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Three Essays on Tax Collection: A Historical Review, A Formal Model, and an Empirical Test of the Government's Contractual Choice of Tax Collection Between Tax Farming and Tax Bureaucracy

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THREE ESSAYS ON TAX COLLECTION:
A HISTORICAL REVIEW, A FORMAL MODEL, AND AN EMPIRICAL TEST OF THE
GOVERNMENT'S CONTRACTUAL CHOICE OF TAX COLLECTION BETWEEN TAX
FARMING AND TAX BUREAUCRACY

By

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Dedicated to my father and mother; my father and mother in law;
My wife Taehyun; and my lovely daughter Jin and son Joon

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ABSTRACT

The purpose of this dissertation is to explore questions about the government's contractual choice of tax collection between tax farming and tax bureaucracy. It is commonly assumed that tax collection is an inherent function of the government. However, historically governments commonly contracted with private agencies known as "tax farmers" to enhance their tax collection capacities until the nineteenth century. Tax farming is an efficient tax collection method, but it encouraged private tax collectors to exploit taxpayers to maximize their own expected return.

The dissertation tries to answer the following three research questions. First, why did governments outsource tax collection to tax farmers until the eighteenth century, and why have governments fully developed their own tax bureaucracy since the nineteenth century? Second, what are the conditions under which each tax collection contract is optimized, and what are the expected values of optimal tax collection contracts? Third, what are the effects of different tax collection contracts on administrative effectiveness and procedural fairness in contemporary government? To explore these questions, I have used the theory of agency where the principal (the government) incentivizes the agent (the tax collector) to input a high level of effort to implement delegated tasks by offering performance-based compensation. Alternatively, the principal can force the agent to input a minimal necessary level of effort by setting a monitoring system with fixed compensation.

The study examines the tax collection process, exploring questions about the government's contractual choice of tax collection methods, outsourcing or insourcing the tax receivables collection process. To explore this understudied aspect of the governments' tax collection process, I explore both the effectiveness and fairness of the tax receivables collection process. My first essay is from a historical perspective, my second essay address a theoretical model of the process, and my third essay examines the process empirically across the 50 states.

The first essay (Chapter 2) reviews tax collection history in Europe, the Islamic world, and Asia through the lens of the theory of agency to explore the question of why tax farming had been

predominant until the eighteenth century, and why government-run tax bureaucracy have been predominant since the nineteenth century. The historical analysis focuses on identifying generalizable underlying mechanisms of tax collection contracts and key exogenous factors affecting the government's choice of tax collection contract forms.

The second essay (Chapter 3) analyzes optimal conditions and relative value—the net effect of costs and benefits—of tax collection contracts through the development of a formal model of tax collection underpinned by the historical review and theory of agency. The dynamic and static optimization processes will be used to generate comparative statics.

The third essay (Chapter 4) measures the effects of different contract forms on administrative effectiveness and procedural fairness in tax collection. Using panel data for the years 2000 to 2011 in state governments in the U.S., I test the following key hypothesis: delinquent tax collection outsourcing is financially effective, but it negatively impacts procedural fairness, such as the taxpayer's rights, in tax collection. The results imply two things. First, in terms of the administrative effectiveness, private tax collection reduces tax administration cost, but it has no statistical effect on the recover delinquent taxes. Second, in terms of the procedural fairness, private tax collection increases the number of tax appeals filed in the tax appeal division within state tax department, but it decreases the number of tax appeals filed with outside-independent tax appeal agency.

CHAPTER 1

INTRODUCTION

This dissertation is entitled “Three Essays on Tax Collection: A Historical Review, A Formal Model, and An Empirical Test of the Government’s Contractual Choice of Tax Collection between Tax Farming and Tax Bureaucracy”. The purpose of this dissertation is to explore questions about the government’s contractual choice of tax collection between tax farming (the fixed rent and revenue share contracts) as an incentive-based contract and tax bureaucracy (the fixed wage contract) as a control-based contract.

Tax collection is a critical issue because of the unique nature of taxes. In terms of accounting, the tax receivable in the government is identically treated as an asset with account receivables in the corporation. However, the tax receivable has a different nature from the account receivable because taxation is not a voluntary exchange transaction in the private market. Sometimes, a tax is viewed as a price of public goods and services, and taxation is considered as the pricing in the political market. However, although taxpayers could influence taxation through collective action, an individual taxpayer’s influence on taxation is close to zero. In addition, those who pay taxes are not identical to those who receive benefits from taxes. In short, taxation is a coercive and non-exchange transaction based on public authority. It is a forced transfer of money from the private sector to the public sector of government. Thus, taxation is enforcement itself. Such unique nature of taxation leads to a vexing issue of tax collection. The taxpayer naturally does not want to pay taxes, and thus the government’s tax collection process usually involves enforcement. Therefore, the tax collection effort is critical in public finance.

It is commonly assumed that tax collection is an inherent function of the government. However, historically governments commonly contracted with private agencies known as “tax farmers” to enhance their tax collection capacities from the third millennium B.C. to the eighteenth century. Under the tax farming contract, private tax collectors kept the residuals of tax revenue collected after paying a fixed rent or proportional fee. Since the nineteenth century, most countries have shifted the tax collection system from tax farming to tax bureaucracy. However, recently, to

address growing delinquent taxes, many governments reintroduced tax farming as an innovative tax collection method. Since the 1980s, many state and local governments in the U.S. have been using private debt collection agencies, and since the 1990s, the federal government has been considering contracting out delinquent income tax collection with private debt collection companies.

Tax farming as a market mechanism was an efficient tax collection method because it provided the government with stable revenue and solved the issue of the public tax collector shirking the collection of taxes under a bureaucratic tax collection system. However, tax farming was not wholly beneficial as it encouraged private tax collectors to exploit taxpayers to their expected return. This is the inherent problem of tax farming; overzealous collection. Thus, the core issue of contractual choice between the market-oriented method and the bureaucratic method in tax collection is the dilemma between administrative effectiveness and procedural fairness in tax administration.

To analyze the government's choice of tax collection between tax farming and tax bureaucracy in a delegated contract setting, I use the theory of agency (Ross 1973) with two behavioral assumptions: utility maximization and risk aversion. I assume that every actor, such as the government (e.g. kings, rulers, and contemporary representative governments), the tax collection agent (e.g. tax farmers and tax bureaucrats), and the taxpayer, want to maximize their own utility. Also, I assume that every actor is risk-averse, but they have a relative risk aversion. The theory of agency provides us with an analytic framework to examine how to design a contract to mitigate the agency problems (or agency costs). I focus on *moral hazard* as the postcontractual agency problem, rather than *adverse selection* as the precontractual agency problem. In terms of solutions, I concentrate on three contract forms: fixed rent, profit share, and fixed wage contracts. In the theory of agency, the principal incentivizes the agent to input a high level of effort to implement delegated tasks by offering performance-based compensation, or alternatively the principal forces the agent to input a minimal necessary level of effort by setting a monitoring system with fixed compensation.

