemployment as the unemployment that would not change the "present" rate of inflation, whatever that rate might be, and potential output as the output consistent with that unemployment rate. The supporters of this definition had in mind the underlying rate of inflation rather than the actual rate of inflation. They attempted to examine conditions considered as pertinent to the underlying rate of price change and to eliminate the effect on the price level of random influences like upswings of farm prices or oil prices.

Wild fluctuations of the rate of inflation after 1973 lead us to anticipate similar wide fluctuations in potential output and unemployment as far as they are defined as the output and unemployment that would keep the present inflation rate unchanged. It is of little doubt that estimations would be very sensitive to an interpretation of the term "present". Different "present" time periods like "present" month, "present" quarter, or "present" year can produce very different results.

The definition based on stable inflation is far not only from the original idea of potential output as the highest output considered with price stability but also from the customary meaning attached to the words which was related to supply possibilities and high employment. Moreover, the criterion of stable inflation does not provide the basis for a valuable time series. With respect to a rather uncertain trade-off between the unemployment rate and price changes, a series that would really reflect the criterion of stable inflation would be too unstable to be useful.

*Edward Denison* defines potential income in 1972 prices in any given year as the value, that national income in 1972 prices would have taken if:

- 1) unemployment had been at four percent of the civilian labor force being sixteen years of age and over;
- 2) the intensity of the utilization of resources that were in use had been at the same rate

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<sup>9</sup> The reason behind this modification was the belief that the weighted unemployment rate provides a better measure of the tightness of labor markets than the simple unemployment rate. The weighted unemployment rate tries to take into account the relative importance of unemployment rates in individual demographic groups.

every year, namely, that which one on the average<sup>10</sup> would be associated with a four percent unemployment rate;

3) other conditions had been those that actually prevailed in that year (Denison, 1985, p. xxi).

Point two refers to the relationship between the strength of the demand, intensity of utilization, and productivity. According to Denison its importance consists in the fact that the output that is obtained is greatly affected not only by the *rate of change* in output but also by the *level* of unemployment or output. At any unemployment rate, productivity is usually much higher, relative to its trend, when output is rising rapidly than when it is stable or falling.

Point three says that the weather, labor disputes, the size of the armed forces, and all other conditions except demand are taken to be the same under potential conditions as under actual conditions. Many, sometimes erratically changing determinants of output are neither the consequences of changes in demand nor controllable by macroeconomic policy. These determinants affect both actual and potential output, but not the difference between them.

Capital stock, according to Denison, deserves special attention because investment is correlated with the business cycle. The estimates of potential output are based on the capital stock that actually exists in a given year and not on the stock that might have existed if investment had been different in previous periods.

Potential national income in a given year is then obtained by adjusting actual national income which takes into consideration the differences between actual and potential conditions. There are two main components of this adjustment:

a) The first eliminates the effect of fluctuations in the level of demand upon output per unit of input in non-residential business. The aim is to acquire the output that the resources measured as actually in use would have produced under standardized demand conditions corresponding to the definition of potential output.

b) The second component measures the effect on output which stems from the difference between actual and potential labor input. The calculation takes into account the difference between full-time and part-time, the difference between actual and potential hours for each group, the age, sex, and education of workers, and the percentage allocation of workers among sectors of the economy.

One simplification is made that if the unemployment rate had been four percent rather than its actual rate, the entire difference in employment would have appeared among non-farm wage and salary workers in the business sector. This assumption is made because many kinds of unemployment, like for example employment in general government and institutions, are not much affected by short-term fluctuations of aggregate demand. A special approach should be applied with respect to persons employed on government work relief programs, because there would have been no relief programs if unemployment had been at four percent. When adjusting actual national income to a potential basis, the value of the output of work relief workers is first excluded from general government national income. In the estimation of potential output in non-residential business, these workers are considered as if they had been unemployed.

Denison does not find any reason for incorporating price aspects into a definition of

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<sup>10</sup> The term "on average" refers to the average of a hypothetical random sample of years in which unemployment is four percent but output is changing by the amount larger than, the same as, or smaller than the trend rate of change at the time.

potential output. He agrees with definitions of potential output presented for example in January 1977 and January 1979 CEA reports which refer to a high but sustainable utilization of the factors of production - labor, capital, and natural resources. Such utilization "does not represent the absolute maximal level of production that could be generated by wartime or other abnormal levels of aggregate demand, but rather that which could be expected from high utilization rates obtainable under more normal circumstances" (Economic Report of the President, 1977, p. 52). This definition makes no reference to prices and is based on supply capability at high employment. Denison insists on such series of potential output which assume or imply no particular price behavior. The unemployment in such potential output series ought conceptually to be the seasonal, structural, and frictional unemployment but for the sake of simplicity customary four percent could be acceptable.

*Raymond Torres and John Martin* (from the OECD Secretariat) consider the potential output as the maximum level of output that is consistent over the medium-term with stable inflation (Torres and Martin, 1989). The way of definition of this concept arises from the emphasis which is being imposed on controlling inflation as a key medium-term priority. A consistency between labor market equilibrium and product market equilibrium is assumed.

The approach rests on an aggregate three-factor production function of a nested CES form. This "outer" function contains an "inner" function which combines capital and energy into a single aggregate, referred to as the capital-energy bundle. The "outer" production function which combines the capital-energy bundle with the labor input measured in efficiency units is characterized by:

- 1) constant elasticity of factor substitution;
- 2) constant returns to scale; and
- 3) Harrod-neutral technical progress.

The specification of the production function is the following:

$$QBSV = (\beta \cdot (ETB \cdot ELEFF)^\rho + \alpha \cdot KEBSV^\rho)^{1/\rho} \quad [2]$$

where

QBSV is normal output, which represents the output level that would be supplied if the actual quantities of capital, labor and energy were used at average utilization rates;

ETB is **actual** business-sector employment;

ELEFF is the labor efficiency index;

KEBSV is the actual capital-energy bundle;

$\rho$  is equal to  $(r - 1)/r$ , where  $r$  is the elasticity of substitution in the "outer" function between labor and the capital-energy bundle;  $\beta$  and  $\alpha$  are scale parameters.

Potential output in the business-sector is defined as follows:

potential business-sector output = F (potential business-sector employment; ELEFF; actual capital-energy bundle),

where:

F denotes the outer production function [2]; and the inputs are:

- **potential** business-sector employment;<sup>11</sup>
- the labor efficiency index;
- the actual level of the capital-energy bundle;<sup>12</sup>

and the definition of potential business-sector employment is:

potential business-sector employment = "normal" labor force \* (1 - NAWRU) - general government employment<sup>13, 14</sup>.

Potential output for the whole economy is then obtained by adding value added in the government sector and net indirect taxes to potential business-sector output.

It is necessary to stress here that potential output based on standard production function refers implicitly to a production process in the long-run, when production capacities are determined by technological factors which are mostly related to a supply rather than short-run limitations related to a demand.

### 3. Okun's Law: Applied

In this section we shall make an extremely simplifying assumption that a centrally planned economy and also a post-socialist economy have the same features as established market economies and that the analytical methods used to quantify potential output in the latter are easily applicable also to the former. We slightly adjust the Okun's law concept and "fill" it by modified parameters derived from available statistical data for the Czech Republic. We shall see to what extent this approach is workable and whether it gives any reliable results.

If we juxtapose the unemployment rate and GDP figures (without aspiration to discover any kind of relation or even causality between both variables) we receive *Figures 2 and 3*. While the former depicts the development of the monthly unemployment rate and quarterly GDP data (in 1984 prices) the latter shows the changes of unemployment rate and GDP growth both based on yearly data.

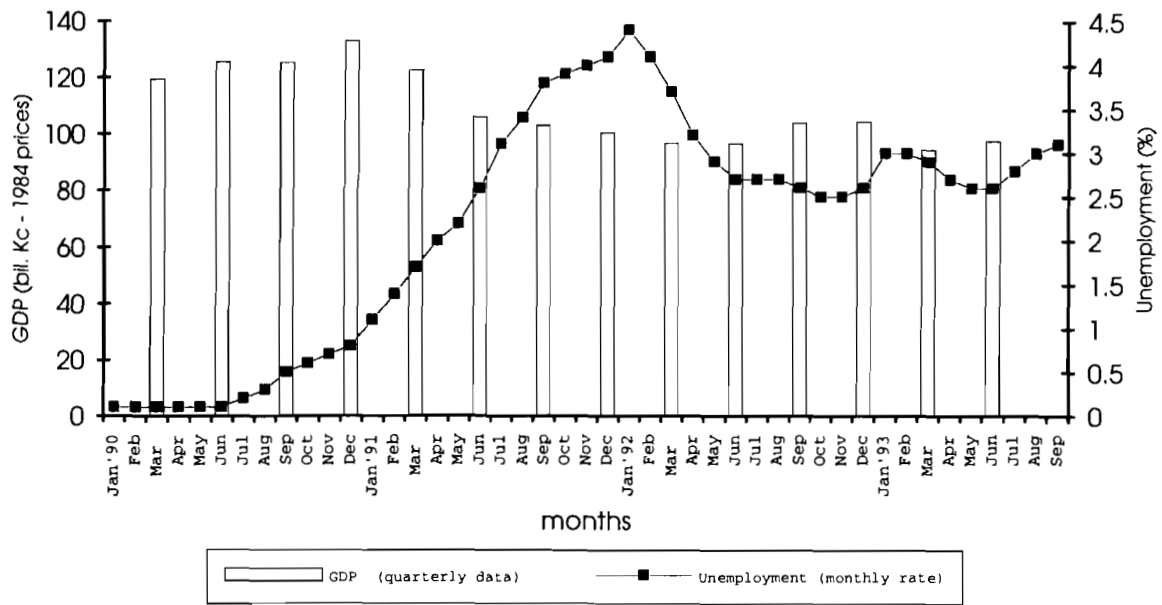
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<sup>11</sup> Potential rather than actual employment is included because the latter may deviate from the level consistent with a stable rate of inflation while the former takes account of the so-called wage-price block.

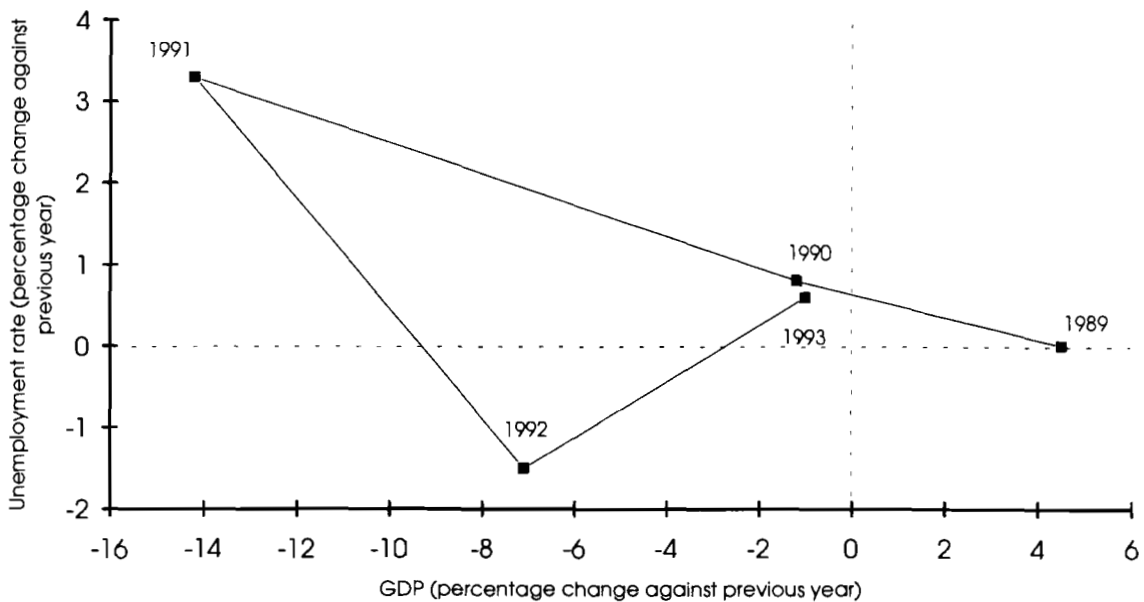
<sup>12</sup> The level of the actual capital-energy bundle is used because it is supposed to reflect a relatively binding physical constraint on supply.

<sup>13</sup> It is the so-called "normal" labor force rather than the actual labor force which enters the definition of potential employment. The labor force has been "normalized" (by using a geometric moving average) to eliminate, as far as possible, the effects of cyclical fluctuations in labor force participation rates in order to avoid introducing undue volatility in the series for both potential employment and potential output.

<sup>14</sup> NAWRU stands for "non-accelerating wages rate of unemployment".



**Figure 2** Okun's Law in the Czech Republic?



**Figure 3** Changes in GDP and Unemployment Rate

These figures, indeed, show a very similar story: while 1989 was the last year of "standard" economic growth under a socialist system, the year 1990 became a mild overture to a slumpflationary 1991 when all unfavorable developments (both internal and external) fully broke out causing a dramatic decrease of output and a steady increase of unemployment. 1992 witnesses further output decline and paradoxically an improvement of the unemployment front. Since the middle of 1992 until now, both variables stabilize despite the occurrence of some other negative circumstances (like the split of the country, the introduction of a new tax system, protracted privatization, recession in neighboring countries, etc.) While GDP figures



are by many observers not expected to decline any more (this situation is sometimes described as "waving near the bottom"), unemployment is expected to increase. It seems that the economy reached a kind of short-run equilibrium with zero growth.

The relative stability of the unemployment rate during six quarters (since the second quarter of 1992 until the third quarter of 1993) leads us to the suggestion that the economy oscillated in the short-run around a "quasi-natural rate of unemployment" which was about 2.8 percent (as the average monthly rate of unemployment from April 1992 until September 1993). Thus, we receive one parameter for the equation [1]. 1991 is the only period which seems to be reasonable for the derivation of the "transformation ratio" between the decline of output and the increase of unemployment. This is because both variables moved in the opposite direction which makes economic sense. From this point of view 1992 is a perverse year (decline of output accompanied by decline of unemployment) and 1993 can be characterized as a steady state. Our interest is to find out whether it was a steady state with used or unused production resources. During 1991 the 14.2 percent decline of GDP was accompanied by the increase of the unemployment rate by 3.3 percentage points (unemployment rate increased from 1.1 percent in January 1991 to 4.4 percent in January 1992). The "ratio" is thus approximately 4.3 : 1 which means that the increase of the unemployment rate by one percentage point is "transformed" into 4.3 percent decrease of GDP according to conditions prevailing during 1991. If we assume that such a ratio is applicable to the whole period 1991-1993, we receive the following equation for potential output:

$$P = A[1 + 0.043(U - 2.8)] \quad \text{if } 2.5 \leq U \leq 3.2 \quad [3]$$

which says that every percentage point of the unemployment rate above 2.8 percent causes a decline of actual output under potential output by 4.3 percent, *ceteris paribus*. However, behind this simple statement, applying Okun's concept, several assumptions remain whose validity in reality is questionable. These are at least the following:

**Assumption 1:** *1991 is a representative year in the sense that all shocks which the economy was exposed to were the demand side factors and not the supply-side factors.* This condition is only hardly fulfilled because besides the strong demand contraction (decline of private consumption, loss of foreign demand, etc.) also strong supply-side disturbances influenced the economy ("oil-shock", devaluations, etc.).

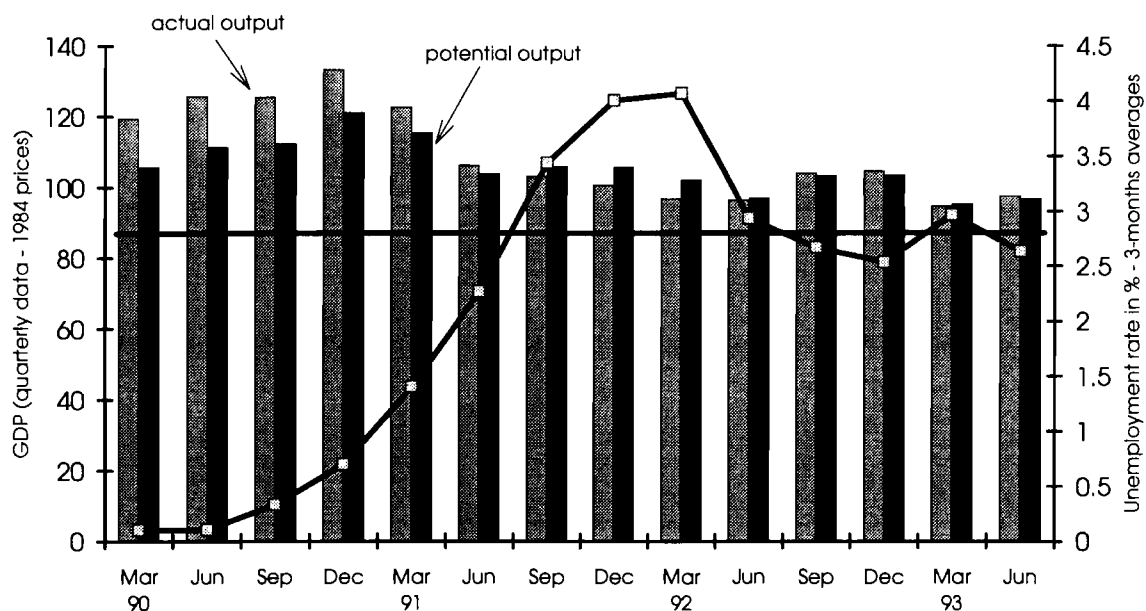
**Assumption 2:** *1991 is a typical year suitable both for the establishment of the transformation ratio between the decline of output and the increase of unemployment.* This is certainly not the case because 1991 was really the first year when only very initial measures of the reform were taken. For that reason many market institutions did not exist at all, markets were immature or even non-existent, economic policy instruments relied much on administrative tools and to a lesser extent on economic tools, etc. Therefore, the resulting transformation ratio however attractive it may look, must be taken with a great care.

**Assumption 3:** *The economy was using their resources fully in the preceding period until about 1990 and only later did the actual output start to diverge from the potential one.* This assumption could be supported by the fact that the unemployment rate increased from virtually zero in January 1990 to only 0.8 percent in December 1990 which comfortably fits the criterion of fully used resources according to whatever market economy standard. While this can be true in a narrow and strict interpretation of the given macroeconomic evidence,

this need not be true when we take a more general perspective which is the aim of Section 5. If it turns out that a large part of production capacities was, in fact, not fully used before 1990 then a certain decrease of utilization during 1990 onwards only contributed to a GDP-gap which existed before but which could not be identified when applying standard analytical tools on a non-standard economic condition prevailing under a centrally planned economy.

**Assumption 4:** *The unemployment rate is a reliable variable in macroeconomic analysis and can be taken as granted.* The unemployment rate could be reliable only if the labor force does not change or changes in affordable limits. In fact the number of people employed in the whole national economy decreased from 5,387 thousand at the end of December 1990 to 4,889 thousand at the end of December 1991 which is a decline of 497 thousand persons in absolute terms or 9 percent in relative terms. Despite the decisive share the decrease (between 60-70 percent) represent people who retired because of being in "post-productive age", even the remaining 40-30 percent who left the labor force could have increased the unemployment rate dramatically if they would be counted as a labor force.<sup>15</sup>

Bearing these objections in mind, we may attempt to display the equation [3] relating actual and potential output via the only variable — unemployment rate (see Figure 4). The limits for the unemployment rate (2.5% and 3.2% respectively) are disregarded.

