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Do Government Wage Cuts Close Budget Deficits? --A Conceptual Framework for Developing Countries and Transition Economies

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Abstract

Real wage declines have been common in the public sector in many countries over substantial periods of time. In several cases, such wage reductions have coincided with a decline in the efficiency of the public sector. In a simple analytical framework, it is shown that higher wage levels alter the incentive compatible equilibrium by attracting relatively skilled human capital to the government sector, which raises the quality of public output--tax revenue collection in this paper. Increases in wages should be complemented with appropriate monitoring and penalty rates for effective tax administration; prescriptions of raising the statutory tax rate alone, however, may not increase revenue collection.

JEL Classification Numbers:
H1, H26, J45, L42

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Contents

Summary

Fiscal corrections in developing countries often involve cuts in real public wages, as governments choose to protect employment for political and social reasons. This paper presents evidence from several countries to show that real wages have declined in the public sector in many countries over substantial periods of time. In this environment of declining wages, key government activities, such as tax collection and the regulation and supervision of markets, may suffer, leading to a general decrease in public sector efficiency and an increase in rent-seeking activities. Such an approach to fiscal control may not be long-lasting, as it may result in either substantial lags in the pickup of economic growth following stabilization or to a stabilization effort that is not sustainable.

Given the strong complementarities between public administration and private sector activities, it is surprising to see that mainstream economics has paid little attention to this issue. This paper develops a model of public administration to understand better the links between government wage policy and administrative efficiency. Specifically, it investigates these links are in the area of revenue collection to see how different public policies and institutional settings affect the fiscal deficit. The model that is developed can be generalized to study other aspects of public administration as well. The analytical results show that, as expected, the incidence of tax evasion and bribes is high when penalty rates on the private sector and tax collectors are low, as well as when the probability of detection is low. More important, the paper establishes a clear link between low civil service salaries and higher levels of tax evasion.

The analytical results show that in an environment characterized by weak institutional arrangements--inadequate monitoring, low penalties, and poor worker incentives--raising or rationalizing the statutory tax rates alone is not likely to achieve the objective of increased revenue collection. The macroeconomic policy implications for the general government budget of choosing between alternative tax rates and wage policy are also derived. The paper finds that there is an optimum combination of wage and tax rates that maximizes the net revenues of the government. An important implication of this result is that cutting wages could actually lead to an increase in the budget deficit. Conversely, a government wage policy that attracts quality human capital is viewed as an important component of the larger set of policies and institutional mechanisms that produce efficient governments.

"The commitment to reform cannot long survive, unless government provides adequate pay, recognition for jobs well done, accessible training, and decent working conditions."

--The Volker Commission (1990)

"Widespread tax evasion and underground activities undermine fiscal revenues and raise equity issues (in transition economies)."

--World Economic Outlook (April 1995)

I. Introduction

Beset by macroeconomic problems, developing countries and transition economies adopt adjustment programs from time to time to get their house in order. Since most problems are rooted in lax budgetary policies, the general government's budget is usually the focal point for corrective measures. A common advice given to governments, particularly by international institutions and donor groups, is to cut "excessive" expenditure items. As public investment expenditures are generally viewed favorably in light of economic growth objectives, the natural targets are current expenditures, particularly the government wage bill. A common rule of thumb that is often employed is to cut (or maintain) the wage bill in real (or even nominal) terms. Governments in these countries have generally been reluctant to shed labor, given relatively high unemployment rates and poorly developed social safety nets. Under these circumstances, a real reduction in government salaries is among the common austerity measures taken.

Despite the complexities involved in determining the appropriate salary levels for civil servants, there can be little disagreement that paying salaries that ensure public administrative efficiency are important for several reasons. First, a predominance of government activity in virtually all spheres of life creates vast opportunities for bureaucratic discretion. Unless the right incentives, of which adequate pay is an important part, are set for government employees, public resources are likely to be misallocated. Second, civil servants in these economies are expected to play a crucial role in helping transform underdeveloped economic structures and rudimentary institutions into advanced market-based ones; to facilitate the process quickly and efficiently, the government must attract skilled human capital by compensating them adequately. Underpaid civil servants have been known to illegally spend a substantial part of their office time

on rent-seeking activities, thus diminishing civil service productivity.1/ Finally, with the recent liberalization of economic regimes in several countries and the growth of the private sector, wages in the private sector are likely to rise rapidly. To preclude mass exodus of skilled government employees to the private sector, government pay-scales, especially of those holding key positions in the government, must also rise in tandem with the trends in private sector. 2/

Given the strong complementarities between public administration and private sector activities, it is surprising to see that mainstream economics has paid little attention to this issue. While much anecdotal evidence on public administration inefficiency and corruption in developing countries and transition economies exists (reported in Section II), there is a dearth of formal analyses in the current literature for understanding macroeconomic relationships among public wage policy, public administration, and private sector activity. This paper is intended to fill this gap. A model of public administration is developed to understand better the links between government wage policy and administrative efficiency. Specifically, we investigate these issues in the area of revenue collection to see how different public policies and institutional settings affect the fiscal deficit. The model that we develop can be generalized to study other aspects of public administration as well.

Our analytical results in the tax administration model developed in this paper show that, as expected, tax evasion and bribes are high when penalty rates on the private sector and tax collectors are low and when the probability of detection is low. 3/ More importantly, we establish a clear link between low civil service salaries and higher tax evasion. We also show that raising statutory tax rates, ceteris paribus, may not increase tax collection. Macroeconomic policy implications for the general government's budget of choosing between alternative tax rates and wage policy are derived. We find that there is an optimum combination of wage and tax rates that maximizes the net revenues of the government. An important implication of this result is that cutting wages could actually lead to an increase in the budget deficit. Thus, a government wage policy that attracts quality human capital is viewed as an important component of the larger set of policies and institutional mechanisms that makes for efficient governments. 4/

1/ See Alam (1989), Gould and Amaro-Reyes (1983), Krueger (1974), Wade (1982), and World Bank (1992).

2/ Those who frequently interact with senior government officials in economies undergoing rapid structural reforms are familiar with the high turnover rates in government jobs.

3/ For more information on experience with tax administration see Tanzi and Pellechio (1992).

4/ In the context of a growth model, Haque and Kim (1995) show that perverse incentives in domestic markets can lead to human capital flight abroad and retard economic growth.

The rest of the paper is organized as follows: Section II motivates the paper by reviewing past trends in public wages and citing anecdotal evidence on public administrative efficiency in developing countries and transition economies. In Section III, a model of revenue collection is developed to analyze the impact of wage policy on public administrative efficiency. In the two subsequent sections, this model is used to investigate the conditions under which tax evasion and corruption emerge; then, macroeconomic implications for incentive compatible tax and wage policies are derived. The paper ends with a concluding section that summarizes its main results.

II. Incentive Myopia: Wage Cuts for Fiscal Needs

In a provocative paper, Klitgaard (1989) faulted governments in developing countries with "incentive myopia," a term used to describe the shortsightedness of policy makers that attempt to close budget deficits by cutting real wages in the public sector. Klitgaard argues that such an approach leads to a collapse of incentives in the public sector. Despite the evidence on incentive myopia presented in several anecdotal studies, there has been little economic analysis or systematic empirical investigation of the phenomenon. In particular, there have been no attempts to link public wage policy with the quality of output in public administration. A genuine problem, of course, is that reliable and consistent time series data, even on the structure of public sector wage and employment are not available for most countries. Some studies (such as those by the World Bank and ILO) provide snapshots of key issues on the basis of sparse and disjointed data series. These studies are important in that they demonstrate the nature of problems that exist in the public sector. Unfortunately, despite the authors' attempts, a comprehensive data set on public wages and public sector inefficiency cannot be collected from these studies to pursue a thorough econometric investigation at this time. However, in examining the available evidence, the following stylized facts emerge.