This dissertation consist of three essays, and the research will be conducted through the following three steps: historical review, formal model, and data analysis. The first essay (Chapter 2) reviews tax collection history in Europe, the Islamic world, and Asia through the lens of the theory of agency to explore the question of why governments outsourced tax collection to tax farmers until the eighteenth century, and why governments have fully developed their own tax bureaucracy since the nineteenth century. Most historical studies on tax collection focus on a single case by describing the detailed features of tax collection of a single country during a certain time period. However, I focus on identifying generalizable underlying mechanisms of tax collection contracts and key exogenous factors affecting the government's choice of contracts. I also concentrate on interpreting tax collection history from the perspective of public finance.

The historical review shows that the government's contractual choice of tax collection is a product of underlying endogenous mechanisms of tax collection contracts and time-and-country specific exogenous constraints. Under exogenous conditions until the eighteenth century, such as the underdeveloped bureaucracy, monitoring infrastructure, and capital market, the predatory government had chosen tax farming which is a self-fundable and self-motivated tax collection system. Under this unfavorable situation, tax farming provided the government with stable revenue at low collection costs and risks. However, it leads to brutal tax collection which was ultimately costly to both the government and taxpayer. Meanwhile, under exogenous conditions since the eighteenth century, such as the developed bureaucracy, monitoring infrastructure, and capital market, the limited government has chosen a fixed wage contract of tax bureaucracy which is a control-based contract and an organizationally innovative tax collection method. It provides governments with command-control systems over whole tax collection processes and provides taxpayers with procedurally fair collection processes. Tax bureaucracy solves the agency problem of tax farmers' overzealous tax collection, but it leads to shirking. In addition, the government confronts the problem of rigid cost structure of tax bureaucracy, and has to assume all of the tax revenue risks. In short, both tax farming and tax bureaucracy have their own relative comparative superiority and inferiority to each other due to the tradeoff among agency costs for tax collection contracts. The results of this historical review are summarized in Figure 1 Conceptual Framework of the Contractual Choice of the Tax Collection in History, and the implications of the historical review are the bases for the last two essays.

The second essay (Chapter 3) analyzes the relative superiority of tax collection contracts through the development of a formal model to answer the question of what conditions is each tax collection contract optimized under the agency problem, and what the expected values of optimal tax collection contracts. Even if tax revenue is a function of tax base, tax rate, and collection effort, much of the taxation literature has focused on modeling optimal tax rates and tax bases. However, I focus on modeling optimal tax collection efforts. The dynamic and static optimization processes will be used to generate comparative statics, such as optimal conditions and relative value—the net effect of costs and benefits—of tax collection contracts.

The model shows the optimal conditions of contracts derived by the optimization processes, but it is not straightforward to compare the relative values of contracts. Seven important comparative statics are driven by the formal analysis. It is relatively straightforward to compare each level of the agent's collection effort, compensation cost, and gross tax revenue among contracts. Meanwhile, it is hard to compare each net tax revenue, agency cost, agency cost adjusted net tax revenue, and the impact of agency cost on the change of tax base for contracts. The modeling process and results are summarized in Table 1 through Table 5.

The formal modeling provides several implications. The government can indirectly choose the level of effort of the tax collection agent by offering each a different compensation scheme to maximize its tax revenue. However, compensation-to-effort mapping leads to a trade-off among agency costs. Therefore, when choosing a contractual form of tax collection, the government needs to consider not only the simple compensation-to-effort mapping issue but also agency costs resulting from such a mapping. Furthermore, the government needs to consider not only revenue and cost in the short-run, but also the impacts of the level of collection efforts and agency costs on the change of tax base over time in the long-run. For an application to contemporary case, the model implies that Federal delinquent income tax collection outsourcing may increase gross tax revenue and tax collection rate, but these benefits of an incentive-based contract may be partly offset by increasing compensation cost and social costs associated with taxpayer's harassment.

The third essay (Chapter 4) empirically examines a new direction in tax collection by using the random effect model and principal component regression. Since the 1980s, state governments in the U.S. have reintroduced tax farming, which was replaced with tax bureaucracy during the nineteenth century, to facilitate and expedite the collection of delinquent taxes. However, this contemporary tax collection outsourcing has not been sufficiently studied. This study attempts to measure the effects of different contract forms on effectiveness and fairness by using empirical data analysis to explore the effects of state governments' contracting out delinquent tax collection with private debt collection companies during the last decade, focusing on effectiveness and fairness in tax collection. By using panel data for the years 2000 to 2011 in state governments in the U.S., I test the following key hypothesis: delinquent tax collection outsourcing is financially effective, but negatively impacts procedural fairness, such as the taxpayers' rights, in tax collection. There are two implications based on the empirical results. First the outsourcing of the delinquent tax collection is administratively financially effective in terms of collection cost. However, the use of private collection agency has no statistical effect on recovering delinquent taxes. Second, in terms of the procedural fairness, private tax collection increases the number of tax appeals filed in the tax appeal division within state tax department, but it decreases the number of tax appeals filed with outside-independent tax appeal agency. While private tax collectors lead to negative effect on procedural fairness, the degree of seriousness of the negative effect is modest in the contemporary government.

CHAPTER 2

A HISTORICAL REVIEW OF CONTRACTUAL CHOICES OF TAX COLLECTION: ENDOGENOUS MECHANISMS AND EXOGENOUS FACTORS OF TAX COLLECTION CONTRACTS

2.1 Introduction

It is commonly assumed that tax collection is an inherent function of the government. However, historically, governments commonly contracted with private agents known as “tax farmers” to enhance their tax collection capacities from the third millennium B.C. to the eighteenth century. However, since the nineteenth century, most countries have shifted the tax collection system from tax farming to tax bureaucracy. Therefore, one of the key questions of tax administration is why did governments outsource tax collection until the early modern period and why have governments developed their own tax bureaucracy since the late modern period, after the French Revolution and the Industrial Revolution.

