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**Incomplete Contracts
and Privatization**

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Abstract: The paper offers a selective survey on the incomplete contracts approach to privatization. Furthermore, a simple model of privatization to an owner-manager is developed in which different allocations of ownership rights lead to different allocations of inside information about the firm which in turn affect allocative and productive efficiency. In this model, privatization is a commitment device of the government to credibly reward the manager for a successful cost reduction and to harden his budget constraint.

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1 Introduction

The 1980s and early 1990s witnessed a dramatic global shift in economic policy away from state-owned enterprises (SOEs) towards privatization. More than 80 countries have launched ambitious efforts to privatize most of their SOEs, a process which is far from being completed. One surprising fact about privatizations in the early 1980s is that they were undertaken largely on faith. There was hardly any theoretical analysis of the costs and benefits of privatized versus nationalized enterprises that could have served as a guideline for which enterprises should be privatized and how this should be done. Furthermore, the little empirical evidence available at the time was far from being conclusive.¹

In the meantime, a lot of progress has been made at the empirical front. The evidence suggests that in many (but not all) industries privatized firms are run more efficiently than SOEs. Furthermore, there are several studies assessing the postprivatization performance of privatized firms, showing that in most cases there have been substantial welfare improvements.² However, economic theory still finds it difficult to predict under what circumstances privatized firms will outperform SOEs. In fact, the hardest question seems to be why privatization matters at all.

This puzzle can be traced back at least to the debate on market socialism in the 1930s.³ It is most clearly expressed by Williamson's (1985) idea of selective intervention: The government always has the option to organize the firm in exactly the same way as a private owner would do, to give the same incentive schemes to managers and workers, and to deviate from this policy only if there is a possibility to strictly improve on the private owner's decisions (for example in order to correct for an externality). Hence, a nationalized firm should always be at least as efficient as a private firm.

A complementary idea has been put forward by Sappington and Stiglitz (1987). They argue that a privatized firm should always be at least as efficient as a SOE. They suggest the following privatization procedure: The government auctions a contract which entitles the highest bidder to run the privatized firm and to receive a payment for the firm's

¹See Megginson, Nash and van Randenborgh (1994).

²For surveys on the recent empirical literature see Boardman and Vining (1989), Donahue (1989), Galal, Jones, Tandon and Vogelsang (1992), and Megginson, Nash and van Randenborgh (1994).

³See Hayek (1935) and Lange (1936).

output which exactly equals its social valuation. Given this contract, the private owner will fully internalize all external effects of his production decision on society, and, since he wants to minimize costs, he will produce efficiently. This mechanism implements the efficient allocation even if the government has imperfect information about the firm's cost function. Furthermore, if the auction is competitive, the government will extract all the rents from this contract through the auction price ex ante.

Note that these arguments require a rational and well organized, but not a benevolent government. No matter what the government's objectives are, the arguments given above suggest an "irrelevance proposition": Whatever can be achieved with a SOE can also be achieved through privatization, and vice versa.⁴

However, this proposition rests on two implicit assumptions: First, unlimited side payments have to be feasible. Suppose, for example, that the government's objective is to achieve an inefficiently high level of employment in the firm. Paying a high subsidy to a private owner (in order to bribe him to increase his employment) may be more difficult than to pay the same subsidy to a SOE. This point has been emphasized by Shleifer and Vishny (1994). Second, and this is the focus of the present paper, it has to be possible to write complete contingent contracts which govern the entire lifespan of the firm at the stage of privatization (or nationalization). For example, Sappington and Stiglitz's privatization procedure requires to specify the social valuation of all future production of the firm in all possible states of the world in the contract when it is auctioned off. If this is not possible the private owner will refrain from making relationship specific investments because he foresees that the government will exploit the fact that investment costs are sunk in order to expropriate his quasi-rents.

If side-payments are feasible and complete contingent contracts can be written, then it is not surprising that the final allocation is unaffected by whether the firm is private or state owned. It is well known that any organizational mode can be mimicked by any other organizational mode through a complete contingent contract.⁵ Hence, if privatization makes a difference it must be due to the fact that only incomplete contracts are feasible

⁴Formal statements of such an "irrelevance proposition" can be found in Sappington and Stiglitz (1987, "Fundamental Privatization Theorem"), Shapiro and Willig (1991, Proposition 1), and Shleifer and Vishny (1994, Proposition 1).

