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Output performance under central planning: a model of poor incentives

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Abstract

Centrally planned economies tend to be less efficient than economies in which agents are free to choose their output targets, as well as the means to meet them. This paper presents a simple model of planner–manager interactions and shows how planned economies can end up in a low-effort, low-output equilibrium even though they may have started in a high-effort, high-output equilibrium.

JEL classification: D73; O41; P21

Keywords: Central planning; Incentives; Output

1. Introduction

Centrally planned economies are usually less efficient than those economies in which agents are free to choose their output targets, as well as the means to meet them. Indeed, in the long run, market economies have outperformed command ones by a wide margin. However, disagreements remain regarding why most of these economies grew fast initially after planning was introduced, but slowed down later? We argue that a hypothetical optimal contract could not be implemented, since penalties for underperformance could not easily be applied. This is our point of departure from traditional models of planned economies that attribute the worsening of output performance to poor investment decisions, coordination problems under central planning and disproportionally large military expenditures.

We model an economy in which the planner may not be able to offer sufficient incentives to firm managers to sustain high-effort, high-output outcomes, and, as a result, managers

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switch to low effort, leading to low-output outcome. The planner and firms are mutually dependent, that is, they lose if either plan targets are missed or these targets are set too low. We construct a simple model of planner–firm manager interactions and show how such an economy may end up in an inefficient, low-effort equilibrium. The model is consistent with the empirical evidence from eight central and eastern European (CEE) countries during 1948–1989, namely, that the growth decline was systemic in nature.

The paper is organized as follows. First, we review the selected literature and stylized facts of planned systems, paying particular attention to CEE countries and their growth deceleration. Second, we formulate a model specifying the objective functions of the planner and firm managers, discuss the contract between them, and assess the output and welfare implications.

2. Centrally planned economies: why are they inefficient?

One of the main debates of the 20th century was about the economic efficiency of planned economies, and the comparative analysis was mostly seen as a competition between the capitalist West and communist East. However, the latter generalization means little—the actual institutional structures differed markedly both among individual planned economies (say, the USSR versus Yugoslavia) and over time (say, Hungary in the 1950s versus Hungary in the 1980s). At the same time, these systems have had a lot in common in general terms; this debate has been about the economics of bureaucracy, as discussed in Olson (2000). For example, the literature on information sharing between a regulator and a firm in a market economy (Baron and Besanko, 1984) is a mirror image of the "optimal tautness" literature on planning (Hunter, 1961; Keren, 1991).

How do we define planned systems? Unlike in market systems, where the profit motive is the driving force, in planning systems the issue is how administrative pressure applied by the planner affects effort exerted by firms. We argue that in these systems the state either owns the means of production or at least has control over long-term investment decisions, and resources are allocated predominantly—but not necessarily exclusively—through planning. As a result, firms and consumers have a narrower set of permissible activities than agents in market economies. In the next part, after outlining the CEE postwar growth record, we discuss the competing theories of the growth decline and describe the institutional setting of our model.

2.1. Central and eastern European economies: the output record during 1949–1989

Fast output growth in the CEE economies (Bulgaria, Czechoslovakia, Hungary, Poland, the German Democratic Republic (GDR), Romania, the USSR, and Yugoslavia) following postwar recovery and nationalization lasted less than two decades. A few basic observations warrant attention. First, the rate of growth of output measured by the net material product (NMP) was high at the beginning of the period. Despite being denied access to their previously dominant foreign markets, missing out on transfers under the Marshall Plan, and having to reengineer their economies, the eight CEE countries started with NMP growth rates averaging in the double digits in the early 1950s (Fig. 1). Even after taking into