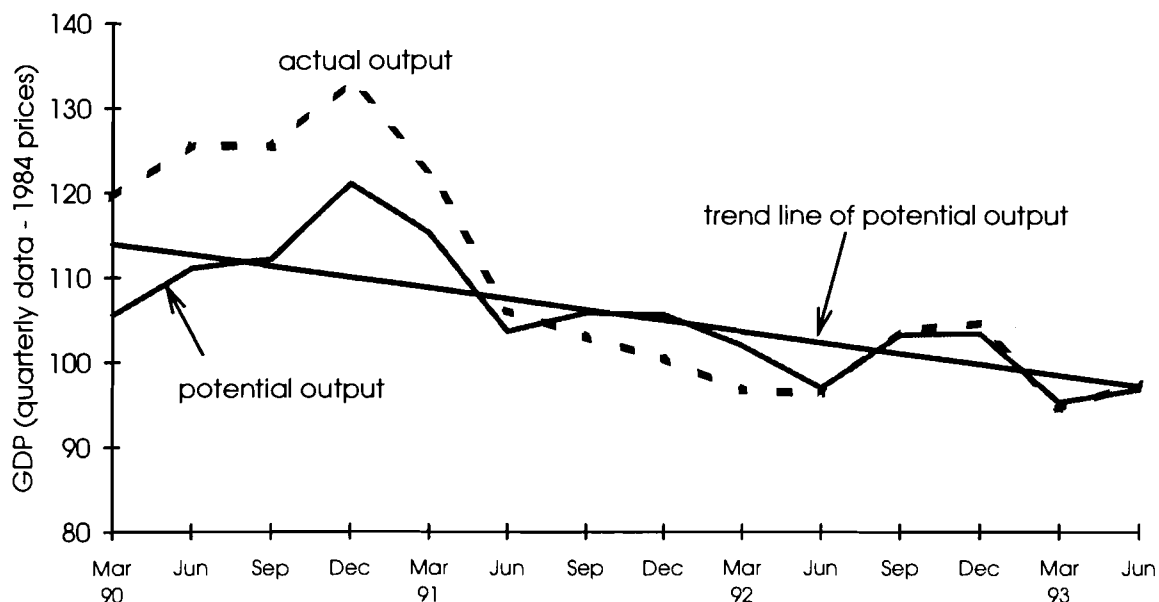


**Figure 4** Potential Output Driven by Unemployment?

Figure 4 shows that whenever the unemployment rate is lower than "quasi-natural rate of unemployment" (2.8 percent) actual output is, by a definition, higher than potential output and *vice versa*. Unemployment here is the only one driving force behind the inter-relation between

<sup>15</sup> If we realize that 35 percent from 497 thousand employees is 174 thousand and the average number of unemployed in 1991 was 149 thousand, the resulting hypothetical unemployment rate could more than double the real one.

actual and potential output. *Figure 5* tells the same story, where the solid straight line is a fitted line to the potential output trajectory being thus the visualization of a variable which we want to find in our analysis.



**Figure 5** Potential and Actual Output

The inspection of Figures leads us to the following conclusions:

- 1) Potential output declined heavily during the last 14 quarters of the transformation period.
- 2) The unemployment rate, as the only factor relating actual and potential output, brings to a development of the latter an excessive variability and instability even on quarter to quarter basis.
- 3) If there is any grain of truth in the above stated relationship, in 1990 the economy was extremely "overheated" (actual output much higher above the trend line of potential output) employing all resources nearly fully (in an utmost physical meaning), while 1991 and 1992 brought more consistency between actual output and production potential. Such a conclusion, however, contradicts the development of some important macroeconomic indicators, like the rate of inflation, budget deficits, or trade deficits. If we take inflation into consideration, we see that its rate was "only" 10 percent per year in ("overheated") 1990 whereby a good portion is to be attributed to abolishing of food subsidies in July. Its generally low level can be explained by an extensive price regulation existing before the implementation of major reform steps at the very beginning of 1991. On the other hand, when the economy slipped into a depressionary year 1991 (when actual output was lower than potential output) the yearly inflation jumped to 57 percent which can be mostly attributed to price liberalization, monopoly pricing, preceding devaluations, etc. If we take into account the foreign trade balance normally we could expect its deficit in overheated years because of increased imports. In fact, exactly this occurred in 1990 but the main reason behind this was not a growth of nominal incomes but very strong inflationary and devaluation expectations which generated

a sweeping buying spree of all economic subjects.<sup>16</sup> Depressionary 1991 and 1992 witnessed a faster growth of exports in relation to imports but the export boom can be attributed, to a large extent, to three devaluations at the end of 1990. In other words, in terms of Okun's law 1992 is a *contradictio in adjecto*.

4) It seems that systemic changes combined with numerous administrative and reform measures were so influential and had such a strong impact on the economy that there is no space for applying the standard market paradigm (at least on Okun's law basis) on the economy in transition. It is evident, that this method is very sensitive to the choice of the typical year or period for the establishment of both the transformation ratio between unemployment rate and GDP change, and the identification of the a kind of full employment ("quasi-natural rate of unemployment'). 1991 seems to be the most promising basis for the first task and the period from the second quarter of 1992 through the third quarter of 1993 as the reference period for quantifying the second parameter. As we do not have any better period-for-observation at our disposal and because the application of the above parameters in Okun's law framework does not have credibility (especially for 1990) we have to refuse this concept and postpone its application to later occasion when some kind of market normality will emerge.

#### 4. Technological Measures of Potential Output

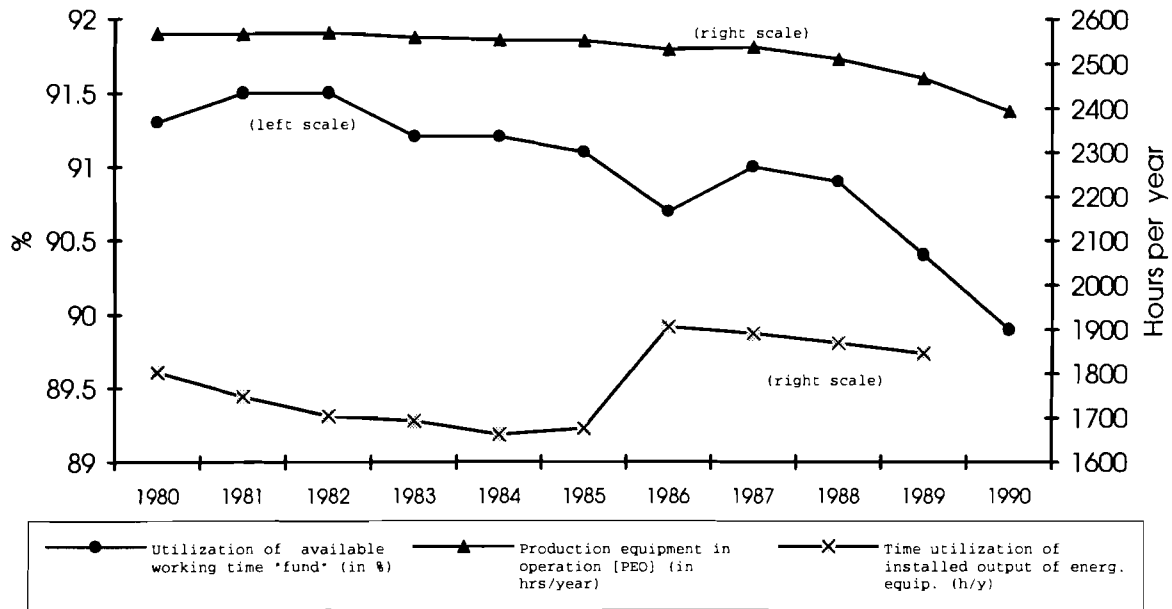
Other ways of how to approach potential output estimates consist in watching the utilization rates of production capacities and/or the utilization of other production factors. If a sufficiently long series of data is available, global peak (or two or three local peaks) is (are) then pragmatically taken as a year (or years) when production capacities were used to an extent which receives the tag "fully" and the level of output actually recorded at that year is declared as potential output.

One of the indirect technological measures is a measure of *electric utilization*. This concept is based on two assumptions: a) there is a close relationship between real utilization of equipment and energy which is consumed to run the equipment; and b) all machines or equipment in the industry use the electricity as the only source of energy. The advantage of this measure is that it is not related to value variables and that it can be also applied on non-homogenous production and on non-homogenous production equipment. The development of *time utilization of installed output of energetic equipment* (measured in hours per year) in the former ČSSR and ČSFR (in 1990) is displayed in *Figure 6* (see *Table IA* in the *Appendix* for the data). It shows the steady decline of the level until 1989 if we ignore the time series inconsistency in 1986 which was caused probably by the change of methodology of data collection or by a change of the definition of the concept. Unfortunately the data for 1990 onwards are not available.

Another method takes into account the labor force. It assumes that labor force is a limiting factor and that the utilization of equipment depends (assuming the fixed relation between capital and labor) on time utilization of the labor force. The so-called *classic method*

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<sup>16</sup> The population was buying foreign currency in large quantities. The rate of saving decreased from 3.7 percent in 1988 to 3.5 percent in 1989 to only 0.3 percent in 1990. There was a decrease of deposits in absolute terms for the first time since 1953.



**Figure 6** Some Indicators of Utilization in Industry

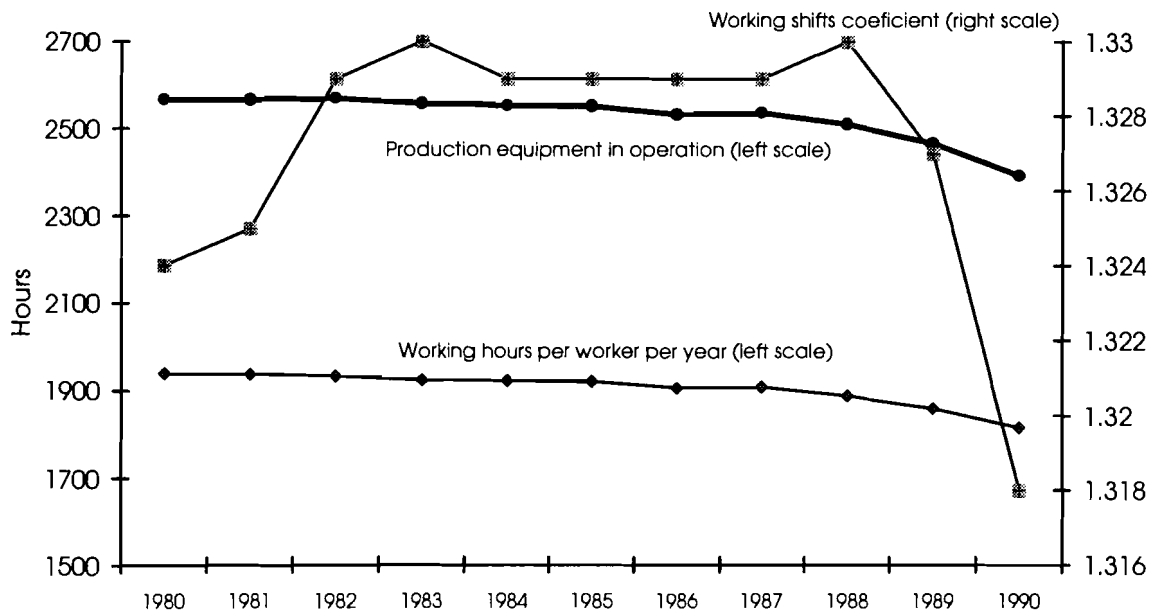
*of utilization* approximates the number of hours during which the machines work by a multiple of working shift coefficient (as a rough indicator of utilization during a day) and number of working hours per worker per year. The number of hours during which the equipment is in operation [PEO] is given by the formula:

$$PEO = WH \cdot SC \quad [4]$$

where WH is the number of working hours per worker per year and SC is working shifts coefficient.<sup>17</sup> *Figure 7* (see *Table 1A* in the *Appendix* for the data) shows that the production equipment had been working (in terms of number of hours in operation) rather steadily until 1988. Its mild medium-term decline during 1980-1988 reflected a decrease of the number of working hours per week from 41.7 in 1985 to 40.8 in 1986 (See *Table 1A*) and a continuing abolishment of several working Saturdays per year during 1980s. A more rapid decline occurred in 1989 and especially in 1990 when both the number of working hours per worker per year and the working shifts coefficient decreased substantially. It is difficult to find out the reasons for the decline of both factors but part of the explanation could be that the working discipline worsened and the search for new jobs and higher fluctuation began to be more common. In any case, according to this method, the time during which the production equipment in industry was in operation was shortened by 5.3 percent in 1990 in comparison with the average during the period 1986-88. All three discussed measures are summarized in *Figure 6*.

It must be noted, however, that many studies prove that shortening the working time does not necessarily lead to an equivalent decrease of production. Decreased number of working hours is partially offset by an increase of hourly productivity of labor caused by

<sup>17</sup> Working shifts coefficient is defined as the ratio between the total number of days worked in all three shifts and the number of days worked in the first shift during a year.



**Figure 7** Operating Hours in Industry

growing intensity and improved organization of work (Klacek, Nešporová, 1983). All these circumstances should be taken into account when considering potential output in a given field.

A supplementary though rather vague source of information comes from "business tendency tests" when the enterprises in given industries are asked about their capacity utilization during certain, quite short, periods of time. A representative sample of enterprises is chosen and the answers are weighted by the volume of production or by amount of employment. According to one research done in the Czech Republic in October 1992, the industrial respondents reported 74 percent capacity utilization while respondents in construction even 83 percent utilization (Conjuncture Investigation, 1992). The value of such results is diminished by the subjective evaluation of capacity utilization by individual respondents and by inconsistency in time series. The data collected in this way have some indicative importance for the short- term conjuncture forecast but not for the potential output estimates.

## 5. Indirect Mezzo-Economic Approach: Qualitative Analysis

It can be maintained, that the macroeconomic approach, practiced in the previous section - using a high level of aggregation - can bring, in certain circumstances, the results of a disputable value. Stabilization, opening up, and restructuring of an economy during the transition may lead to changes of potential production capacities across individual industries which can fully cancel each other in their aggregate impact. Alas, this is a typical price paid for each macroeconomic approach. Therefore, more detailed mezzo-economic analysis is desirable to provide more revealing insights into the process of cross-industry restructuring.

There are three pivotal questions to be asked and thus three answers to be found in our analysis. What was the level of potential output at the beginning of the transition? Which factors caused the shift of potential output and in which way? What is the level of potential output now? We attempt to answer all these questions.

## 5. 1. Some systemic features of a centrally planned economy

Before we answer the question "What was the level of potential output at the beginning of the transition?", we should recall some characteristic features of the logic of a centrally planned economy.<sup>18</sup> The entire social-economic establishment of former socialist countries displayed numerous peculiarities, irregularities, or even abnormalities which contradicted common sense. They stemmed from one common reason which was the existence of **generally soft, non-parametric economic environment occupied by socialist ultra-monopolies**. All phenomena concerning the behavior of all economic (or better quasi-economic) agents could be fruitfully attributed to this basic "system-building principle". Non-parametric environment penetrated virtually all segments of the economic system covering planning procedures, price system, trade relations, labor market, and financial-credit system. Because every system dislikes inconsistencies, all these parts of one "big factory" had to cooperate in a concerted way (and did so very "efficiently" and consequently). One of the major "tasks" of a typical production unit was to develop every effort to influence the soft external environment and subject it to its own interests. The open possibility to do this consumed the energy of managers to such an extent that the effort to increase the internal economic efficiency of the enterprises was largely disregarded. The necessity to form broad enterprise coalitions was manifested by intensive and numerous relations of the enterprise managers to the "outside world". Constant bargaining of managers for example with the State Planning Commission (for soft plans which could be easily fulfilled), with the Central Price Committee (for the highest attainable prices of the production), with suppliers (for the highest quantities of materials needed and all imaginable conditions of "preferential treatment"), with the mono-bank system (for granting the necessary financing), with the local state bodies (for acquiring as much labor as possible), with other central bodies (for getting as much investment means as possible), and again with the mono-bank (for having as much foreign currencies as possible) are described as a "sap-type reflex" which was a predominant type of behavior determining both the macroeconomic and microeconomic features of the system. These were for example:

### 1) Low level of capital utilization

In prevailing cases the enterprises were not forced to use their production equipment intensively or efficiently in a standard western-type meaning. A soft, competition-free, and monopolistic environment provided small incentives to economize costs. It was the case that enterprises were interested in hiding their real production-possibility frontier against higher "planning" bodies. The higher the capital intensive production plan which an enterprise succeeded in "selling" (pushing through) to the "planning" body, the higher capacity reserve was incorporated into the plan and the easier fulfillment in the next period was "guaranteed". In order to create the highest possible reserve, the enterprises demanded (and during long years successfully hoarded) higher than really needed capital stock which was only partly used. High production, maintenance, and overhead costs were usually smoothly "smuggled" into prices which were in a prevailing environment of shortage willingly accepted by price-

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<sup>18</sup> Our task here is not to present a full description and explanation of models dealing with CPEs. Rather, we want to mention briefly some characteristics which are, according to us, relevant for the potential output analysis. Some observations by L. Mičoch (1990) are reflected here.

taking customers. Soft budget constraint combined with an endless subsidization of apparently insane enterprises by comparably "prosperous" ones created no pressures on economizing the resources neither in "bad" nor in "good" enterprises and led to a long-run demoralization of producers and an erosion of existing incentives. It was also quite common that the production of technologically more complicated products was often interrupted because of the lack of materials or component parts. Just-in-time methods were, for many producers, something like a "bad joke". Enterprises sometimes used quite extensively rather old machines and premises. Because they were largely written off the maintenance costs and energy intensity were high but technological parameters of the production were low. Resulting widespread inefficiencies were reflected by a low levels of both one-factor and multi-factor productivity in comparison with market economies and many other indicators.

## **2) Low level of working time utilization**

Another production factor - labor - enjoyed the similar treatment as capital. The "sapping instinct" also led to the hoarding of labor. An excessive number of people were employed in many countless departments of enterprises whose main tasks were not related to production activities but to the subjection of external soft environment and/or to the producing of "reports" for higher planning bodies which, alas, had no information value for enterprises themselves. The competition for the "rests" of the available employees created a peculiar situation of the general shortage of labor on the nation-wide "labor market" but of hidden unemployment inside the enterprises.<sup>19</sup> Also, in order not to act against the logic of the system the workers used to work for a certain number of hours per day only (for example 6.5 hours) in order to fulfill the plan just by a certain amount of percentage points (for example by 117,5 percent) to "deserve" the highest possible wage without hardening the working norms and increasing the plan for the next planning period (ratchet effect). The dark side of having an easy life as producers, the people had to "pay the price" as consumers. An incredible time was spent by the nation in queues of different kinds by searching for the lacking services or better quality products during official working hours. The vicious circle of low productivity was thus only reinforced. People also typically worked a lot in their houses and gardens (in their real small kingdoms) during the weekends and they "returned" back to work to "have a rest" and "recover" from demanding week-end "shifts". It is easy to imagine that the work intensity was not very high on average and only in some factories or branches was comparable with western standards.<sup>20</sup>

## **3) Regular existence of technological imbalances in production**

It was very customary that because of the planning system it was extremely difficult to reach and maintain (both in individual enterprises and in the whole economy) such allocation of production factors which would satisfy all necessary technological proportions and ensure a technologically optimum production. The ensuing existence of bottlenecks thus negatively determined not only actual output possibilities but especially potential output. It is reasonable

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<sup>19</sup> The high level of employment is reflected by the extremely high participation rate of both men and women. Švejnar (1993) suggests that female labor force participation in former Czechoslovakia - 83.4 percent in 1989 - was one of the highest in the world.