⁵See Coase (1960), Williamson (1985), and Grossman and Hart (1986).

at the stage of privatization.

2 Incomplete Contracts Approaches to Privatization

The starting point of the incomplete contracts literature is the assumption that complete contingent long-term contracts cannot be written.⁶ Suppose that the future surplus that can be generated by the involved parties depends on the amounts of some non-contractible, relationship specific investments. The division of the quasi-rents from these investments cannot be controlled through a contract *ex ante* but will be determined solely by the *ex post* bargaining power of the involved parties. However, the allocation of bargaining power can be affected by the choice of an appropriate governance structure (e.g., the allocation of ownership rights, privatization versus nationalization, the allocation of voting rights, etc.). Hence, the governance structure matters because it affects the investment incentives of the involved parties.

In this section I will briefly discuss a few papers which try to adapt the incomplete contracts approach to the privatization context.⁷ All of these papers differ from Grossman and Hart's (1986) symmetric information framework in that they focus on an information asymmetry between the government on the one hand and the firm and/or its private owner on the other hand. The specific trade-offs analyzed in these papers are quite different from each other, however.

Laffont and Tirole (1991) consider the problem of a manager who can make a non-contractible, relationship specific investment which may be used in two different ways. It can either be used internally, in which case the manager derives a private benefit from his investment, or it can be used externally, in which case the manager's benefit is zero. Suppose that the investment is efficient and that the manager would invest if he received the private benefit. The government prefers the investment to be redeployed to some external use (for example because this is *ex post* efficient), while a private owner has

⁶The seminal paper in this literature is Grossman and Hart (1986). For a critical assessment of this assumption see Aghion, Dewatripont and Rey (1994) and Nöldeke and Schmidt (1995).

⁷This is not intended to be a comprehensive survey. The three papers I focus on have been written independently in 1990 and are probably the first in this literature.

no incentive to do so. Hence, the manager will not invest under nationalization because he rationally foresees that his investment will be expropriated, while he may invest in a privatized firm. This is the benefit of privatization. The cost is a common agency problem which arises if the government regulates the firm. The government and the private owner have incomplete information about the firm's cost function. They simultaneously offer incentive schemes to the manager which leads to a double marginalization problem with less managerial effort and a larger distortion of production than if the manager contracted only with the government. While this model offers a plausible trade-off for the costs and benefits of privatization, its main drawback is that it restricts the ex post bargaining possibilities. For example, the government is not allowed to bribe the private owner to redeploy the manager's investment. Nor is it possible for the government and the private owner to contract on which incentive scheme to offer to the manager.

Shapiro and Willig (1990) and Schmidt (1990) both argue that the government is less informed about a privatized than about a nationalized firm. For example, the British government presumably finds it more difficult to obtain detailed information about British Telecom now that British Telecom is a private company. The reason is that ownership of the firm gives privileged access to its accounting system. It is the owner who can manipulate transfer prices or choose among different depreciation methods in order to manipulate the information about his firm.⁸ In the terminology of Grossman and Hart (1986), access to inside information of the firm is not a specific right, which can be contracted away to some outsider, but rather a residual right of control which is tied together with ownership.

In both articles, Shapiro and Willig (1990) and Schmidt (1990), the cost of privatization is that the government has to pay an information rent to the private owner and that the optimal regulation scheme under asymmetric information will induce an inefficiently low production level. Nevertheless, both articles show that the government may deliberately choose not to be informed about the firm's cost structure.

In Shapiro and Willig (1990) the argument is that the regulator (who regulates the privatized or controls the nationalized firm) may pursue different objectives than the

⁸For a more detailed discussion of this point see Schmidt (1990). The importance of these "accounting contrivances" has been stressed by Williamson (1985, p. 139). See also Arrow (1975) and the excellent discussion in Riordan (1990).

“framer” (the government or parliament). The benefit of privatization is that if the regulator is less informed it is more difficult for him to pursue his private agenda. Thus, privatization is seen as a constraint on malevolent government agencies.