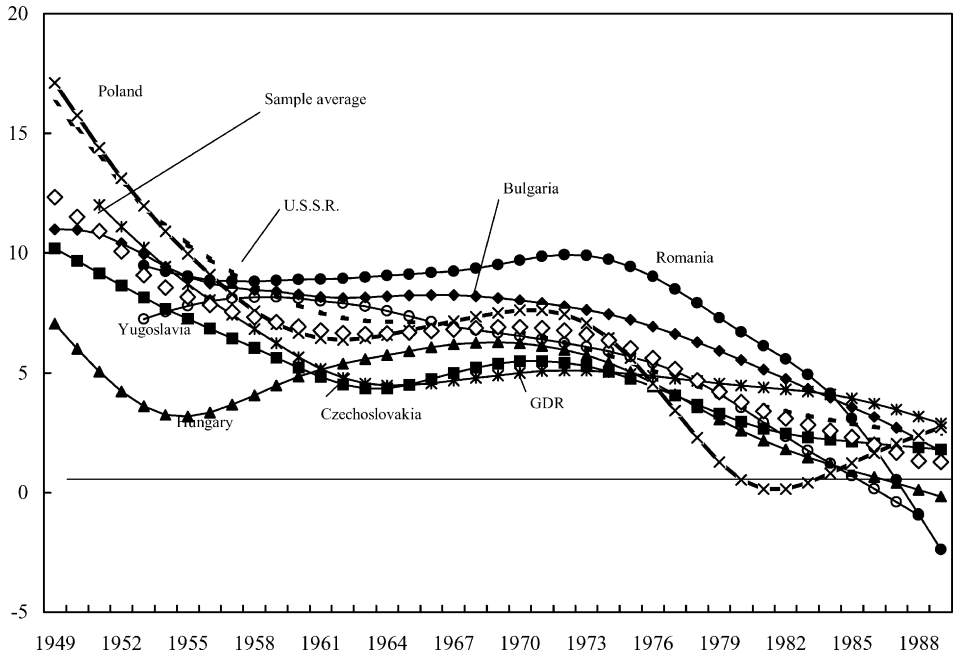

Fig. 1. Selected countries: trends in net material product, 1949–1989 (Hodrick–Prescott filter, annual percentage change). *Source*: United Nations (various dates), World Bank (1993), authors' calculations.

account measurement problems,[1] the available data show that output of the CEE countries grew faster than in most developed market economies in 1950–1965 (Murrell and Olson, 1991). Second, the rates of growth began to decline some 10–15 years after the introduction of planning. Third, all economies grew at closely correlated rates and the major turning points were essentially identical for all of them.

In the 1960s and early 1970s, the average rate slowed to about 5–8% and, thereafter, decelerated gradually to nil in 1988–1989. At the same time, population grew modestly, and capital accumulation remained high, hence, the decline was attributable to a negative trend in total factor productivity (Pollard, 1991). On average, the rate of growth deceleration was between −0.1 and −0.2 percentage points per annum during the 1949–1989 period. It is worth noting that the growth decay began long before the first oil shock and the rate of growth declined in both oil-exporting and -importing countries.

Could the USSR growth slowdown explain the performance in the rest of the CEE countries? We are not convinced. First, Brixiová and Bulíř (2001) observed that the cyclical fluctuations of the Soviet output were uncorrelated with all but a few CEE countries. Second, it is unclear through which channels the shocks would propagate. As shown by Ickes

[1] First, the CEE countries may have overestimated real output figures. According to Havlik (1983), the true real rate of growth of NMP was on average lower by some 1–2 percentage points than that published officially, owing to improperly estimated price indices. However, as Leamer and Taylor (1999) documented, it is unlikely that this bias was more prevalent in the 1950s than, for example, in the 1980s.

(1990a), intra-regional trade fluctuations were not causing growth fluctuations, owing, in part, to infrequently adjusted prices and exchange rates, and negotiated volumes of trade. Finally, the political cycles of individual CEE countries were unsynchronized (Adam, 1989).

2.2. What else may explain the gradually worsening output performance in the CEE countries?

Several explanations were put forward. The initial growth spur was attributed to massive factor mobilization following nationalization of most industries, that is, the so-called extensive growth policies.[2] The eventual deceleration is then attributed to the exhaustion of the initial factor stimulus, poor macroeconomic policies (Brada, 1989), the slow adjustment to the oil and debt-crisis shocks (Murrell, 1990), excessive defense spending (Landau, 1994), credit shocks (Bulíř, 1998), and so on. However, relatively strong output performance was sustained into the early 1970s, two decades past the initial factor mobilization, and bad policies were present throughout the sample period.