<sup>20</sup> According to some estimates the long-term utilization of working time in the construction industry was not higher than 50 percent.



to assume that, in many cases, even relatively small additional investment directed to a proper place of the existing bottlenecks could have increased potential output significantly. Serious long-term technological imbalance existed between capital stock and labor. As a matter of fact, the increase in production had been achieved most importantly by a vigorous growth of investment especially during 1970s and 1980s. However, because of the relative shortage of labor, the increase of production used to be frequently less than proportional to the unbalanced increase of the new capital stock and additional labor.

#### **4) Limited influence of foreign trade**

There was a semi-Chinese wall between the domestic economy and foreign markets. In the case of former Czechoslovakia two thirds of foreign trade turnover was realized with other socialist countries (with the same kind of non-parametric environment) and only one third with market economies and developing countries. However, the system of export subsidies and controlled imports largely eliminated any direct threat from foreign competition. I do not want to claim that certain export-oriented sectors or enterprises were not influenced at all but the aggregate impact of the external environment on the whole economy was marginal.

#### **5) High level of inventories**

In addition to the hoarding of other production factors, firms typically accumulated a high level of input inventories encouraged by enormous difficulties connected with their acquisition. Only small economic costs were incurred with excessive inventories because credits for working capital were granted by a passive financial system without any major problems.

#### **6) Demand overhang, supply constrained markets and forced substitution**

Because of controlled prices and wages which did not reflect the real performance of labor, smaller or bigger monetary overhand accumulated in centrally planned economies over the years. The existing system of relative prices and unshakable position of producers forced consumers to consumption patterns which did not satisfy their preferences adequately implying over-consumption of subsidized items and under-consumption of over-taxed items.

The above mentioned points show that the system driven by distortionary "norms" and peculiar incentives produced a bizarre type of rationality incomparable with a market-derived type of efficiency. The consequence of its consistent enforcement was systemic-conditioned and everywhere present wasting not only all production factors (capital, labor, production materials, energy) but also time and natural creativity of people. These observations lead us to the suggestion that the actual output level might have been well below the potential output under a centrally planned system. But the reasons why the gap existed were much different from the reasons why the GDP-gap exists in market economies. While in the former case the reasons stemmed largely from the features embodied in the very logic of the centrally planned economy, the latter case refers mostly to fluctuations of the aggregate demand. Because both concepts refer to completely different circumstances and a different set of factors the necessity to develop a kind of transformation bridge between the centrally planned economy and the market economy emerges. In the following subsection this transformation bridge is outlined and some definitions and approached are presented.

## 5. 2. Three concepts of potential output: definitions

The following concepts are suggested in our potential output analysis:

*Technical potential output (TPO)* refers to a maximum volume of output which can be produced with the existing capital equipment when fully using disposable calendar time from which the time needed for necessary repairs and maintenance is subtracted. This definition puts TPO equal to a technological capacity of the production equipment, which is fully derived from its technical features. Any additions to the aggregate capital stock could be automatically considered as an increase of the production potential no matter what happens with hypothetically produced output later on. In graphical terms, TPO as a most simple concept, can be expressed as the production possibility frontier and new investment as its shift outward. By definition, it is the least fluctuating variable independent of any economic conditions.

*Economic potential output (EPO)* adjusts the technical potential output to the conditions on the market in the medium-run. These conditions comprise prices of final products, costs of production factors, aggregate demand, the structure of relative prices of substitutes and complements to given products, etc. The main criterion here is the medium- and long-term competitiveness of the production of a given firm, industry or the whole economy: as an economic potential of the country only those production capacities could be regarded which produce the output which is effectively demanded not only in the short-term but also in the medium- and long-term. An implicit condition is the prevalence of long-term "normal working conditions" i.e., usual number of shifts or working hours, usual intensity of work, usual availability of production inputs (energy or semi-finished products), etc.<sup>21</sup>

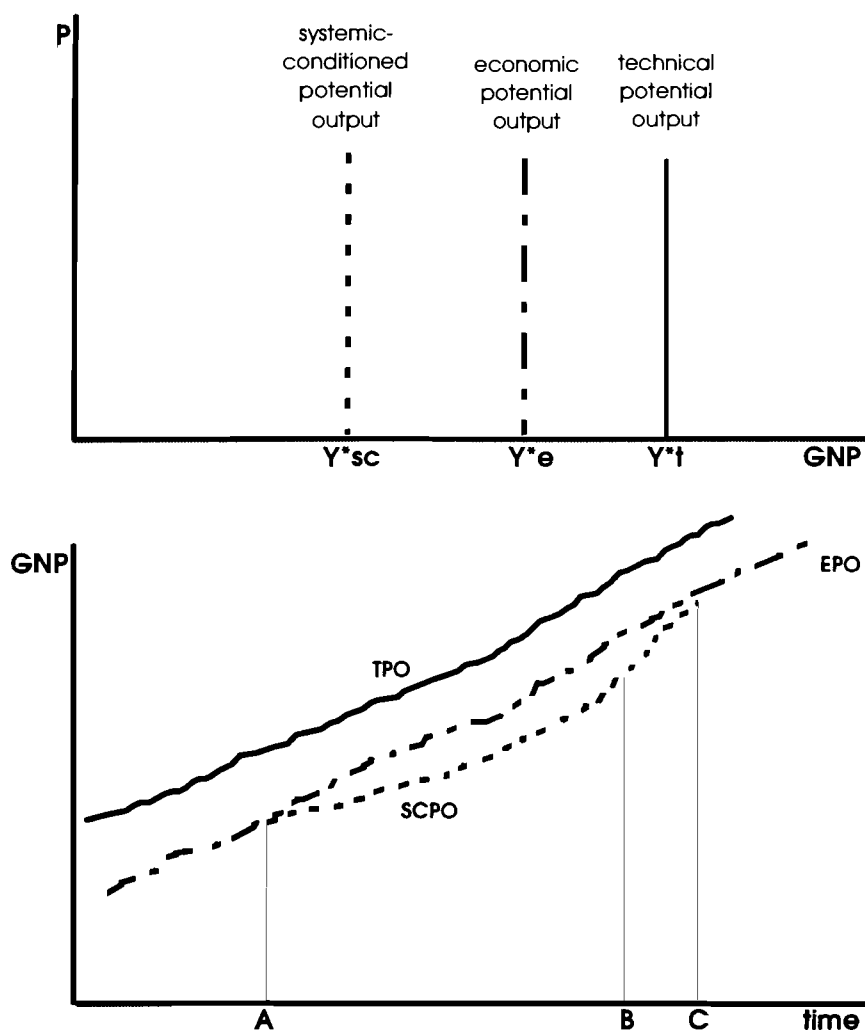
*Systemic-conditioned potential output (SCPO)* then adjusts the technical potential output and economic potential output to the factors stemming from the given economic establishment and to the factors which are indirectly related to broadly defined social parameters. While the former cover the features driven by economic incentives and interests (like the above mentioned systemic-induced low utilization of working time) the latter include the broader non-economic set of legislative norms (like work legislation or social net laws) valid or followed in the given country and time. These may also reflect the social values and norms being accepted by the majority of people. To paraphrase Leibenstein's concept we may use the notation 'y-efficiency' implying thus the explanatory transformation bridge in the movement from the centrally-planned socio-economic system to the market one. In the analysis of potential output in a homogeneous world (either market or centrally planned) this concept would be missing. Though the concept is difficult to operationalize, from the methodological point of view we consider its introduction here as essential.

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<sup>21</sup> The concept of "normal working conditions" could also be applied in case of technical potential output. Then we can discern a so-called pure capacity of production equipment and practical capacity of production equipment, which takes into account the discussed factors. It is observable regularity that practical capacity fluctuates more than the pure (technological) capacity.

It is obvious, that the borders between all these concepts are somewhat blurred because of different interrelations and feed-backs. These are typically the economic incentives that shape the general attitudes of the population (especially private entrepreneurs) to the work-effort or working overtime rather than any administrative measures. Also, technological parameters of a newly introduced investment are not derived from technical but rather from the economic (more broad) parameters of the old equipment.

Despite these objections, the usefulness of the above-stated categorization could still be advocated. Especially the comprehension of the concept of systemic-conditioned potential output plays a significant role in understanding the evolution of production potential issues during transition from a centrally planned to a market-based system. This concept would not emerge in the analysis of potential output in established market economies at all.



AB - period of the centrally planned economy  
 BC - transition period

**Figure 8** Three Concepts of Potential Output

*Actual output*, to be complete, refers to the output produced in a given period of time. It is typically determined by the short-term or seasonal fluctuations of the aggregate demand and other transitory shocks. The above outlined concepts of potential outputs are illustrated in *Figure 8*. The highest level occupies technical potential output, the middle level the economic potential output and the lowest level the systemic-conditioned potential output. The order indicates how technical PO and economic PO respectively has to be adjusted to arrive at an observable level of output. The lower panel of the figure portrays the emergence of systemic-conditioned potential output when a centrally planned economy is established (point A) and its fading out during the transition period to the market (period B to C)<sup>22</sup>. The difference between  $Y^e$  and  $Y^{sc}$  (on the upper panel) and between SCPO and EPO (on the bottom panel) indicates a "systemic-driven GNP-gap" defined as an output which is lost because the logic of a centrally planned economy imposes *sui generis* limits on the utilization of all production factors available.

Observations from subsection 5.1, with the help of the concepts introduced in this subsection lead us to the suggestion that **under the centrally planned economy, the potential production possibilities of the country (in terms of economic potential output) were substantially higher than actual output which was driven by systemic-conditioned potential output**. The word "substantially" means that the output gap (in terms of percentage points) in former CPE was several times higher than in market economies and that this gap was never "zero" or "close to zero" under standard socialism as used to be the case in market economies several times during the post-war period. We shall try to investigate how the production potential increases during the transition period without putting more substantial investment into operation. In other words, we shall study how successfully the economy moves from the trajectory of systemic-conditioned potential output to a path of economic potential output benefiting mostly from the introduction of the market system.

### 5. 3. Some assumptions and working hypotheses

As the potential output analysis is cumbersome, a kind of **the black box approach** seems to be advisable and instrumental. We do not aspire to identify, describe, explain and quantify all of the possible relations between numerous quasi-dependent and quasi-independent variables in the whole picture. Instead, we regard the potential output as an unknown variable (being thus a mystery of the black box) and speculate about its location and changes by considering the evolution of observable variables (inputs and outputs) which are supposed to bear some relevant information. The application of this indirect method assumes the formulation of certain **intuitive working assumptions** about the expected relations between

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<sup>22</sup> As J. Gács correctly suggested the path of the systemic-conditioned potential output after introduction of the centrally planned economy might have look differently. There was not probably a decline of potential output (as showed on the figure) but a steep rise generated by fast industrialization and by enthusiasm of the large part of population in the era of the "build-up" of communism. A more detailed look at this period, indeed, is beyond the intention of this paper but the caveat can be done that careful distinction must be made between increase of the potential output itself (which definitely was the case) and the high level of utilization of existing resources (which was the case as well).

measurable variables and potential output. These could be the following:

1) The whole analysis is more workable the more free is the market formation of prices and the more demand constrained are particular markets.

2) Price-, trade- and foreign trade liberalizations had most probably diversified impacts on different industries, sectors and regions. Generally, those sectors which were "over-dimensioned" under the centrally planned economy are supposed to decline and whose sectors which were "under-dimensioned" are expected to grow. The respective movements of "sectoral potential outputs" are to be anticipated. Therefore, the desegregated or mezzo-economic (cross-industries and cross-sectoral) approach seems to be necessary and proper.

3) The economy in transition is exposed to numerous shocks. They originate both on the demand and on the supply side of the economy; they are caused both by external reasons and by reform-induced causes. In potential output analysis we tend to disregard the short run or temporary disturbances which are in some way absorbed by a system. Rather, we take into account only persistent shocks with protracted impacts.

4) There is asymmetry in the factors which move the level of potential output (production possibility frontier respectively). While the increase of the potential output<sup>23</sup> can be generated by:

- new fixed investment (additions to the existing capital stock), or
- employment of additional labor (in existing production bottlenecks), or
- increased utilization of production factors, all *ceteris paribus*;

its decrease can be induced by a different set of factors. They comprise:

- permanent decrease of the aggregate demand, or
- negative supply-side shocks which are irreversible in the medium and long-run, or
- permanent loss of international competitiveness caused by external factors or by exchange rate movements, or
- (understandably) decreased utilization of the production factors, or
- physical liquidation of capital assets (as an extreme case), again all *ceteris paribus*.

5) I assume that these factors could be directly or indirectly monitored by the evolution of inventory accumulation and decumulation, sales, changes of capacity utilization, by changes of employment, profits, exports and imports, etc. These variables are not equally important in all circumstances, rather they make a set of indicators which, taken together, could have some explanatory power.<sup>24</sup>

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<sup>23</sup> The right-ward shift of the vertical curve in AS-AD diagram or outward shift of the production possibility frontier.

<sup>24</sup> An additional reason why different proxies are advisable stems from the fact that official statistical data concerning the newly emerging private sector are **biased downwards**, because of the countless number of incentives to cheat the state administration or to hide

6) The potential output level (both in the whole economy and in any particular industry) is likely to increase when either net investment grows *ceteris paribus* and/or employment grows *ceteris paribus* and/or capacity utilization grows *ceteris paribus*, with all of the actual output being sold, all in the long-run. On the other hand, potential output level is likely to diminish when net investments are zero **and** employment decreases **and** capacity utilization decreases **and** finished goods inventories increase *all at the same time* in the long-run. Because a great number of possibilities may exist and their assessment would be extremely complicated and not furnished due to the absence of statistical data, several possible alternatives are outlined in *Table 2A* in the *Appendix* without any further discussion.

7) Another indication of inventory accumulation consists in a faster decline of sales in comparison with actual output.<sup>25</sup> The expected implications for potential output evolution stemming from the relationship between actual output and long-term inventories are described in *Table 3*.

**Table 3.** Hypothesis About the Impacts of Actual Output and Long-term Inventories on Potential Output

movements of observable variables		description	hypothesis on behavior of the potential output
actual output	long-term inventories		
+	+	growing production for warehouse	A0 (if both growth equally)
	0	growing market clearing	A+
	-	growing warehouse cleaning - "everything is sold out"	A+
0	+	stagnant production for warehouse	A-
	0	stagnant market clearing	A0
	-	stagnant warehouse cleaning	A+
-	+	declining production for warehouse - "no-hope case"	A-
	0	declining market clearing	A-
	-	declining warehouse cleaning	A-

Explanation of signs: + growth; 0 steady state; - decline;

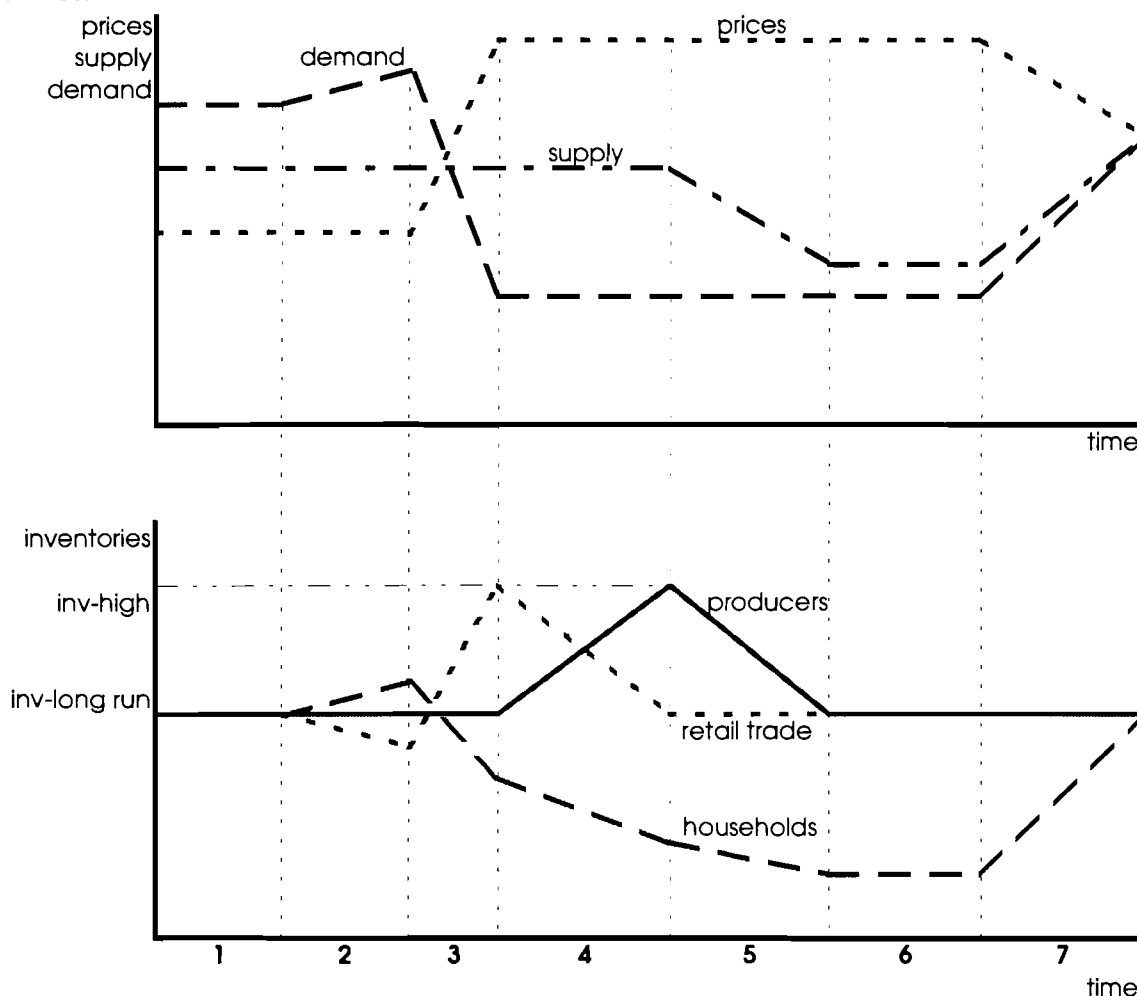
8) The potential output analysis is critically dependent on the level of international competitiveness of individual industries and of the whole economy. The level of the exchange rate of the currency plays a crucial role. If the currency is undervalued, large parts of the economy are protected against import competition and the dividing line between prosperous and unhealthy enterprises or industries is generous towards many, providing smaller incentives for an active restructuring. On the other hand, if the currency is overvalued, the segment of

black economy activities. Indeed, also proxies may be biased in different directions.