Schmidt (1990) develops an argument which does not require a malevolent government. He assumes that the manager of the firm is an empire builder who derives some private benefits from a higher production level. Suppose that the manager can make a relationship specific investment in order to reduce the firm’s future production costs. In order to improve his investment incentives the government would like to commit to a hard budget constraint, i.e., to cut back subsidies and to reduce production if costs are high. However, in a nationalized firm this commitment is not credible. Having observed the realized cost function the government will always subsidize the firm in order to implement the ex post efficient production level. Hence, the manager faces a soft budget constraint. Under privatization, however, the government does not know the cost function of the firm. The optimal regulation scheme offered to the private owner has the property that it induces an inefficiently low production level if costs are high. Since the manager dislikes low production levels he has a stronger incentive to invest in order to avoid the high cost state. This effect can be interpreted as a hardening of the manager’s budget constraint. Under privatization the manager knows that the government is less inclined to subsidize the firm if costs are high.

In the remainder of this paper I develop a simple model of the costs and benefits of privatization which is a variant of Schmidt (1990). While my (1990) paper considered the case of privatization to an employee manager, the model developed here applies to the case of privatization to an owner-manager. This case is less realistic, but it is simpler and does not require the assumption that the manager is an empire builder.

3 A Simple Model of Privatization to an Owner-Manager

Consider a monopolistic firm which produces quantity y of a public good. The “social benefit” of y is $b(y)$.⁹ To guarantee an interior solution of the following maximization problems assume that $b(y)$ is strictly increasing and concave and satisfies the Inada conditions. Production costs are given by $c(y, \theta)$, where $\theta \in \{\underline{\theta}, \bar{\theta}\}$ is a parameter of the cost function which is private information of the owner of the firm. That is, as discussed in Section 2, the government is informed about θ only if it owns and controls the firm. The cost function $c(y, \theta)$ is strictly increasing and convex with $c(y, \underline{\theta}) < c(y, \bar{\theta})$ and $c_y(y, \underline{\theta}) < c_y(y, \bar{\theta})$.¹⁰

The firm is run by a manager whose main role is to make a personal, non-monetary investment, e , in order to reduce future production cost. This investment should be interpreted as an effort decision the returns to which accrue at some later date. For example, the manager can try to “re-engineer” the production process, to shed redundant workers, to find cheaper suppliers of inputs, etc. The manager’s effort affects the probability distribution over θ , i.e. if the manager chooses effort e , then the probability of the low cost state $\underline{\theta}$ is given by $q(e)$, where $q(e)$ is strictly increasing and concave with $\lim_{e \rightarrow 0} q_e(e) = \infty$ and $0 < q(e) < 1$ for all $e \geq 0$. Effort is measured in terms of its utility costs to the manager. It is normalized such that $e \geq 0$ denotes the level of effort exercised when the manager is given no monetary incentives. Effort is unobservable and cannot be contracted upon. The time structure of the model is summarized in Figure 1.

In period 0, the government has to decide whether to privatize the firm and sell it to an owner-manager, or whether to keep it nationalized and hire an employee-manager to run the firm. In both cases we assume that the government has all the bargaining power. That is, the privatization price z (or the wage contract w) is chosen by the government such that the expected utility of the owner-manger (or the employee-manager, respectively) just equals his outside option utility which is normalized to 0. In period 1, the manager

⁹Throughout the paper $b(y)$ will be interpreted as a measure for social welfare, e.g. consumer surplus. But it is also possible that it reflects some rather narrow interests of a selfish government or a government captured by interest groups. In any case, $b(y)$ is what the government cares about.

¹⁰Subscripts indicate derivatives. The latter condition is a standard single crossing property.