Others argued that the planned economies overinvested in fixed capital and that low substitution between capital and labor caused "acute diminishing returns to capital".[3] Although the "overinvestment" model fits time series of some countries reasonably well (for example, the USSR or Czechoslovakia),[4] the growth performance in the 1950s was exceptional even after controlling for investment (Easterly and Fischer, 1995).[5] These theories did not, however, examine optimizing behavior of agents in these economies and, hence, they explained neither why and how the particular type of technology was chosen, nor who chose it.[6]

Yet another group of economists focused on the coordination problem of central planning (von Hayek, 1940), stressing the problems entailed in introducing and evaluating innovations. A version of this explanation is Kornai's (1980) concept of shortage, where growth rates under central planning have come down because producers could not find inputs in the quality or variety they needed.[7] These theories are silent on why it took 20 or so years for the rate of growth to slow down, or why the rate of growth declined in all countries, irrespective of their innovation cycle or the severity of shortages (Dlouhý, 1990).

Most of the above explanations are missing a framework that would tie together the effects of economic policies and institutional features of the planning system and allow

[2] Unsustainability of the "extensive growth" policies without technological progress was recognized as early as in the late 1950s by policymakers in the CMEA countries (Adam, 1989). Weitzman (1970) and Ofer (1987) provide theoretical underpinning of the extensive growth model.

[3] Sapir (1980) and Rusek (1989) estimated the elasticity of substitution of production factors for Yugoslavia and Czechoslovakia at about 0.1. These estimates contrast with the almost unitary elasticity found in other extensively growing, but non-socialist countries (see Easterly and Fischer (1995) for a review).

[4] See, for example, Easterly and Fischer (1995). While the low-quality investment had positive temporary demand effects, it did not result in accumulation of sufficiently productive capital and eventually slowed down the rate of growth of potential output.

[5] Hernández-Catá (2000) demonstrated the ambiguous impact of investment in the case of Cuba: the total factor productivity component can dominate the medium-term rate of growth.

[6] In several CEE countries, the firms themselves made some of the technology decisions and small-scale investment was completely decentralized during the 1980s. Parsons (1986) and Bulíř (1995) discussed this feature for the GDR and Czechoslovakia, respectively.

[7] See Banerjee and Spagat (1991, 1992) for some theoretical models.

welfare analysis. The exceptions include Keren (1991, 1993): we extend his framework by introducing technological progress, which allows us to examine how the centrally planned economies evolved over time.

3. An economy where everybody wants to meet the targets

3.1. Stylized facts

In this section, we summarize stylized facts about the planner–manager relationship that we explore formally in the following sections. First, the planning authority knew neither the true production functions of individual firms nor their capacity utilization. Firms had a vested interest to hide this information to ensure both contemporaneous and future plan compliance, and the planner possessed only a rudimentary monitoring technology. Although this is a well-known feature of planned economies, many models assumed some Bayesian learning processes through which the planner can eventually learn the firms' true production functions. In contrast, we assume that the planner knew only the distribution of production functions in the economy as a whole.

Second, the planner was concerned about compliance as much as the individual firms because he was penalized for economy-wide underperformance. Hence, the planner was motivated to set the plan such as to minimize the risk of missing the plan targets.[8] Consequently, we see the planner as a selfish agent maximizing his own utility by keeping a portion of output for himself as opposed to maximizing "welfare of the people". At the same time, plan targets had to be above some threshold, such as last year's output. On the one hand, poorly designed plans, or even unsuccessful plans owing to exogenous shocks, had ruinous effects for their authors: from executions in the 1920s USSR to more gentle career consequences later on. On the other hand, very few annual or 5-year plans were officially declared off track. There is ample evidence that either the plan targets were lowered halfway through the planning period,[9] or the actual, firm-level outturn was falsified, with the tacit approval of the planner.[10] This was possible, of course, only because both planners and firm managers belonged to the same elite.

Third, penalties for underperformance declined over time. Who would punish firms for underperformance and the planner for poor plans, and can an "optimal punishment" be devised? In most of these countries, either a dictator or a collective body oversaw the economy and set penalties. The penalties were quite harsh initially, however, the ruler(s) soon recognized the declining effectiveness of intimidation as managers were not willing to accept responsibility for risky projects. The empirical literature unambiguously suggests that

[8] This argument has somehow never become a part of mainstream thinking about planned economies. See Brada (1978), Hlaváček (1990), or Ickes (1990b) for risk minimizing behavior under planning.

