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Information, Incentives and Commitment: An Empirical Analysis of  
Contracts between Government and State Enterprises\*

by

Mary M. Shirley and Lixin Colin Xu

The World Bank

**Abstract:** This article analyzes the experience with performance contracts between developing country governments and the managers of their state owned enterprises. It identifies how problems of information asymmetry, incentives, and commitment can lead to shirking. It applies this conceptual framework to a sample of 12 contracts with monopoly state enterprises in 6 developing countries and finds that all suffer from serious contracting problems and there is no pattern of improved performance that can be attributed to the contracts.

## I. Introduction

A critical challenge facing developing countries is to improve the performance of government, including state-owned enterprises (SOEs). SOEs are responsible for an average of 10 percent of GDP in developing market countries, and much more in former socialist economies and such developing countries as Algeria (65 percent), Egypt (34 percent), Guyana (41 percent) or Zambia (31 percent). SOE deficits have been an important source of fiscal problems and inefficient state enterprises are a drag on growth (World Bank, 1995).

Incentive contracts, similar to the contracts between management and owners that are widely used in private companies, have been suggested as a tool to improve the performance of SOEs (Jones, 1991; Trevedi, 1990) and central government bureaus (Mookherjee, 1997). Substantial resources have been sunk into the design and enforcement of such contracts for SOEs, yet the few assessments to date show mixed results (see, for example, Shirley, 1989, 1991; Nellis, 1989; Trivedi, 1990). This article analyzes the experience with incentive contracts through case studies of 12 SOEs in six countries and finds that they failed to improve performance. It sheds light on some reasons why contracts seem to work less well in government settings than in the private sector.

Written contracts between governments and state-owned enterprises (SOE) have enjoyed a vogue since the mid-1980s, thanks partly to their embrace by the World Bank and bilateral donors. Our survey of developing countries found 565 such contracts for some of the largest SOEs in 32 countries plus another 103,000 in China as of June, 1994

(table 1). We defined these contracts, which we termed performance contracts, as negotiated, written agreements between governments and the managers of their SOEs which specify explicit targets that SOE management pledges to achieve in a given time frame, and where performance is measured at the end of a specified period.

The next section develops a conceptual framework to analyze how three contracting problems -- information, incentives and commitment -- might affect the impact of incentive contracts on SOE performance. Section III analyzes how a sample of contracts dealt with each of the contracting problems and Section IV measures the success or failure of the contracts. Section V concludes with an assessment of the implications for incentive contracts in public settings.

## **II. Conceptual Framework**

Drawing on the work of Sappington (1991), Lafont and Tirole (1986, 1993) and Williamson (1976 and 1985),<sup>1</sup> we hypothesized that how well a contract does in improving SOE economic performance depends on how well it addresses three interrelated problems: information asymmetry, incentives, and commitment. Agency problems arise because the principal has imperfect information; the agent's actions cannot be observed but can only be imperfectly inferred on the basis of what can be observed. In the case of incentive contracts the principal cannot measure accurately the effort expended by the agent or distinguish the effects of effort from other factors affecting performance. The agent faces a disutility of effort and can use the information she holds exclusively to shirk. To induce the agent to comply with the principal's goals, contracts are written which include promises of incentives based on achievement.

Since it is costly for the principal to pay the incentive, she will try to maximize her welfare while minimizing the amount transferred to the manager of the enterprise. In the case of SOEs, the costs of incentives include foregone revenues (which a bureaucrat might have used to expand her power or a politician to reward her supporters), the costs of monitoring and evaluating the SOE's performance, and any distortions introduced by associated tax increases. The more imperfect the principal's information, the lower the principal will set the reward in order to reduce the cost associated with paying an incentive without any gains in performance. As a result the reward may be set too low to motivate managers to improve performance.

Incentive contracts with government actors confront additional problems beyond the usual. SOEs have no clear residual claimants; instead they are subject to many principals who impose multiple, often conflicting objectives and constraints on the enterprise (Jones, 1990). Some of these multiple principals may derive benefits from objectives which run contrary to improving SOE efficiency. While in some cases these contrary goals may maximize social welfare, we assume with Shapiro and Willig (1990) that government is not always benevolent. For example, politicians may benefit politically from instructing SOEs to maximize employment (Shleifer and Vishny, 1994). Bureaucrats might benefit from instructing SOEs to engage in activities that increase their power, prestige or perks (Niskanin, 1991). Many of these objectives are likely to be much harder to contract upon than profit maximization (Laffont and Tirole, 1993). Moreover, to safeguard their rents, the principals may use their powers to protect the SOE from competition, bankruptcy, and takeover (Vickers and Yarrow, 1988). All of these

circumstances make it more difficult to judge managerial performance or to motivate managers to exert effort.

Another contracting problem that is greater with SOEs is commitment. This problem arises when the principal's commitment to honor the contract now and as circumstances change is not credible. If managers believe that there is a high probability that government will renege on its commitments (such as the commitment to pay an incentive), they will not invest in learning or exert effort to improve results. When government is the principal, it is usually impossible for an SOE manager to force government to comply. There are no neutral third parties with the power to compel the present government or its successors to meet its promises. This problem is especially severe in developing countries because the institutions (checks and balances, reputation, etc.) which curb arbitrary actions and bind successor administrations to the promises of their predecessors are weak (North and Weingast, 1989; Levy and Spiller, 1996). While private owners might also renege and it may be costly for private managers to use third party enforcement, the risk of renegeing is greater for the public manager. Objectives can change more between successive government administrations than between private owners, where the objective of value maximization stays the same over time (Laffont and Tirole, 1993).

Proponents of performance contracts argue that they can be written in ways that clarify multiple objectives and make it easier to judge performance and motivate managers (for example, see Jones, 1981). Thus, the contract can translate multiple goals into targets measured by specified criteria and weighted to reflect government priorities.

Management could be motivated to improve performance through bonuses based on achievement of the targets, while poor performance could be penalized through firing or demotion.

An underlying assumption is that even as the principals' social or political objectives are being maximized, performance on efficiency measures can still be improved, by setting appropriate targets. For example, even though a government requires a SOE to keep its labor force at current levels despite over-staffing, the company could still achieve contractual targets aimed at, for instance, improving quality or minimizing materials costs. In addition, performance could be judged against past trends, rather than against some objective standard, to take account of factors which management can't change much from year to year. For instance, even if managers can't reduce over-staffing they may still be able to improve the trend in labor productivity through better use of plant and equipment.