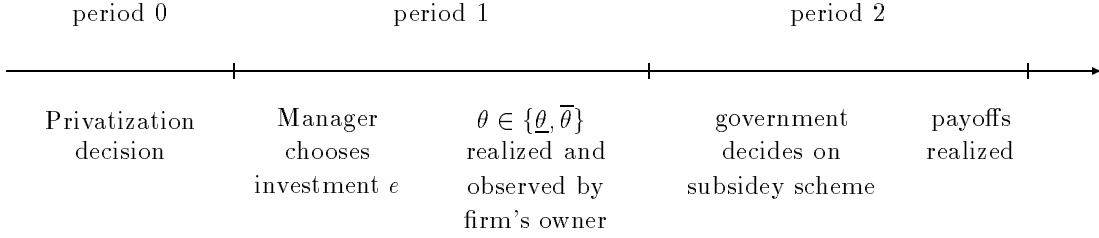


Figure 1: Time structure of the model

makes his investment decision. Thereafter the state of the world is realized and observed by the owner of the firm. In period 2, the government may offer a subsidy scheme to the firm. Again it is assumed that the government can make a take-it-or-leave-it offer. If the government owns the firm, it knows the realization of θ and can choose the level of production, y , and of subsidies, s , directly, subject to the constraint that the firm breaks even. In case of privatization the government does not know the realization of θ but must elicit this information from the private owner through an optimal revelation mechanism.

All parties are risk neutral and there is no discounting. Payoffs are realized at the end of period 2 and are given by

$$V = \begin{cases} b(y^n) - w - c(y^n, \theta) & \text{after nationalization} \\ b(y^p) + z - s^p & \text{after privatization} \end{cases} \quad (1)$$

for the government and

$$U = \begin{cases} w - e^n & \text{after nationalization} \\ -z + s^p - c(y^p, \theta) - e^p & \text{after privatization} \end{cases} \quad (2)$$

for the manager.

As a point of reference consider the first best allocation which would obtain in the absence of any contractual problems. The first best production level y^* depends on θ and is uniquely characterized by

$$b_y(y^*(\theta)) = c_y(y^*(\theta), \theta). \quad (3)$$

Note that $y^*(\underline{\theta}) > y^*(\bar{\theta}) > 0$. Let $W^*(\theta) = b(y^*(\theta)) - c(y^*(\theta), \theta)$. Then, the first best investment level, e^* , has to be chosen in period 1 such that

$$q_e(e^*) [W^*(\underline{\theta}) - W^*(\bar{\theta})] = 1. \quad (4)$$

4 Nationalization versus Privatization

Suppose that long-term state contingent contracts are not feasible, i.e., it is impossible to make the manager's wage or the level of subsidies a function of the state of the world (or, which is equivalent in this model, of the level of costs, social benefits, or output). Hence, contracts on w and z can only specify fixed payments. The model is solved by backwards induction.

The analysis of the nationalized firm is straightforward. The government knows the state of the world and can choose the production level directly. Thus, it will always choose the ex post efficient production level, i.e. $y^n(\theta) = y^*(\theta)$. In period 1, the manager has to decide on his investment in cost reduction. Since his wage is fixed, he has no incentive to put in any additional effort and chooses $e^n = 0$. This is anticipated by the government which will offer a wage contract $w = 0$ to the manager in period 0 holding him down to his reservation utility. The government's overall expected payoff is given by

$$V^n = q(0)W^*(\underline{\theta}) + (1 - q(0))W^*(\bar{\theta}) . \quad (5)$$

Thus, while nationalization achieves an ex post efficient level of production, expected costs are too high. The manager has no incentives to invest in cost reduction because the government cannot commit to reward him for good performance or to punish him for high costs.

Consider now the case of a privatized firm. At date 2, the government does not know the cost parameter of the firm but has some prior probability distribution over θ . Note that the government does not know the effort taken by the manager either. Thus, the prior over θ depends on the beliefs of the government about which action was chosen by the manager. However, given this belief the government's problem is a standard mechanism design problem à la Baron and Myerson (1982). The government has to find a direct mechanism $\{y^p(\theta), s^p(\theta)\}$ (saying that if the firm announces its cost parameter to be θ it has to produce $y^p(\theta)$ and receives subsidy $s^p(\theta)$), such that this mechanism maximizes the government's expected payoff function subject to the participation and incentive constraints of the firm. This problem is by now well understood and has the following solution:¹¹

¹¹Proposition 1 characterizes only an interior solution to this problem. An interior solution obtains if