[9] See Keren (1982) for evidence on ex post adjustments, both down and up, of macroeconomic planning targets in the GDR.

[10] Mlčoch (1990) described the so-called planning games used in the former Czechoslovakia to fulfill formally the plan at the margin (price changes, changes in structure of output, overinvoicing, end-period inventory repurchase agreements, etc.). The planning games are an analogue to the "storming" pattern of enterprise behavior (Alexeev, 1991).

the penalty for non-performance declined both in relative and absolute terms as exhibited, for example, by bureaucrats' tenure (Faith and Short, 1995) or by the manager's share of total income (Mlčoch, 1990).[11] This is a crucial fact that we utilize in our model.

Fourth, planning, by definition, limited the set of permissible activities and hence—following the increase in personal consumption—offered comparatively low return to effort. After achieving the average, "guaranteed" standard of living, managers and workers had little chance of wealth accumulation as "law abiding citizens".[12] In the end, all CEE economies had compressed distributions of personal incomes—their Gini coefficients were some one-half of their value in countries with comparable GDP per capita (Milanovic, 2001).

3.2. The framework

Leaving aside the direct role of the ruler (the Party), the economy in our model consists of two types of agents: a large number of managers (M) with population normalized to 1, and one planner (P).[13] All agents live for two periods ($t = 1, 2$), and have the same risk-neutral preferences $\sum_{t=1}^{2} E(c_t^i)$, where c_t^i is the consumption of a single good in period t by an agent $i = (\mathrm{M}, \mathrm{P})$ and E denotes expectation formed at the beginning of each period. Agents are endowed with an amount w of the consumption good in each period.

At the beginning of each period, managers choose how much effort (x_t) they will put into production. This costs them γx_t units of consumption good, where $0 < \gamma < 1$. The effort, known only to the manager, can take on two values: high (H), where $x_t = 1$ or low (L), where $x_t = 0$. In period t, each manager can produce output y_t using x_t amount of effort according to a production function:

$$y_t = \phi_{x(t))} z_{\mathrm{H}(t)} + (1 - \phi_{x(t)}) z_{\mathrm{L}(t)}, \tag{1}$$

where $\phi_{x(t)}$ denotes probability, conditional on the effort x, that the output is high ($z_{\mathrm{H}(t)}$) and $(1 - \phi_{x(t)})$ that it is low ($z_{\mathrm{L}(t)}$), where $z_{\mathrm{H}(t)} > z_{\mathrm{L}(t)} > 0$. Hence, ϕ_{H} is the probability of output being high, given high effort, and ϕ_{L} is the probability of output being high in period t, given low effort, where $\phi_{\mathrm{H}} > \phi_{\mathrm{L}}$. Also, $\phi_{x(t)}$ is i.i.d. variable.

The economy experiences exogenous technological progress (ε) between periods 1 and 2. In period 1, managers produce output z_{H} in "high-output state", and output z_{L} in "low-output

[11] The evidence also suggests that the planner had limited control over workers' consumption—wages in percent of NMP were increasing in all countries during this period.

[12] Once a manager or worker received his (state-owned) accommodation, bought his (the only available) car, and perhaps also built his weekend cottage, he knew that he had reached his bliss point, as additional effort would yield some extra income for which the worker would have little use. At that point the value of leisure increased dramatically: shirking was widespread in the CEE economies (Mlčoch, 1990).

[13] It is possible to argue that the agents (managers) faced two principals: the ruler (Party) and the planner. In our view, the inclusion of the Party as an additional principal adds little to the problem. Even if the ruler decided the policies, it would have to rely on the planner to implement them, including plan design. The agency problem arose because the Party would not be able to observe the actions of the planner, who was under pressure from the ruler to design a taut plan and from managers to design a soft plan (see Spiller (1990) for the general case of multiple-principal agency theory and Klaus and Tříska (1989) for analysis of two competing principals). We reflect the way the Party dealt with the agency problem by imposing a fine on the planner if the planned targets he/she set were too low. We leave issues of corruption, where managers bribe the Party to get away with low targets, and/or managers colluding with the planner to misreport the actual outturn for future research.

state". In period 2, managers produce $z_H + \varepsilon$ in "high-output state" and $z_L + \varepsilon$ in "low-output state", that is, output increases between periods 1 and 2 by ε in both high- and low-effort states. Since this technological progress is the only difference between periods 1 and 2, we suppress the time subscript from now on.