<sup>25</sup> Berg (1993) suggests that output decline caused by production bottlenecks would be manifested by inventory decumulation. On the other hand, the demand contraction would lead firms at the beginning both to cuts in production and to accumulation of inventories.

competitive industries shrinks and the incentives either for restructuring or for closing down of enterprises increase.

9) Quite revealing for the potential output analysis is the recognition whether the current decline of the economic performance was caused by supply-side factors or rather by demand-side factors. To get a more plastic view, we take into account the time dimension. The anticipated development of relevant variables in time are portrayed on *Figures 9* and *10*.<sup>26</sup> While *Figure 9* shows a demand-side shock, *Figure 10* models a supply-side shock. There are altogether seven periods under consideration. Period one shows the stabilized situation on the market under socialism. Period two simulates the situation before price and trade liberalization (driven mainly by expectations) and period three the changes after these liberalizations. Periods four through seven show adjustment processes under different circumstances.

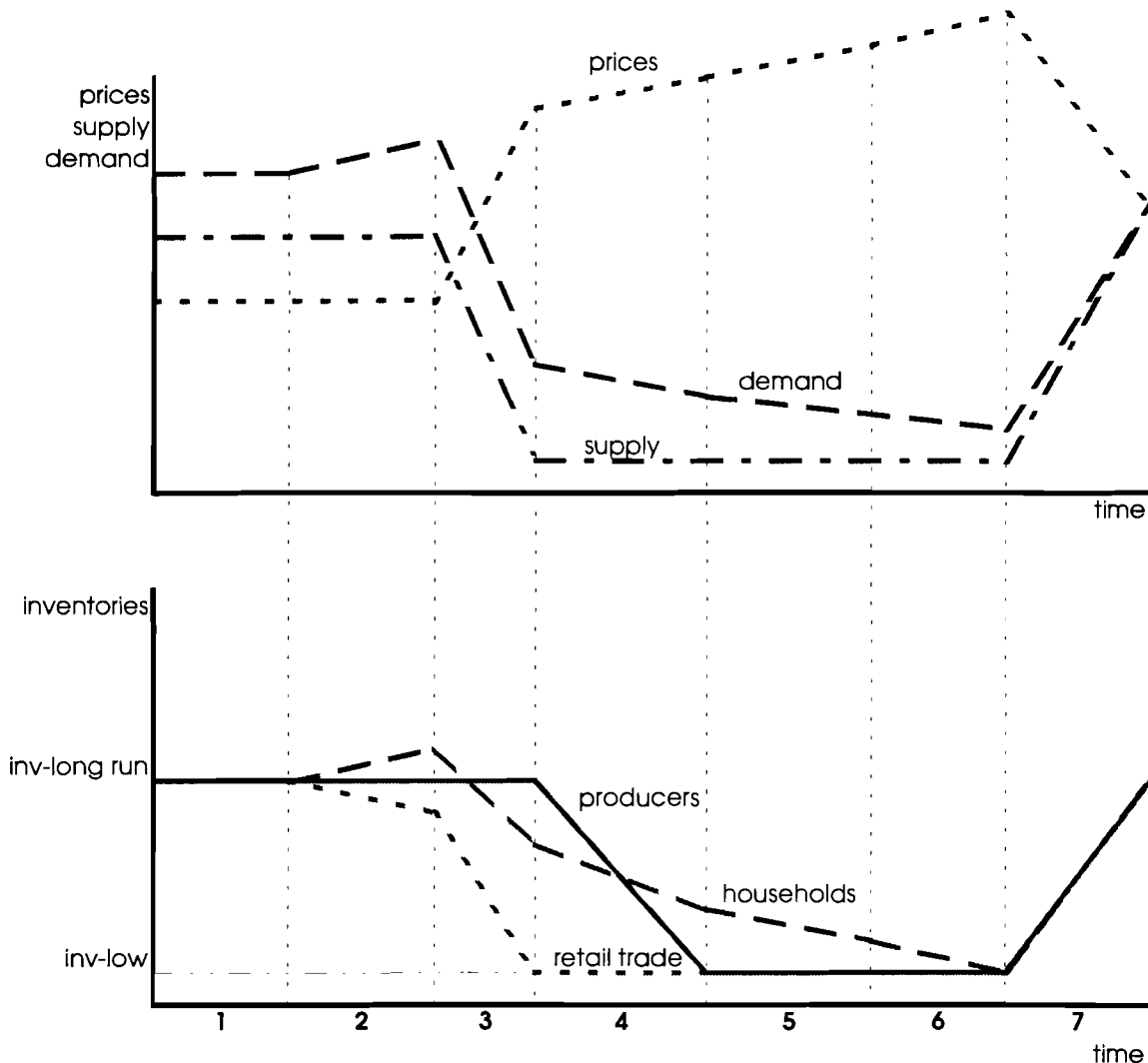


**Figure 9** Price Demand Shock

First, we consider a price-demand shock (*Figure 9*). There is a demand overhang due to artificially low prices under a centrally planned economy which even increases before price

<sup>26</sup> These pictures elaborate the ideas by Šíp (1991) and Berg (1993).

liberalization. On the lower panel it is reflected by an increase of household inventories (hoarding goods in expectation of a price jump) and a decrease of retail trade inventories. After the price jump demanded goods plummet down and retail trade inventories start increasing *ceteris paribus*. When they reach the highest level (affordable for the retailers) they stop ordering new goods from producers and start decumulation in their warehouses. During



**Figure 10** Cost Supply Shock

period four the "black card" is passed over to the producers. They do not stop the production but see the inventories stock piling. They start to act only when their inventories attain the highest possible level. Only after that (in period five) they adjust to the changed market condition, while retailers already adjusted in terms of quantity adjustment. Assuming that they preserved until period five a monopoly position (and above average mark-ups) on the market, during period six they will start losing it. Because producers start using other distribution channels, they are forced to decrease their profit margins and the prices tend to decline. This recovers the demand and the supply follows until equilibrium is attained with all three types of agents reaching the original and sustainable level of inventories. The initial shock is thus absorbed by the system which shift from non-market disequilibrium to a market equilibrium.



The implication for potential output is that it does not change only the production gap widens temporarily as a consequence of demand fluctuation.

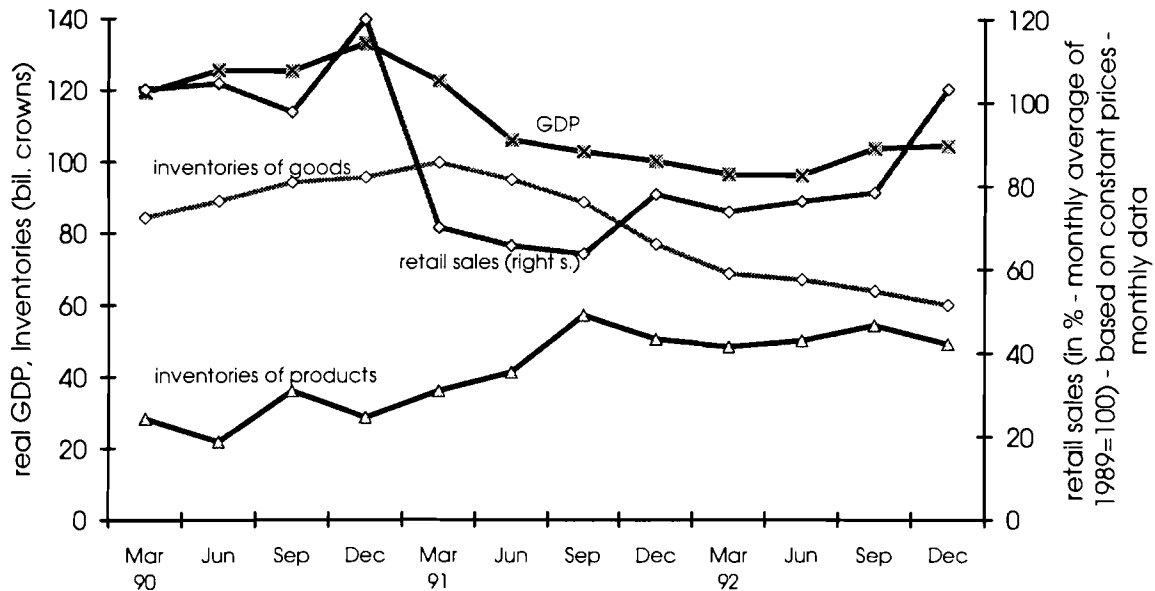
Another situation emerges when supply shock is in place (*Figure 10*). While the development is identical with the preceding case in the first two periods it diverges in the third. We assume that inputs costs increase substantially which causes problems in the production connected for example with a limited substitution of production factors. As a consequence, supply decreases rapidly and the existing (though also declining) demand is being partially satisfied by the depletion of retail trade inventories. After their depletion at the end of period three the depletion of producer's inventories starts and their depletion at the end of period four adds to another price increase and demand decline. After depletion of households inventories at the end of period five the most critical - period six - arrives. If the domestic supply does not recover (even when "exposed" to such a high prices) a long-run import substitution has to come on stage and bring about the decrease of prices implying an irreversible decline of potential output. If, on the other hand, domestic supply recovers in a reasonably short time it is up to our judgment (or introduction of another criteria) whether potential output changed or not.

The whole inspection is difficult because of several reasons. As Berg (1993) points out, one problem is connected with the way of properly measuring the real inventories in the inflationary period when the accumulated stocks are counted in historical costs. Another inconvenience arises from the fact that statistical data about inventories in private trade firms are difficult to obtain and, namely, this sector developed most rapidly.

## 6. A Glimpse of Statistical Data

*Figure 11* (see *Tables 6A* and *6Aa* in the *Appendix* for the data) juxtaposes the development of relevant variables. "Inventories of goods" reflect the stock of output at wholesalers and retailers (including semi-finished products) which is bought with the purpose to be sold. "Products", on the other hand, is an output which is on the stock of the producers. While the first term records primarily the items which are traded, the second refers mainly to output which is still in the hands of direct producers.

Bearing in mind the above mentioned qualifications and inescapable suspicion towards reliability of data, we can discern two different patterns. Inventories of goods seem to indicate much stronger adjustment than inventories of products having the turning point in the first quarter of 1991. Somewhat surprising is only the marginal sensitivity of inventories of goods to a buying spree in the last quarter of 1990 (steep increase of retail sales curve) and its extended (and not accelerated) trend in the first quarter of 1991 in spite of a spectacular decline of retail sales. However, since the second quarter of 1991 a constant decline of inventories of goods is visible. However, it is questionable to what extent was this swift adjustment (accompanied by a further decline of retail trade) translated into vigorous growth in inventories of products from the fourth quarter 1990 to the third quarter of 1991. The sequence of both developments seem to indicate that the adjustment of producers was delayed by half a year compared to the trading sector. The general observation is that during 12 quarters the inventories of goods decreased to a lower level in comparison with the pre-reform period while inventories of products stabilized on higher level than before. If this is the case, we may conclude that the trading sector found a kind of low inventories equilibrium and the burden of adjustment was shifted to producers which seem to be less flexible and show a



**Figure 11** GDP, Inventories, and Retail Trade Sales

higher inertia. Returning to *Figures 9 and 10* we may conclude that empirical evidence based on inventories confirm the price-demand shock hypothesis of *Figure 9* and reject the cost-supply shock hypothesis of *Figure 10* although the reality is less persuasive than the pure concepts suggested.

More light on the demand- versus supply-driven shock dispute is shed in *Figure 12*.



**Figure 12** Wage-Push Inflation in Industry?

Figure 12<sup>27</sup> portrays real wages<sup>28</sup>, industrial production and prices of industrial producers. Although it does not identify the reasons behind the increase of prices of industrial producers it brings conclusive arguments in favor of the hypothesis that the increase was not generated by real wages. Genuinely inverse movements of both variables refutes the inflationary impact of real wage costs supporting thus the demand shock hypothesis.

Certain information about the shape of the demand shock we receive if we look at the development of some price indices. A more or less uniform development of both consumer and producer prices is documented in Figure 13.

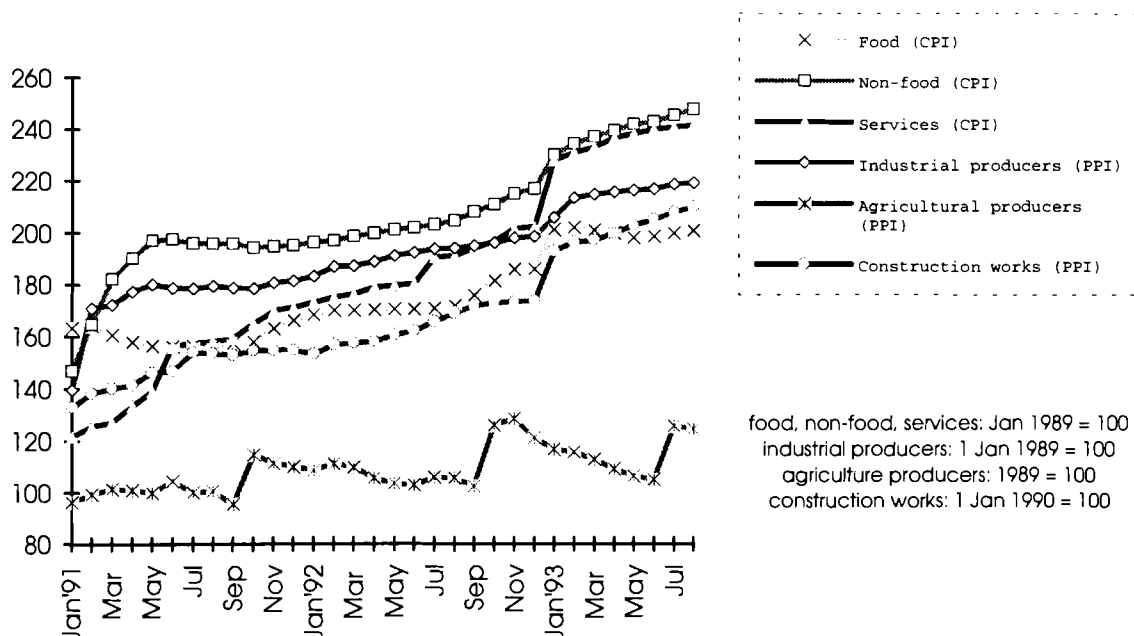


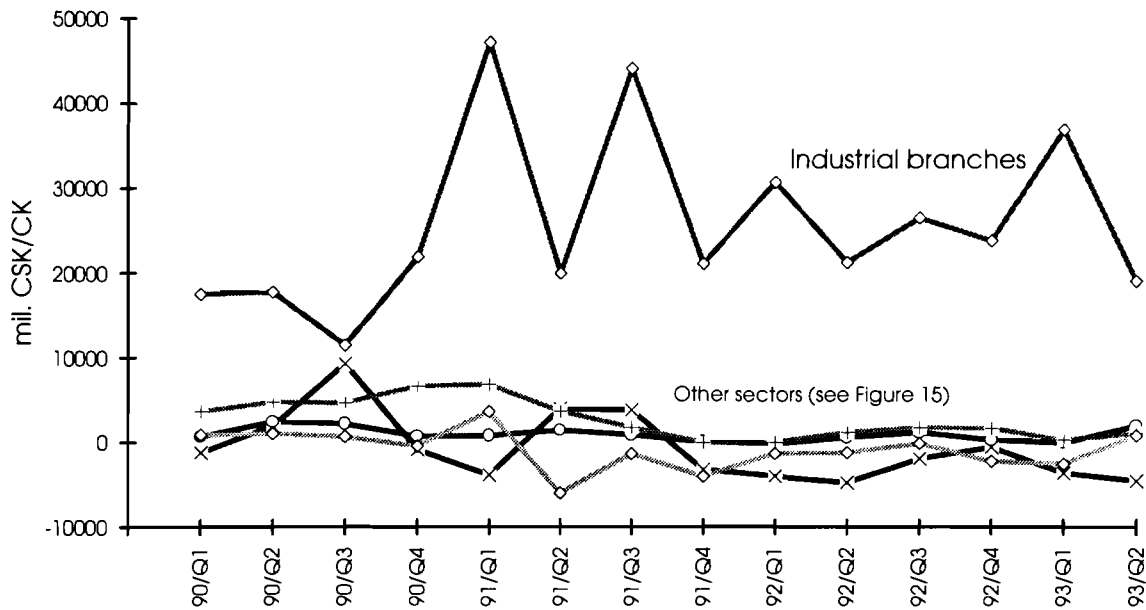
Figure 13 Price Indices

The only striking exception is prices of agriculture producers (and partially also food prices) which increased only marginally in contrast with all the other indices implying a negative income redistribution away from agriculture producers and worsening of production conditions. "Closing" of agricultural "scissors" indicates the decline of potential output in this sector.

An additional grain of truth can bring the inspection of profits in main economic sectors (see Figures 14 and 15; see Table 7 in the Appendix for the data). Figure 14 indicates that the sum of all industries (including extractive, processing, electricity, gas, and water, etc.) play a dominant role in the bulk of overall profits. The fluctuation of profits after a relatively calm 1990 became very wild during 1991 — the year of liberalization — and then settled down somewhat during 1992, and again being pushed up by the introduction of VAT at the beginning of 1993. A closer look at other industries (Figure 15) suggests a characteristic pattern of movements showing generally black numbers before the beginning of the reform

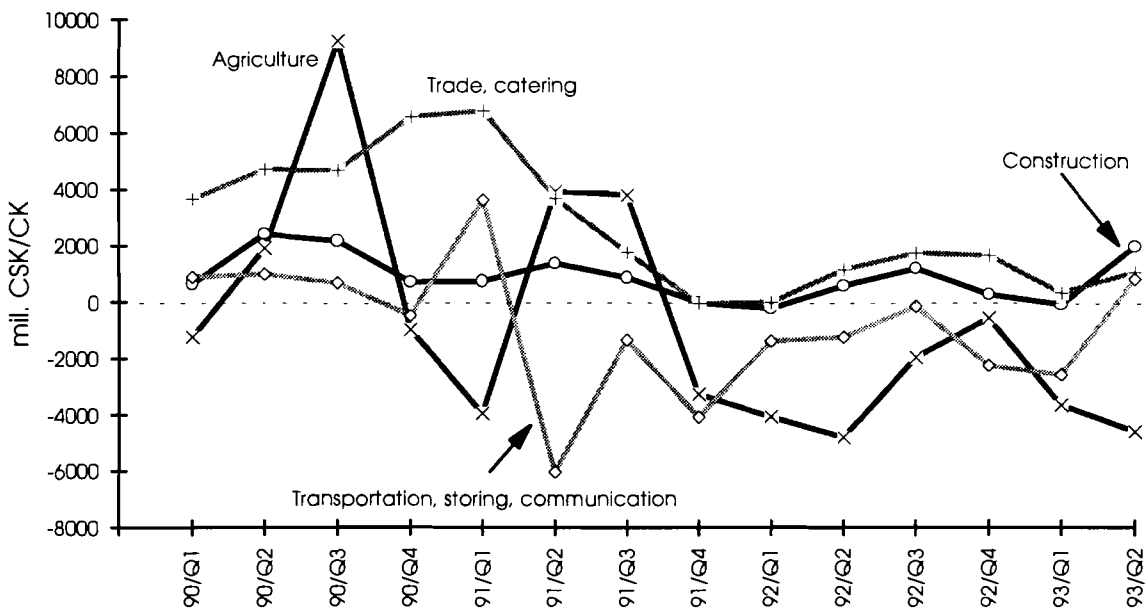
<sup>27</sup> Statistical source: Bulletin of the Czech Statistical Office, September 1993.