The efficiency effects of performance contracts is thus an empirical question. We explored this question using the following hypothesis: contracts will improve performance if they: (a) reduce manager's information advantage; (b) provide sufficient incentives for managers to increase effort; and, (c) manifest that government's commitment to honor its promises under the contract is credible. We expected that all three of these conditions may be necessary for change to occur. We also hypothesized that performance contracts could make performance worse. This might happen if government rewards managers for actions which cause performance to deteriorate, (for example by setting targets which maximize the government's rents), or if managers are able to exploit

their information advantage to negotiate targets that require less effort than they would have expended in the absence of the contract.

To address our question we first assessed whether there was any improvement in the information available to the government under the performance contracts in our sample.<sup>2</sup> Proponents have argued that performance contracts improve the timeliness, detail and quality of information available to government (Hartmann and Nawab, 1985), perhaps because the evaluation process forces supervisors to focus more on information or because the managers' incentive will not be paid if the information is of poor quality or late.<sup>3</sup> We assessed the quality and timelines of the reporting used by the bureau responsible for negotiating, monitoring and evaluating the contracts (henceforth supervisors). For the contract to reduce information asymmetry the supervisors must also have sufficient status and capacity to compel managers to provide the necessary information and to negotiate targets which can only be achieved through increased effort. To assess this we analyzed the pay, status and capability of the supervisors. We also analyzed the targets to determine if managers were manipulating the targets, in which case we expected to find targets which were manifestly soft, numerous or frequently changing, or likely to induce perverse behavior. The targets in performance contracts are usually based on improvements over past performance, rather than some objective standard, which requires the supervisors to learn about what constitutes good performance for each individual firm. Learning which values are hard and which soft is more difficult when criteria are numerous or constantly changing.

Next we assessed whether the contracts included explicit incentives and explored through our questionnaire whether managers considered them sufficiently high powered enough to motivate performance improvements. First we assessed punishments: whether the managers could lose their jobs or be demoted because of poor performance under the contracts. Second, we analyzed rewards: bonuses or other awards given based on target achievements.

Last we judged the credibility of government's commitment to the contract. Since the contracts were repeated games (most were annual, see table 2), we assumed that managers would judge government commitment to abide by the contracts by whether government took costly action (such allowing layoffs or price increases) early in the process to signal its commitment to the contract's goals; (see Spence 1973 and Lupia and McCubbins 1996 for discussions of costly action to signal credibility). Second, we looked at government compliance with promises made under the first contacts as a signal of credibility in later contracts, particularly promises critical for managers to achieve their targets. Finally we assessed whether government agreed to and complied with a third party enforcement mechanism (such as independent courts, the World Bank, or private actors).

### **III. Empirical Application**

To test our hypothesis we examined how performance contracts addressed problems of information, incentives and commitment in a sample of twelve companies in six countries (For ease of reading we have used simplified enterprise names; see table 2.)



Our analysis is based on the contract documents and reports from the monitoring agency, a questionnaire administered to each sample company and government monitoring agency, World Bank file data, interviews in the field and with knowledgeable World Bank staff, and the enterprises' own audited accounts and reports.<sup>4</sup> In order to study the cases in sufficient detail we limited ourselves to a small sample, so care must be used in generalizing from the results.<sup>5</sup> Also there are weaknesses in the data: accounting is weak in Ghana and Senegal, and in some cases our pre-contract period is short and the length of the post-contract period varies, which makes it hard to measure trends.<sup>6</sup> Even so, the sample does include countries at very different levels of income that employed varying approaches to performance contracting. A lack of improvement in post-contract performance across such differing country and contract experiences would suggest that the contracts cannot be used to reduce the three contracting problems (unless other exogenous factors were at work, something we also investigated).

#### **A. Information Asymmetries**

Part i of our hypothesis suggests that performance contracts will improve performance if they can reduce government's information problems compared to the situation without a contract.<sup>7</sup> All of the supervisors used SOEs' annual, audited accounts as the main sources of their information, but in five of the cases (three in Ghana and two in Senegal) the quality of the data were very poor. For example, in 1991, twelve of the seventeen SOEs supervised by the State Enterprise Commission (SEC) of Ghana were seven weeks late in delivering their 1990 fourth quarter results; only five of the firms had current audited accounts; the most recent audited accounts for the others ranged from one to three

years old (SEC, 1991). Similar problems were cited in interviews in Senegal, where enterprises were also reported to evaluate themselves. While such delays are typical of SOEs in these countries, there was no evidence that the contracts improved timeliness of accuracy of accounting.

In all but Korea and India (where outsiders played a role) contracts were negotiated, monitored and evaluated by middle- or low-level civil servants, while the SOE's representatives were better paid and had much higher status. According to interviews the lower status of the government supervisors made it hard for them to negotiate tough targets and demand the information necessary to evaluate performance or give the SOEs an unsatisfactory score. For example, in Ghana the SOEs were often represented at the bargaining table by a managing director with status equivalent to a cabinet minister (and better pay), while the government supervisors were low-level functionaries.<sup>8</sup>

Korea and India used private individuals for evaluation. According to interviews, outsiders were more likely to rival the status of the SOE representatives and be able to overcome some of the managers' bargaining power. However, since the outsiders were brought into the process on an ad hoc basis, their lack of continuity may have reduced their opportunity to learn about the company's performance over time. And since outsiders were used only for evaluation, the status and capacity problems of bureaucratic supervisors could still have adversely affected target negotiations.

The asymmetry in the status of the government supervisors was aggravated in three of our cases by frequent changes in supervisors' responsibilities and authority. The supervisory agency in Senegal was moved twice after contracting began (from the

Presidency to the Prime Minister's office to the Ministry of Finance), and, according to interviews, these moves diluted its authority vis-à-vis the enterprises. Similar changes were reported to have undermined the authority of the responsible agencies in the Philippines (where the supervisory agency also has a high rate of staff turnover) and in Ghana.<sup>9</sup>

Anecdotal evidence suggests managers were able to manipulate the targets to assure that they were easy to achieve or evade. For example:

- Senegal Telecom's target for call completion rates was lower in the 1986 performance contract than in the company's business plan of ten years before; (call completion rates average about half the international industry standard).
- In India, negotiations on targets often dragged on so long that the targets were set to be the same as actual performance.<sup>10</sup>
- In Ghana contract targets were set by the companies themselves; the supervisory agency considered many targets too low and established a penalty for under-targeting (State Enterprise Commission, 1991).
- In the Philippines, one of Philippines Electricity's most important and difficult challenges was to improve its reliability, but its reliability indicator (the percentage of electricity which its customers have contracted for but the company never supplied) became less important in its performance score, falling from 30 percent of total targets in 1990 to 10 percent in 1991 and 15 percent in 1992. This is not because the firm became more reliable; on the contrary, by 1992-93 outages of seven hours per day were common in many parts of the country.<sup>11</sup>

- Korea has a comprehensive target for assessing performance of the sample enterprises which follows a trend very close to total factor productivity and can be calculated using shadow prices to account for price distortions; as a target it would be hard to manipulate.<sup>12</sup> The share of this target in the contracts for Korea Telecoms and Electricity fell from 20 percent to 12 percent from 1985 to 1992 because SOE managers successfully negotiated the addition of other, less comprehensive targets (field interviews).