Proposition 1 *Suppose the government believes the manager has chosen action \hat{e} and that costs are low with probability $\hat{q} = q(\hat{e})$. An interior solution to the government's problem is fully characterized by*

$$b_y(y^p(\underline{\theta}, \hat{e})) = c_y(y^p(\underline{\theta}, \hat{e}), \underline{\theta}) , \quad (6)$$

$$b_y(y^p(\bar{\theta}, \hat{e})) = c_y(y^p(\bar{\theta}, \hat{e}), \bar{\theta}) + \frac{\hat{q}}{1 - \hat{q}} \cdot [c_y(y^p(\bar{\theta}, \hat{e}), \bar{\theta}) - c_y(y^p(\bar{\theta}, \hat{e}), \underline{\theta})] , \quad (7)$$

$$s^p(\underline{\theta}) = c(y^p(\underline{\theta}, \hat{e}), \underline{\theta}) + c(y^p(\bar{\theta}, \hat{e}), \bar{\theta}) - c(y^p(\bar{\theta}, \hat{e}), \underline{\theta}) , \quad (8)$$

$$s^p(\bar{\theta}) = c(y^p(\bar{\theta}, \hat{e}), \bar{\theta}) . \quad (9)$$

The proof is standard. Note that $y^p(\underline{\theta}, \hat{e}) = y^*(\underline{\theta})$ and $y^p(\bar{\theta}, \hat{e}) < y^*(\bar{\theta})$. These are the classical “no-distortion-at-the-top” and “under-production” properties of a standard adverse selection problem. The production level in the bad state, $y^p(\bar{\theta}, \hat{e})$, is a strictly decreasing function of \hat{q} and thus of \hat{e} . The higher the probability the government attaches to the event that costs are high, the more it is willing to distort production in the bad state of the world in order to reduce the information rent that has to be paid to induce the private owner to reveal his low cost type truthfully. This information rent is given by $R(\hat{e}) = c(y^p(\bar{\theta}, \hat{e}), \bar{\theta}) - c(y^p(\bar{\theta}, \hat{e}), \underline{\theta}) > 0$. Note that the single crossing property implies that $R(\hat{e})$ is a decreasing function of \hat{e} .

Consider now the manager's incentives to invest in effort in period 1. By choosing the high effort level he can increase the probability of receiving the information rent described above. Note that the size of this rent is not affected by his actual effort decision. This is due to the fact that the government does not observe his managerial effort. Hence, the government's belief about the probability of the good state, \hat{q} , is independent of the manager's action.

Proposition 2 *Under privatization, if the government believes that the manager has taken \hat{e} with probability 1, the owner-manager will choose effort level $e^p(\hat{e})$, $0 < e^p(\hat{e}) < e^*$, which is given by*

$$q_e(e^p(\hat{e})) \cdot R(\hat{e}) = 1 . \quad (10)$$

and only if

$$b(y^p(\bar{\theta}, \hat{e})) - c(y^p(\bar{\theta}, \hat{e}), \bar{\theta}) - \frac{\hat{q}}{1 - \hat{q}} \cdot [c(y^p(\bar{\theta}, \hat{e}), \bar{\theta}) - c(y^p(\bar{\theta}, \hat{e}), \underline{\theta})] \geq 0 .$$

If the probability of the low cost state, $q(\hat{e})$, is sufficiently close to 1, a corner solution with $y^p(\bar{\theta}, \hat{e}) = 0$ is optimal.

There exists a unique fixed point with $e^p(\hat{e}) = \hat{e}$.

Proof: In period 1 the manager maximizes

$$U(e) = q(e) \cdot R(\hat{e}) + (1 - q(e)) \cdot 0 - e . \quad (11)$$

Given the assumptions on $q(e)$ and the fact that $R(\hat{e}) > 0$, the manager's optimal effort is strictly positive and fully characterized by the FOC (10). Furthermore, $e^p(\hat{e}) < e^*$ if and only if

$$R(\hat{e}) = c(y^p(\bar{\theta}, \hat{e}), \bar{\theta}) - c(y^p(\bar{\theta}, \hat{e}), \underline{\theta}) < W^*(\underline{\theta}) - W^*(\bar{\theta}) . \quad (12)$$