<sup>28</sup> Real wages in industry are computed as nominal wages in industry deflated by GDP deflator.



**Figure 14** Gross Profits

and still in the first half of the year 1991 and oscillations around zero in successive quarters. We can also observe that agriculture (preserving obvious seasonal movements of profits and having its more bright days after crops) becomes a net loser during transition getting into troubles and red numbers. This unfavorable trend fully confirms the conclusions made during the assessment of price indices.



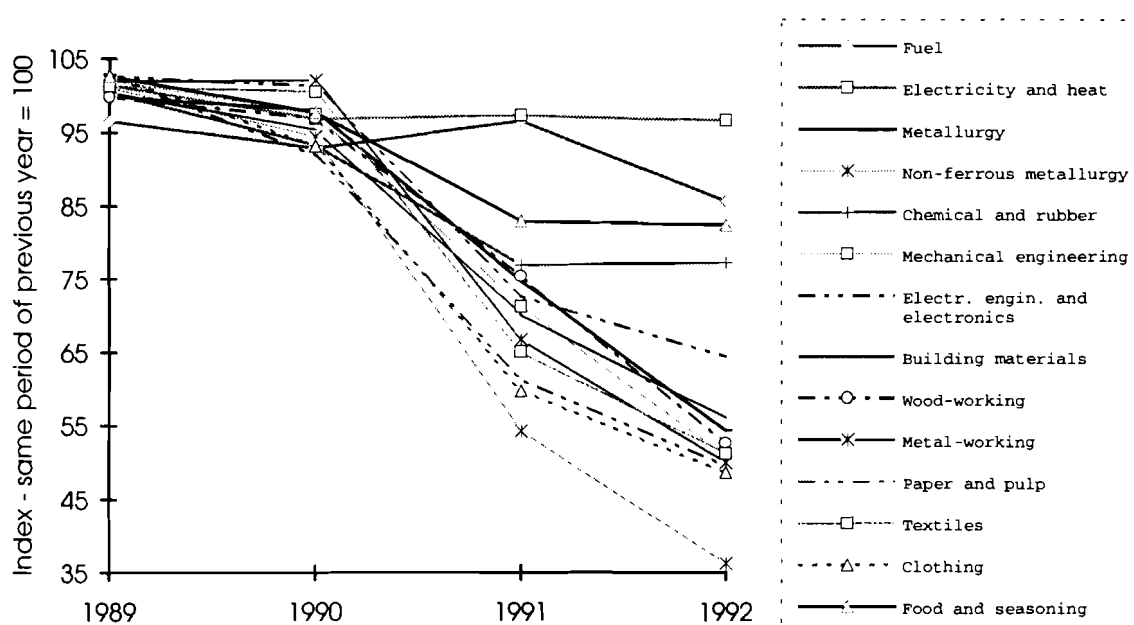
**Figure 15** Gross Profits in Selected Sectors

It must be stressed, however, that profits reported by enterprises or industrial branches need not be a good signpost of the real profitability of given activities. The time consistency is especially doubtful. The term 'profit' in the first half of 1990 (when strong subsidization of

enterprises and also retail prices was practiced) refers, most probably, to something else than the term 'profit' after price liberalization in 1991 or even in late 1993.

Another perspective is obtained if we look at the international competitiveness. Hughes and Hare (1991) estimated the level of competitiveness of desaggregated industries on 1987 or 1988 data for the former Czechoslovakia, Hungary and Poland. The comparison of value-added at world prices relative to their value-added at domestic prices brought the following results for Czechoslovakia (based on 1987 data): Industries with negative value-added at world prices (e.g., net value subtracting industries) comprised many branches in food industry and also tobacco and leather products. On the other hand, the most competitive industries in terms of world prices seemed to be pottery and chinaware, glass and glassware, machinery, transport equipment, other manufacturers and quite competitive also plastic products and non-ferrous metallurgy.

A more detailed look into the performance of selected industries in the Czech Republic during transition period is provided in *Figure 16*.



**Figure 16** Production of Goods in Selected Industries

*Figure 16* (see *Table 8* in the *Appendix* for the data) shows that four industries (fuel, electricity and heat, food, and chemicals) somehow adjusted to the reform-related shocks decreasing their output marginally or somewhat. On the other edge of the diapason we see "hopeless cases" like mechanical engineering, metal working, clothing, and especially non-ferrous metallurgy which lost the most. If the decline in these branches will continue in the next several quarters we could reasonably assume that potential output in these industries diminished markedly because the overall economic decline already stopped implying a more fundamental loss of competitiveness. In any case, the figure confirms the conclusion that if some competitive advantages do exist in current reforming countries, they tend to be in industries with a lower level of value-added. Unfortunately, this analysis cannot be completed by the information about employment in the given branches due to the absence of data.

To get a kind of complementary picture, we might be interested in knowing whether these trends were translated also into import and export performance. *Figures 17 - 22* (see

Table 9A in the Appendix for the data) show the shares of commodity groups (according to SITC classification) in total exports and total imports of the Czech Republic and the ratios of commodity groups exports and imports in nominal GNP respectively.

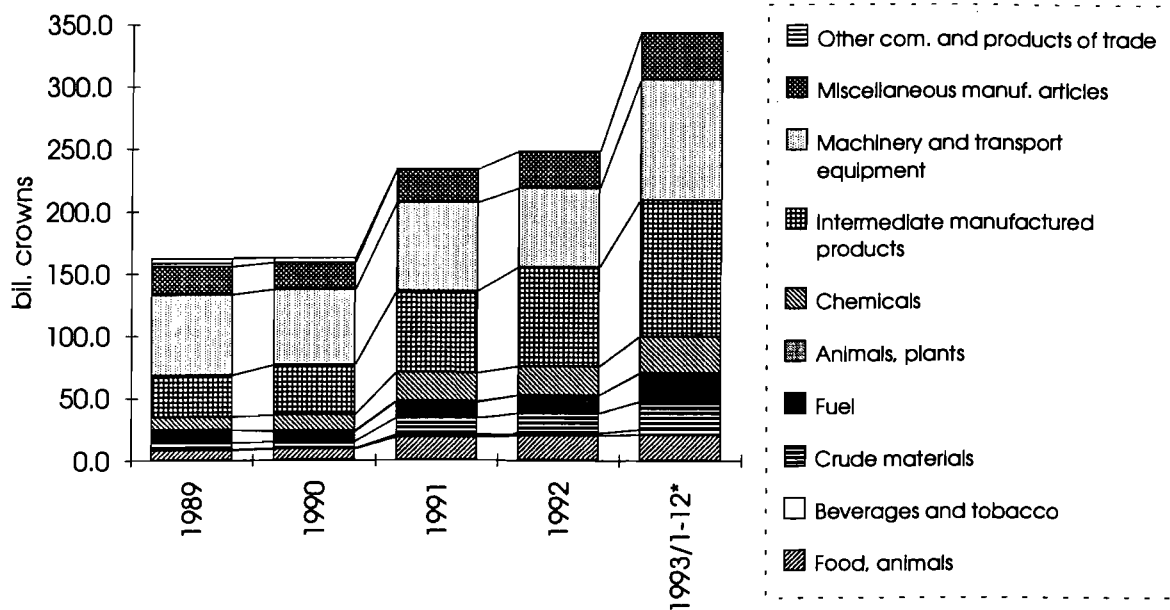


Figure 17 Exports by Commodity Groups (SITC)

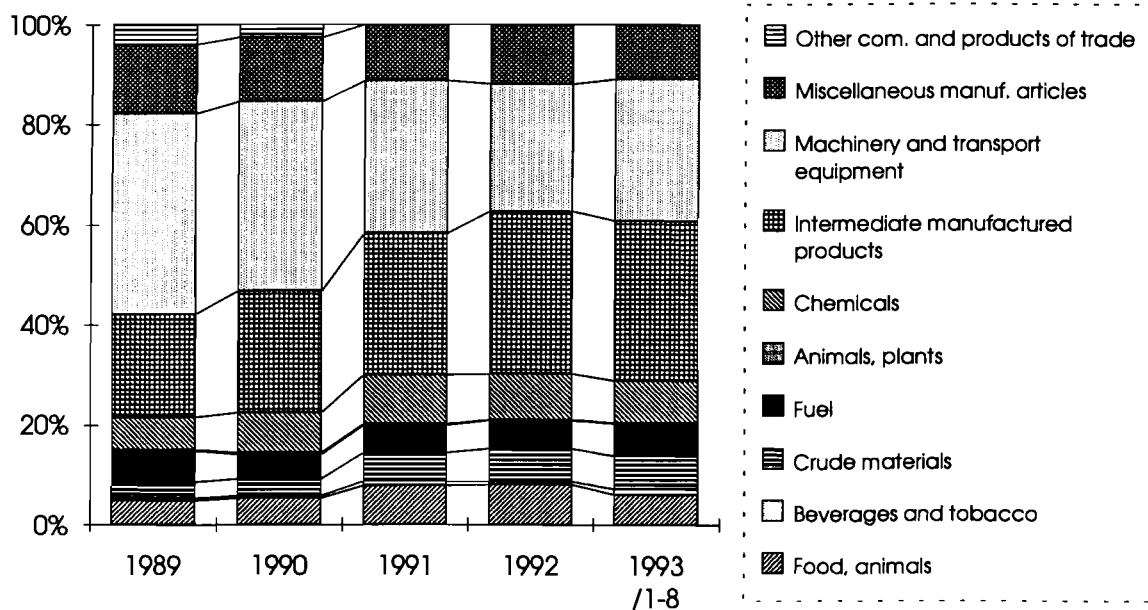
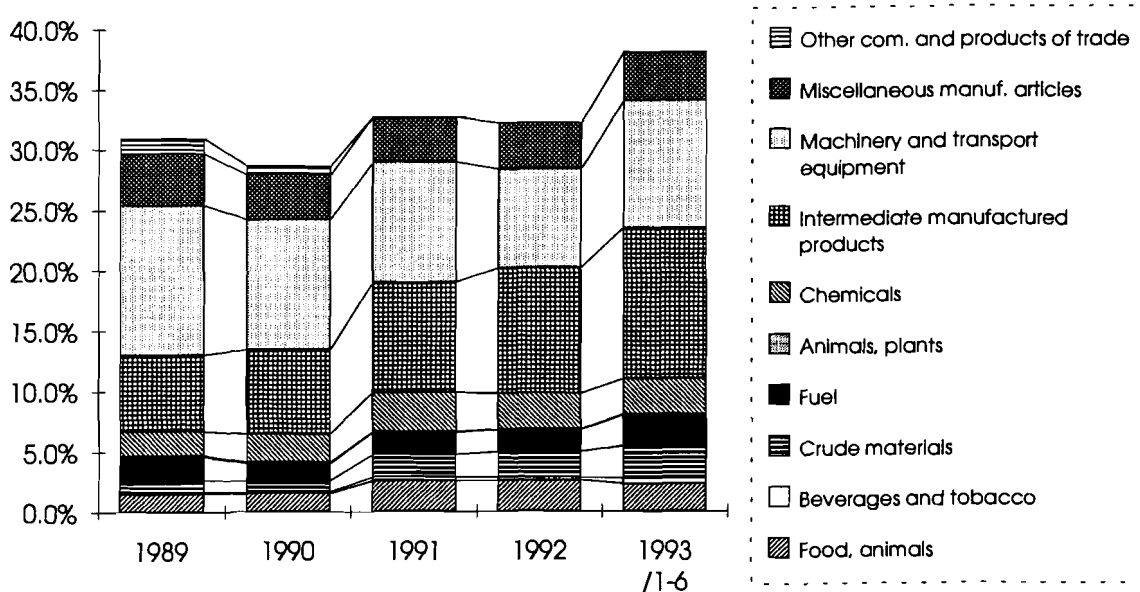
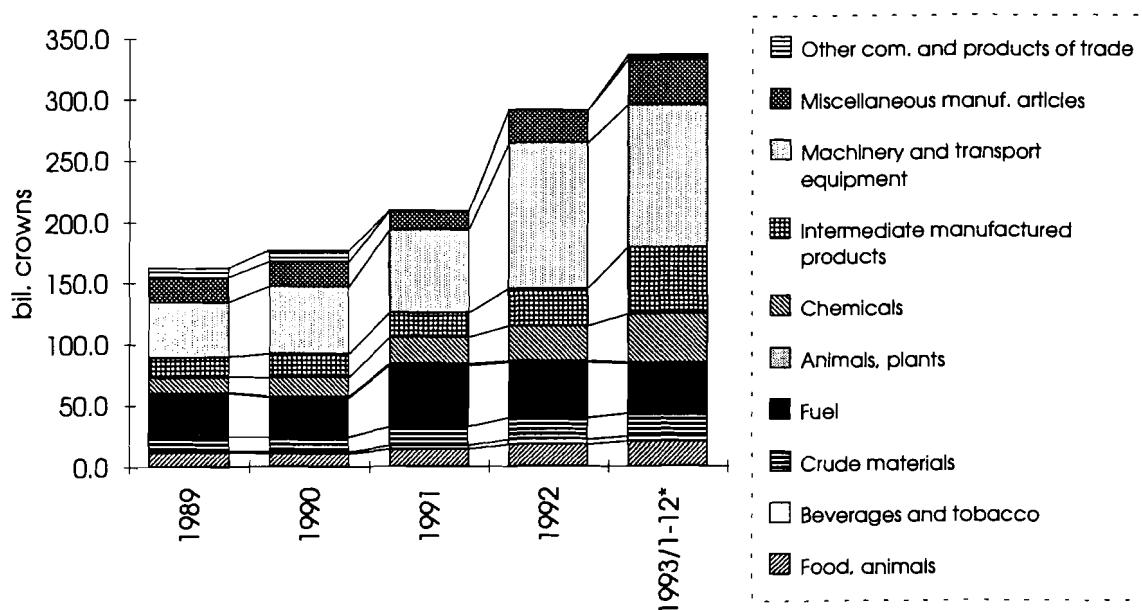


Figure 18 Shares of Commodity Groups in Total Exports



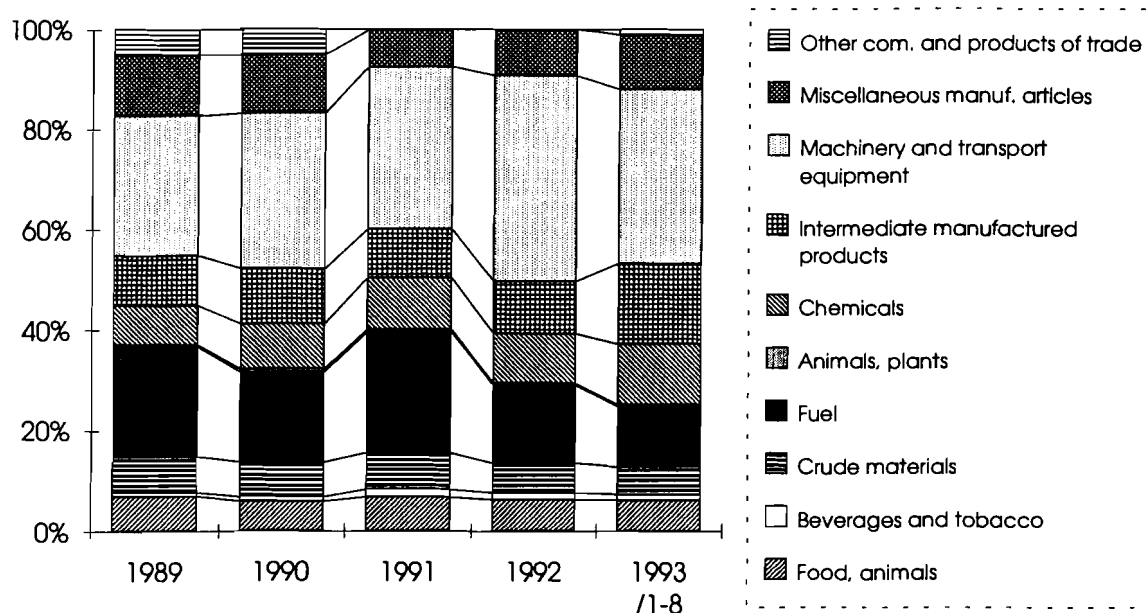
**Figure 19** Ratios of Commodity Groups Exports to Nominal GNP



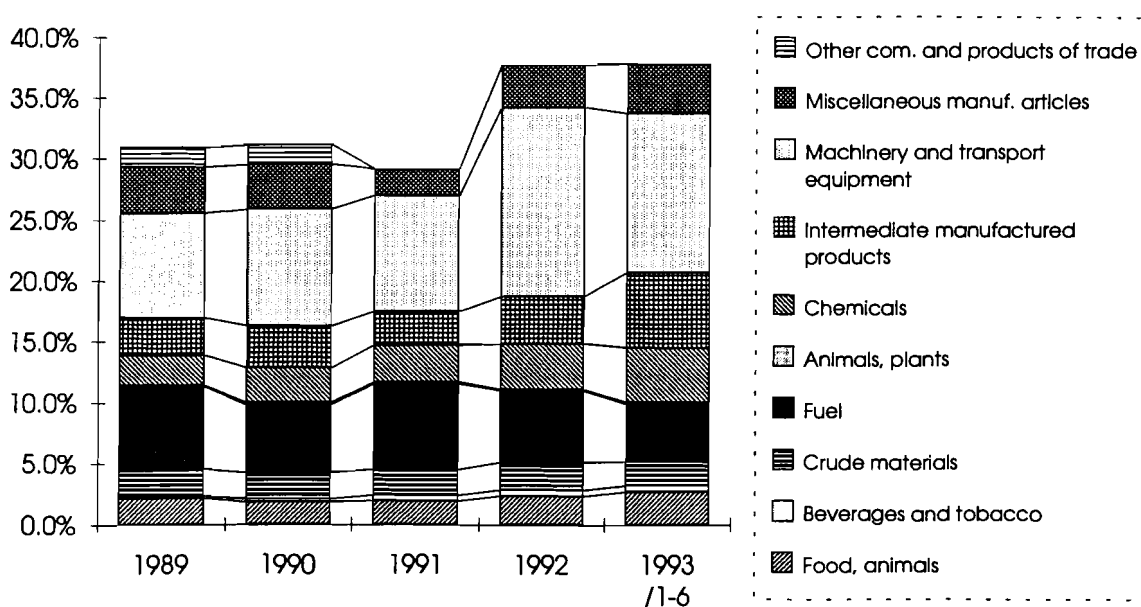
**Figure 20** Imports by Commodity Groups (SITC)

On the export side, we observe a relative increase of the share of intermediate manufactured products (during 1989-1993) and relative decrease of machinery and transport equipment with other groups being approximately stable. The same kind of shift occurred also in terms of the ratio to nominal GNP implying more or less permanent restructuring of tradables away from higher value-added to lower value-added activities. On the import side, the share of machinery and transport equipment, chemicals, and intermediate manufactured products increased in relative terms being even more explicit in terms of the ratio to nominal GNP; the share of fuel decreased somewhat.