Besides this anecdotal evidence there is comprehensive evidence that all of the sample contracts had targets which put the government supervisors at a serious disadvantage vis-à-vis the enterprise. For each criterion evaluators have to decide on the criterion value—what constitutes good, fair, or poor performance -- the weight of the target in the total score, and how the enterprise's performance ranks compared to the criterion value. All but two of the sample contracts had either many targets (seven had more than 20 targets on average) or targets which changed frequently (four changed more than 20 percent of their targets a year on average), or both (Table 3). For example, Korea Telecoms' contracts had about 40 targets, most with weights of 1 percent or less. On average, over one third of the targets in the contracts with the three SOEs in Ghana changed every year. In other cases the weights fluctuated; for example, the weight assigned to India Oil's financial targets went from 20 percent in 1989 to 12 percent in 1990, then climbed to 40 percent by 1992.<sup>13</sup>

Such numerous, unstable, and increasingly less stringent targets suggest that managers were exploiting their information advantage. Field interviews confirm that managers were

the ones who usually negotiated for changes or additions to targets. However, another factor may also be partly responsible. As mentioned, SOEs faced numerous objectives from multiple principals; the government supervisors may have had trouble mediating and opted for numerous, relatively evenly weighted targets. Since the political strength of the principals changed from time to time, this could account for some of the fluctuations in the targets.<sup>14</sup>

Finally we found some evidence of possibly perverse targets. For example, Philippines Electricity achieved two targets in 1991 by cutting capital expenditures, even though the company badly needs to upgrade its infrastructure.<sup>15</sup> India Oil could achieve its target of wells drilled regardless of whether it struck oil or not, and the number of non-producing wells has been increasing since contracts were introduced.<sup>16</sup>

## **B. Incentives**

Punishment turned out not to be a relevant incentive in most of our cases. Only in the case of the two Korean contracts was there any evidence that management achievements had some effect on managerial careers (Shirley, 1991); interviews in the other countries revealed that managers' job assignments were largely politically determined and not affected by performance.<sup>17</sup> Furthermore, the ability of managers to manipulate the targets vitiated the importance of punishment because none of the sample received a less than satisfactory grade against the contract criteria, so there was no basis for government to discipline the managers or not pay the promised incentives.

We judged the rewards to be insufficient to motivate change. Managers and staff could receive a pecuniary bonus for good achievement of their targets in only two of the

12 sample contracts (Korea Electricity and Korea Telecoms). Bonuses were part of the contracts in the three sample contracts in Ghana, but according to survey responses promised bonuses have not been paid. In two other contracts (India Electricity and Oil) managers could receive an award for good performance in a public ceremony, but interviews suggest that this was not viewed as a very strong motivation.

In the two Korean cases, the staff of the company could get a bonus of up to three months salary for “A” graded performance. These bonuses were reported by managers to be high powered incentives in part because they were paid to all staff; managers reported feeling pressured to improve performance so as not to disappoint their employees (Shirley, 1990). Moreover, bonus ratings were reported in the media, which managers stated was a strong motivating force (Ibid.). Since Korea had less information problems than the other countries, its experience lends some support to the conjecture that less information asymmetry leads to higher power incentives, although the nature of our evidence leaves the relationship between incentives and information ill defined.

### **C. Lack of Government Commitment**

Our next task was to assess if governments manifested credible commitment. Since the contracts are repeated (mostly annual) games, we looked for costly actions and keeping important promises in the first contract to establish credibility in later contracts. We also checked if there were mechanisms for third party enforcement.

*Costly Action.* We found no evidence that any costly signals were provided when the contracts were first introduced, except in Korea. The Korean government substantially increased the managerial autonomy of the two SOEs in our sample (and of all other so-

called Government Invested Enterprises) simultaneously with the introduction of the contracts, an action that was strongly opposed by some of the ministries.<sup>18</sup> This signal seems to have boosted the contracts' credibility with managers and employees.<sup>19</sup>

*Promises and Reneging.* Governments promised bonuses in four of the contracts and made explicit or implicit promises to take actions crucial to the successful achievement of the targets in all of them. We therefore expected that government's action on these promises at the start of the game would affect its credibility in all future contracts.

The Government of Ghana failed to pay the bonuses promised under the first performance contracts. The Governments of Ghana, India, the Philippines and Senegal failed to keep their promises in the first contracts to assure prompt payment of bills by state agencies (table 4). For example, the first contract for India Electricity promised government help in enforcing prompt payment from its customers, the State Electricity Boards, yet accounts receivable did not decline. Promises to raise tariffs promptly were also made and not met in the first contracts in these four countries. Reneging in the first contracts in Senegal led Senegal Electricity to refuse to sign a second contract (see below). Senegal Telecom, three years into the process, commented in a 1989 company report, "It must be remembered that the *contract plan* was never considered a binding contract by the public powers." In contrast, the Mexican government met its obligations in the contract with the Electricity Company, albeit with some delay.<sup>20</sup> The Korean government met its obligation to pay the bonuses under its first contracts, and did not make any other explicit or implicit promises under the contracts.

*Enforcement.* None of the contracts specify an enforcement mechanism in the sense of a neutral third party, insulated from politics, with the power and information to compel both parties to comply, such as an independent court. In several cases, however, government obligations were potentially enforceable by an outside party. The World Bank included government contractual obligations as covenants in its loans for SOEs in Ghana, Mexico and Senegal. (Although these covenants were drawn up on the basis of project or sector needs rather than because they were part of the contracts, governments' agreement to the World Bank loan could be interpreted as a signal of commitment to the contract as well).

Interviews suggested that outside enforcement helped the contracts' credibility in Ghana and Mexico, but reduced the contracts' credibility in Senegal. Survey respondents and other observers agreed that the contracts in Senegal were viewed by the signatories as donor driven and not as credible obligations. The role of outside pressure from agencies such as the World Bank is necessarily a limited one, since such agencies are not party to the contract and have, at best, only an indirect stake in the outcome. Moreover, the penalties an outsider can impose may not be designed to motivate government commitment to keep its promises. For example, the suspension of disbursement of a World Bank loan to Senegal Electricity after government reneged on its contract obligations to settle arrears to the company did not change government behavior and penalized the company as much as, if not more than, the government.