1. Public wages have declined in real terms over time

Evidence from a number of developing countries suggests that real wage levels for public sector employees have been declining over long periods of time. 1/ Table 1 presents the trend growth in real wage levels in the general government. Our estimates include all the countries for which time-series data were available and for as many years as the data permitted. The

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1/ Gould and Amaro-Reyes (1983) conducted a study of the salary structure of middle and low level civil servants in Africa and Latin America and found that their salary levels were, at times, so low that officials could not even afford a balanced diet. Lindauer and Nunberg (1994) and Chaudhry et al. (1994) have also provided evidence for low and declining wages of the public sector in Africa and Latin America in the 1980s.

Table 1. Trends in Real Wages in General Government
(percent per annum)

	Time Period	Real Wage Trend in General Government
Argentina	1976-89	-3.1
Bulgaria	1989-92	-17.7
Bolivia	1985-91	2.3
Congo	1980-83	-3.8
Costa Rica	1974-93	1.7
Czechoslovakia	1989-92	-11.7
Fiji	1985-93	-1.7
Gabon	1985-91	3.4
Hungary	1989-92	-0.8
India	1979-84	3.8
Kenya	1982-92	-2.2
Mauritius	1974-92	1.3
Morocco	1980-89	-1.6
Myanmar	1987-92	-0.5
Panama	1973-91	0.6
Poland	1989-92	-10.3
Romania	1989-92	-8.9
Rwanda	1985-89	-2.0
Solomon Island	1988-91	1.6
Suriname	1984-86	-8.3
Ghana	1986-90	4.4
Simple average for all countries		-1.4 1/

Source: National authorities.

1/ Estimated from a fixed effects pooled regression of the countries listed. The coefficient was significant at the 5 percent level.

trend regressions indicate that, since the mid-1970s, real wage levels in the general government declined for 13 out of the 21 countries. In the remaining eight countries that registered positive growth rates, the highest was in Ghana at four percent per annum. For the sample as a whole, real wages declined by about 1.4 percent per annum.

Recognizing that trends in average wages could be misleading since they abstract from changes in the structure of wages, in Table 2 we focus on the two extremes in the government hierarchy. (See Van Ginneken (1991)). 1/ Over the 1975-85 period, real wages have declined, in virtually all the African countries for which data were available. This occurred at the lowest as well as the highest grade levels. 2/ The decline has been quite distinct in most cases--over 40 percent during 1975-85 in 11 out of the 13 countries at the highest grade level, and to a somewhat lesser extent at the lowest grade level. It is also revealing that the erosion has been greater at the highest grade level than at the lowest grade level in virtually all cases. 3/ The latter fact assumes significance in that it is arguably a reflection of the extent to which the quality of top bureaucrats, significant contributors in formulating public policy, may have declined in these countries.

A recent study by Kraay and Van Rijckeghem (1995), based on a fairly extensive data set for a large number of developing countries, also confirms the decline in real wages. In their sample, the average government wage relative to per capita income declined by an average of 8 percentage points per annum in the last two decades. The decline in government wage relative to per capita incomes is not uniform across countries. The poorer countries experienced a larger decline during the seventies. During the eighties the decline was reversed but not by enough to correct the declining trend over the entire period. 4/

Some studies on stabilization programs suggest that fiscal adjustments are frequently associated with a decline in real wages in the public sector. Kraay and van Rijckeghem (1995) also found that short-term stabilization programs have a significant negative impact on real wages, while overall wage expenditures of the government are protected (Hewitt and Van Rijckeghem (1995)). Such programs, therefore, appear to protect employment at the cost of reducing real wages. The incentive problem that

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1/ It is possible that a measured decline in real average wage levels may merely indicate a relative expansion of low-paid jobs rather than a decline in wages at all grade levels in the government.

2/ The only exception is in Zimbabwe, where real wages at the lowest grade level rose over the decade.

3/ The sole exception is Benin.

4/ Kraay and Van Rijckeghem (1995) also show that governments do attempt to protect employment; employment growth over the period of their estimation remains positive, while the real wage declines for a large number of countries.

Table 2. Real Government Wage Index in Selected African Countries in 1985

(1975=100)

Country	At the Lowest Grade Level	At the Highest Grade Level
Benin	54.8	63.0
Central African Republic	66.0	54.0
Ethiopia	81.4	31.3
Gambia	50.1	43.6
Kenya	87.6	50.3
Morocco	83.8	75.0
Nigeria	46.4	24.1
Sierra Leone	23.8	18.0
Sudan	58.2	34.0
Tanzania	23.8	18.8
Togo	84.0	78.2
Tunisia	86.1	52.8
Zimbabwe	161.5	58.1

Source: Van Ginneken (1991).

arises from real wage declines is being increasingly recognized and explicitly addressed in the design of recent longer term structural adjustment programs (see Lindauer and Nunberg (1994), Chaudhry et al. (1994), and Kraay and van Rijckeghem (1995)). Such programs often include civil service reforms that seek to increase public sector efficiency by reducing public employment and streamlining the wage structure and incentive mechanisms.

In transition economies, large-scale liberalization of prices accompanied by wage controls led to a decline in real wages in the public sector, particularly during the initial stages. In the absence of data on government wages, we report wage movements for the public sector as a whole. 1/ Table 1 also reports a decline in real wages for five Eastern European countries during 1989-92. A similar pattern, to an even larger extent, is evident in the countries of the former Soviet Union (FSU). Table 3 shows that, with the exception of Latvia and Estonia (two countries that reformed earlier than others), real public wages declined in all FSU countries in the sample. Thus, during the initial transition years, a fall in real wages was common in the majority of transition economies.

2. Evidence on public-private wage differentials

Evidence on government wages relative to the private sector was presented in a fairly comprehensive cross-country study by Heller and Tait (1984). We report one of their results in summary form in Table 4. The cross-section study shows that during the late seventies and early eighties the ratio of public to private wages was lower in developing countries than in industrial countries. This evidence is somewhat surprising, since one would expect that in developing countries, on average, the quality of human capital would be higher in the government relative to the underdeveloped private sector (Heller and Tait, 1984). In Table 5 we present more evidence on the trends in the ratio of government to private wages for those years and countries that we collected from other sources. Once again the relative decline in wages in the government sector becomes apparent. To control for changes in the structure of wages, public wages at the highest and lowest grade levels in the government hierarchy are compared with private sector wages at similar levels in Table 6 (see Chaudhry et al. (1994) for details). Public sector wages are, in most cases, lower than private sector wages at both grade levels, particularly at the highest grade levels.

Comparable data on public and private sector wages are not yet available for the transition economies, with the possible exception of the Czech Republic. In a rare study that compares public sector to private

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1/ Based on newspaper reports and anecdotal evidence, it is perhaps fair to assess that in transition economies, wages in the government sector have declined more sharply than wages for the public sector as a whole. Protests and demands for higher wages from civil servants in education, health, and public administration are often headline news in transition economies.