In this essay, to explore these questions, I adopt the theory of agency (Ross 1973) to identify the underlying mechanisms of tax collection contracts and the key exogenous factors for the government to choose a contract form for tax collection by reviewing tax collection history. The principal’s choice of a contract is determined by his preferences, but the preferences are constrained by exogenous elements surrounding him. The government’s contractual choice of tax collection is a product of exogenous constraints—the level of bureaucratization, availability of monitoring infrastructure, accessibility of financial market, and political environment—and endogenous mechanisms, such as incentives versus controls of tax collection contracts. The principal’s preference and environments change over time, and such changes lead to change of contract form of tax collection. However, underlying endogenous mechanisms of tax collection contracts do not change over time like the law of nature. The most critical element to understanding the underlying mechanism of tax collection is agency costs. Ancient, middle age, modern, and contemporary governments have confronted the vexing problem of agency, and

have struggled to design a tax collection system to address agency costs under the given constraints.

I attempt to contribute to the literature on tax collection history by addressing the following two limitations of the literature. First, many studies on tax farming and history of taxation tend to see tax farming as “evil” and tax bureaucracy as “good,” although there are exceptions, for example, White’s (2004) study on tax farming in France. However, tax farming would be an optimal and feasible choice of contract form for tax collection under constraints until the eighteenth century. Meanwhile, tax bureaucracy has its own costs. In this essay, I attempt to provide a balanced idea of tax collection methods by identifying both costs and benefits of tax collection contracts. Second, most historical studies on tax collection focus on a single historical case by describing detailed features of tax collection of a single country during a certain time period. However, the goal of this essay is to derive a general trend, underlying mechanisms, key exogenous factors for contractual choice of tax collection in history, rather than to examine detailed variations over time and across countries in tax collection. My historical analysis focuses on the western history even though sometimes I illustrate some non-western examples.

Section II provides theoretical framework of theory of agency. Section III shows the historical review of tax farming as rent and share contracts, and section IV shows the historical review of tax bureaucracy as wage contracts. Finally, Section V provides a conclusion.

2.2 Theoretical Framework: Theory of Agency

I adopt the theory of agency as a theoretical framework to analyze underlying mechanisms and the key exogenous conditions for governments’ contractual choice of tax collection in history. Agency theory provides a useful analytic framework to examine the principal’s choice of a contract for implementing delegated tasks under constraints, and corresponding results associated with the principal’s costs and benefits from the contract. In a principal-agent relation, the principal chooses a contract form to address agency problems under constraints, such as the level of risk-handling capacity and monitoring capacity. The theory of agency focuses on selecting a compensation system as a monetary incentive system in a contract situation. Thus, a

contract form—fixed rent contract, revenue share contract, and fixed wage contract—represents a compensation scheme.

Usually, Ross' seminal paper about the relationship of agency in 1973 is viewed as the origin of the theory of agency. Ross first used the term of "the theory of agency" explicitly even though there was risk-sharing literature using implicitly the notion of the agency relation, for example, Arrow's (1970) work on moral hazard, Spence and Zeckhauser's (1971) work on insurance and risk, Marschak and Radner's (1972) work on information flows, and the study of financial intermediaries in monetary models. After Ross's work, the theory of agency was expanded by Jensen and Meckling's (1976) work on agency cost and ownership structure, and Mirrlees' (1976) work on optimal structure of incentives and authority. In particular, the theory of agency is highly related to risks because it was built on the risk literature. Risk literature, for example Stiglitz (1974), Allen and Lueck (1995 and 1999), and Akerberg and Botticini (2000), explain a choice of contracts by combinations of the principal and agent's risk preference. Therefore, the choice of contract forms can be interpreted in terms of not only compensation type but also distribution of risks.

In fact, Ross's "work was supported by grants from the Rodney L. White Center for Financial Research at the University of Pennsylvania" (Ross 1973: 134). Thus, agency theory was for the study of finance, although recently many fields in social science apply the theory of agency to their areas. The theory of agency has become a dominant theory in the study of corporate finance and financial economics. It is usually utilized to analyze most financial contracts in private firms, such as equity contracts as the relation between stockholders and managers, and debt contracts as the relation between investors and borrowers (Tirole 2006). Recently in the field of public finance and budgeting, the agency theory as a contractual approach is frequently used to analyze the expenditure side of public finance, such as public-private partnerships in the procurement of public service (Maskin and Tirole 2008) and infrastructure construction finance (Eger and Guo 2008). However, there is relatively limited research applying agency theory to the revenue side of public finance.

I distinguish the theory of agency from transaction cost theory, especially Williams (1975; 1981; and 1985), although there are similarities between them. Transaction cost theory is insightful, but

the theory is incomplete and too broad to analyze contractual choice of tax collection. First, the concept of transaction costs is too imprecise and broad (Levy 1988: 27). As Williamson compares transaction costs to the economic equivalent of friction in the physical system (Williams 1985: 19), transaction costs represent all costs which occur in an imperfect market situation. There are operationalized versions of the definition of transaction costs, for example, Cheung's (1978: 24) definition of transaction costs as "the costs of searching, negotiating and enforcing contracts, and of defining and policing of rights." However, the concept of transaction cost is still too broad to analyze the government's contractual choice of tax collection. Second, transaction cost theory on a choice between market and hierarchy focuses on the benefit of shifting toward hierarchy from the market to minimize transaction cost (Kiser 1994). Minimizing transaction costs means that vertical integration, such as M&A, allows the firm to control easily other parties who were previously outside contractors. Thus, transaction cost theory tends to ignore costs of hierarchies, such as shirking.

Meanwhile, agency theory focuses on the incentive structure and corresponding behavior of the agent. Thus the theory of agency provides specific and precise analytic framework to examine costs, benefits, and condition for a choice of contracts. In addition, the theory of agency provides useful tools to analyze financial risks and returns of contracts.

2.2.1 Moral Hazard: Shirking

In the principal-agent relation, agency problems are due to the following two fundamental reasons: first, the difference between the principal's utility function and the agent's utility function; and second, the asymmetry of information between the principal and the agent. In interest conflict and imperfect information situations, agency problems are defined as two issues: *moral hazard*, which is referred to as the lack of efforts or shirking, and *adverse selection*, which is referred to as the misrepresentation of ability by the agent (Eisenhardt 1989). In terms of time, moral hazard occurs after contracting while adverse selection occurs before or at the date of contracting (Tirole 2006).