The participation of private individuals (non-government accountants, lawyers, and academics) and a prestigious government think tank, the autonomous Korea Development



Institute, was credited in interviews with having increased the credibility of government's commitment to the contracts with Korea Electricity and Telecoms. The participation of knowledgeable outsiders was seen by some managers as a check on government actions that would have violated the contract. These outsiders had a more direct stake in the outcome, than, for example, the World Bank; they stated in interviews that they felt their reputation was on the line in the highly publicized evaluation process in Korea (Shirley 1991). India also used outside evaluators, but their role was more limited than in Korea where the outside team had primary responsibility for evaluation.

*In sum*, due to weak enforcement, lack of costly signals and/or early renegeing, government commitment to the performance contracts in Ghana, India, the Philippines and Senegal was not credible, while the Mexican contract may have been marginally credible. We judged only the Korean contracts as credible, since government took costly action, met its promise to pay the bonus, and instituted an enforcement mechanism that used outside evaluators.

### **C. Contracting Problems: Summary**

Our framework suggests three ways in which performance contracts might fail, and as Table 4 shows, all but the two contracts with the SOEs in Korea evidenced all three kinds of failure. Information asymmetries were not reduced, judging from the quality of reporting, the problems of the supervisors, and the manipulation of the targets; incentives were low-powered: punishment and cash awards were not used; and commitment was not credible due to lack of costly signals, renegeing on the first contracts and weak enforcement. The information in Table 4 suggests that all of the contracts except the two

in Korea did a poor job in addressing the three contracting problems. And even in the two Korean contracts, the contracts failed to reduce information asymmetry enough to avoid managerial manipulation of the targets. The next section examines how well the contracts did in improving SOE performance.

#### **IV. The Impact of the Contracts on Performance**

To assess the impact of contracts on companies' economic performance we compared trends in profitability (return on assets, or ROA), labor productivity (LP) and total factor productivity (TFP) before and after the introduction of the contract.<sup>21</sup> ROA was calculated as sales minus cost of goods sold and depreciation over revalued fixed assets.<sup>22</sup> LP was calculated as the real value of production divided by the number of workers; and, to facilitate comparison, LP in the first year for each firm was normalized to 1. Since labor productivity could be raised by increasing the use of other factors, rather than by improving overall efficiency, we considered TFP a more reliable indicator of productivity. TFP was calculated as the constant value of production over the constant costs of all production factors (labor, intermediate inputs and capital), using company volume data to construct company-specific price indices for each factor and output where available; otherwise we used the relevant country-specific price indices.

A frequent question is why we did not assess how well the firms did on their non-commercial objectives, especially since some observers consider these more important for a state enterprise than its economic objectives, and success in these goals may be responsible for (and outweigh) failures in profitability or productivity. Since 75 percent of the respondents to our questionnaire saw improving profitability or efficiency as the

number one objective of the contracts and 88 percent, as objective number one or two, and since two thirds of the score of the enterprises were based on economic achievements, we deemed improvement on ROA, LP and TFP as better measures of the success of the contracts than non-economic achievements.<sup>23</sup> Moreover, as we noted in the introduction, an important rationale for performance contracts is to maximize economic performance within the constraints of non-economic goals.<sup>24</sup>

Our counterfactual was based on the pre-contract level and trend of each firm for the three dependent variables, controlling also for GDP growth rates to take account of macroeconomic effects. The firm-specific levels of, for example, TFP should capture productivity effects stemming from the firm's pre-contract market power, management ability, labor quality, and other time-invariant factors; similarly, the firm-specific growth rate is hypothesized to be the firm-specific rate of technical change. Our goal is to determine to what extent the performance contracts raise, for example, TFP levels and growth rates above what each firm's pre-contract performance would predict. The GDP growth rates capture the effects of macroeconomic factors. For example, a booming economy would likely increase the demand for these companies' products -- especially since they were natural monopolies. Ideally, the counterfactual should also control for other simultaneous reforms, if there were any; however, we have no access to such measures. Since other reforms most likely either increased or did not affect productivity, by estimating contract effects without controlling for other reforms, we likely overstate the contracts' positive effects. Since the contracts' effects, as we show below, are found to be negligible or even negative in some cases, our choice of counterfactual should not

reduce confidence in our conclusion of no effects. This said, we specifically ran the following regression:

$$Y_{it} = \alpha_{1i} + \alpha_{2i}t + \alpha_3GDPGR_{it} + \beta_1PC_{it} + \beta_2T_{it}^{post-PC} + \varepsilon_{it} \quad (1)$$

with  $Y_{it}$  = TFP, ROA, or LP,

$\alpha_{1i}, \alpha_{2i}$  = firm-specific, pre-contract productivity level and growth rate in  $Y_{it}$ .

$GDPGR_{it}$  = the GDP growth rate for the country of firm  $i$ ;  $\alpha_3$  is its coefficient.

$PC_{it}$  = a dummy variable whose value is 1 if a performance contract was adopted at year  $t$ .  $\beta_1$  is the effects of contracts on productivity level.

$T_{it}^{post-PC}$  = the number of years since the contract's adoption.  $\beta_2$  captures the effects of the contract on the productivity growth rate.

$\varepsilon_{it}$  = the error term.

Since we have to control for the counterfactual trends, companies with only one year of pre-contract experiences (Ghana Water, Korea Telecom., and Senegal Telecom.) had to be deleted from the regression analysis. (We also experimented with including these firms--in this case the counterfactual could only be firm-specific productivity levels and macro effects--and found that it remained true that PCs had a negligible and insignificant effect on productivity levels.) Another reason to delete Senegal Telecom was that it was split off from the postal service in 1986, the first year of the contract, making it hard to isolate the telecommunications side prior to the split. We also excluded Ghana Telecoms because a 330 line international exchange came on stream just before the first contract and caused a ten fold increase in international calls; this windfall -- with nothing to do

with the introduction of performance contracts -- distorted the findings for the entire sample. In the end we included eight companies in a series of regressions of productivity measures on performance contracts, with or without controlling for the counterfactuals, and with or without allowing for the effects of contracts on productivity growth rates. To check the possibility of reverse causality -- i.e., productivity determined who participated in the contracts instead of contracts determining productivity-- we included a dummy variable whose value is one at the year before contract adoption. If reverse causality is important, the coefficient of this variable would be significant and large. The results are contained in tables 5 to 7.

*Profitability.* Columns (1) to (3) of Table 5 show the effects of contracts on ROA levels, and column (4) to (6) allow for both level and rate effects. In column (1), where we do not account for the counterfactual, the adoption of contracts is found to reduce the level of ROA by 12 percentage points, but the coefficient is statistically insignificant. In column (2) we take into account pre-contract levels and growth rates in ROA of each firm, and the effects of GDP growth rates. The effects of contracts on ROA levels are reduced, but they are still negative and insignificant. This model explains 71 percent of ROA variations.