Table 3. Real Public Wage Indices in
Selected Former Soviet Union Countries, 1992-1994

Country	1992	1993	1994
Armenia	100	22.9	15.3
Belarus	100	93.5	59.4
Kyrgyz Republic	100	57.2	41.2
Russia	100	98.9	90.4
Ukraine	100	50.5	44.9
Estonia	100	106.1	109.9
Latvia	100	107.5	120.3
Lithuania	100	54.7	70.7
Average for all countries	100	84.0	57.6

Source: National authorities. IMF Staff estimates.

Table 4. Ratio of Central Government to "Other" Wage Rate, 1979-81 1/ 2/

Industrial Countries		Developing Countries	
Australia	0.81	Benin	0.56
Austria	0.32	Botswana	0.90
Belgium	0.73	Kenya	0.94
Canada	1.29	Mauritius	0.68
Denmark	1.96	South Africa	1.16
Germany	1.32	Swaziland	1.04
Ireland	1.12	Togo	0.35
Italy	1.03	Zambia	0.37
Japan	1.77	Zimbabwe	1.18
Netherlands	1.21	India	0.37
New Zealand	0.77	Sri Lanka	0.65
Norway	1.35	Egypt	2.43
Sweden	1.04	Argentina	1.20
United Kingdom	1.14	Ecuador	1.12
United States	1.09	Jamaica	1.80
		Panama	1.02
Average	1.13	Korea	4.40
		Average (excluding Korea)	0.99
		Average (including Korea)	1.19

Source: Heller and Tait (1984).

1/ Only one data point for each country taken from one of the three years in 1979-81.

2/ Average Central Government wage to average wage of employees outside central government.

Table 5. Trend in the Ratio of Government to Private Sector Average Wages (Percent Per Annum)

	Time Period	Trend
Bolivia	1985-91	4.0
Costa Rica	1974-93	-0.8
Fiji	1985-93	-27.0
Kenya	1982-92	-3.0
Mauritius	1974-92	-0.4
Panama	1973-91	2.0
Peru	1985-92	-25.0
Poland	1989-92	-0.4
Suriname	1984-86	-1.0
Ghana	1986-90	-8.0
Average for all countries		-6.0

Source: National authorities.

Table 6. Ratio of Government to Private Wages at Similar Grade Levels

Country	Year	At the Lowest Grade Level	At the Highest Grade Level
Trinadad & Tobago	1992	86.4	63.5
Uruguay	1989	125.4	37.5
Chile	1990	23.0	70.4
Venezuela	1992	50.6	29.5
Argentina	1992	88.7	24.1
Bolivia	1989	36.9	138.7
Bangladesh	1987	24.8	9.3

Source: Chaudhry et al. (1994).

sector wages in the Czech Republic, Flanagan (1995) finds that full-time employees in the private sector earn considerably more than their counterparts in the state sector. After controlling for schooling and potential experience, survey results show that workers (owners) in new private firms earn 18 (43) percent more than those in current or former state enterprises.

Another noteworthy observation is that rapidly growing developing countries with stable macroeconomic environment appear to compensate their government employees well. Korea is clearly an exception in Heller and Tait's study (Table 4) in that the relative wage in the government sector was not only higher compared to other developing countries but also in comparison with the OECD countries. Table 5 also shows that Bolivia, Singapore, and Chile--the countries with better macroeconomic performance during the sample period 1987-92--had the highest public-private wage ratios at the highest grade levels. In Singapore, the principle of using private sector wage rates to compensate public servants has existed for a long time and was re-emphasized during the salary revision exercise in 1989 (see Quah in Chaudhry et al. (1994) and Lee (1959)). 1/ It would appear--and this needs further investigation--that one determinant of the successful implementation of public policy in the better performing developing countries may have been the government's ability to attract and retain high quality staff, particularly at the higher grade level, from the start of their development process. 2/

3. Public wages, corruption, and misallocation of resources

Low and declining public wages are likely to encourage rent-seeking and corrupt activities that, in turn, tend to aggravate public sector inefficiencies. 3/ In fact, the limited recorded evidence available suggests that corruption is quite pervasive in most developing countries and transition economies, and that it imposes significant economic costs on these countries. While arguments can be made supporting corruption along the lines that it cuts red tape and undermines rigid and unjustified regulations (Leff (1964)), Gould and Amaro-Reyes (1983) show that the practice of giving "speed money" was actually the cause of administrative delays because civil servants developed the habit of slowing paperwork until some kind of payment was made to them. Shortages in the supply of critical

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1/ Lee justifies the high wages paid to the civil servants by arguing that "low salary and slow advancements are major factors in low recruitment and high resignation rate.... We should pay civil servants market rates for their abilities and responsibilities. [Our policy] is therefore to offer whatever salaries are necessary to attract and retain talent."

2/ In the context of an endogenous growth model, Haque and Kim (1995) show that policy-induced distortions in the domestic labor markets can lead to human capital flight and retard economic growth.

3/ See Besley and Mclaren (1993), Bhagwati (1982), Gould and Amaro-Reyes (1983), Alfiler (1986), Klitgaard (1989), and Van Ginneken (1991).

government-controlled inputs (such as electricity, transportation services, and imported inputs) have also created rent-seeking opportunities and have led firms to create wasteful excess capacity to get higher allocations of inputs (Sahay (1990) and (1991)). Mauro (1995) uses qualitative measures of corruption to test their effects on economic growth and finds a significant negative relationship between corruption and growth for a number of developing countries.

One of the most comprehensive projects on tax evasion and bribes was funded by the International Development Research Center (IDRC), Canada (Alfiler (1986)) during 1975-78. 1/ The IDRC found that under Nepal's dasturi system monthly average bribes for customs officials ranged from 50 to 200 percent of the staff's monthly pay. 2/ Revenue administrative officers estimated that between 20 to 30 percent of Nepal's targeted revenue was "lost" on account of bribes. An ex-prime minister in Thailand was quoted as stating that the country could collect about 47 percent more revenues if there were no corruption and tax evasion, particularly in the Bangkok region. Only 15 percent of the total tax revenues in the timber industry in Malaysia was actually collected by the state during 1964-74. At the other end of the spectrum, bribe-taking was found to be a high-risk activity in Singapore, since penalties were high and anti-corruption measures were strictly enforced. 3/ In Hong Kong, corruption was lucrative in the 1960s but this changed in the 1970s when the Independent Commission Against Corruption was established.

Tanzi (1994), in a recent paper, provides compelling arguments for the existence of bureaucratic corruption. He also argues that less developed countries may be more prone to corruption than industrial countries because the cultural environment, such as the facility to develop close personal relationships, is more conducive for such behavior in developing countries. While it is true that with the passage of time, corruption can become institutionalized in any country and may appear to be more characteristic of developing countries and transition economies, it is not obvious that these are "cultural factors" per se. Some good reasons why they are more common in these countries are because the administrative system and institutions are poorly developed and government wages low, so that widespread corruption becomes feasible and attractive.

1/ Twenty-two case studies were prepared by research teams from 7 Asian countries--Hong Kong, Korea, Malaysia, Nepal, Philippines, Singapore, and Thailand. Information was based on journalistic sources, government commission reports, and personal interviews.

2/ Dasturi means periodic payment for "services" rendered.

3/ For example, a messenger of the Port of Singapore Authority paid a fine of 1,500 Singapore dollars for accepting a two-dollar and a five-dollar bribe for leaking confidential information twice.