Real life events (recorded in the Czech Republic) seem to contradict the analysis by



**Figure 21** Shares of Commodity Groups in Total Imports



**Figure 22** Ratios of Commodity Groups Imports in Nominal GNP

Hughes and Hare (based on former Czechoslovakian data) as far as non-ferrous metallurgy, machinery and food is concerned. While relative shares of machinery and transport equipment (both in terms of total exports and in terms of the ratio of exports to nominal GNP) diminished, the share of intermediate products and food increases. A mirror development can be seen in imports of machinery and transport equipment whose share increased both in terms of total imports and in terms of ratio to nominal GNP.

A well known fact is that the whole economic structure and especially industrial structure was distorted towards the secondary sector and towards heavy industries respectively under CPE. As a consequence, the restructuring towards patterns common in developed



economies could have been anticipated. However, these trends, at least in industry, do not seem to be vigorously initiated during the first several years of transition. Landesmann (1991) concludes that the "recent developments have rather strengthened the position of those parts of the industrial sector (in spite of strong falls in output levels) where reorganization is most needed". Similarly, a major role under CPE played a heavy subsidization of energy prices. Therefore, it could have been reasonably expected that the composition of industrial output biased strongly towards energy-intensive industries like paper products, pottery, glass, structural clay products, non-metallic mineral products and ferrous metallurgy (Hughes, Hare) should be shaken after the abolishment of distortionary subsidization. Statistical data indicate, again, that this is far from being the case.

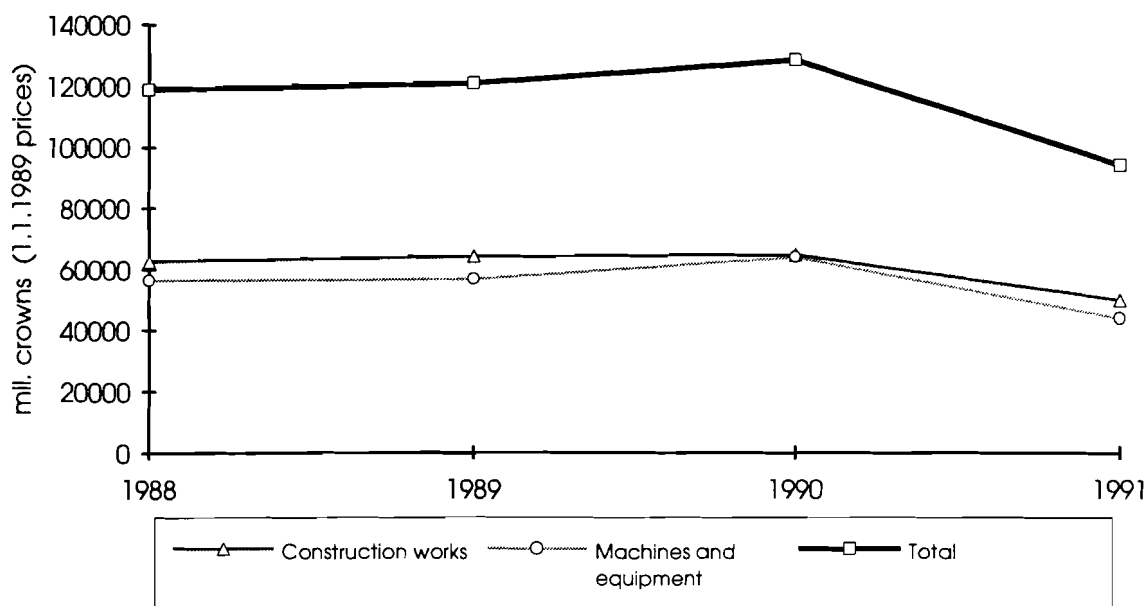
Last but not least piece of information we receive from *Table 4A* (in the *Appendix*) which shows the investment activities in the period 1988 - 1991. We see a significant decline of overall investment both in production branches and in non-production branches in 1991 compared to 1989. The only exception is an increase of investments into machines and equipment in trade (by almost 62 percent), which is, however, small in absolute terms. This strongly indicates the take-off of this traditionally (under socialism) under-developed sector connected with the progress in small-scale privatization. Among the major sectors, agriculture records the most critical decline of investment especially into machines and equipment. Particularly revealing is the peak of investment into machines and equipment in the whole economy (increase by 12.7 percent on 1990/89 basis) and especially in industry (increase by 21.3 percent) in 1990 followed by a steep decline in 1991. This extraordinary phenomenon can be explained by a strong effort of enterprises to buy (or better spend on) any possible piece of equipment for available money before price liberalization and connected devaluations come into effect. Another striking fact is a incomparably faster increase of investment (both into construction works and into machines and equipment) in non-production branches (by 16.6 percent) compared to production branches (by 2.1 percent) in 1990. The evidence suggests that with the exception of trade, there is no argument that in the whole economy any kind of potential output could have increased since the beginning of 1991. Rather its decrease could be anticipated. In any case both years - 1990 and 1991 - brought into an investment process very strong disturbances. If we realize the depth of decline of overall investment in 1991 compared to 1989 (22 percent) we may express serious doubts about the efficiency of hastily done investment in 1990. The aggregated view on the investment process is shown in *Figure 23* (based on data from *Table 4A*).

## 7. Potential Output: Resolution

This analysis was to done in order to arrive at a more precise judgment about three points:

- 1) whether the actual output decline was caused by demand or supply shock (or by any combination of both);
- 2) whether the changes are permanent or just transitory, and
- 3) what factors or variables could have some explanatory power for the potential output issue.

1) If the demand shock would be the case, there is a higher probability, that the existing production capacities do not become automatically unusable forever. Rather it could simply mean that they are not used for the time being and the existing output-gap will be replaced after demand recovers to the previous level. This could be indirectly indicated by across-the-



**Figure 23** Investment in the Czech Republic

board and parallel movements of economic activity in all industries regarding the specific sensitivity of each one to the aggregate demand fluctuations.

However, due to changes in relative prices after price and foreign trade liberalizations we could have witnessed structural shifts of aggregate demand both on the domestic market and in the foreign demand for domestic production. The demand for foreign (though expensive) goods increased substantially and domestic producers in some industries experienced problems indicating that either their supply response was sluggish or that they inherited a competitive disadvantage.

On the other hand, if the negative supply shock would be on stage, the inventory accumulation is to appear and non-parallel movements of individual industries are to be anticipated with the profound decline in those which were most hit (for example energy-intensive industries). If aggregate demand would pertain on the previous level, more robust incentives for the cost adjustment could be expected as well as inflationary pressures. After price liberalization, sharp shifts could be discerned on production factor markets.

The overall evaluation of the disposable data leads us to the conclusion that the combination of shocks occurred in case of the Czech transformation with the demand shock being stronger and more profound while the supply shock having more selective impacts across the sectors and industries.

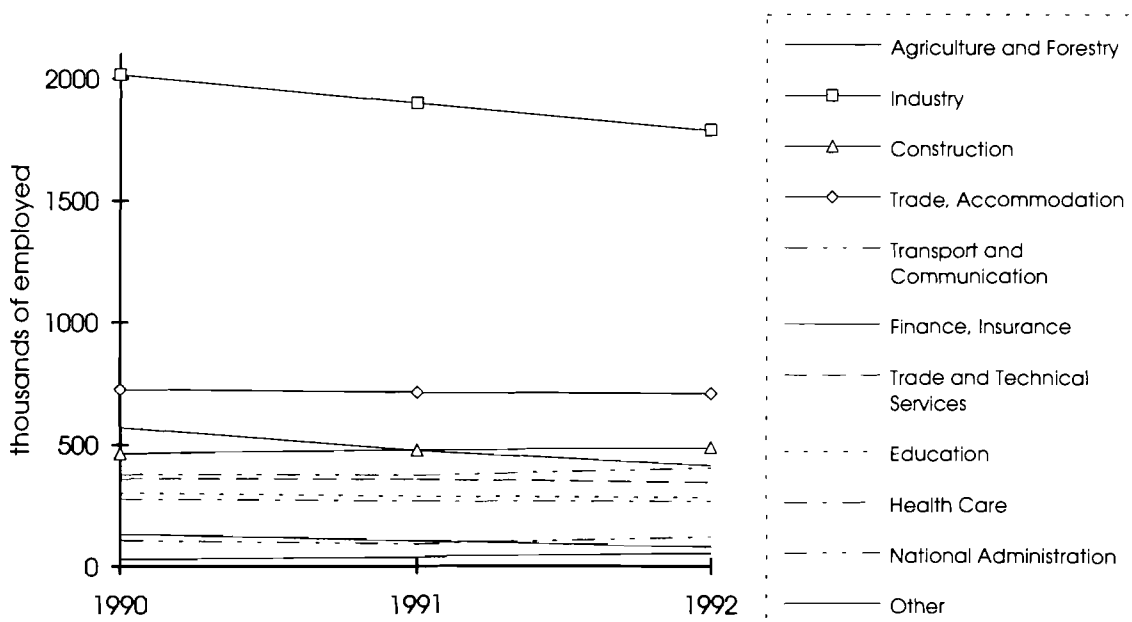
In any case we should understand that the supply response was strongly limited by numerous factors. These are: inherited and inflexible production potential, rudimentary markets and limited production factors mobility, unclear property rights, underdeveloped market institutions, to enumerate just some of them. More dynamic restructuring is being hindered by a limited substitution between production factors.

2) If we find out that permanent shocks are the case we may assume that the actual output reflects the movement of potential output. If, on the other hand, we identify only transitory changes, GDP-gap occurs and we could conclude that actual output records become a poor guide for the indication of the potential output location. However, **it is quite difficult to**

**discern the character of the changes, because more types** (external versus internal, reform-induced versus long-term versus cyclical, repeatable versus unrepeatable) **are combined at once**. As prime candidates for permanent shock, according to Blanchard and Fischer (1989), are improvements in productivity or changes in the labor force in standard market-based economies. In economies in transition several more additional shocks emerge. They comprise opening of countries to real economic environment, collapse of CMEA market, deep restructuring of whole economic sectors, build-up of market type institutions, etc. The reason for a careful assessment of different shocks provides the case of former East Germany which was capable of increasing the output after a steep decline in an unexpected scale implying an existence of an "hidden output".

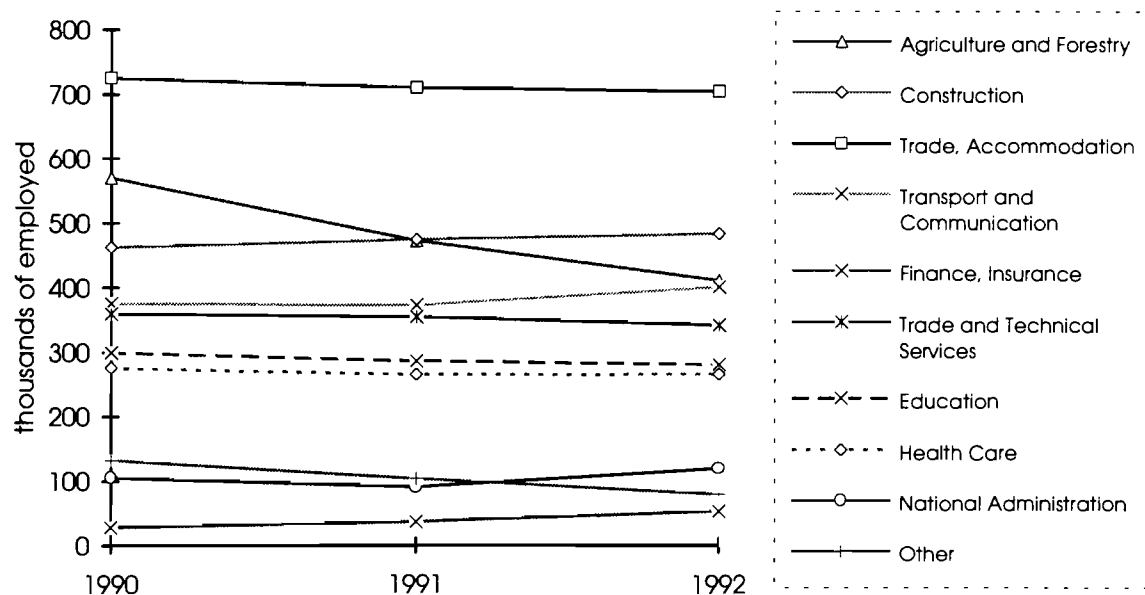
3) Because we cannot rely much on the variables like inflation or unemployment, we will watch the employment data more closely and elaborate another kind of inquiry here.

We may assume that the number of people employed approximates the medium-term expectations of enterprises as far as the future economic outlooks is concerned. *Table 5A* in the *Appendix* and *Figures 24* and *25* show the employment in all major sectors in the economy.



**Figure 24** Structure of Employment in the Economy by Sector

Apart from the decline of total employment by 8 percent, the most striking development is rather steep and steady decline of the employment in industry and even steeper in agriculture. The number of employees declined by 11.5 percent in the former and by 28 percent in the latter during the period 1990-1992. On the other hand, a recognizable growth can be registered in construction (4.5 percent), in trade and communication (6.6 percent). Spectacular increase, indeed, can be seen in banking (93 percent) whose share on overall employment is, however, negligible. In spite of the decline of employment in trade in absolute terms, its share in total employment increased from 13.5 percent to 14.3 percent confirming thus the position of the second most important sector.



**Figure 25** Structure of Employment in Selected Sectors

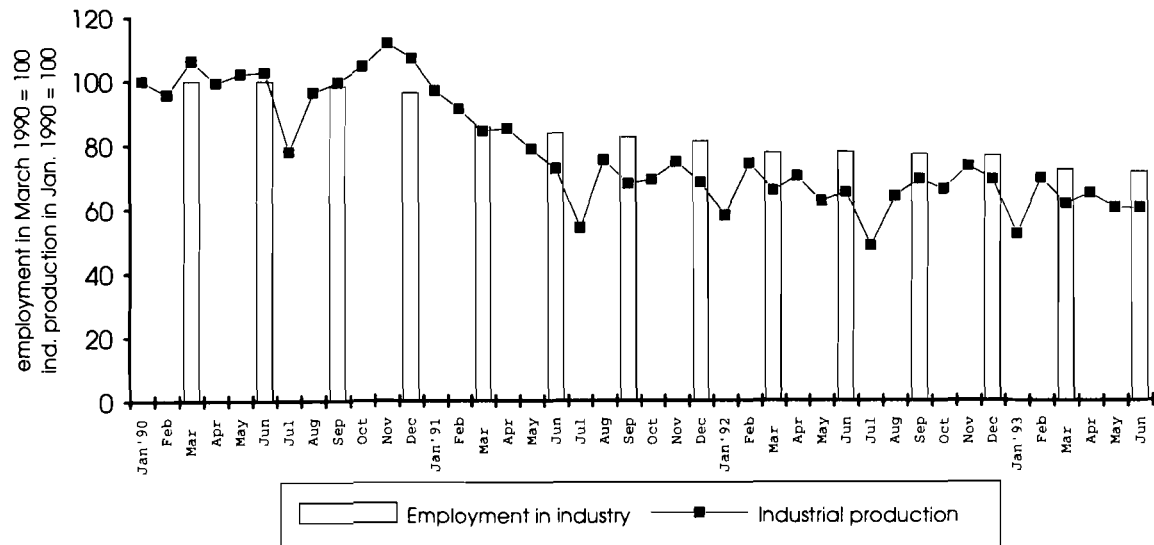
If we compare the dynamics of the decline in employment with the decline of production (*Figure 26*)<sup>29</sup>, we see a slower pace of the former implying a decline in productivity (see *Figure 27*)<sup>30</sup>. At least two explanations can be found for this development. Firstly, the enterprises do not shed labor in proportion to the decline of production due to the fear that they will not be able to find the needed labor in the future when demand recovers. This is a typical phenomenon also in market economies. Secondly, in addition to ‘labor hoarding’, the enterprises, in their effort to escape the excessive wage tax (implemented in 1991), probably employ more workers than they would without income policy.

A feasible way how to estimate potential output in industry seems to consist in the **adjustment of actual output to employment and productivity**. However, both employment and productivity should be adjusted. We make the following assumptions:

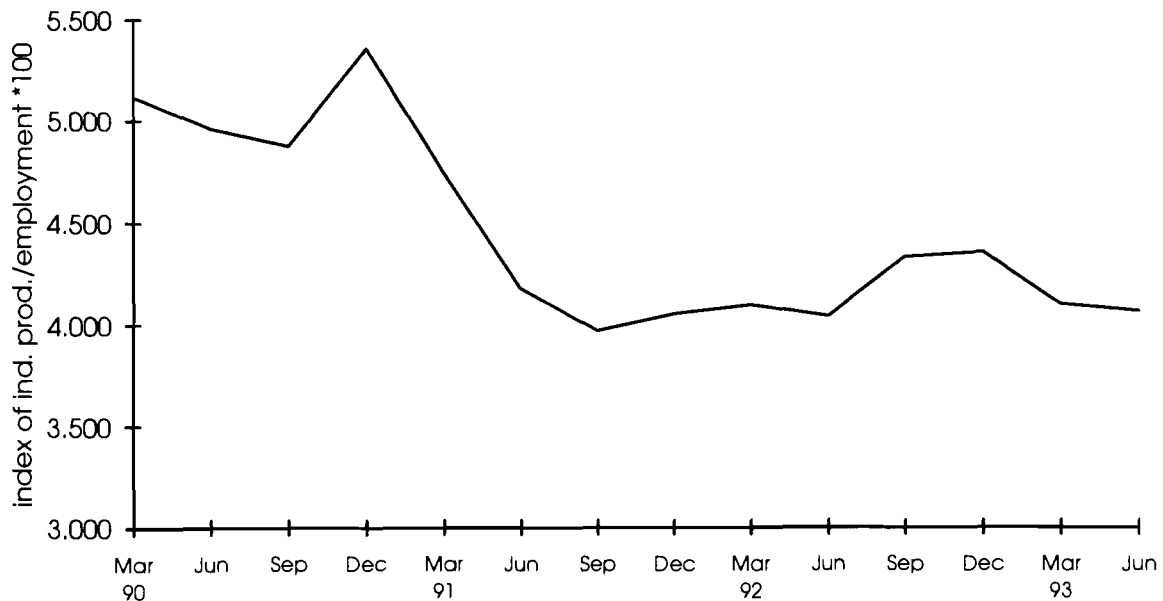
- 1) The labor productivity recorded in 1990 (yearly average) will serve as a benchmark. We shall impose this level of productivity as a condition to be fulfilled for the rest of the period under consideration.
- 2) We assume that employment figures are biased because of the labor market distortions originating in the systemic features of CPE. The main distortion consists in over-employment inside enterprises. We consider two types of over-employment: one type is inherited from the past and pertains during the period before the bulk of privatization is completed, e.g., since 1990 and after; the second type is derived from labor hoarding and lower labor utilization as

<sup>29</sup> The data for employment in industry in *Figure 26* are not consistent with the data in *Figure 24* because of a different classification. The difference does not alter the conclusions of the analysis.

<sup>30</sup> The data for *Figures 27 - 29* contains *Table 10* in the *Appendix*.