In every period, each manager then chooses consumption (c^M) and effort (x) to solve the following consumption problem:

$$\max_{c,x} E(c^M), \tag{2}$$

subject to:

$$c^M + \gamma x \leq w + \lambda\{x[\phi_H z_H + (1-\phi_H)z_L] + (1-x)[\phi_L z_H + (1-\phi_L)z_L]\},$$

where λ is the share of output that the manager can keep.

Prior to the beginning of each period, the planner chooses a contract to maximize his consumption. The contract is a set of explicit payoffs (output shares) to the manager, conditional on the publicly observable output, and a set of residual payoffs to the planner. Contracts can take many forms, some of them very complex. In reality, most CEE countries used a simple version of the linear contract and we focus on this particular type of arrangement. It is a couple $s = (s_H, s_L)$ determining payoffs to the planner as $s^P = [(1-\lambda)z_H, (1-\lambda)z_L]$, where λ $(0 \leq \lambda \leq 1)$ is the share of output that the manager can keep.[14]

The planner has an obligation to announce publicly a planned aggregate output ($\hat{Y}$), and this information is used by the public to monitor output performance ex post. Since the contracts designed by the planner are incentive compatible and the aggregate production technology is public information, the planner knows what effort managers will put into production and to what aggregate output such effort would lead; consequently, the actual output ($\bar{Y}$) equals the plan.[15]

In deciding the payoffs, the planner is constrained by several requirements. First, managers' individual consumption must stay above their reservation level (c_{min}) in both periods.[16] Second, if the plan/output is below its potential, the planner pays a fine τ. We assume that the fine, which can be interpreted as a punishment for "failing the trust" of the ruler, is exogenous and identical in both periods.[17] The fine is a deadweight loss for both the planner and

[14] In reality, the share of output collected by the planner $(1-\lambda)$, is not necessarily consumed by the planner himself; he probably collects only its portion (α). For simplicity, we set α to 1 and $(1-\lambda)$ then represents a share of output confiscated by the state.

[15] As mentioned earlier, the model abstracts from monitoring problems and corruption. Two plausible problems could be: (i) managers producing high output do not surrender the adequate shares, an analogue of tax evasion; and (ii) high aggregate output is produced, but managers and the planner collude to announce to the ruler that low output was produced and split the difference.

[16] We restrict parameters to $c_{min} > w > \gamma > 0$, where c_{min} is the managers' reservation consumption. This guarantees that the endowment of a manager is high enough to cover cost of high effort, but too low to cover minimum consumption, hence giving him an incentive to produce.

[17] The potential aggregate output in period t is the aggregate output under high effort. As discussed earlier, we believe that the assumption of a fixed fine corresponds well to the reality of planned economies. Fines were neither increasing in time nor fixed as ratios of total output. In determining the size of the fine, the planner was limited by political–economy constraints. Hypothetically, two types of fine are possible: for setting too low targets, corresponding to our τ, and for not meeting the plan ($\hat{Y} < \bar{Y}$). In our model, however, the plan is always met and the second fine is never imposed.

managers and neither of them could benefit from its proceeds—the output is "wasted" (say, used to build bigger Party headquarters). The planner thus chooses his consumption (c^{P}) and managers' payoffs (λ) to solve the following:

$$\max_{c,\lambda} c^{\mathrm{P}}, \tag{3}$$

subject to:

$$c^{\mathrm{P}} + \gamma x \leq w + (1-\lambda)\{x[\phi_{\mathrm{H}} z_{\mathrm{H}} + (1-\phi_{\mathrm{H}}) z_{\mathrm{L}}] + (1-x)[\phi_{\mathrm{L}} z_{\mathrm{H}} + (1-\phi_{\mathrm{L}}) z_{\mathrm{L}}]\} - \tau,$$

and subject to manager's condition on minimum consumption: $c^{\mathrm{M}} \geq c_{\min}$.