I focus on postcontractual asymmetric information issues, such as moral hazard issues, rather than adverse selection. Even though the principal selects an agent through perfect competition and there is no adverse selection at the date of contracting, informational asymmetries will develop after the contract, and it ultimately leads to moral hazard (Mas-Colell, Michael, and Grees 1995). Under the absence of monitoring, the principal cannot observe every detailed activity of agents. In such situations, the agent maximizes his own utility rather than the principal's utility. Usually the principal can conjecture his agent's deviated behaviors from his interests, but he cannot verify the agent's moral hazard without costs. In the theory of agency, the agent's action is usually interpreted as effort. Hence, the most typical moral hazard is that the agent chooses a low level of effort rather than a high effort when his efforts are not observed or not compensated, so called *shirking*. Usually, the negative aspect of bureaucratic behaviors of public employees, in particular under the wage contract, is expressed as shirking.

Principals have two options to solve agency problems: first, to set an incentive scheme to reduce the gap between their utility functions; or second, to set a monitoring system to reduce the asymmetry of information between them. The most ideal solution is to combine these two solutions. For example, Chow (1983) argues that a truth-inducing pay scheme is profit sharing plus a probabilistic audit. In standard principal-agent theory, to remedy shirking, the principal sets up an incentive payment in the contract, such as rent contract or share contract.

2.2.2 Extended Concept of Moral Hazard

To address the agency problem—shirking—, the principal usually has two options: *control*, such as investment on monitoring or information systems, or *incentive*, such as outcome-based contracts (Eisenhardt 1989). However, sometimes, agency problems are not simple. In some cases, such as tax farming contracts, an incentive-based compensation scheme (or an incentive-based contract form) mitigates an agency cost, such as shirking, but leads to other agency costs, such as over-enforcement and underreporting. A contract form does not eliminate agency costs but substitutes an agency cost with another one. If the agent has strong incentive for an object, such as profits, then the agent may shirk other objectives (Holmström and Milgrom 1991, 1994), such as public service quality (Hart, Shleifer, and Vishny 1997). Thus, in traditional agency

model monitoring issue is associated with fixed wage contract model. However, monitoring issue may be also critical under the fixed rent and profit share contracts.

2.2.3 Risks

Contract forms are traditionally sorted by compensation type. However, they can also be sorted by the level of monitoring or risk. Under a principal-agent problem, a choice of contract is also related to risk (Stiglitz 1974; and Allen and Lueck 1995 and 1999; and Akerberg and Botticini 2000). Risk literature shows a choice of contract by combinations of the principal and agent's risk preferences, such as risk-aversion, risk-neutral, and risk-taking. However, the most realistic assumption is that both the principal and agent are risk-averse. Relative degree of risk-aversion between the principal and agent determines contract form (White 2004), and such relative degree of risk-aversion between them depends on capacity to address risks.

2.2.4 Contract Forms: Compensations, Efforts, Risks, and Monitoring

In the principal-agent relation, the principal chooses a contract form to address agency problems. The principal chooses the contract form through setting the compensation scheme to control the level of effort of the agent, but the choice depends on the principal's capacities to address risks and to monitor the level of effort of the agent. In terms of optimization process, the principal chooses the optimal compensation type to induce the high level of effort of the agent to implement a delegated task from the principal. The agent also chooses the optimal act which is the level of effort, conditional on the particular compensation type offered by the principal. In short, an optimally chosen compensation type is a contract form.

The level of compensation can be viewed as not only the level of effort but also the level of risk. In terms of risk perspective, the fixed wage of agents does not include any compensation for taking risks because the principal absorbs all risks under the fixed wage contract. Thus, the cost of compensation of a fixed rent contract should be higher than the cost of compensation of a fixed wage contract. If the principal wants to save the difference between two compensation schemes, the principal has to assume the risk as a cost of saving compensation cost.

In the theory of agency, contract forms are categorized into the following three forms by the compensation scheme: a fixed rent, a profit share, and a fixed wage. (1) Under the fixed rent contract, the agent keeps the residuals of profit after paying a fixed rent to the principal. Thus, in the rent contract, the principal receives a fixed return regardless of the agent's performance and any exogenous shocks. In terms of financial risk, the principal receives a guaranteed return, but the agent's return fluctuates with his level of effort and uncontrollable exogenous factors. Therefore, under the fixed rent contract, the agent has an incentive to input the highest level of effort into implementation of the delegated task to maximize his return. Thus, the principal does not need to monitor the low level of effort of the agent. The level of compensation for the agent is high in the rent contract because of the high level of effort and risk. (2) The fixed wage contract is opposite to the fixed rent contract. Under the wage contract, the principal keeps the residuals of profit after paying a fixed wage to the agent. Thus, in the wage contract, the agent receives a fixed wage regardless of his efforts and any contingency. In terms of financial risk, the agent receives a guaranteed return, but the principal's return fluctuates with his agent's level of effort and uncontrollable exogenous factors. Therefore, under the fixed wage contract, the agent has an incentive to input the lowest level of effort to implement the delegated task. Thus, the principal needs to force the agent to input a minimal necessary level of effort by monitoring the level of effort of the agent. The level of wage is relatively low because the agent does not take any risk and he inputs the low level of effort. (3) The profit share contract is between the extremes of the rent and wage contracts. Under the share contract, the principal and the agent share the profit and risk. The agent receives a proportional fee based on his performance, and take corresponding risks based on the sharing rule. Hence, the agent has an incentive to input a modest level of effort which is lower than the level of effort in the fixed rent contract, but higher than the one in the wage contract. Thus, the principal's willingness to monitor the level of effort of the agent is weak. The theory of agency expects that the principal would choose a fixed wage contract if he has the capacity to monitor the level of the agent's effort and to control risks. Otherwise, the principal would choose a fixed rent or profit share contract.

As a road-map in this essay, Figure 1 shows a conceptual framework of the government's contractual choice of the tax collection in history. The government's contractual choice of the tax collection depends on both exogenous factors and endogenous mechanism of contracts.

Exogenous factors change in the long-run. However, these environmental factors are fixed in the short-run. In contractual choice, the government views these given exogenous factors as constraints. Meanwhile endogenous mechanisms do not change over time because these mechanisms are underlying features of contracts. In contractual choice, the government views these inherent mechanisms as choice set (or choice options). The government does not choose a contract form purely based on its preference only. Rather, the government adjusts its preference to both external factors and its choice set. Exogenous factors may be considered as determinants of contractual choices. However, it may not be true. Contemporary governments may choose tax farming under the highly bureaucratized tax organization, developed financial market, and democratic political system. Contemporary governments want to use the beneficial mechanism of tax farming. In this case, endogenous mechanisms of contracts may be considered as determinants of contractual choices. Therefore, my conceptual framework emphasizes that the government simultaneously considers both exogenous factors and endogenous mechanisms of contracts in its contractual choice. In addition, exogenous factors and endogenous mechanisms of contracts interact each other.