This strict inequality holds because

$$\begin{aligned} c(y^p(\bar{\theta}, \hat{e}), \bar{\theta}) - c(y^p(\bar{\theta}, \hat{e}), \underline{\theta}) &\leq c(y^*(\bar{\theta}), \bar{\theta}) - c(y^*(\bar{\theta}), \underline{\theta}) \\ &= [b(y^*(\bar{\theta})) - c(y^*(\bar{\theta}), \underline{\theta})] - [b(y^*(\bar{\theta})) - c(y^*(\bar{\theta}), \bar{\theta})] \\ &< [b(y^*(\underline{\theta})) - c(y^*(\underline{\theta}), \underline{\theta})] - [b(y^*(\bar{\theta})) - c(y^*(\bar{\theta}), \bar{\theta})] \\ &= W^*(\underline{\theta}) - W^*(\bar{\theta}) . \end{aligned} \quad (13)$$

The last statement of the proposition follows from the fact that $R(\hat{e})$ is differentiable and decreasing in \hat{e} . Using the implicit function theorem it can be shown that $e^p(\hat{e})$ is also a differentiable and decreasing function of \hat{e} . Furthermore, we know that $e^p(0) \geq 0$ and $e^p(e^*) < e^*$. Hence, the mean value theorem together with the monotonicity of $e^p(\hat{e})$ imply that there exists a unique e^p satisfying $e^p = e^p(\hat{e}) = \hat{e}$. *Q.E.D.*

Note that under privatization the manager spends too little effort as compared to the first best, but works harder as compared to nationalization.¹² Propositions 1 and 2 fully characterize the unique subgame perfect equilibrium of the subgame after the firm has been privatized. The privatization prize z is determined by the expected zero profit condition of the owner-manager:

$$z = q(e^p) \cdot R(e^p) - e^p . \quad (14)$$

Note that the government recovers all of the information rent ex ante through the auction of the firm. Substituting z , $R(e^p)$, and $s^p(\theta)$ in the payoff function of the government,

¹²Riordan (1990) uses a similar model to explain the costs and benefits of vertical integration. In his model, it is assumed that $y \in \{0, 1\}$. It is interesting to note that in this special case the manager's effort is chosen efficiently given the probability of trade in the second best.

and using $W^p(\bar{\theta}, e^p) = b(y^p(\bar{\theta}, e^p)) - c(y^p(\bar{\theta}, e^p), \bar{\theta})$ we get for the government's expected payoff under privatization:

$$V^p = q(e^p)W^*(\underline{\theta}) + (1 - q(e^p))W^p(\bar{\theta}, e^p) - e^p . \quad (15)$$

Now we can summarize our main result:

Theorem 1 *Privatization to an owner-manager is preferred by the government to nationalization if and only if the welfare gain through the more efficient effort decision of the owner-manager outweighs the welfare loss due to the ex post inefficient low production level under privatization, i.e. if and only if*

$$\begin{aligned} V^p &= q(e^p)W^*(\underline{\theta}) + (1 - q(e^p))W^p(\bar{\theta}, e^p) - e^p \\ &\geq q(0)W^*(\underline{\theta}) + (1 - q(0))W^*(\bar{\theta}) = V^n . \end{aligned} \quad (16)$$

Comparing the expected payoffs of the government under privatization and under nationalization the costs and benefits of privatization are clear. On the one hand production is carried out more efficiently (higher *productive efficiency*) under privatization because the information rent induces the manager to work harder. From the point of view of the government in period 2 this rent is a pure deadweight loss. However, ex ante it is beneficial because it gives better cost saving incentives to the manager. The government cannot offer the same incentives under nationalization because it cannot commit not to expropriate the returns on the manager's investment once investment costs are sunk. It is the asymmetric information in the privatization subgame which is crucial to make the incentives credible. On the other hand, asymmetric information causes a distortion of the production level (lower *allocative efficiency*) under privatization. Note that ex ante the government would like to commit not to distort production in period 2. First, this would enhance allocative efficiency. Second, the information rent (which can be recovered through the auction) increases with $y^p(\bar{\theta})$ and so does the level of effort. However, this commitment is impossible if complete long-term contracts are not feasible.

The trade-off between higher productive and lower allocative efficiency under privatization seems to be plausible and consistent with the empirical evidence.¹³ Furthermore,

¹³For a detailed discussion of the empirical evidence see Schmidt (1990).

the model shows that privatization can be beneficial even if the government is a benevolent and fully rational dictator. The main drawback of this model (and also of Shapiro and Willig (1990)) is that the different information structures under privatization and nationalization are imposed by assumption. An important topic for future research is to derive the information structure endogenously as a function of the underlying governance structure.

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