III. An Analytical Framework

To analyze the efficiency of public administration, the model developed in this section allows for bureaucratic corruption. 1/ Empirical studies on bureaucratic corruption point to three main factors that determine the extent of corruption: opportunities (the size of government à la Tanzi (1994)), low salaries, and poor policing. 2/ We address the last two in this paper. We recognize that there is a distinction between bureaucratic corruption (where bribes emerge) and bureaucratic inefficiency (due to low skills and mismanagement), although the two may observationally be the same (for example, resulting in low rates of tax collection). The two phenomena and a distinction between the two fall out fairly neatly in the model presented below.

1. Some related work

Well-known models on tax evasion (Allingham and Sandmo (1972) and Srinivasan (1973)) are based on asymmetric honesty between tax payers (who could be dishonest) and tax collectors (who are honest by assumption). Although this scenario is likely in industrial countries, it is not a reasonable assumption in less-developed countries.

Our model allows for the possibility that both tax collectors and tax payers are corrupt. Virmani (1987) also allows for symmetric dishonesty and considers different bureaucratic regimes (honest or dishonest, depending on what he calls a "social weakness" factor) that are independent of the incentive scheme for tax collectors. Within the dishonest regimes, he determines optimal incentive schemes in a bargaining framework that ensure honesty of bureaucrats for "corruption deterring societies" and "weak societies". He shows how, if bribes exist, evasion does not increase in the corruption-deterring society when penalties are raised--it merely leads to a transfer of rent from payer to collector. In the weak society, on the other hand, higher penalties lead to higher tax evasion. The intuition for the latter is that if penalties are increased, it becomes more profitable for the tax evader and collector to collude, and the administrative system goes from being honest to corrupt. In contrast to Virmani's model, our model does not assume a priori that some regimes are more corruptible than others --the emergence of corruption is simply a result of the incentive mechanisms in the administrative system.

Following Becker and Stigler (1974), Rose-Ackerman (1975), Klitgaard (1988, 1991), Basu et al. (1992) and Mookherjee and Png (1995), our model also focuses on the principal-agent problem of corruption. The model

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1/ While political corruption could also decrease efficiency of the public sector, this paper focuses only on bureaucratic corruption. We intend to extend our model to allow for political corruption in the future on the basis of insightful suggestions made by Assaf Razin.

2/ See also Alfiler (1986) and Gould and Amaro-Reyes (1983).

presented below analyzes the interaction between the government (the principal) on the one hand, and the tax collector and the private sector firm (the agents) on the other to ascertain how statutory taxes, penalties, and public wage policy determine the level of tax evasion and bribes. In addition to examining ways of motivating the agent to be honest, we derive macroeconomic budgetary implications of alternative wage and tax policies. 1/ While Shleifer and Vishny (1993) also derive the consequences of corruption for resource allocation, they take the principal-agent solution as given.

2. The model

The model basically consists of four sets of players: the government, the auditors (or the monitors), the tax collectors, and private sector firms. The private sector firm produces output y_i on which the government imposes a statutory tax rate t which is uniform across all firms such that total taxes in the economy that are due to the government are $T = tY = \Sigma T_i = t\Sigma y_i$, where Y is the aggregate output in the economy, T_i are total taxes due by each firm i, and y_i is the output of firm i. It is assumed that the government knows aggregate output Y (and therefore T) in the economy perfectly. 2/ However, taxes due by each firm $T_i = ty_i$ can only be observed imperfectly by the government or the auditors, who monitor the tax collectors and the private firms. The government (the principal) collects taxes through its agents, the tax collectors.

a. Collusion and asymmetric information

There is perfect information between the government and the auditors but imperfect information between the auditors and the tax collectors. The tax collectors observe the firm's output perfectly (and hence the firm's tax liability) but the government and the auditors do not. Thus, the extent of tax evasion or the presence of side-deals between the private sector and the tax collector are not fully observed by the government and the auditors. The assumptions on information flows among the various players are illustrated in Figure 1.

Since the government and the auditors cannot fully observe the activities of the tax collectors and the firm, the collector and the firm could potentially cheat the government of taxes. We assume that if tax evasion occurs, the tax collector and the firm play a cooperative game to determine $\tau_i = \mu T_i$, where μ is a fraction of T_i and τ_i are the total taxes declared by firm i and collected by the government. (Note that $0 \leq \mu \leq 1$).

1/ Becker and Stigler (1974) argue for efficiency wages to motivate the agent to be honest, while Klitgaard (1991) makes a case for indoctrination.

2/ Output y_i are assumed to be exogenous and fixed in this model. It will, therefore, be ignored from now on and the model will concern itself only with T_i, and T. Thus, a higher T_i simply implies that the tax rate has gone up for the same level of y_i.

The firm pays the tax collector a bribe b and reduces its tax liability by $(T_i - \tau_i)$. 1/ Since the firm and the bureaucrat share in the gains from collusion, $b_i \leq T_i - \tau_i$.

b. Institutional set-up: monitoring and penalties

The government is aware of the potential for collusion between the firms and tax collectors to cheat it of tax revenues. In response, it sets up institutional arrangements to monitor their activity. Specifically, the government hires auditors who can discover evasion with a finite probability p, with $0 \leq p \leq 1$, where p is directly proportional to the auditors' ability to detect cheating. The auditor's actions are fully observable by the government. Her ability depends on her skills, which are a function of the wage she receives. Her level of skill is, therefore, assumed to be directly proportional to her wage (w_g) relative to the wage in the private sector (w_p); since both w_g and w_p can be observed, the level of skill is an observable. 2/ The underlying assumption is that a higher relative wage in the public sector, represented by $\alpha = w_g/w_p$, allows for better human capital to flow into the government sector. 3/ Thus, the probability of being caught is proportional to α since α determines the auditors' ability to detect cheating. In addition, we assume that the probability of getting caught increases as tax evasion increases. Or, the probability of getting caught is

$$p = p(\alpha\ ,\ T-\tau), \tag{1}$$

where $T = \Sigma T_i$ and $\tau = \Sigma \tau_i$ are aggregates taxes due and collected in the economy and are therefore observable to the government and its agents. The function p is assumed to be differentiable, increasing, and convex in both arguments. It is also assumed that each firm's decision to cheat or not affects τ, since $\tau = \Sigma \tau_i$. Thus, p is, in part, a choice variable for the firm.