The model is closed with two market clearing conditions. The first condition states that in both periods the aggregate consumption of managers and the planner equals the aggregate endowments and net production:

$$c^{\mathrm{P}} + c^{\mathrm{M}} \leq 2w + x[\phi_{\mathrm{H}} z_{\mathrm{H}} + (1-\phi_{\mathrm{H}}) z_{\mathrm{L}}] + (1-x)[\phi_{\mathrm{L}} z_{\mathrm{H}} + (1-\phi_{\mathrm{L}}) z_{\mathrm{L}}] - \tau. \tag{4}$$

The second condition states that the sum of shares of managers producing high output (m_{H}) and managers producing low output (m_{L}) equals the total supply of managers, where:[18]

$$m_{\mathrm{H}} = \begin{cases} \phi_{\mathrm{H}}, & \text{if } x = 1, \\ \phi_{\mathrm{L}}, & \text{if } x = 0. \end{cases}$$

Formally,

$$m_{\mathrm{H}} + m_{\mathrm{L}} = 1. \tag{5}$$

The equilibrium in this model is defined as the allocation of consumption and managers, and a set of payoffs to managers such that: (i) taking the set of payoffs as given, managers choose each period how much effort (x) to put into production in order to maximize their utility of consumption; (ii) knowing the behavior of managers, the planner chooses each period the set of payoffs (λ) to maximize his utility; and (iii) the markets for managers and products clear.

3.3. Characterization of equilibrium

By solving the managers' maximization problem, we find that high effort ($x = 1$) is the optimal choice when:

$$\lambda(\phi_{\mathrm{H}} - \phi_{\mathrm{L}})(z_{\mathrm{H}} - z_{\mathrm{L}}) \geq \gamma. \tag{6}$$

In other words, high effort is optimal only if the marginal benefit of higher consumption from the extra effort, $\lambda(\phi_{\mathrm{H}} - \phi_{\mathrm{L}})(z_{\mathrm{H}} - z_{\mathrm{L}})$, exceeds the marginal cost of that effort (γ).

[18] Note that since the population of managers is normalized to 1 and all managers are identical, the probability of each manager producing high output given the effort x (ϕ_x) also represents the portion of all managers producing high output.

The planner chooses λ, taking behavior of managers, described by (3), as given. His choices are two-fold. First, the planner can select the smallest share of output that would stimulate managers to achieve high−effort output, that is:

$$\lambda_{\mathrm{H}} = \frac{\gamma}{(\phi_{\mathrm{H}} - \phi_{\mathrm{L}})(z_{\mathrm{H}} - z_{\mathrm{L}})}. \tag{7}$$

On the aggregate level this would lead to achieving the potential output in both periods, however, the planner gets a smaller share of a bigger pie. Output is higher, but the planner leaves a bigger share of it to managers.[19]

Second, the planner can select the lowest share of output guaranteeing reservation consumption of managers ($\lambda_{\min}$). By offering low-effort incentives, the planner gets a larger share of a smaller pie:

$$\lambda_{\min} = \frac{c_{\min} - w^{\mathrm{M}} + \gamma}{z_{\mathrm{L}}}. \tag{8}$$

How will the planner decide? Obviously, the planner will provide high-effort incentives (the first option) if the loss of share of output to the planner caused by higher λ is compensated for by a higher aggregate output accruing to him. Formally, the following must be true for the planner to choose the high-effort option:

$$(1 - \lambda_{\mathrm{H}})Y_{\mathrm{H}} \geq (1 - \lambda_{\min})Y_{\mathrm{L}} - \tau, \tag{9}$$

where $Y_{\mathrm{H}} = \phi_{\mathrm{H}} z_{\mathrm{H}} + (1 - \phi_{\mathrm{H}})z_{\mathrm{L}}$ and $Y_{\mathrm{L}} = \phi_{\mathrm{L}} z_{\mathrm{H}} + (1 - \phi_{\mathrm{L}})z_{\mathrm{L}}$. In other words, the planner provides high-effort incentives and announces an output plan consistent with those incentives if and only if the fine for the low output is bigger than the difference between the planner's shares of output under low effort and high effort:

$$\tau \geq \lambda_{\mathrm{H}} Y_{\mathrm{H}} - \lambda_{\min} Y_{\mathrm{L}} - (\phi_{\mathrm{H}} - \phi_{\mathrm{L}})(z_{\mathrm{H}} - z_{\mathrm{L}}). \tag{10}$$