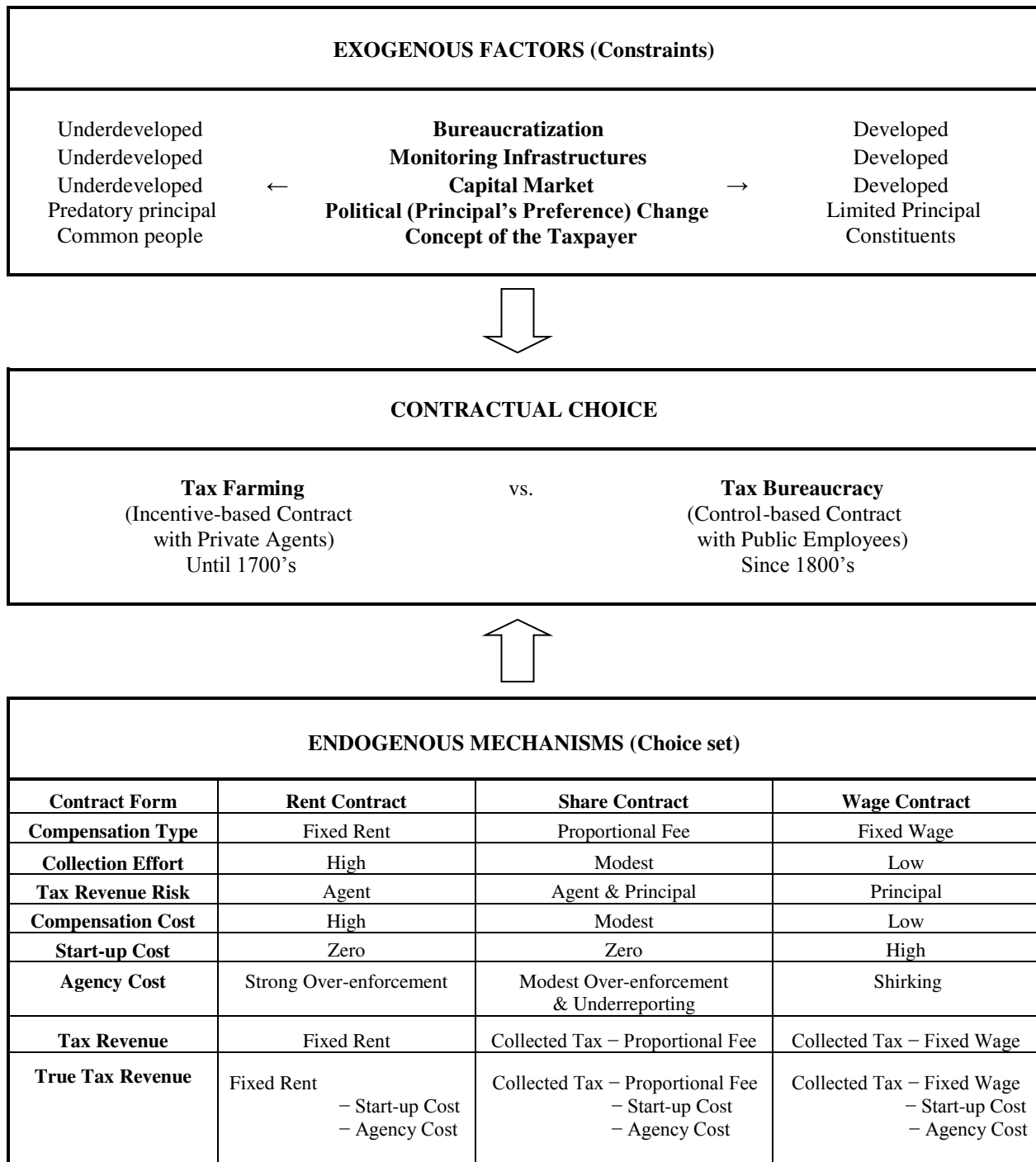


Figure 1 Conceptual Framework of the Contractual Choice of the Tax Collection in History

2.3 Tax Farming: Rent and Share Contracts (B.C. 3000 - A.D. 1800)

Tax farming can be traced back to the city-states of Mesopotamia in the third millennium B.C., and it was pervasive until the early modern period. Until the Middle Ages (fifth to fifteenth century) in Europe, governments were “the private governments” (Webber and Wildavaky 1986). The principals of governments were kings under a decentralized feudal system. Most activities of the medieval government, including tax collection, were considered as to king’s private household. Thus, feudal kings used private contracts based on market mechanism to address their personal political and economic affairs.

Tax farming continued during the early modern era (the fifteenth to the eighteen centuries) under the monarchy system in Europe. In the early modern era, many key ideas and institutions—the concept of public government, public market for state debt, and state-administrated centralized tax bureaucracy—emerged and started to be developed, but not fully (Webber and Wildavaky 1986). Webber and Wildavaky (1986: 283) characterize the fiscal administrative mechanism in this era as a “mixed state/private financial administration,” and a “half hierarchical/half market” system. In this transition era, both medieval and modern characteristics were mixed. Even though the concept of “public” emerged, it was just conceptual, and most government affairs were implemented as a monarch’s private household. The capital market emerged but was still rudimentary. Monarchs developed centralized and hierarchical organizations, but management and control capacities to operate these organizations were not sophisticated. In short, the principals of the government were monarchs under the centralized state system. During this period the government was also “the private government” of monarchy. Tax farming was the dominant method of collecting taxes in this period.

2.3.1 Historical Evidences of Private Tax Collection

Tax farming can be traced back to the city-states of Mesopotamia in the third millennium B.C., and it was pervasive before governments developed tax bureaucracy during the late modern period (Webber and Wildavsky 1986). Governments commonly outsourced tax collection to private tax collectors, so called “tax farmers,” to enhance their tax collection capacities.

Collecting taxes was viewed as harvesting crops. Hence, tax farmers, first, invest their labors and financial resources on tax collection processes. After that, they made a profit by collecting taxes or shared the collected tax revenue with rulers. In spite of some variations, the most common type of tax farming is that the government chooses private tax collectors through auctions (or negotiations) and delegates tax collection while the government receives revenue at the bid price or contract fee. Under the tax farming contract, private tax collectors keep the residuals of tax revenue collected after paying the fixed rent or proportional fee. Thus, tax farming is categorized into two types of contracts: the fixed rent contract and the revenue share contract. In the fixed rent contract, the government sells off tax receivables to tax farmers for a fixed rent fee, which is the discounted value of the face value of tax receivables. Meanwhile, tax farmers make a profit by collecting tax revenues greater than the price of the purchased tax receivable. In the revenue share contract, the government hires tax farmers to collect taxes, and pays proportional fees based on tax farmers' tax collection performance. In short, under the revenue share contract, the government and tax farmer share the tax revenue proportionally based on a certain sharing rule.