We find no evidence of reverse causality (column (3)), and the contract effect is still insignificant. Finally, running the same regressions but allowing for PC effects or ROA growth rates as well as levels (columns (4) to (6)) does not alter the conclusion that performance contracts have no discernible correlation with changes in profitability.

*Labor Productivity.* The regressions suggest that contracts were not effective in improving LP (Table 6). Without controlling for pre-contract, firm-specific trends and levels (columns (1) and (4)), contracts were associated with a large gain of labor productivity (roughly 77 percent if only allow for PC level effect). However, when we control for the counterfactual (columns (2) and (5)) the effects of performance contracts are insignificant, and reverse causality is not important (column (3) and (6)).

*Total Factor Productivity.* The regressions of TFP suggest that the contracts may in fact have reduced productivity. Without controlling for the counterfactual the contract effects on TFP are positive but insignificant (Table 7; columns (1) and (4)). Once the counterfactual is taken into account, however, the effects become negative. And when both level and growth rate effects are taken into account, however, the negative contracts effects are significant at the 10 percent level (column (5) and (6)). Taking the counterfactual into account is important: the inherent TFP trends are positive and significant (column (2), (3), (5) and (6)), and in countries with higher GDP growth rates, the TFP of the enterprises in our sample also grew faster.

## **V. Conclusions**

The evidence from our sample does not support to the premise that performance contracts helped improve SOE performance. Moreover, in regression analysis, once the counterfactual is properly controlled for, contracts are negatively correlated with TFP growth.

If we compare the contracting problems in Table 4 with our performance measures we see no clear patterns. Even the contracts with the least problems (Korea Electricity and Telecom) were with companies which showed no change in performance; the two SOEs continued their pre-contract (improving) trends. Since these contracts had problems of information asymmetry as reflected in the number of targets, this suggests that improving supervisors' information may be a necessary condition for performance contracts to have a positive impact on performance.

Why do incentive contracts seem to perform so poorly in state-owned enterprises? As we mentioned, performance contracting assumes that government's objectives can be maximized, and performance improved, by setting targets which take into account the constraints placed on managers. For this to occur, the principals will need to be willing explicitly to state their objectives, assign priorities to multiple objectives (by assigning weights), translate these objectives into targets aimed at performance improvement, negotiate these monitorable targets with managers, provide incentives to meet these targets, monitor the agents without incurring substantial costs, and credibly signal their commitment to the contract.

All these assumptions failed to materialize in our sample. First, with the exception of Korea, the governments negotiating our sample contracts chose to pledge actions that they were not motivated or able to implement. Second, with the exception of India, Korea and Mexico, the supervisory agencies were not given the capacity to negotiate, monitor and evaluate well. Their information disadvantage was reinforced by other government actions, such as giving them low pay and status, frequently moving them

within the government and failing to force the SOEs to comply with their information requirements. This allowed managers to manipulate the targets, which proved to be a serious failing of all the contracts in our sample.

Why would governments introduce the contract process and then not try to make it work? Some governments may have been motivated to make promises that were politically unrealistic because the contracts allowed them to earn foreign assistance. Such assistance might not have been forthcoming if they could only promise the marginal improvements possible without changes in government behavior. This may have been the case in the contracts in Senegal and Ghana where the negotiating agents pledged actions (regular increases in tariffs, end to arrears) that were not politically possible, and in the Philippines, where target achievement depended on government actions that were politically unlikely. That they did this knowingly is suggested by the fact that the problems they pledged to correct were long standing and had proved immutable.

Less hard to understand is the managers willingness to manipulate the targets rather than increasing effort. In contrast to a private firm, the SOE managers in our sample had little choice but to sign the contract (the case of Senegal Electricity notwithstanding). Not surprisingly, managers with information advantages and bargaining power, and without high powered incentives or credible commitment from government, chose to use their advantages to manipulate the targets so as to assure that their performance would be judged as satisfactory.

The policy implication for developing country governments considering performance contracts is that such contracts will only succeed if the contracting problems described



here can be overcome. Granted, our sample is small, and it is not representative of the contracts used in transitional economies for competitive SOEs; and we lacked controls (SOEs without contracts).<sup>25</sup> Nevertheless, since all the contracts failed to improve performance, we cannot say with certainty whether or not a well designed contract would have done better. Also unknown is whether alternatives which create a residual claimant, such as contracts with private managers or sale of the enterprise to a private owners, might produce better results (although findings in World Bank 1995 are very suggestive). What is clear is that, if the contracts in our sample are representative of the performance contracts in use with state-owned monopolies worldwide, then considerable time and effort is being expended on an exercise with little theoretical or empirical justification.

## References

- Barron, David. 1988. "Design of Regulatory Mechanisms and Institutions," in R. Schmalensee and R. Willing (eds). Handbook of Industrial Organization. Amsterdam: North-Holland.
- Besanko, David and David Sappington. 1987. Designing Regulatory Policy with Limited Information. London: Harwood Academic Publishers.
- Dyer Cissé, Nichola. 1994. "The Impact of Performance Contracts on Public Enterprise Performance." Mimeo.
- Freixas, Xavier, Roger Guesnerie, and Jean Tirole. 1985. "Planning under Incomplete Information and the Ratchet Effect." Review of Economic Studies. LII: 173-191.

- Hartmann, Arnard and S.A. Nawab. 1985 "Evaluating Public Manufacturing Enterprises in Pakistan." Finance and Development. Vol. 22 (3).
- Jones, Leroy. 1975. *Public Enterprise and Economic Development: The Korean Case*. Seoul: Korea Development Institute.
- \_\_\_\_\_. 1981. "Towards a Performance Evaluation Methodology for Public Enterprises: With Special Reference to Pakistan." Paper presented at the international symposium on Economic Performance of Public Enterprises, Islamabad.
- \_\_\_\_\_. 1985. "Public Enterprise for Whom? Perverse Distributional Consequences of Public Operational Decisions." Economic Development and Cultural Changes 33 (2): 333-47.
- \_\_\_\_\_. 1990. "The Linkage Between Objectives and Control Mechanisms in the Public Manufacturing Systems," in P. Trivedi, ed., Memorandum of Understanding: An Approach to Improving Public Enterprise Performance. New Delhi: International Management Publishers.
- \_\_\_\_\_. 1991. "Performance Evaluation for Public Enterprise" World Bank Discussion Paper 122. Washington, D.C.
- Laffont, Jean-Jacques, and Jean Tirole. 1986. "Using Cost Observation to Regulate Firms." Journal of Political Economy. 94, Part 1:614-41.
- \_\_\_\_\_. 1993. A Theory of Incentives in Procurement and Regulation. MIT Press: Cambridge, MA
- Levy, Brian, and Pablo Spiller, eds. 1996. *Regulations, Institutions, and Commitment: Comparative Studies of Telecommunications*. New York: Cambridge University Press.
- Lupia, Arthur and Mathew D. McCubbins. 1996. *The Triumph of Reason: Knowledge and the Foundation of Democracy*. New York: Cambridge University Press.
- Milgrom, Paul and John Roberts. 1992. Economics, Organization and Management. Englewood Cliffs, NJ: Prentice-Hall, Inc.