In this model, three output outcomes therefore can occur in equilibrium. First, high aggregate output is produced in both periods (H, H). Second, low aggregate output is produced in both periods (L, L). Finally, high aggregate output is produced in the first period, but low aggregate output is produced in the second period (H, L).[20] These outcomes depend on the parameters of the model and, consequently, on the shares of output that the planner offers to the managers. While the (H, H) outcome has been the goal of planning, we focus on the outcome in which the managers reduce their effort in the second period (H, L).

The case when high aggregate output is produced in the first period but low output is produced in the second period is relevant for explaining the growth slowdown that has occurred in the centrally planned economies. Under this scenario, the planner is more concerned about expanding his output share than expanding output itself. The following condition must hold:[21]

[19] In case condition (7) would not guarantee minimum consumption for the managers, λ would become $\lambda = (c_{\min} - w + \gamma)/z_{\mathrm{L}}$.

[20] It can be shown that a combination of low-effort incentives in the first period and high-effort incentives in the second one (L, H) is not an equilibrium outcome.

[21] Note that since the difference $z_{\mathrm{H}} - z_{\mathrm{L}}$ is identical in both periods, λ_{H} remains constant. However, since output increases over time (due to technological progress), $\lambda_{\min}$ is lower in period 2 than in period 1.

$$\lambda_{\mathrm{H}} Y_{\mathrm{H}(1)} - \lambda_{\min(1)} Y_{\mathrm{L}(1)} \leq \tau + (z_{\mathrm{H}} - z_{\mathrm{L}})(\phi_{\mathrm{H}} - \phi_{\mathrm{L}}) < \lambda_{\mathrm{H}} Y_{\mathrm{H}(2)} - \lambda_{\min(2)} Y_{\mathrm{L}(2)}, \quad (11)$$

that is, in the second period, the fine for producing low output is smaller than the planner's share of extra output under high effort.

What is the driving force behind this switching of effort/output from high to low? In our model aggregate output (Y) and its share to be allocated to managers (λ) are functions of technological progress (ε). Technological progress may increase aggregate output and decrease managers' reservation share of output ($\lambda_{\min}$), so that the planner's additional share of output exceeds the fine associated with low effort.[22] To summarize, the high effort necessary for maintaining high-output performance is generated only by the allocation of sufficiently large shares of output to managers. If either the managers' "reservation consumption" decreases or if the fine that can be imposed on the planner for low output declines, the economy may end up in the low-effort equilibrium. Also, other things being equal, the economy is likely to switch from a high-effort outcome in the first period to a low-effort outcome in the second period, provided the technological progress has been sufficiently strong to satisfy the managers' reservation consumption, even at low-effort output.

Finally, we examine the welfare implications of the high- and low-effort equilibrium mix. We compare it to the optimal solution, which can be derived by maximizing the aggregate consumption subject to feasibility constraints, that is maximizing the aggregate consumption subject to (4) and (5). Solving this problem, it follows that high effort is optimal in both periods if the following condition is satisfied in both periods:

$$\frac{\gamma}{(\phi_{\mathrm{H}} - \phi_{\mathrm{L}})(z_{\mathrm{H}} - z_{\mathrm{L}})} \leq 1. \quad (12)$$

We stress two observations regarding the optimality of the equilibrium solution. First, the condition (12) is identical to a situation where the managers get the entire output, $\lambda = 1$. Hence, we find a range of parameters, where high effort would be the optimal solution, but managers put in low effort, $\lambda(\phi_{\mathrm{H}} - \phi_{\mathrm{L}})(z_{\mathrm{H}} - z_{\mathrm{L}}) < \gamma \leq (\phi_{\mathrm{H}} - \phi_{\mathrm{L}})(z_{\mathrm{H}} - z_{\mathrm{L}})$ (see Fig. 2). This is the result of managers receiving only a fraction λ of additional output while internalizing all the cost of additional effort γ. Paradoxically, the aggregate additional effort may be much smaller than the aggregate gain in output.