**Figure 26** Production and Employment in Industry



**Figure 27** Productivity in Industry

a consequence of output decline and emerges only with output decline, e.g., starting in 1991 and after. We make three alternative estimates — A, B, and C. We choose 0 percent of the first type of over-employment and 0 percent of the second type of over-employment [version A] which is in fact no adjustment; then, 5 percent of the former (for 1990) and 7 percent of the latter (from 1991 onwards) [version B]; and 10 percent and 12 percent [version C] respectively.

The estimates of potential output are then given by formulas:

$$PO_A = LP' \cdot E'_A / 100 \quad [5a]$$

$$PO_B = LP' \cdot E'_B / 100 \quad [5b]$$

$$PO_C = LP' \cdot E'_C / 100, \text{ where} \quad [5c]$$

LP' is labor productivity adjusted = average labor productivity for 1990 (quarterly data)  
 E'\_A, E'\_B, and E'\_C stand for employment adjusted — versions A, B, and C, being

$$E'_A = 0 \text{ for the period } 1990\text{-}1993/Q2$$

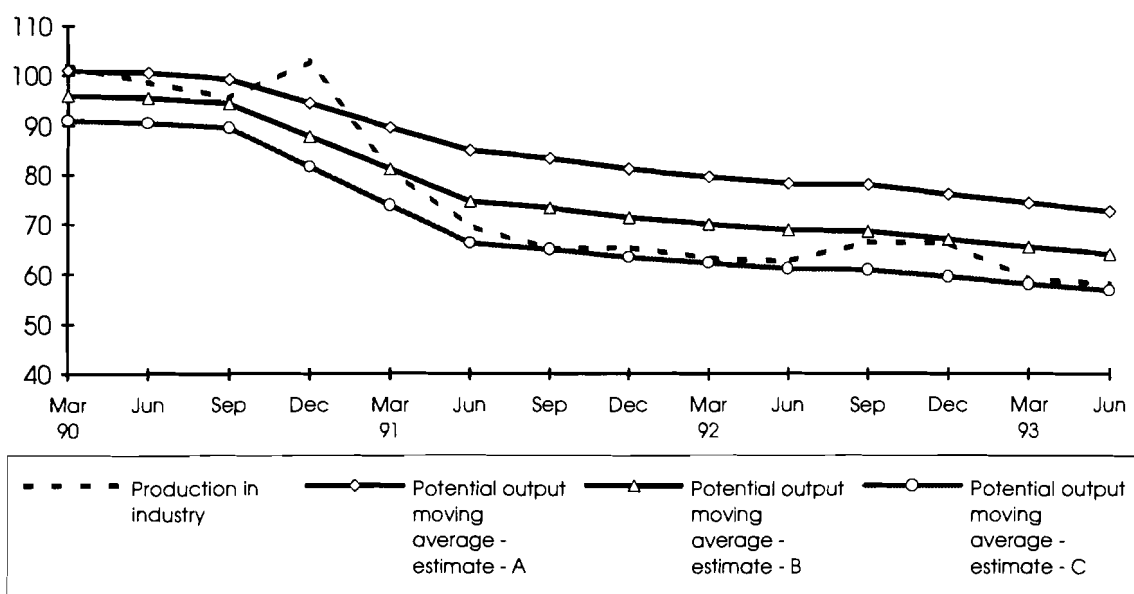
$$E'_{B\ 90} = E_{90} \cdot 0.95 \text{ for } 1990 \text{ and}$$

$$E'_{B\ 91-93} = E_{91-93} \cdot 0.88 \text{ for } 1991\text{-}1993/Q2$$

$$E'_{C\ 90} = E_{90} \cdot 0.9 \text{ for } 1990 \text{ and}$$

$$E'_{C\ 91-93} = E_{91-93} \cdot 0.78 \text{ for } 1991\text{-}1993/Q2$$

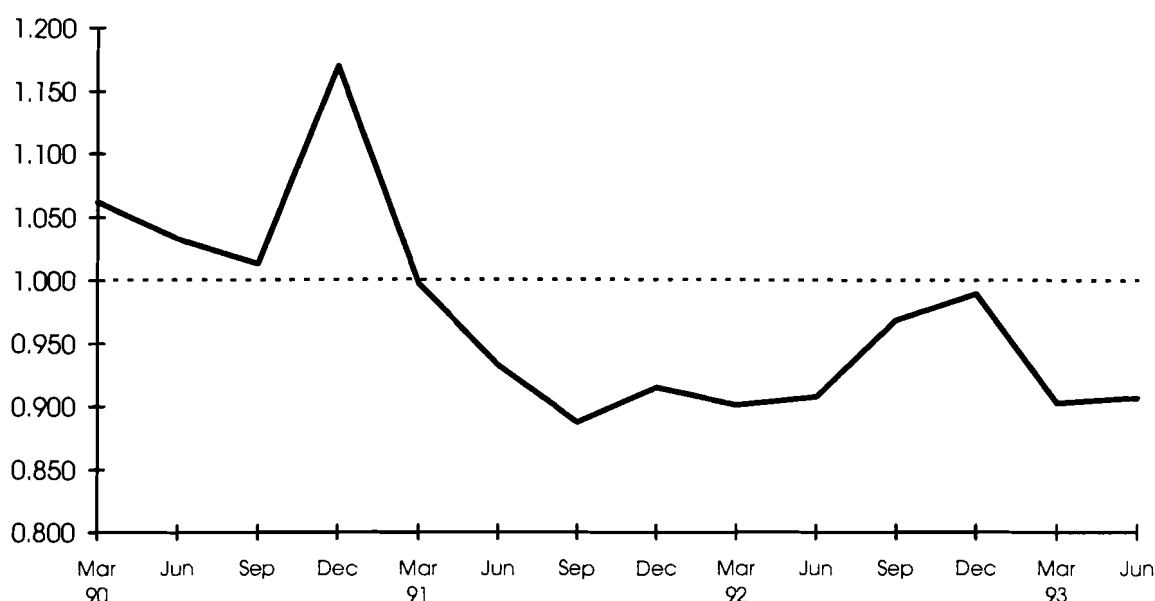
The visualization of the moving averages (three periods) of alternative estimates of potential output in industry are shown in *Figure 28* (see *Table 10A* in the *Appendix*). We can recognize a steady decline of potential output during the whole period with accelerated decline through



**Figure 28** Potential Output in Industry

the fourth quarter of 1990 to the second quarter of 1991. Except the fourth quarter of 1990 the trajectory of actual output (dotted line) moves within the range of three estimates. The excess from the end of 1990 could be explained by the enormous effort of enterprises to produce as much as possible in order to obtain high revenues from sales after price liberalization. Otherwise we see, that the higher the over-employment in enterprises, the lower the output-gap. In other words, if the labor conditions were "tight" since the very beginning (version A), a substantial output-gap emerged providing low inflationary pressures, other things being equal. If, on the other hand, the over-employment was significant already in 1990 (version C), the economy was "overheated" in the first five quarters of the period and the output decline brings the economy to neutral inflationary impacts, *ceteris paribus*. In any case, under the conditions 1 and 2 above, we can talk about the decline of potential output in

industry within the range of 30-35 percentage points on June 1993/June 1990 basis. The output gap in industry, according to version B (as the middle estimate), is shown in *Figure 29*. Above the dotted line, the output gap is negative indicating that the industry used its



**Figure 29** Output-gap in Industry

**Table 4** Estimation of the Potential Output Decline, June 1990 to June 1993

Branch	share of actual output in GDP in 1991 <sup>a)</sup> [1]	estimated change of potential output in a branch [2]	coefficient of the change [3]	[1]x[3] = [4]
Industry	54.6	— 30-35%	0.675	36.86
Agriculture	4.9	— 15%	0.850	4.17
Construction	6.3	+ 5% <sup>b)</sup>	1.050	6.62
Transport	4.0	+ 5% <sup>c)</sup>	1.050	4.20
Other	30.2	0%	1.000	30.20
<b>Total</b>	<b>100.0</b>	-	-	<b>82.05</b>

*Notes:*

a) Although actual output figures, by a definition, do not reflect the levels of utilization of production factors they are used as the best available approximation of the output share of selected branches in total GDP.

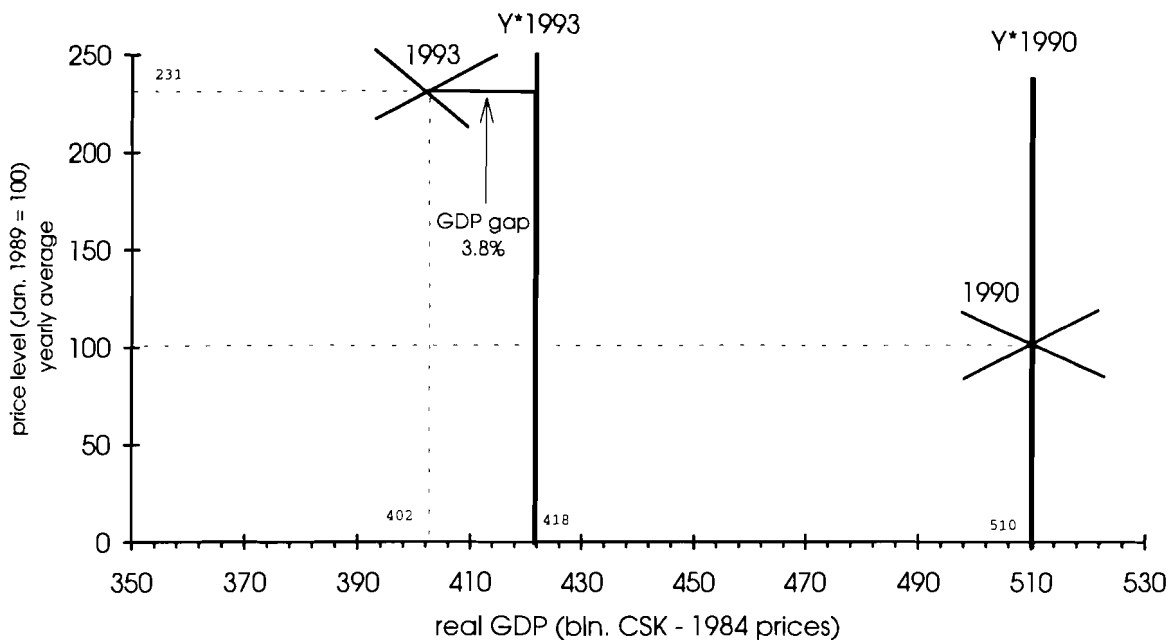
b) Increase of potential output is assumed because of better organization of work implied by privatization.

c) Increase of potential output is assumed because of modernization of some means of transport in private companies. Simultaneous deep decrease of actual output and slight increase of estimated potential output in construction and transport indicate a high output gap in these branches.

resources more than fully. However, starting with the first quarter of 1991, industry slipped into a protracted period when production resources are not used by the amount of 10 percentage points.

If we "guesstimate" the decline of potential output in agriculture by 15 percent and some small increases in construction and transportation with all the other sectors remaining on approximately the same level, we may arrive at the decrease of potential output for the whole economy by about 16-20 percent on June 1993/June 1990 basis (see *Table 4*).

These results allow us to return to the basic question expressed in *Figure 1* whether potential output shifted or not during transformation period in the Czech Republic and if so, to what extent and what was the relation between this shift and the evolution of actual output. The summary is given by *Figure 30* where we assume that the level of potential output was



**Figure 30** Shift of Potential Output in the Czech Republic, 1990-1993

equal to the level of actual output in 1990. While these were in real terms 510 bil. CSK on annual basis (1984 prices) in 1990 the level of potential output declined to 418 bil. CSK and the level of actual output declined to 402 bil. CSK in 1993 implying 3.8% GDP-gap in this year.

## 8. Systemic-Conditioned Potential Output: Revisited

Less obvious than the preceding analysis is the penetration into the concept of systemic-conditioned potential output. Though it largely refers to an anecdotal evidence, or to the phenomena which are difficult to quantify and measure we should make the concept at least partly operational.

Generally, the disappearance of the systemic-conditioned potential output is based on the fading-out and/or reversal of those features which defined the substance of a centrally planned economy, e.g., soft, non-parametric and isolated environment. The more omnipresent



the market-conform features will be the higher level of potential output should be attained *ceteris paribus*. Thus, the transformation entails:

1) *Changes of incentives derived from changed rules of the game*. We can assume that less and less energy of managers will be devoted to a subjection of the external environment to the goals of a given enterprise and more effort will be directed to the compliance with customers' demand.<sup>31</sup> Therefore, the level of capital utilization and utilization of labor and working time will not be driven by the incentives to maintain the necessary reserves *vis-à-vis* plan and the danger of its eventual non-fulfillment but rather *vis-à-vis* sudden upsurge of the demand, which, if not met, would mean a loss of potential (and very real) profit.

2) *Improvement in coordination of economic activities*. The synergy effect of the introduction of the market system consists in the replacement of over-bureaucratic, tardy, and inefficient allocation and distribution of resources by a more flexible and swift one. The unproductive use of resources and very high coordination cost of the former economic system are supposed to be stopped and decreased respectively.

3) *Release of creative activities of population*. Although the transformation process shows many deficiencies, attrition, and inefficiencies, there is much evidence that people have incomparably bigger space for their self-realization than before. Whether it is derived from their wishes, selfish interests, or dictated by the necessity to survive in a competitive environment is not much relevant here. One of the most striking phenomena in a short period of transition is that people, typically, become busy and spend (and use) time in another way than before.<sup>32</sup> It can be assumed that the opportunity costs of many leisure-related activities became suddenly very high so that the whole layers of more qualified persons started their engagement in business-related activities. This rather massive adjustment constitutes an important quasi-productive factor which can augment the level of potential output *ceteris paribus*.

4) *Increase of welfare gains*. Notwithstanding, this point does not allude directly to the production capabilities, it deals with a consumer's side of the economy. As a matter of fact consumer patterns under centrally planned economies were largely determined by forced substitution bringing the lower level of consumer's satisfaction. Under such circumstances the potential output basket of goods did not generate such a welfare that would be generated by

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<sup>31</sup> This is not typically a case in enterprises which find themselves in a "privatization agony". Before completion of reasonable and satisfactory privatization, the managers usually continue paying extremely high attention to external factors other than demand and disregard the internal efficiency of the company. Patchy evidence even indicate that in order to attain the favorable position during the preparation of privatization, managers manipulate in sophisticated ways the reported (and inescapably also real) performance of the enterprise causing thus the transitory deterioration of the efficiency.

<sup>32</sup> Anecdotal evidence suggests the rocket rise of people's complaint about general and increasing "lack" of time. Many people are engaged in multiple activities, they do not have time to visit and meet each other, to spend a calm weekend at weekend houses or to read books, etc.

a potential output basket without the forced substitution. To say it in other words, market-driven potential output has a higher value (in terms of consumer satisfaction) than the same level of potential output created under CPE *ceteris paribus*. If CPEs produced about 10 percent of the gross social product which went "straight into inventories never to re-appear" (Winiecki, 1991), market provides with a wider choice of socially desirable goods.

The strong proposition should be made that the main driving force behind the convergence of systemic-conditioned potential output towards economic potential output is the process of marketization and privatization of the economy supplemented by the world-market conform economic restructuring. The main contours of these goals may be achieved within 5-8 years since the beginning of transition. Indeed, many observations lead us to suggest that the gap between systemic-conditioned potential output and economic potential output already started closing; in other words, "y-efficiency" started to creep up at least in some segments of the economy. As one indication could serve increasing shares of GDP produced in private sector (see *Table 6A* in the *Appendix*).

Abrupt changes on a quarter-to-quarter basis must not lead us to the conclusion that the efficiency and productivity of private sector production proceeds at the same pace. While some remarkable productivity gains may be seen in small private firms which started from scratch, those big firms (which simply received the tag "**private**" after the distribution of property rights to inexperienced funds or to thousands of privatization voucher owners) will struggle with their own inertia and behavioral patterns inherited from the past displaying not really spectacular improvements. Indeed, more detailed information could be fruitfully received from market research-, microeconomic-, and sociological studies.

If we combine the concept of systemic conditioned potential output presented in section 5.2 with analysis of this section we have to conclude that three versions of potential output refer (at least in 1990) not to economic potential output but rather to systemic conditioned potential output. With the progress in marketization and privatization the potential output path will be more and more market-driven and will loose the conditionality derived from the logic of functioning of the former economic system. In the process, the dynamism of economic growth will be gaining the components which could be hardly attributed to a traditional growth accounting unless some necessary adjustments will be made. These should take into account for example: 1) newly emerging incentives to work and incentives to the better use available scarce production resources; 2) the synergy effects resulting from the better functioning of the markets; 3) benefits from the higher utility of consumers; etc.

## 9. Policy Implications

The above analysis indicates the implications for economic policy-making. Basically we may define two areas of policy activities. The first area is the standard macroeconomic policies (monetary, fiscal) which are potent enough to stabilize the economy and manipulate some relevant economic variables from "inside" the system. These exogenous variables refer mostly to a sort of tools like money supply, interest rates, government expenditures, or marginal tax rates.

On the other hand, the second area consists of system-constituting, legislative, institutional, and microeconomic measures which are only marginally influenceable by macroeconomic policies. Here we have in mind the social network which generates the broad

range of political and economic expectations, which minimizes risks of undertaking socially desirable investments, which leads individuals to believe in their future, which build up a respectable legal framework supporting the smooth and non-distortionary enforcement of contracts, which alleviate some externalities, which provide more efficiently agreeable public goods, which creates condition for sustainable growth, etc. All these factors can be seen as "independent" variables enter the economic system from "outside", need a medium-run for their implementation and only bring benefits in the long-run. While the former group basically influences the economic concept of potential output, the latter group deals predominantly with systemic-conditioned potential output. And most importantly, while the role of the former group policies in generating economic growth is very limited, the role of the factors from the second group is essential.

If our assumptions and conclusions from the analysis done in the previous section were correct, the lesson for policy makers is that some limited dosage of expansionary policies would not have led to a danger of inflation in 1991 and the first half of 1992 because the aggregated production resources of the economy were far from being fully utilized according to western standards. Indeed, for a better recognition of possible bottlenecks in utilization of resources in individual branches, mezzo-economic analysis would need to be done.

## 10. Conclusions

Our excursion into the issue of potential output in a transitional economy suggests that the analysis is extremely burdensome and tricky. One firm spot on which we could stay escapes our skills of its more precise identification. Many circumstances indicate that this task will be more successfully fulfilled only after a fully-fledged market economy "settles down" and numerous uncertainties especially on the supply side stop clouding the magnifying lens of researchers.