- Nalebuff, Barry and Joseph Stiglitz. 1983. "Information, Competition, and Markets." American Economic Review. 73(2):278-283.
- Nellis, John 1989. "Contract Plans and Public Enterprise Performance." Policy, Planning, and Research Working Paper 118. World Bank, Washington, D.C.
- Niskanen, William. 1971. Bureaucracy and Representative Government. Chicago: Aldine-Atherton.
- North, Douglass C. 1990. Institutions, Institutional Change, and Economic Performance. New York: Cambridge University Press.
- \_\_\_\_\_, and Barry R. Weingast. December 1989. "Constitutions and Commitment: The Evolution of Institutions Governing Public Choice in Seventeenth-Century England." The Journal of Economic History. Vol. XLIX. No. 4.
- Sappington, David E. M. 1991. "Incentives in Principal-Agent Relationships." Journal of Economic Perspectives 5 (2): 45-66.
- \_\_\_\_\_, and Joseph E. Stiglitz. 1987. "Privatization, Information, and Incentives." National Bureau of Economic Research (NBER) Working Paper 2196. Harvard University, Cambridge Mass.
- Shirley, Mary. 1989. "Evaluating the Performance of Public Enterprises in Pakistan." Policy, Planning, and Research Working Paper 160. World Bank, Washington, D.C.
- \_\_\_\_\_. 1991. "Improving Public Enterprise Performance: Lessons from South Korea." Annales de l'économie publique sociale et coopérative 62 (1). De Boeck Universiteit, Brussels.
- \_\_\_\_\_ and Lixin Colin Xu, "The Empirical Effects of Performance Contracts: Evidence from China," mimeo, the World Bank, 1997.
- Shleifer, Andrei and Robert W. Vishny. 1994. "Politicians and Firms." Quarterly Journal of Economics. 109:995-1024.
- Song, Dae Hee. 1988. "Korea Public Enterprise Performance Evaluation System." Asian Economic Journal. 106-138.
- Spence, A. Michael. 1973. "Job Market Signaling." Quarterly Journal of Economics. 353-374.
- State Enterprises Commission (SEC). 1991. *SOE Performance Evaluation Report*. Accra, Ghana.

- \_\_\_\_\_. 1993. The SOE Reform Program 1984/1992: Review and Recommendations. Accra, Ghana.
- Stiglitz, Joseph. 1989. "Principal and Agent." John Eatwell, Murray Milgate and Peter Newman eds. The New Palgrave. Allocation, Information and Markets. New York: W.W. Norton.
- Trivedi, Prajapati, ed. 1990. Memorandum of Understanding: An Approach to Improving Public Enterprise Performance. New Delhi: International Management Publishers.
- Vickers, John and George Yarrow. 1988. Privatization: An Economic Analysis. Cambridge, MA.:The MIT Press.
- Weitzman, Martin L. "The Ratchet Principle and Performance Incentives." The Bell Journal of Economics. 11 (1):302-08.
- Williamson, Oliver. 1975. Markets and Hierarchies. New York: The Free Press.
- \_\_\_\_\_. 1976. "Franchise Bidding for Natural Monopolies - in General and with Respect to CATV." Bell Journal of Economics 7 (1): 73-104.
- \_\_\_\_\_. 1985. The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting. New York: Free Press.
- World Bank. 1992. "Mexico, Public Enterprise Reform Loan" Loan 3086. Program Performance Audit Report. Operations Evaluations Department. World Bank, Washington, D.C.
- \_\_\_\_\_. 1995. Bureaucrats in Business: The Economics and Politics of Government Ownership. Washington, D.C.: Oxford University Press.

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expressed are the authors own and do not necessarily reflect those of the World Bank, its Board of Directors or the countries they represent.

<sup>1</sup> See also Milgrom and Roberts (1992).

<sup>2</sup> Independent auditors for Senegal Electricity concluded that “the accounting and financial management show such an amount of anomalies and deficiencies that the auditor will not be able to release an opinion on the matter.”

<sup>3</sup> Jones (1981) further suggested a disclosure bonus that would reward managers who give a more realistic estimate of their potential.

<sup>4</sup> There were 17 respondents to the questionnaires, one from each of the sample companies and monitoring agencies, with the exception of the Mexican Government which did not respond. Field interviews were done in Ghana and Senegal by Nichola Dyer Cissé (whose interview reports were used for this article), and in India and Korea (during several earlier visits from 1990 to 1994) by one of the authors. Staff from the Philippines government responsible for the contracts were interviewed in Washington, D.C. One of the authors was also involved in the initial discussions of the Mexico contracts.

<sup>5</sup> We included one electricity company from each country to test for industry effects (none were found).

<sup>6</sup> Korea Telecoms was created as a separate company only two years before its contract started. Senegal Telecoms was created in the same year that it signed its first contract; we extrapolated backwards two years, using data from prereorganization telecom units. We included Senegal Electricity's second contract (starting in 1990), even though it was never signed. The conclusions would not change if that period were omitted. We also took 1987 as the start date for India Oil's contracts even though it signed a pilot form of contract in 1986 (based on the multi-year French *contract plan*). The government later switched to a very different sort of contract (closer to the Korean model, using yearly weighted targets). The conclusions would not change if the earlier contract period were included.

<sup>7</sup> Competition between firms for the market or bidding between potential managers for the privilege of operating the firm increases government's information by allowing comparisons between the firms'

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performance or the managers' bids. However, all of the sample enterprises were monopolies and none of the contracts were competitively bid, so this form of information revelation was not employed.

<sup>8</sup> Interview with Hafeez Shaikh (1994).

<sup>9</sup> In Ghana, government negotiators and monitors in the State Enterprises Commission (SEC) lost power when responsibility for energy contracts was shifted to the sector agencies. Although the shift only affected two SOEs directly (including one of the three in our sample), staff in the SEC believe that the change adversely affected the credibility of all monitoring and negotiating. According to an SEC report "This situation tends to create considerable uncertainty about who can require performance information from the SOEs. This has affected the ability of the Commission to perform its reporting and evaluation function." (SEC, 1991).

<sup>10</sup> Field interviews.