If corruption is discovered, both the firm and the bureaucrat are fined such that they individually pay penalties that are higher than the level of the cheat. Thus, the firm pays a penalty that is a multiple of the level of

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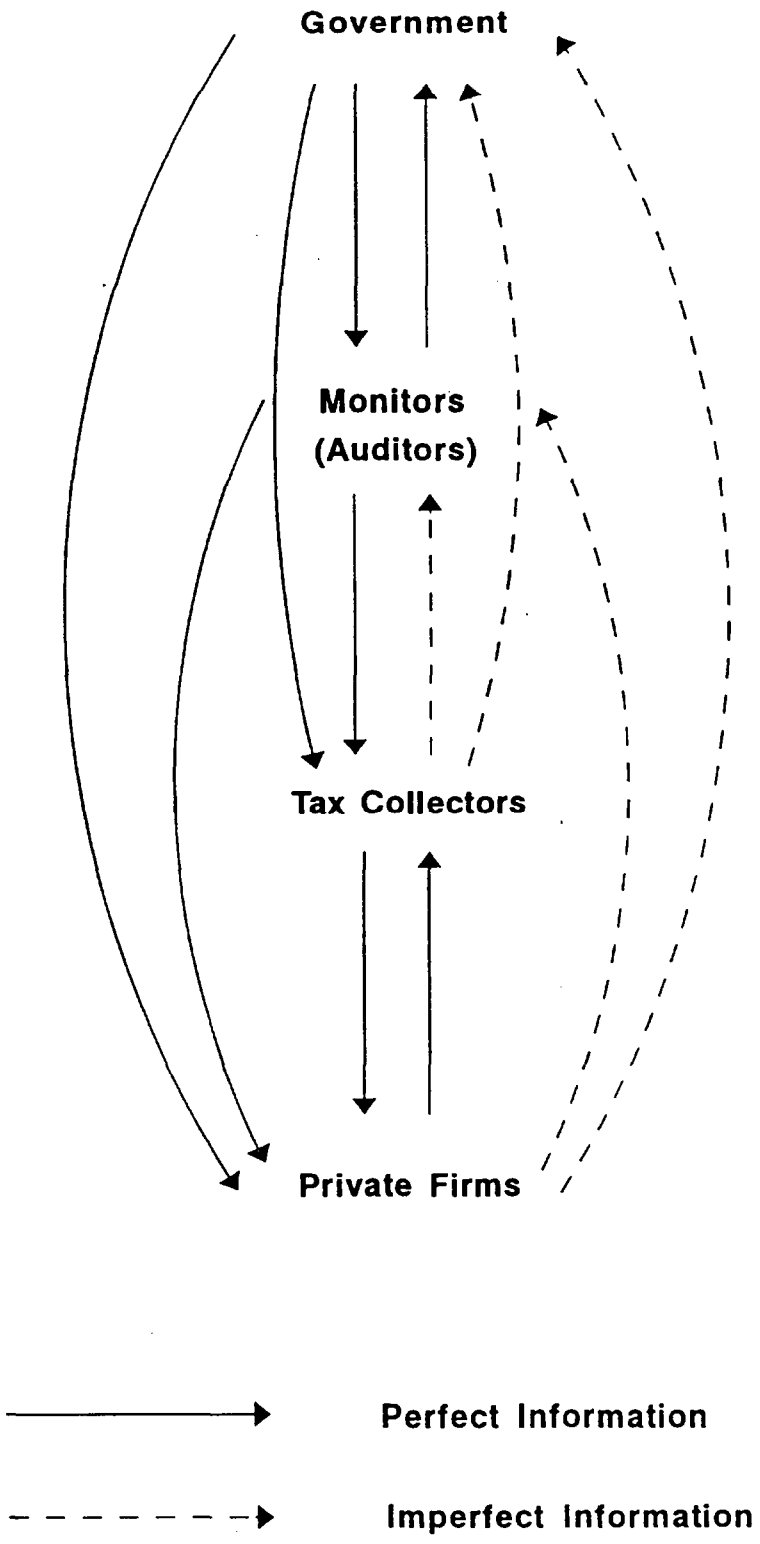
1/ It is assumed that the penalties on the tax collector are sufficiently high to ensure that he will not overreport or that the costs to the private sector of appealing an excessive report are sufficiently low such that $\tau < T$.

2/ For simplicity, we also assume that the tax collectors receive the same wages as the auditors. We relax this assumption later in the paper to see if it leads to a different outcome.

3/ The variable, α, is, for analytical simplicity, normalized such that it is bounded between 0 and 1. It is also plausible to expect that the government would, at best, pay the auditors and collectors no more than their opportunity cost in the private sector.

Figure 1. A Description of Information Content and Flows



tax evasion, that is, $\delta_p(T_i - \tau_i)$ with $\delta_p > 1$. Similarly, in the event of a detection, the collector will pay $\delta_g(T_i - \tau_i)$ where $\delta_g > 1$.

IV. Corruption and Tax Evasion

Given the public policy variables, T, α, δ_g, and δ_p, the collector and the firm collectively decide whether or not to evade taxes. Tax evasion and bribes emerge if their respective pay-offs from cheating the government are higher than from not cheating.

1. The payoffs

We assume that all parties are risk-neutral. If no evasion occurs, neither the firm nor the collector gains or loses anything. The payoffs, as well as the structure of the game, are summarized in Figure 2 and described below.

a. The firm

If evasion occurs and is not discovered by the auditors, the firm's pay-off is

$$(T_i - b_i - \tau_i) . \tag{2}$$

If auditors discover the evasion the firm pays a penalty δ_p on the tax evaded as described in the previous section. Thus, when tax evasion occurs and is discovered by the auditors the firm's payoff is

$$T_i - b_i - \tau_i - \delta_p(T_i - \tau_i) . \tag{3}$$

The total expected payoff to the firm for participating in the evasion game is simply the probability-weighted sum of equations (2) and (3):

$$p[(T_i - b_i - \tau_i) - \delta_p(T_i - \tau_i)] + (1-p)(T_i - b_i - \tau_i) , \tag{4}$$

which simplifies to

$$(T_i - \tau)(1 - p\delta_p) - b_i . \tag{5}$$

b. The tax collector

The payoff to the tax collector (net of wages received) when she is not discovered by the auditor is b_i. Since discovery of cheating leads to a penalty assessment of δ_g on the amount of tax that was evaded, the net gain to the collector when discovered is

$b_i - \delta_g(T_i - \tau_i)$. 1/ The total expected payoff to the collector is, therefore,

$$p[b_i - \delta_g(T_i - \tau_i)] + (1-p)(b_i), \tag{6}$$

which simplifies to

$$b_i - p\delta_g(T_i - \tau_i). \tag{7}$$

The choice between cheating the government of its tax revenues or not will depend on whether the expected payoffs to the tax collector and the firm are more if they cheat than if they do not. A necessary and sufficient condition for bribes and tax evasion to exist is that each of the two players gains. This condition is satisfied if expressions (5) and (7) are each greater than zero. Alternatively, the conditions can be collapsed into

$$8(T_i - \tau_i)(1 - p\delta_p) - b_i \geq 0, \tag{8}$$

and

$$b_i - p\delta_g(T_i - \tau_i) \geq 0. \tag{9}$$

A necessary condition for the non-negativity conditions in equations (8) and (9) to be satisfied so that $T_i - \tau_i$ is strictly positive is

$$p(\delta_p + \delta_g) \leq 1. \tag{10}$$

The economic interpretation of equation (10) is that bribes and tax evasion will exist only if the monitoring arrangements are weak (that is, p is small) and there are relatively low penalties for such activities (that is, δ_p and δ_g are low). Alternatively, weak institutional setups raise payoffs to corrupt and illegal activities. 2/

2. Optimal level of tax evasion

If the condition specified in equation (10) is met, the tax collector and the firm bargain to determine the optimal levels of tax evasion and bribes. We solve the problem in two stages. At the first stage, the firm and the collector determine τ_i (the taxes declared) to maximize their joint net payoffs (that is, maximize the size of the total pie). At the second