Tax farming was a global phenomenon until the nineteenth century. In Ancient Greece and the Roman Republic and Empire (Latouche 1961; Webber and Wildavsky 1986; Levy 1988; Adams 1999), and Egypt (Webber 1992 and 1993), instead of the cumbersome administrative machinery tax farming was utilized for collecting revenue from distant provincial cities as the hierarchy reached its limits. Tax farming reappeared in Byzantium and was also reborn in European countries, such as England (Newton 1918; and Webber and Wildavsky 1986), France (Mathews 1958; and Webber and Wildavsky 1986), the Netherlands, Spain, Sweden (Roberts 1967; Scott 1977; and Kiser 1994), Russia (Pipes 1974; and Bushkovitch 1978), and Prussia (Bushkovitch 1978; Kiser and Schneider 1994) in the late Middle Ages, and was the dominant tax collection method until the early modern era, the eighteenth century (Webber and Wildavsky 1986; Kiser 1994).

Beyond Europe, other countries also utilized the tax farming method. Tax farming also was pervasive in the Islamic world from the Mediterranean to the Indian Ocean from the ancient period to the early modern period (Pamuk 2004). It was used in the Middle East, Asia, and America (Butcher and Dick 1993; Cizakca 1993, 1996). In the Middle East and North Africa

(Issawi 1982), the Abbasid Empire of a forerunner of Islamic states (Løkkegaard 1950), Egypt (Copland and Godley 1993; and Cizakca 1996), the Ottoman Turkey Empire (Kiser 1994; Salzmann 1993; and Cizakca 1993, 1996), Tunisia (Azebou and Nugent 1988, 1989), and other Muslim states (Wink 1983) used tax farmers more extensively than European countries. In Asia, Mughal Empires India (Wink 1983; and Habib 1967 and 1999), and Qing Dynasty China (Ho 1959; He 1972; Elvin 1973; Copland and Godley 1993; and Cizakca 1996) also used tax farmers. In Southeast Asia, from the seventeenth century to the twentieth century, Malay (Malaysia), Thailand, and Java (Indonesia) used Chinese businessmen as tax farmers (Butcher and Dick 1993). Tax farming is still used in some countries, such as Tunisia (Azebou and Nugent 1988, 1989).

2.3.2 Endogenous Mechanism of Tax Farming: Incentive-based Contract

Why did governments outsource tax collection until the eighteenth century? Given the lack of infrastructures for tax collection, such as underdeveloped tax bureaucracy and capital market, the government wanted a self-fundable and self-motivated tax collection system. The underlying mechanisms of tax farming contracts met with governments' needs under such constraints at that time. By using tax farming, the government did not need to invest efforts and money to create and maintain their own tax bureaucracy, and the government did not need to worry about tax collection agent's shirking. The incentive structure of tax farming made this possible. However, tax farming is not wholly beneficial as it encourages private tax collectors to exploit taxpayers to maximize their expected return and to underreport collected tax revenue to the government.

2.3.2.1 Benefits of Tax Farming: Financially Innovative Tax Collection

Tax farming was an incentive-based contract to encourage private agents to choose a relatively higher level of effort to collect taxes than the effort level in a bureaucratic tax collection system. Under the tax farming contract, the private debt collector is incentivized to collect taxes to maximize their own profits until his marginal cost of tax collection is equal to his marginal tax revenue. The incentives under the rent or share contract are stronger than ones under the wage contract. In terms of the level of effort of the agent, the share contract is between these two

extreme contracts: wage contracts under which public agents have no incentive to improve their performance and fixed rent contracts under which all of the residual except a fixed amount belongs to the collection agent like debt contracts.

Under the tax farming, such incentive structure was installed not only between the government and tax farmers, but also between the principal tax farmer and his collection staff. Usually, principal tax farmers not only monitored their employees, but also gave incentives by using “subfarming,” for example, in Spain (Mackay 1977), England (Stone 1965; and Ashley 1934), and France (Matthews 1958). In short, as a market mechanism, such underlying mechanism— incentive-based compensation—makes tax farming efficient to collect taxes, and makes it attractive to both governments and tax farmers. It provided the government with stable revenue at low collection cost while it was profitable business to tax farmers.

First, governments can stabilize their revenue stream by transferring or sharing tax revenue risk through tax farming. Tax revenue is a function of the level of collection effort, but tax revenue also varies with uncontrollable random contingencies, such as economic fluctuation, natural disasters, or political upheavals. Under the fixed rent contract of tax farming, the government can transfer such financial risks to the tax farmer by selling off tax receivables to tax farmers for a fixed rent fee, and by receiving a guaranteed amount of tax revenue regardless of tax farmers’ tax collection performance and exogenous shocks in the future. Thus, it is similar to a risk-free zero coupon bond contract in contemporary governments. Government’s fixed rent is less than the original value of tax receivable. The difference between the face value and the discounted value of tax receivable is the cost of transferring risks from the standpoint of the government. Meanwhile, the difference is the compensation for taking the risks from the standpoint of the tax farmers (Smith 2009; and White 2004). To diversify transferred risks, tax farmers used sub-contracting as a kind of portfolio diversification in the Ottoman Empire (Cizakca 1996). Under the revenue share contract of tax farming, the government and tax farmer share not only collected tax revenue, but also tax revenue risk. Thus, through the revenue share contract, governments can reduce financial risk. In short, the government can control tax revenue risks resulting from the fluctuation of tax revenues, for example, in France (Matthews 1958), England (Parker 1974), and the Ottoman Empire (Cizakca 1996).

Second, governments can save costs associated with tax bureaucracy by using tax farming. Developing and running tax bureaucracy are costly. The government needs to invest huge resources to create and maintain their own tax bureaucracy. The government has to hire and pay public tax collectors a fixed wage regularly regardless of their performance. A more critical issue is that the government has to invest resources into developing control systems to address the shirking issue resulting from the nature of fixed wage contract of tax bureaucracy. Under the tax farming, governments did not need to spend scarce resources on creating tax bureaucracies and dealing with related vexing problems. Meanwhile, tax farming was an attractive option to the government. The government's funding tax farming can be viewed as revolving funding system. Under the tax farming, without any spending on tax collection, the government can simply receive net tax revenue from the tax farmer after subtracting tax farmer's collection costs. Except for minimal bidding or negotiation costs for tax farming contracts, governments do not need to invest setup-costs for tax collection processes and pay the fixed cost for paying fixed wages for tax bureaucracy. In addition, tax farming contract solved the issue of the public tax collector shirking the collection of taxes under a bureaucratic tax collection system by motivating tax farmers to input the high level of effort into tax collection processes.