Nevertheless, some benefits of the above attempt could be traced. We found out that the economic processes in an economy in transition are too discontinuous to be suitable for the application of refined tools developed for market economies. Especially the condition of non-inflationary utilization of resources loses its applicability because inflation is generated by completely different factors than those stemming from tight utilization of resources. Similarly, unemployment cannot serve as a benchmark due to high labor participation and strong over-employment inherited from the past. Some insights and useful explanations could be received from the simultaneous assessment of different variables like inventories, profits, investment, foreign trade and direct measures related to the utilization of production equipment although they are much more difficult to obtain from existing statistical data. Rather important seems to be the data on employment despite the hesitant labor shedding practiced during extended privatization agony makes the analysis sometimes uncertain. A big unknown factor remains the long-term impact of the existing exchange rate on competitiveness of individual sectors. Although the exchange rate is not an independent variable, the discretion in its setting by the central bank can have profound impacts both on the absolute level of potential output and on its structure. The empirical evidence accumulated during the transition period seems to suggest that the restructuring of the economy does not necessarily follow the patterns of comparative advantages (either perceived or real). A useful methodological tool seems to be the introduction of a kind of transformation bridge between the

centrally planned economy and a full-fledged market economy (a systemic-conditioned potential output). Though its operationalization is rather difficult, because it escapes the field of standard economic analysis, it helps to discern the tasks which are relevant for traditional macroeconomic policies from the goals which stand for widely based microeconomic policies and institutional restructuring.

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## **Appendix - Statistical Data**

**Table 1A Some Industry Indicators in the CSSR and the CSFR in 1980 - 1990**  
(Figures 6 and 7)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Utilization of available working time "fund" (in %)	91.3	91.5	91.5	91.2	91.2	91.1	90.7	91	90.9	90.4	89.9
Share of over-time work (in %)	5.8	5.6	5.3	5.2	5.1	5.2	5.3	5.3	5	4.6	4.3
Length of working week (in hours)	41.8	41.8	41.8	41.8	41.7	41.7	40.8	40.8	40.8	40.8	40.8
Working hours (WH) (in hours per worker per year)	1939	1936	1933	1923	1921	1920	1905	1908	1887	1859	1815
Working shifts coefficient (SC)	1.324	1.325	1.329	1.33	1.329	1.329	1.329	1.329	1.33	1.327	1.318
Production equipment in operation (PEO) (in hrs/year)	2567	2565	2569	2558	2553	2552	2532	2536	2510	2467	2392
Time utilization of installed output of energ. equip. (h/y)	1803	1749	1704	1693	1662	1676	1907	1891	1868	1845	NA

Note: The so-called "local" and "cooperative" industries are not included.

Source: Prepočet časových rad základních ukazatelů v průmyslu za roky 1948 - 1990, Československá statistika, Praha, 1991.

**Table 2A** Hypothesis about the impact of actual output, employment, net investment, and capacity utilization on potential output

movements of observable variables				hypothesis on the behavior of potential output: movement A	hypotheses on movements B,C,D and other movements
actual output (sold)	employment	net investment (t-1)	capacity utilization		
+	+	+	+	A+	C+
			0	A+	
			-	off-setting ?	
	-	0	+	A0	C+
			0	A0	B0 or D0
			-	?	used capacities are used more efficiently
0	+	+	+	A0	efficiency of production and investment decreases
			0	A0	efficiency of investment decreases
			-	A0	efficiency of investment increases
	-	0	+	?	efficiency of production capacities decreases
			0	A0	if B or D, then output-neutral
			-	A0	efficiency of production capacities increases
-	+	+	+	?	efficiency of production and investment decreases
			0	?	efficiency of investment decreases
			-	?	if output & util. decrease equally, invest. = output-neutr.
	-	0	+	A-	efficiency of production decreases
			0	A-	efficiency of production decreases
			-	A-	if output & util. decrease equally, prod. eff. is steady

Notes:

- 1) Explanation of signs: + growth; 0 steady state; - decline.
- 2) We do not assume the decline of net investment.
- 3) Actual output in constant prices, capacity utilization in %.
- 4) Typology of movements:
  - A - shift of the whole production possibility frontier (ppf);
  - B - movement along the ppf on the ppf;
  - C - movement inside the ppf (towards to- and away from ppf);
  - D - movement along the ppf inside the ppf.
- 5) t-1: previous quarter.
- 6) Off-setting: Some variables move in opposite directions; the resulting movement depends on which influence is stronger.
- 7) Typically we assume no change of potential output but indicate the off-setting situation in parentheses.
- 8) Employment: to simplify we assume either increase or decrease only.



**Table 4A Investment in the Czech Republic**

Selected sectors in production sphere

(Figure 23)

	1988	1989	1990	1991	91/89	91/90	90/89
<i>construction works</i>							
Agriculture	8585	8019	7016	3990	0.498	0.569	0.875
Water	3903	4061	4297	2700	0.665	0.628	1.058
Industry	15349	15903	14773	12504	0.786	0.846	0.929
Construction	3186	3318	2476	2753	0.830	1.112	0.746
Transportation	1997	2007	1957	1776	0.885	0.908	0.975
Trade	1800	2038	1994	1238	0.607	0.621	0.978
-----							
production branches - total*	36231	36662	33779	26313	0.718	0.779	0.921
non-prod. branches - total**	26301	27422	30890	23751	0.866	0.769	1.126
Construction works	62532	64084	64669	50064	0.781	0.774	1.009
<i>machines and equipment</i>							
Agriculture	6831	7215	6490	1802	0.250	0.278	0.900
Water	421	487	572	367	0.754	0.642	1.175
Industry	30546	29939	36312	25840	0.863	0.712	1.213
Construction	2238	2015	1630	408	0.202	0.250	0.809
Transportation	3279	4282	2838	2254	0.526	0.794	0.663
Trade	1082	1170	1372	1892	1.617	1.379	1.173
-----							
production branches - total*	46906	47773	52407	34685	0.726	0.662	1.097
non-prod. branches - total**	9368	9047	11645	9500	1.050	0.816	1.287
Machines and equipment	56274	56820	64052	44185	0.778	0.690	1.127
<i>Total</i>							
Agriculture	15416	15234	13506	5792	0.380	0.429	0.887
Industry	45895	45842	51085	38344	0.836	0.751	1.114
Water	4324	4548	4869	3067	0.674	0.630	1.071
Construction	5424	5333	4106	3161	0.593	0.770	0.770
Transportation	5276	6289	4795	4030	0.641	0.840	0.762
Trade	2882	3208	3366	3130	0.976	0.930	1.049
-----							
production branches - total*	83137	84435	86186	60998	0.722	0.708	1.021
non-prod. branches - total**	35669	36469	42535	33251	0.912	0.782	1.166
Total	118806	120904	128721	94249	0.780	0.732	1.065

Source: Czech Statistical Office.

Notes:

absolute figures in mil. crowns (in 1.1.1989 prices)

\* production branches - total is not the sum of selected industries

\*\* among the most important branches are: personal transportation; housing; accommodation, community services and travel services; and health.

**Table 5A Structure of Employment by Sector in the Czech Republic**  
(Figures 24 and 25)

	Average number of workers (thousands)				Percentage shares		
	1990	1991	1992	92/90	1990	1991	1992
Agriculture and Forestry	570	472	411	0.721	10.7	9.3	8.3
Industry	2014	1894	1783	0.885	37.6	37.4	36.2
Construction	463	474	484	1.045	8.7	9.4	9.8
Trade, Accommodation	725	710	705	0.972	13.5	14.0	14.3
Transport and Communicator	376	372	401	1.066	7.0	7.4	8.1
Finance, Insurance	28	37	54	1.929	0.5	0.7	1.1
Trade and Technical Services	360	354	342	0.950	6.7	7.0	6.9
Education	300	286	281	0.937	5.6	5.7	5.7
Health Care	276	265	266	0.964	5.2	5.2	5.4
National Administration	106	91	120	1.132	2.0	1.8	2.4
Other	133	104	80	0.602	2.5	2.1	1.6
<b>Economy Total</b>	<b>5351</b>	<b>5059</b>	<b>4927</b>	0.921	100.0	100.0	100.0

Source: Ham, Svejnar, Terrell (1993) (Table 20).

**Table 6A GDP, Inventories, and Retail Trade Sales**  
(Figure 11)

	Mar 90	Jun	Sep	Dec	Mar 91	Jun	Sep	Dec	Mar 92	Jun	Sep	Dec
GDP (quarterly data)	119.4	125.7	125.5	133.1	122.6	106.1	103	100.4	96.7	96.4	103.8	104.6
GDP (quarterly data)	100	105.3	105.1	111.5	102.7	88.9	86.3	84.1	81.0	80.7	86.9	87.6
Retail sales total (constant prices)	103	104.5	97.7	119.9	69.9	65.5	63.6	78.1	73.8	76.3	78.3	103.4
Retail sales total (constant prices)	100	101.5	94.9	116.4	67.9	63.6	61.7	75.8	71.7	74.1	76.0	100.4
Inventories of products	28.3	21.9	36.1	28.7	36.0	41.1	57.2	50.5	48.5	50.1	54.4	49.2
Inventories of products	100	77.3	127.4	101.4	127.0	145.1	201.7	178.4	171.3	176.9	192.0	173.6
Inventories of goods	84.4	89.1	94.4	95.7	99.7	95.1	88.6	77.1	68.9	67.2	64.0	60.2
Inventories of goods	100.0	105.6	111.9	113.4	118.2	112.7	105.1	91.4	81.7	79.6	75.9	71.3

Source: Czech Statistical Office.

**Table 6Aa Inventories - Czech Republic**  
(Figure 11)

	28341	21894	36118	28731	36003	41110	57151	50549	48549	50124	54410	49202
<b>Products total</b>	6496	5395	16579	12393	8602	5312	17631	14906	9048	6155	15069	11214
Agriculture	14815	16008	17954	15892	24758	34771	38618	34838	38880	43365	38042	34838
Industries	135	50	53	55	104	116	117	120	63	86	60	70
Construction industry	130	164	1234	132	153	417	371	268	290	300	304	280
Trade, catering	<b>84365</b>	<b>89073</b>	<b>94396</b>	<b>95657</b>	<b>99713</b>	<b>95088</b>	<b>88643</b>	<b>77146</b>	<b>68936</b>	<b>67186</b>	<b>64044</b>	<b>60153</b>
<b>Goods total</b>	2496	2029	2771	3892	2709	1615	2196	2284	1804	1122	1206	1137
Agriculture	11019	6358	4805	5642	7191	7055	6363	6313	7851	7038	7150	6313
Industries	44	30	33	59	102	122	120	178	143	286	86	148
Construction industry	69270	74936	80810	80281	83226	80033	73325	63869	55753	53604	50223	46998
Trade, catering												

Source: Czech Statistical Office, Prague.

**Table 7A Gross profits - Czech Republic Total**  
(Figures 14 and 15)

	90/Q1	90/Q2	90/Q3	90/Q4	91/Q1	91/Q2	91/Q3	91/Q4	92/Q1	92/Q2	92/Q3	92/Q4	93/Q1	93/Q2
	(mil. CSK/CK)													
<b>Profits (+), losses (-) total</b>	22395	28979	29153	52334	54710	36777	27425	11882	25627	17213	32302	19728	22096	19782
Agricultural Industries	-1240	1912	9237	-970	-3955	3920	3777	-3267	-4051	-4799	-1952	-560	-3644	-4590
Extractive industry	17483	17788	11467	21860	47171	19995	44232	21125	30728	21289	26502	23817	36977	19167
Processing industries									2858	837	410	2138	2877	470
Electricity, gas and water									12560	12588	12465	10979	10415	10898
Construction industry	632	2419	2177	698	722	1365	857	-20	-213	581	1178	271	-87	1978
Trade, catering	3660	4713	4682	6572	6748	3665	1755	-45	-1	1137	1739	1647	333	1072
Transportation, storing and communication	876	997	688	-477	3611	-6034	-1359	-4094	-1379	-1237	-146	-2243	-2570	805
Miscellaneous									596	10	863	433	735	576

Source: Czech Statistical Office.

**Table 8A Production of Goods in Selected Industries**  
(Figure 16)

<b>Industry</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>
Fuel	99.8	96.6	92.8	96.5	85.6
Electricity and heat	102.4	101.4	96.8	97.2	96.6
Metallurgy	100.6	99.9	97.9	74.7	54.3
Non-ferrous metallurgy	102	101.1	94.3	54.2	36.2
Chemical and rubber	102.4	100.4	93.2	76.9	77.2
Mechanical engineering	102.4	102.1	97.4	71.2	50.8
Electr. engin. and electronics	105.3	102.7	91.8	61.2	49.5
Building materials	104.4	100.4	95.3	70.1	56
Wood-working	102.8	99.8	96.8	75.3	52.5
Metal-working	103.3	102	102	66.7	49.9
Paper and pulp	102.8	102.6	101.2	72.6	64.4
Textiles	102.1	101.3	100.4	65	51.2
Clothing	101.8	102.8	93.1	59.7	48.6
Food and seasoning	99.9	102.6	97.6	82.9	82.3

*Source:*

Selected Economic and Social Development Indicators of the Czech Republic, Czech Statistical Office, 1993/3

*Notes:*

- 1) In 1992 a new Branch Classification of Economic Activities (OKEC) was introduced.
- 2) This classification is not compatible with a former one (called JKPOV).
- 3) Till 1990 indexes of gross production, since 1.1.1991 indexes of production of goods.
- 4) Mechanical engineering till 1989 incl. electrical engineering, electronic industry, and metal-working industry.

**Table 9A Exports and Imports by Commodity Groups**

(Figures 17 - 22)

	1989	1990	1991	1992	1993/1-8	1993/1-6		1989	1990
<i>In relative terms</i>							<i>In absolute terms</i>		
<b>Exports total</b>	<b>162.1</b>	<b>162.5</b>	<b>233.6</b>	<b>247.9</b>	<b>228.9</b>	<b>165.6</b>	<b>Exports total</b>		
Food, animals	4.9	5.4	7.9	8.1	6.1	6.1	Food, animals	7.9	8.8
Beverages and tobacco	0.4	0.5	0.9	0.7	1.2	1.2	Beverages and tobacco	0.6	0.8
Crude materials	3.3	3.3	5.7	6.5	6.6	7.0	Crude materials	5.3	5.4
Fuel	6.3	4.9	5.5	5.7	6.5	6.6	Fuel	10.2	8.0
Animals, plants	0.2	0.4	0.2	0.1	0.1	0.1	Animals, plants	0.3	0.7
Chemicals	6.5	7.9	9.9	9.2	8.5	7.8	Chemicals	10.5	12.8
Intermediate manufactured product	20.5	24.4	28.1	32.3	31.8	32.8	Intermediate manufactured product	33.2	39.7
Machinery and transport equipment	40.1	37.7	30.4	25.4	28.2	27.8	Machinery and transport equipmen	65.0	61.3
Miscellaneous manuf. articles	13.8	12.9	11.4	12	11.0	10.5	Miscellaneous manuf. articles	22.4	21.0
Other com. and products of trade	4	2.6	0	0	0.0	0.1	Other com. and products of trade	6.5	4.2
	100	100	100	100	100	100		162.1	162.5
<i>In relative terms</i>							<i>In absolute terms</i>		
<b>Imports total</b>	<b>162.2</b>	<b>176.2</b>	<b>208.8</b>	<b>290.5</b>	<b>223.6</b>	<b>164.7</b>	<b>Imports total</b>		
Food, animals	6.9	5.9	6.7	6.2	6.1	7.2	Food, animals	11.2	10.4
Beverages and tobacco	0.7	0.9	1.5	1.4	1.2	1.2	Beverages and tobacco	1.1	1.6
Crude materials	7.1	6.8	7.3	5.9	5.4	5.3	Crude materials	11.5	12.0
Fuel	21.9	17.9	24	15.6	12.2	12.5	Fuel	35.5	31.5
Animals, plants	0.4	0.7	0.5	0.3	0.3	0.3	Animals, plants	0.6	1.2
Chemicals	7.9	9	10.4	9.9	11.9	11.8	Chemicals	12.8	15.9
Intermediate manufactured product	10	11.1	9.6	10.4	16.2	16.4	Intermediate manufactured produc	16.2	19.6
Machinery and transport equipment	27.7	30.8	32.4	41	34.6	34.5	Machinery and transport equipmen	44.9	54.3
Miscellaneous manuf. articles	12.3	11.8	7.5	9.3	10.9	10.7	Miscellaneous manuf. articles	20.0	20.8
Other com. and products of trade	5.1	5.1	0.1	0	1.2	0.1	Other com. and products of trade	8.3	9.0
	100	100	100	100	100	100		162.2	176.2

**Sources:**Selected Economic and Social Indicators of the Czech Republic, 1993/3  
Foreign Trade, August, 1993Odhad tvorby a uziti hrubeho domaciho produktu 1. a 2. ctvrtleti 1993, September 1993  
All: Czech Statistical Office, Prague.own computations  
\* extrapolation



**Table 10A Potential Output in Industry**  
(Figures 27,28,29)

	Mar 90	Jun	Sep	Dec	Mar 91	Jun	Sep	Dec	Mar 92	Jun	Sep	Dec	Mar 93	Jun
Production in industry	101.9	98.6	95.5	102.6	80.8	69.6	65	65.3	63.1	62.5	66.4	66.2	58.9	57.9
Employment in industry	1990	1988	1960	1917	1705	1668	1639	1613	1542	1548	1535	1522	1438	1426
Productivity*	5.121	4.960	4.872	5.352	4.739	4.173	3.966	4.048	4.092	4.037	4.326	4.350	4.096	4.060
1990 average productivity**	5.076	5.076	5.076	5.076	5.076	5.076	5.076	5.076	5.076	5.076	5.076	5.076	5.076	5.076
Productivity adjusted	1990	1988	1960	1917	1705	1668	1639	1613	1542	1548	1535	1522	1438	1426
Employment (non)adjusted - A -(0,0)***	1890.5	1888.6	1862	1821.2	1500.4	1467.8	1442.3	1419.4	1357	1362.2	1350.8	1339.4	1265.4	1254.9
Employment adjusted - B - (5.7)***	1791	1789.2	1764	1725.3	1329.9	1301	1278.4	1258.1	1202.8	1207.4	1197.3	1187.2	1121.6	1112.3
Employment adjusted - C - (10.12)***	101.0	100.9	99.5	97.3	86.5	84.7	83.2	81.9	78.3	78.6	77.9	77.3	73.0	72.4
Potential output estimate - A	96.0	95.9	94.5	92.4	76.2	74.5	73.2	72.1	68.9	69.1	68.6	68.0	64.2	63.7
Potential output estimate - B	90.9	90.8	89.5	87.6	67.5	66.0	64.9	63.9	61.1	61.3	60.8	60.3	56.9	56.5
Potential output estimate - C	101.0	100.5	99.2	94.4	89.5	84.8	83.2	81.1	79.6	78.3	77.9	76.1	74.2	72.6
Potential output moving average - est. - A	95.9	95.4	94.3	87.7	81.0	74.6	73.3	71.4	70.0	68.9	68.6	66.9	65.3	63.9
Potential output moving average - est. - B	90.9	90.4	89.3	81.5	73.7	66.1	64.9	63.3	62.1	61.0	60.8	59.3	57.9	56.6
Potential output moving average - est. - C	1.062	1.033	1.013	1.170	0.997	0.933	0.887	0.915	0.901	0.908	0.968	0.989	0.902	0.906
Output gap in industry														

**Notes:**

\* based on index

\*\* average of quarterly data for 1990

\*\*\* for 1990 we assume (X,...)% of over-employment

for 1991-1993 we assume additional (...)% of over-employment for labor hoarding plus lower labor utilization

**Sources:**

Production in industry: Bulletin of the Czech Statistical Office, September 1993.

Employment in industry: Figures Reflecting the Czech Economy, 5/1993.

Own computations.