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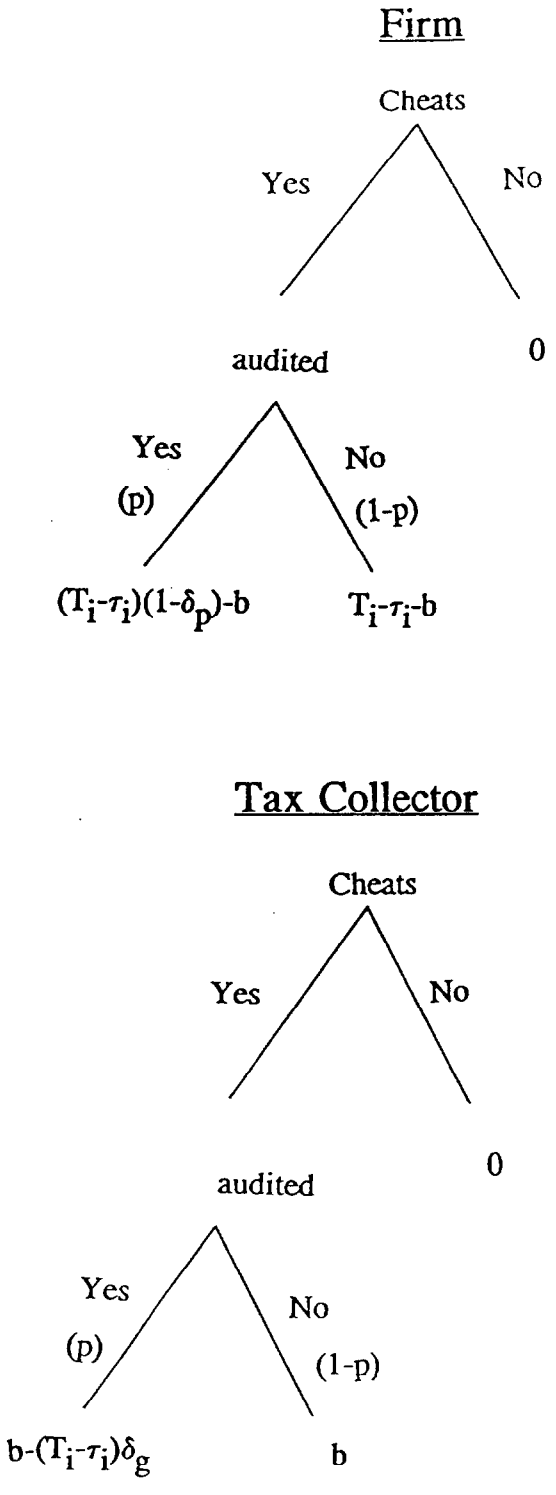
1/ Note that penalty on the collector will be levied irrespective of whether she took a bribe or not since she failed to perform her duties. The analysis does not change qualitatively if we assume that a penalty on the collector is levied only when she accepts the bribe.

2/ Examples in Samad (1993) and Klitgaard (1989) substantiate this result.

Figure 2. Pay-off Functions of Tax Collector and Private Firm.



stage, they bargain to divide the gains from evasion (that is, determine how to split the pie); this determines the bribe that the collector receives. We basically follow Mookherjee and Png (1995) in taking this approach. A simple Nash bargaining technique is used to find a solution to the second stage of the problem.

At the first stage, the sum of equations (5) and (7) with respect to τ_i is maximized as follows:

$$\underset{\tau_i}{Max}\ (T_i-\tau_i)\ [1-p(\delta_p+\delta_g)]\,. \tag{11}$$

The first order condition 1/ is

$$T_i - \tau_i + \frac{(1-(\delta_p+\delta_g)\,p)}{(\delta_p+\delta_g)\,\frac{\partial p}{\partial \tau_i}} = 0\,. \tag{12}$$

Given that $\partial p/\partial \tau_i$ is negative (from equation (1)), if equation (10) holds, then $T_i > \tau_i$ (that is, taxes are evaded). Given equations (10) and (12), the following proposition follows:

Proposition 1: *Tax evasion occurs when institutional arrangements are weak; that is, when there is both a low probability of detection and a relatively minor punishment in the event of conviction.*

Solving for τ_i (the tax that the government collects), we can obtain τ_i as a function of the policy variables of the government. Thus

$$\tau_i = \tau_i(\alpha, \delta_p, \delta_g, T_i)\,. \tag{13}$$

Using the optimality conditions, the qualitative effects of changes in the policy variables on revenue collection can be derived.

Under fairly reasonable assumptions 2/, the total derivatives of τ_i with respect to α, δ_p and δ_g are positive. That is, when civil service wages and penalty rates are raised, tax collection increases. The intuition is that as wages increase, the quality of auditors improves, raising the probability of detection which deters tax evasion. Also raising penalty rates on either the tax collector or the private sector firm deters tax evasion. On the other hand, raising the statutory rate of taxation, T_i does not guarantee an increase in tax collection. Under certain conditions, it

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1/ The second order conditions are satisfied if the probability function is either linear or convex in τ_i; the latter has been assumed here.

2/ The partial cross derivative $p_{\tau\alpha}$ should be ≤ 0. No restrictions on $p_{\tau T}$ are required.

is possible to show that raising the statutory tax rate may actually lead to a decline in collection. 1/ Proposition 2 follows:

Proposition 2: *Tax collection rises unambiguously when penalty rates on both private firms and tax collectors are raised, and when government wages are raised.*

So far we have not differentiated between the effects of raising wages of tax collectors and auditors separately. Assume that α_1 and α_2 are the relative wages of the tax collectors and the auditors, respectively. Then, in equation (1) we can see that $\tau^* = \tau^*(T, \alpha_2, \delta_p, \delta_g)$. Consequently, increasing the salary (α_1) of the tax collector only, has no effect on the level of tax evasion. The intuition is fairly clear in that as all players, including tax collectors are assumed risk-neutral, the expectation of higher remunerations (either from wages or from bribes) is always preferred to less, for given probability of detection and penalty rates. Thus, even if their wages are raised, there is no incentive on their part not to cheat, unless the government takes complementary measures to improve tax administration (that is, raise δ_g and p). Proposition 3 follows:

Proposition 3: *Ceteris paribus, raising the auditor's wages reduces tax evasion; on the other hand, raising only the tax collector's wages has no effect on tax evasion.*

Of course, proposition 3 holds under the assumption that tax collectors are risk-neutral. If tax collectors were risk averse, it can be shown that an increase in the wages of tax collectors would also lead to a reduction in tax evasion. Propositions 1-3 point to the importance of setting the right incentives in government institutions for raising the efficiency of public services. While wage increases attract better human capital into tax administration, other supporting measures such as effective penalties rates are also required for deterring evasion.

3. Optimal level of bribes

We use a simple Nash bargaining solution to determine how the total gains from tax evasion are divided between the tax collector and the private firm. We assume in this simple framework that there is one tax collector for each firm and that the two have equal bargaining power. Equal bargaining power in a Nash bargaining game of this type would imply that the two

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1/ Revenue collection declines if $p_{\tau iTi} \geq 0$ and $T_i - \tau_i \leq (p_{Ti} - p_{\tau i})/p_{\tau iTi}$.

players agree to equalize their expected pay-offs ex-ante. 1/ Setting the net expected gains of the two players equal to each other, we can obtain the optimal level of the bribe, 2/

$$b_i = (T_i - \tau_i)\frac{1 - p(\delta_p - \delta_g)}{2} = \gamma(T_i - \tau_i). \tag{14}$$

The term γ can be interpreted as the "share" parameter that determines the split of the tax evasion pie. Bribes emerge only when γ and $T_i - \tau_i$ are strictly positive and when γ is strictly less than one. 3/ These conditions are satisfied when:

$$1 > p(\delta_g - \delta_p) > -1. \tag{15}$$

It can be shown that if equation (10) holds, the restrictions imposed by equation (15) are satisfied.