Second, since the condition (12) is identical in both periods, the effort must also be identical in both periods in the optimum, and hence the high-low equilibrium cannot be an optimal, output-maximizing solution. Defining $\sigma = z_{\mathrm{H}} - z_{\mathrm{L}}$, in the (H, L) equilibrium, the following condition holds: $\lambda_2(\phi_{\mathrm{H}} - \phi_{\mathrm{L}})\sigma < \gamma \leq \lambda_1(\phi_{\mathrm{H}} - \phi_{\mathrm{L}})\sigma$, where λ_1 denotes manager's share of output in period 1 and λ_2 share of output in period 2. While high effort is an optimal solution in both periods, given the share of output they receive in period 2, the managers put only low effort into the production during that period.

[22] A similar result would be caused by changes in other parameters, reducing $\lambda_{\min}$, such as an increase in the managers' endowment (w^{M}) a decrease in their reservation consumption ($c_{\min}$) or an exogenous decrease in γ (see Eq. (9)).

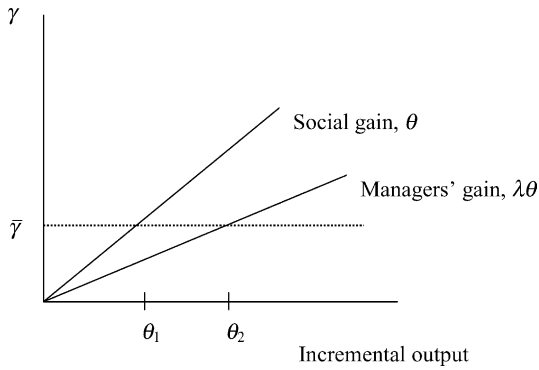

Fig. 2. Cost of effort–output relationship. *Notes*: Let $\theta = (\phi_H - \phi_L)(z_{H(t)} - z_{L(t)})$. For $\theta < \theta_1$, the cost of high effort ($\bar{\gamma}$) is larger than both the social gain of the incremental, high-effort output $(\phi_H - \phi_L)(z_H - z_L)$ and the share that goes to the managers, $\lambda(\phi_H - \phi_L)(z_H - z_L)$. Similarly, for $\theta > \theta_2$, γ is smaller than both the social and managers' gain. However, for $\theta_1 \leq \theta \leq \theta_2$, the social gain is larger than γ but smaller than the managers' gain.

3.4. Policy implications

Two main conclusions regarding behavior of the planner in centrally planned economies can be made based on our model. First, unless a sufficiently high penalty for offering low-effort incentives can be implemented, the planner would not set output targets leading to high effort (and high output) in the long run. Second, as long as the planner maximizes his own consumption, he may not be interested in formulating the socially optimal plan. We generalize that output targets in centrally planned economies are likely to have a medium- to long-term adverse impact on output performance as long as the planner tries to confiscate a large share of output and the fine imposed on the planner for underperformance vis-a-vis potential output relatively declines over time. Although high output could have been achieved hypothetically by fine-tuning the penalty, in reality there were severe limits to this option.

These results are consistent with the CEE countries empirical evidence. Not only was the state redistributing an increasingly larger share of output, but more and more of this redistribution was wasteful, such as subsidies to loss-making firms. At the same time, the punishment for underperformance declined over time.

4. Conclusions

Over time, planned economies proved to be less efficient than economies in which agents are free to choose their output targets as well as the means to meet them. Historically, market economies have outperformed command ones by a wide margin. However, economists agree relatively little on what is the main source of this difference. In this paper, we argue that the difficulties in implementing optimal contracts between the planner and managers contributed to the decline in output performance of planned economies.

We model an economic system in which the planner, under certain conditions, has strong incentives not to choose the ambitious plan. In particular, these conditions include sufficiently strong technological progress, an increase in the managers' reservation consumption, and, most importantly, a lack of sufficiently high penalty imposed on a planner for designing an incentive scheme leading to low effort/low output. Our model is consistent with the empirical evidence from eight CEE countries during 1948–1989, namely, that the growth decline was systemic in nature. An interesting future research would be to model explicitly the monitoring and corruption problems in planned economies.

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