<sup>11</sup> In addition Philippines Electricity's targets for new lines, main lines, income, rate of return on revalued assets and power generation per employee were reduced even though the company had exceeded the target the previous year. Delays in getting information on achievements may be a reason why government agents agreed to set targets well below the previous year's achievements.

<sup>12</sup> Public profits are private profits adjusted to measure returns to society as a whole and to exclude factors beyond the control of managers (Jones, 1991).

<sup>13</sup> Interviews with government evaluators and knowledgeable observers also suggest that the managers in our sample negotiated for more and softer targets and were often responsible for changes in the criteria.

<sup>14</sup> Some observers have suggested in discussions of this paper that the weaknesses in the targets are due to a lack of capacity on the part of the government agencies or are part of the early phase of a learning process about how to contract successfully. These explanation do not seem credible to us because numerous or fluctuating targets are found in the entire sample, in countries where government capacity is strong (India,

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Korea or Mexico) and in countries where the contract process has been in place for more than five years (Korea and Senegal).

<sup>15</sup> The decline in capital spending allowed it to exceed its targets for self financing and debt service. The combined scores on these two criteria cancelled out its poor performance on its capital project target.

<sup>16</sup> This was partly due to shutdowns of older wells.

<sup>17</sup> In Korea, evaluations of how different departments, divisions and offices contributed to contract achievements are taken into account in internal promotions (Shirley, 1991).

<sup>18</sup> Standing boards of directors were replaced by executive boards; government representation on the boards was reduced to two members; only board approval of the budget was required when previously the supervising ministry, the Economic Planning Board and the cabinet also had to approve; responsibility for most personnel decisions was shifted from the supervising ministry to the enterprise; procurement through a centralized office was made voluntary instead of compulsory; all oversight was centered in the contract with one yearly inspection, compared to the extensive system of controls and inspections used before (in one year before the contracts Korea Electricity had eight different inspections lasting 108 days); preference was shifted to internal candidates for senior positions (previously over half of all such appointments were from outside the firm) and an explicit merit assessment was introduced (Shirley, 1991: 11-12).

<sup>19</sup> An early opinion survey of 750 employees in all ranks of the SOEs under contract found that 93 percent thought that management had improved, thanks to the performance evaluation system; 55 percent saw substantial improvement; 94 percent of the executive directors said that there had been substantial or significant improvement (Song, 1988).

<sup>20</sup> Mexico Electricity's experience under the contract differs from that of other SOEs in Mexico in that the government followed through on its commitments under the contract. The Mexican government distinguishes between the Financial Restructuring Pact applied to Mexico's Electricity and performance contracts. A World Bank assessment of Mexico's standard performance contracts with five other SOEs

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concluded that the results were disappointing. The study attributed the poor outcomes to a lack of adequate consultation between government and the SOEs; government attempts to treat the contracts as one more instrument of control among many; and targets which lack coherence, simultaneously overlapping and leaving gaps (World Bank, 1992).

<sup>21</sup> The data were taken from enterprise audited accounts and put into comparable formats where necessary. Although every effort was made to verify the accuracy of the data, in some cases the underlying information systems are weak. However, it seems plausible that errors are not correlated over time and do not greatly affect the trend analysis.

<sup>22</sup> Where assets were not revalued by the company, we revalued them, using company figures for depreciation and the GDP deflator for inflation.

<sup>23</sup> Out of a total of 17 respondents to this question.

<sup>24</sup> Some commentators have asked us why we did not judge each firm's performance by its attainment of the economic targets specified in its contract. As mentioned, we did investigate performance against targets and found that all of the sample SOEs achieved at least satisfactory ratings where a score was assigned (Senegal had no such score). However, since many of the targets (as we analyzed above) were subject to manipulation, firms might attain their economic targets under the contract but not necessarily operate more profitably or productively. For example, 30 percent of India Electricity's score in 1991-92 depended on the volume of electricity they generated; output went up but the use of material inputs rose even faster. India Electricity achieved its target and received a score of excellent that year, but its TFP fell below precontract levels.

<sup>25</sup> The authors are currently studying the experience with performance contracts for competitive and monopoly SOEs in China (Shirley and Xu, 1997). This study corrects some of these problems, since it has a much larger sample, and we can control specifically contract provisions pertaining to information, incentives, and commitment.





Table 1. Number of Performance Contracts in Developing Countries, by Sector

<i>Sector</i>	<i>Africa</i>	<i>Asia</i>	<i>Latin America</i>	<i>Mid-East and North Africa</i>	<i>Central Europe<sup>a</sup></i>	<i>Total</i>
Transport	26	8	4	6	2	46
Telecom and Post	15	2	1	1	0	19
Extractive industries	6	26	2	2	3	39
Agriculture	13	3	2	0	0	18
Water	4	4	0	1	0	9
Electricity	11	8	6	1	1	27
Other	61	160	1	1	4	227
Total	136	211	16	12	10	385 <sup>a</sup>

a. Data for Romania only. Contracts are also being used in Bulgaria, but no details are available.

b. Total figures cover thirty-one countries. In addition, Indonesia reports 180 firms, and China 103,000; no breakdown by industry was available. Data reflects situation as of June 1994. Based on a world-wide search using World Bank and other sources. In some countries additional contracts may have been awarded.

Source: Survey of World Bank reports and staff.

Table 2. Case Study Enterprises

<i>Country (Contract Type)</i>	<i>Enterprise Name: (NAME USED IN TEXT)</i>	<i>Contract Duration</i>	<i>First Contract year</i>
Ghana (performance contract)	Electricity Corporation of Ghana (ECG): GHANA ELECTRICITY	Yearly	1989
	Ghana Water and Sewerage Corporation (GWSC): GHANA WATER		1989
	Ghana Posts and Telecommunication (GP&T): GHANA TELECOM		1990
India (Memorandum of understanding)	National Thermal Power Corporation (NTPC): INDIA ELECTRICITY		
	Oil and Natural Gas Commission (ONGC): INDIA OIL	Yearly (published)	1987
Korea (Performance evaluation and measurement system)	Korea Electric Power Corporation (KEPCO): KOREA ELECTRICITY	List of yearly targets	1984
	Korea Telecommunications Authority (KTA): KOREA TELECOM		
Mexico (convenio de rehabilitacion financiera)	Comision Federal de Electricidad (CFE): MEXICO ELECTRICITY	3 years	1986
Philippines (Performance monitoring and evaluation system)	Metropolitan Water and Sewerage System (MWSS): PHILIPPINE WATER	List of yearly targets	1989
	National Power Corporation (NPC): PHILIPPINE ELECTRICITY		
Senegal (contract plan)	Societe nationale d'Electricite (SENELEC): SENEGAL ELECTRICITY		1987
	Societe Nationale des Telecommunications du Senegal (SONATEL): SENEGAL TELECOMS	3 years	1986

Source: World Bank data.