The effect of exogenous changes in the policy variables (δ_p, δ_g, α and T) on bribes in equation (14) arise from two distinct channels: from the direct effect of the policy variables on the amount evaded, $T_i - \tau_i$, and from their indirect effect on the share parameter γ. Since $\partial b_i/\partial \tau_i = -\gamma$ in equation (14), a one unit increase in the revenue collection leads to a decline in b_i by the extent of the share parameter γ. The effect of increasing penalties on bribes depends on whether δ_p or δ_g is raised. We have seen in the previous section that as penalties rise, revenue collection increases and tax evasion ($T_i - \tau_i$) falls. An increase in δ_p reduces the share parameter (as firms have higher costs of cheating) while an increase in δ_g raises the share parameter (as collectors face higher costs of cheating). A one unit increase in both δ_p and δ_g leaves γ unchanged as the costs borne by both parties rise by equivalent proportions. Thus, when δ_p is raised, b_i falls unambiguously, while if δ_g is raised, $T_i - \tau_i$ falls, but γ increases, leaving the net effect on bribes ambiguous. Thus, we find that

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1/ It is possible to complicate the problem by endogenously determining the bargaining strength of the two players by altering the game between the two players. However, we avoid this exercise for two reasons: first, it was difficult to come up with closed-form solutions with general functional forms; and second, the exact share of the tax evasion pie was not of consequence to the main problem we are addressing, which is how to design appropriate incentives in government institutions. See also Mookherjee and Png (1995).

2/ Optimal bribe is obtained when equations (5) and (7) are set equal to each other. This results in the following equation being solved for b

$$(T_i - \tau_i)(1 - p\delta_p) - b = b - p\delta_g(T_i - \tau_i)$$

3/ Since the gain from tax evasion has to be split between the firm and the collector, it must be the case that $\gamma < 1$.

raising the penalties on civil servants alone may not be sufficient to reduce the emergence of bribes.

The effect of a general increase in the tax administration wage rates has an unambiguous effect on reducing bribes. This occurs because of the rise in the auditor's wages (α_2). As α_2 rises, bribes fall through two channels: a direct reduction in bribes because of a decline in γ as the probability of an audit (p) increases, and indirectly, because an increase in p reduces tax evasion, $(T - \tau)$.

Finally, the effect of an increase in the statutory tax rate on bribes is ambiguous. As the tax rate increases, bribes increase, since $\partial\gamma/\partial T > 0$ at a given level of γ. However, the probability of detection p (see equation (1)) increases as $(T - \tau)$ increases and the "share" parameter, γ, declines. Hence, bribes could fall at higher rates of taxation.

The effects of exogenous changes in the policy variables on bribes can be summarized in the following proposition:

Proposition 4: *Bribes fall unambiguously when wages of auditors or penalty rates on private firms are raised. On the other hand, raising the statutory tax rate or increasing the penalty rates on tax collectors has an ambiguous effect on bribes. In addition, a ceteris paribus increase in the wages of tax collectors only has no effect on bribes.*

V. Incentive Compatible Public Policies

Policy implications derived from a general equilibrium analysis of bureaucratic corruption have received little attention in designing public policies. Corruption-related activities have traditionally been viewed as reflecting declines in the "moral fiber" of the society, and several schemes are set up to avowedly eradicate their occurrence. Frequently adopted approaches to dealing with these problems are ones that set up elaborate mechanisms (and therefore, spend more public money), such as oversight committees and one-time asset-declaration schemes. 1/ The model that we have developed here suggests that, in view of the asymmetric information that exists in government production (or revenue collection in our example), we need to design incentive-compatible policies and institutional arrangements to achieve the objective of increasing efficiency in government services.

To determine optimal public policies and institutional arrangements (that is, T, δ_p, δ_g, and α) in the framework developed in the previous sections, we will assume in this paper that the objective of government is simply to maximize its revenues net of expenditures. The government chooses

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1/ See Samad (1993) and Klitgaard (1989) for examples and discussions of the processes that are often used to reduce corruption.

the punishment levels, δ_p and δ_g, the wage rate, w_g, and T such that they are incentive compatible with the behavior of private firms and tax collectors. Since the effects of increasing penalty rates on evasion are clear (i.e., they lead to less tax evasion), we will concentrate only on determining optimal levels of T and α (or w_g, given w_p). 1/ Thus, given the optimality conditions for tax evasion and bribes, and given δ_p and δ_g, the government chooses w_g and T to maximize net revenues.

The only sources of revenues for the government are: (1) tax collections which amount to τ, (2) penalties ($\delta_p(T - \tau)$) imposed on private firm in the event of detection, and (3) penalties ($\delta_g(T - \tau)$) imposed on tax collectors when cheating is detected. For simplicity, we normalize the number of auditors, tax collectors, and private sector firms to be each equal to one. 2/

Expenditures consist of (1) administrative costs associated with the primary function of the government which is tax collection and (2) wages paid to tax collectors and auditors, $w_g = w_p\alpha$. The expenditure function can be written as

$$E(T, w_p\alpha) . \tag{16}$$

We assume that E is strictly increasing and convex in both arguments. This is a reasonable assumption, since increases in the statutory tax lead to increases in collection costs, and hiring better skilled workers increases overhead costs (because of, say, the need for better office environment).

To determine optimal wage and tax policies, the government maximizes its net revenues with respect to T and α, given the optimal tax collection function, τ^* (equation (13)), derived from the Nash bargaining problem of tax collector and the firm. 3/ The net revenue function can, therefore, be written as

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1/ Alternatively, we could assume that the maximum possible (or politically feasible) penalty has already been imposed.

2/ Assuming different numbers of firms, tax collectors and monitors does not change the qualitative results. It is also possible to endogenize these numbers to see how many firms survive and what are the optimal number of tax collectors and monitors the government should hire. While the latter may yield interesting results, we postpone it for our future work.

3/ The approach used here is also similar to the "efficiency wage" model when workers who are caught performing at less than par have to suffer the cost of firing (see Shapiro and Stiglitz (1984)).

$$\max_{T,\alpha} \tau^*(T,\delta_p,\delta_g,\alpha) + p[\alpha, T-\tau^*(T,\delta_p,\delta_g,\alpha)](\delta_p+\delta_g)(T-\tau^*(T,\delta_p,\delta_g,\alpha)) - E(T, w_p\alpha). \tag{17}$$

To simplify the algebra, we use an explicit functional form for the probability of detection (equation (1)). Let

$$p(\alpha, T-\tau) = \alpha(1-\frac{\tau}{T}). \tag{18}$$

This equation satisfies all the conditions required on p that are derived in Section IV. Using this function, the level of revenue collection from the optimization problem of the firm can be derived as follows:

$$\tau^* = (1-\frac{1}{2\alpha(\delta_p+\delta_g)})T. \tag{19}$$

Substituting (18) and (19) into (17), and defining $\delta_p + \delta_g = \delta$, we can rewrite the government's objective function (17) as follows:

$$\max_{T,\alpha} T(1-\frac{1}{4\alpha\delta}) - E(T, w_p\alpha). \tag{20}$$

The solution to this problem yields optimum values of T and α that maximize net revenues of the government. The first order conditions yield