Such a compensation system made tax farming financially innovative even from a modern financial point of view. The contractual structure of tax farming is very similar to several modern financial techniques in the private and public sectors. First, tax farming, in particular the fixed rent contract, can be viewed as an investment contract where tax farmers as investors keep any residual profit—taxes additionally collected—after paying the investment costs as a contract fee. Meanwhile, it can be viewed as a debt contract with the collateral as tax receivables: assets of governments. In the fixed rent contracts, the government would be viewed as borrowers. Second, tax farming, in particular the share contract, can be viewed as a franchisee contract under which governments temporally lease out the right of tax collection to private agents. From the perspective of corporate finance, the share contract can be viewed as an equity contract. In the share contract, tax farmers can be viewed as stockholders or CEOs with stock options. Under this share contract, rulers and tax farmers share the revenue proportionally. Under this equity contract, the utility functions of both the ruler and the tax farmer become close even though their utility function can never be identical. In short, tax farming is the market-driven financial management

alternative to solve financial administrative difficulties that states faced historically, such as the difficulties with underdeveloped capital market, unstable and uncertain tax revenue, and a lack of expert financial personnel.

Tax farming contracts are mutually beneficial to both the government (e.g. rulers and kings) and the private tax collector (e.g. businessmen, bankers, merchants, and created tax farming syndicates). With an underdeveloped tax bureaucracy and capital market, the government can collect tax revenue with reduced collection costs and low risk through tax farming. Meanwhile, tax farming is a profitable investment for the tax farmer who was using their capital, human resources, and local knowledge to obtain positive returns from tax farming contracts similar to other business activities. In short, tax farming was a financially innovative and efficient tax collection method. Such positive results of tax farming are due to its underlying mechanism of outcome-based compensation. However, tax farming is not wholly beneficial as it encourages private tax collectors to exploit taxpayers to maximize their expected return and to underreport collected tax revenue to the government. None of contracts is free from the agency problem although each contract form has its superiority.

2.3.2.2 Costs of Tax Farming: Overzealous Collection and Underreporting

We can observe tax farming from an alternative view historically. Tax farmers have an incentive to abuse the delegated authority while tax farming was efficient to collect the taxes (Webber and Wildavsky 1986; Levi 1988; Azabou and Nugent 1988; Stella 1993; and Ma 2003). Much of the tax farming literature points out detrimental effects on both the taxpayer and the government. Ma (2003: 449) argues that “the historical experience of tax farming provides the very case illustrating how governments achieved efficiency (e.g. revenue maximization or cost saving) at the price of the public interest and taxpayer right.” Stella (1993) argues that tax farming practice increases gross revenue, but it does not reduce administrative costs if the government need to monitor malpractices of tax farmers. Such negative effects of tax farming lead to other types of agency costs.

The negative effects of tax farming are most pronounced in two aspects: over-enforcement and underreporting. First, tax farmers can potentially exploit the taxpayer and tax base. This is observed in over-zealous collection which results in taxpayer abuse during the profit maximizing behavior of private collectors. This was observed when tax farmers could obtain a speculative profit by arbitraging when collecting in-kind taxes. Tax farmers collected in-kind taxes when the market price of the product was low and sold them when the price increased. Tax farmers could force taxpayers to borrow to refinance tax debts with unmerciful repayment conditions. Sometimes, tax farmers collected more than the official tax rate from uninformed taxpayers (Webber and Wildavsky 1986). This over-enforcement problem has a direct negative financial effect on the taxpayer and an indirect negative effect on government. Over-enforcement leads to taxpayers' reduced compliance with the tax systems, leading to ill-will and in the extreme, rioting, against the government system. Some countries, for example Ottoman Empire and Prussia in the eighteenth century, used long-term tax farming, but in many cases tax farming led to negative effect on tax base.

Theoretically, the over-enforcement incentive is larger under the fixed rent contract than the share contract. Such a difference between the fixed rent contract and the share contract is due to the cost structure, payment timing, and ownership. Under the fixed rent contract, tax farmers pay the government a fixed rent in advance and after recouping the rent they fully realized any collection residuals. In the fixed rent contract, tax farmers had full ownership of the tax receivables since the tax farmer had purchased the asset from the government. Meanwhile, under the share contract, the tax farmers first must collect taxes due and then were allocated some of the residual revenue after providing the payment, which is a portion of the revenue collected to the government. In the share contract, the tax farmers only have partial ownership of the tax receivables. The incentive to collect taxes is stronger in the rent contract than in the share contract. Thus, the share contract in tax farming can lead to over-enforcement, but over-enforcement is modest relative to the fixed rent contract.

Second, the share contract leads to a modest over-enforcement issue, but the contract results in another problem, the underreporting of true revenue due (Azebou and Nugent 1988). Under the share contract, tax farmers have an incentive to report less than true tax revenue collected to the

government because underreporting reduces their contract cost as a proportional fee and increases the tax farmer's returns. Under the fixed rent contract, the tax farmer has no such incentive to underreport true tax revenue because they pay a fixed rent to the government before collecting the tax revenue. This underreporting problem leads to a negative financial effect on the government.

However, it is important to know that brutal enforcement of tax farmers results from not only incentive structure of the contracts, but also the coercive nature of tax collection and enforcement themselves. Under the tax farming contracts, rulers delegated "coercive police power" to the tax farmers as "financial police" (White 2004: 647). For example, in France such coercive authority to collect taxes includes right to arm tax farmer's employees, right to search and seizure, and right to patrol the seas and rivers with ships to guard against tax evasion through smuggling (White 2004). In short, that the tax farmer collects taxes means that the tax farmer polices taxes.

2.3.3 Exogenous Factors

The underlying mechanism of tax farming itself was attractive to governments. However, exogenous factors—an underdeveloped bureaucracy, monitoring infrastructure, and capital market—surrounding governments until the eighteenth century made tax farming more attractive to governments. Until the early modern period, the government had lack of resources to develop and maintain tax bureaucracy, and tax revenue was not uncertain. These factors contributed to use of tax farming.