**Table 3: Comparison of Target Characteristics**

	<i>Average number</i>	<i>Average yearly change (percent)</i>
Ghana Electricity	20	36
Ghana Telecoms	31	30
Ghana Water	14	35
India Electricity	12	19
India Oil	20	9
Korea Electricity	41	8
Korea Telecoms	42	18
Mexico Electricity	11	23
Philippines Electricity	11	6
Philippines Water	10	18
Senegal Electricity	23	0
Senegal Telecoms	37	9

Table 4. Summary of the features of Performance Contracts

	Ghana Electricity	Ghana Water	Ghana Telecom	India Electricity	India Oil	Korea Electricity	Korea Telecom	Mexico Electricity	Philippines Water	Philippines Electricity	Senegal Electricity	Senegal Telecom
<b>Contract traits:</b> quality of annual reports	poor			adequate		adequate		adequate	adequate		poor	
<b>Information:</b> Managerial bargaining power	* low pay and status * reduction in powers			* used outside experts * competent professionals * stable staff	* used outside experts * delay caused targets based on ex post performance * weights changed frequently	* used outside experts * competent professionals * stable staff		* low pay and status * stable staff	* low pay and status * high staff turnover		* low pay and status * frequent shifts in hierarchical position	
<b>Information:</b> Targets manipulation by managers	* targets set by managers * targets changed frequently			* delay caused targets based on ex post performance * weights changed frequently	* delay caused targets based on ex post performance * weights changed frequently	* the weight of shadow priced profit decreased over time * more than 40 targets		* targets not weighted * targets changed frequently	* most important targets had decreasing weights		* averaged 23 targets by managers * targets set by managers * averaged 37 targets	
<b>Incentives:</b> rewards and punishments	* had bonus, but not paid * managers political appointees			managers could receive award, not viewed as a strong incentives	managers could receive award, not viewed as a strong incentives	manager and staff receive 3 month pay if got "A" grade	No	No	No		No	
<b>Commitment:</b> Costly action as signal	No			No		yes, allowed managerial autonomy		No	No		No	
<b>Commitment:</b> Enforcement mechanisms	* loans from the World Bank, backed government contractual obligation * no neutral third party			* used outside experts to evaluate performance * no neutral third party	* used outside experts to evaluate performance * no neutral third party	* used outside experts to evaluate * no neutral third party		* loans from the World Bank, backed government contractual obligation * no neutral third party	no neutral third party		* loans from the World Bank backed government contractual obligation; but not credible because the government reneged * no neutral third party	
<b>Commitment:</b> Government reneging on key promises	reneged on bonus, but met some early promises (increased tariff)			yes, e.g. not requiring public sector to pay bills	yes, e.g. not requiring public sector to pay bills	no		met its obligations (with some delays)	yes, e.g. not requiring the public sector to pay bills		yes, e.g. not requiring public sector to pay bills	

Table 5. The effects of PC on ROA

	PC level Effects Only			Both PC level and growth effects		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.046 (0.668)	-0.055 (-0.492)	-0.064 (-0.564)	0.046 (0.665)	0.292* (1.752)	0.268 (1.396)
PC	-0.122 (1.235)	-0.062 (-0.579)	-0.115 (-0.894)	-0.179 (-1.071)	-0.084 (-0.767)	-0.102 (-0.781)
$T_{it}^{post-PC}$				0.019 (0.425)	0.043 (1.092)	0.038 (0.829)
Inherent growth rate		-0.009 (-0.471)	-0.002 (-0.093)		-0.031 (-1.122)	-0.025 (-0.721)
GDP growth rate		0.027** (2.234)	0.029** (2.331)		0.032** (2.481)	0.032** (2.468)
The year before PC adoption			-0.086 (0.747)			-0.034 (0.261)
Control for firm dummies?	No	Yes	Yes	No	Yes	Yes
No. Obs.	75	75	75	75	75	75
R. Square	0.020	0.712	0.714	0.023	0.717	0.718

Note. t-statistics in parentheses. \*,\*\* represent significance at the 10 and 5 percent level.

The sample used exclude firms with only one year of pre-PC history for it does not allow for the construction of the counterfactual firm-specific growth rate.

Table 6. The effects of PC on labor productivity

	PC level Effects			Both PC level and growth effects		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	1.095** (3.799)	0.253 (0.556)	0.241 (0.518)	1.095** (3.781)	0.382 (0.794)	0.383 (0.792)
PC	0.767** (1.916)	-0.016 (-0.032)	0.035 (0.058)	0.516 (0.838)	-0.072 (-0.142)	0.170 (0.275)
$T_{it}^{post-PC}$				0.074 (0.540)	0.158 (0.849)	0.235 (1.078)
Inherent growth rate		0.167* (1.862)	0.160 (1.593)		0.080 (0.587)	0.002 (0.013)
GDP growth rate		-0.056 (1.014)	-0.058 (-1.017)		-0.037 (0.617)	-0.036 (-0.607)
The year before PC adoption			0.080 (0.153)			0.421 (0.686)
Control for firm dummies?	No	Yes	Yes	No	Yes	Yes
No. Obs.	77	74	74	77	74	74
R. Square	0.047	0.668	0.668	0.050	0.672	0.675

Note. t-statistics in parentheses. \*,\*\* represent significance at the 10 and 5 percent level.

The sample used exclude firms with only one year of pre-PC history for it does not allow for the construction of the counterfactual firm-specific growth rate.

Table 7. The effects of PC on TFP

	PC Level Effects Only			Both PC Level and Growth Effects		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.748** (9.798)	0.684** (9.463)	0.684** (9.421)	0.748** (9.738)	0.635** (8.329)	0.634** (8.151)
PC	0.032 (0.109)	-0.093 (-1.304)	-0.063 (-0.744)	0.081 (0.434)	-0.062 (-0.864)	-0.065 (-0.778)
$T_{it}^{post-PC}$				-0.016 (0.323)	-0.044* (-1.806)	-0.045* (-1.656)
Inherent growth rate		0.032** (2.731)	0.028** (2.181)		0.052** (3.260)	0.052** (2.705)
GDP growth rate		0.020** (2.533)	0.019** (2.311)		0.016* (1.89)	0.016* (1.873)
The year before PC adoption			0.054 (0.677)			-0.005 (0.061)
Control for firm dummies?	No	Yes	Yes	No	Yes	Yes
No. Obs.	76	76	76	76	76	76
R. Square	0.001	0.894	0.895	0.003	0.899	0.899

Note. t-statistics in parentheses. \*,\*\* represent significance at the 10 and 5 percent level.

The sample used exclude firms with only one year of pre-PC history for it does not allow for the construction of the counterfactual firm-specific growth rate.