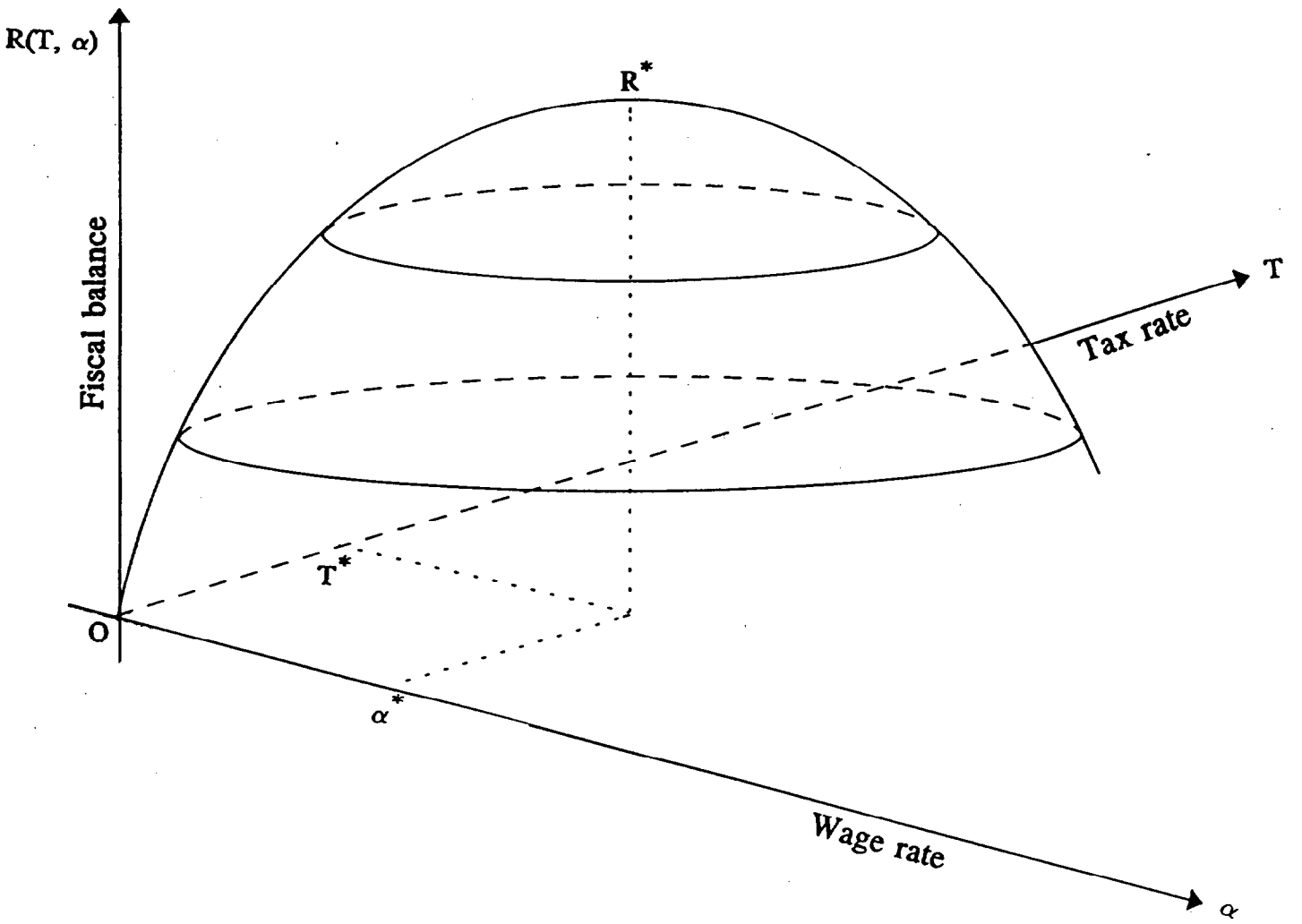
$$\frac{E_T}{E_\alpha} = \frac{(4\alpha\delta - 1)w_p}{\alpha}. \tag{21}$$

Equation (21) can be interpreted as showing that the marginal rate of substitution of the cost of tax collection for wage expenditure equals the net additional revenue gain in equilibrium. The convexity of the expenditure function ensures the conditions required for an interior maximum to derive the incentive-compatible policy vector (T*, α*). A "laffer" curve is thus derived not only for the well-known relationship between tax revenue collections and statutory tax rates, but also between revenue collection and government wage rates. Such a three-way relationship is illustrated in Figure 3. Proposition 5 follows:

<u>Proposition 5</u>: *There exists an optimal mix of statutory tax and wage rates that maximizes the net revenues of the government. Thus, expenditure cuts on government wages can lead to a decline in the government's net revenues if government wages are already low relative to the optimum.*

Using the first and second order conditions, we can determine the effects of changes in the parameters of our model (w_p, δ_p, δ_g) on the optimal policy vector (T*, α*). Totally differentiating w_g and T with respect to the wage rate in the private sector, w_p, we get

Figure 3. Laffer Curve in Tax and Wage Rates.



$$\frac{dw_g}{dw_p} > 0; \quad \frac{dT}{dw_p} < 0. \tag{22}$$

These results show the importance of keeping public sector wage developments in line with those in the private sector. Specifically, if private sector wages increase, civil service wages should be raised to prevent an increase in tax evasion and corruption. Equation (22) also cautions us against raising statutory tax rates when private sector wages are rising.

Differentiating w_g and T with respect to the two penalty variables, we get

$$\frac{dw_g}{d\delta_j} < 0; \quad \frac{dT}{d\delta_j} < 0; \qquad j = p, g. \tag{23}$$

The results suggest that output and efficiency in tax administration would depend on a combination of the appropriate penalty rates, statutory tax rates, and the provision of a wage rate in the public sector that is competitive with the private sector. The analysis also suggests that there is an optimal mix of policies that would allow the net revenue of the government to be maximized.

VI. Conclusion

Adjustment programs often necessitate fiscal correction. In an attempt to reduce expenditures, governments frequently choose to cut wage rates to protect employment in the government sector. Evidence from several countries shows that real wage declines have been common in the public sector over substantial periods of time. Low wages and weak monitoring systems have given rise to bureaucratic corruption. Corruption appears to particularly common in the revenue-raising branches of the government.

In a tax administration model, this paper analyzed the relationship between public wage and tax policy, on the one hand, and public sector efficiency and corruption, on the other. We found that low government wages lead to a decline in public sector productivity (reflected in low tax collection rates) and a rise in corruption. Corruption occurs, because under imperfect information firms are able to collude with tax collectors at a price (bribe) to cheat the government of its taxes. We showed that it was possible to increase tax collection by raising the wages of the monitors, since higher wages attract better skilled human capital to the government sector.

From a macroeconomic perspective, we found that the government could maximize its net revenues by designing incentive compatible tax and wage policies that take into account the potential for collusion between private firms and tax collectors. Thus, any deviation from the optimum combination

of tax and wage rate would result in a deterioration of the fiscal balance. While wage cuts may be politically feasible relative to the reduction of employment in the public sector, our analysis suggests that cutting wages to close the budget deficit could actually lead to a deterioration in the fiscal balance. Moreover, in an environment in which the institutional arrangements are weak, such as poor monitoring and low penalties, raising the statutory tax rates only is unlikely to raise revenue collection.

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