2.3.3.1 Underdeveloped Bureaucracy and Monitoring Infrastructures

Bureaucracy, especially tax bureaucracy, is a product of the late modern period. Until the early modern era, it was difficult for the government to develop sophisticated tax bureaucracy and to administrate it efficiently. First, the governments did not have enough resources to create and run tax bureaucracy (Kiser and Schneider 1994). During the Middle Ages, governments, such as federal kings, were poor (Webber and Wildavsky 1986). During the early modern period,

governments, such as monarchies, were richer than federal kings in the Middle Ages, but they frequently confronted bankruptcy, had to borrow money, and defaulted. Until the early modern era, governments could not afford to pay start-up costs for creating tax bureaucracy and regular wage for public tax collectors.

Second, during the early modern period, governments began to develop centralized tax bureaucracy, but the level of organization was rudimentary and operation of tax bureaucracy was inefficient. The most critical issue was that governments did not have enough a control or monitoring system to address shirking problem of tax bureaucracy from the ancient era to the early modern period. Until the early modern era, underdeveloped monitoring infrastructures, such as accounting system, transportation, and communication, had discouraged governments to adopt tax bureaucracy and to operate it efficiently. It is commonly assumed that ancient empires had highly sophisticated bureaucracy. However, Ancient Republican Rome lacked a bureaucracy (Badian 1972; and Levy 1988) because of difficulties to control over bureaucracy. As one of countries with centralized and developed bureaucracy, the late imperial China—Ming (1368-1644) and Qing (1644-1911)—even had suffered from difficulty to monitor shirking of their tax bureaucracy, especially tax collectors, even though China had the Censorate, which is the division to monitor bureaucracy through supervising exams and performance and financial auditing (Kiser and Tong 1992). Under the underdeveloped monitoring infrastructures, governments had no willingness to invest their scarce resource in developing tax bureaucracy. Even though governments develop tax bureaucracy, they costly operate it under the lack of monitoring infrastructure.

With the lack of a bureaucratic system of tax collection and monitoring systems, rulers and kings were presented with two options to collect taxes: to fully develop a bureaucratic system with substantial effort and costs or to use an existing ready-to-use market system. Historically, governments chose an existing market system, tax farming. In many cases, tax farmers had comparative advantages over a government in terms of capital, human resources, and knowledge. They were richer, had their own organizations and human resources, and had more sophisticated financial and local specific knowledge than the government. Under this situation, tax farming was not only feasible but also an efficient option until the government fully developed a

bureaucratic tax collection system. Until the eighteenth century, tax farmers were more efficient than states in terms of control, incentive structure, and collection techniques. Tax farmers used more innovative collection techniques, accounting methods, and more rigorous internal control systems, such as audits and inspections than states (Matthews 1958; Sabin 1980; and Kiser 1994). The level of financial compensation in tax farming was higher than states, and the level of compensation was also determined performance-base, such as sub-farming (Matthews 1958).

With tax farming, the government did not need complicated hierarchy and uncontrollable distant local tax officers but “only needed relatively modest administrative capacity to negotiate contracts and enforce payment of the contract fee” (Webber and Wildavsky 1986: 88). Such governments “harnessed private enterprise to perform a perennially unpopular task, guaranteed the state a secure revenue without necessitating either an elaborate bureaucracy—difficult control at long distance—or enforcement mechanisms to counteract the citizenry’s perennial reluctance to pay” (Webber and Wildavsky 1986: 119).

Generally governments who have practiced tax farming lacked centralized administration with strong internal controls, although these governments had some degree of a bureaucratic system of tax collection. Most governments adopting the tax farming practice historically were non-centralized systems with fragmented authority (Webber and Wildavsky 1986). For example, Mesopotamia was a city-state rather than a centralized united state. The French kings had no central administrative capacity for finance until the fourteenth century, and thus, they used tax farmers. Meanwhile, centralized ancient governments, such as Egypt, India, and China, minimally used tax farmers.

2.3.3.2 Underdeveloped Capital Market

Underdeveloped capital markets encouraged governments to utilize tax farmers as a kind of financial intermediaries (White 2004). The government wants to stabilize their tax revenue and liquidize tax receivables. Thus, financial markets play a critical role of implementing government’s financial needs. In terms of accounting, collecting taxes means collecting tax receivables, which are assets of the government. The difficulty to collect taxes means the

difficulty to liquidize financial assets of the government. In addition, tax revenue is fluctuated with exogenous factors, such as economic situations. Modern governments can borrow money from the capital market by issuing bonds, such as general bonds pledging tax revenue and revenue bonds pledging user fees. Until the early modern period, capital market was underdeveloped, and thus governments could not address liquidity issue and tax revenue risk through capital market.

Alternatively, governments enjoyed similar financial benefits to modern debt contracts through tax farming contracts under which governments received revenue from tax farmers in advance by transferring the right of collecting tax receivables as assets to tax farmers. Governments even could borrow money directly from tax farmers. In particular, the fixed rent contract of tax farming played a role of capital market of government. It is very similar to tax sales in local governments (Pointdexter, Lizabeth, and Wachter 1997; Alexander 2000). Coşgel and Miceli (2009) refuse the function of tax farmer as financial intermediary. However, tax farming provided governments with liquidity in that governments could receive tax revenues as fixed rent from tax farmer in advance even though sometimes tax farming contracts were not perfectly fit to debt contract.

Tax farmers were financial intermediary for governments, such as most Islamic state (Pamuk 2004), including the Ottoman Empire (Darling 1996; and Cizakca 1996), England (Ashton 1956), France (White 2004), and most European countries (Webber and Wildavsky 1986). In short, under the absence of a developed capital market, tax farming provided liquidity to manage fiscal shortfall and secured revenues for long delayed and hard-to-collect revenues with governments.

2.4 Tax Bureaucracy: Wage Contracts (A.D. 1800s – Contemporary Era)

Tax farming had been the dominant tax collection method in many countries until the early modern period (the eighteenth century). However, many countries in Europe and Non-European countries had begun to centralize their tax system and develop their own tax bureaucracy as a wage contract since the late modern period after the French Revolution and the Industrial Revolution (the nineteenth century). In this period, predatory principals' fiscal power was limited

by parliamentary powers under the constitutional monarchy systems (Dincecco 2009 and 2011), or even previous principals were replaced by new principals during revolution era. The emerging of representative states during the nineteenth century was the political base of centralized bureaucratic public administration of taxation. Finally, in most modern governments, salaried public employees collect the taxes. In this bureaucratic tax collection system, governments delegate other supervisory agents to monitor the effort of salaried public tax collectors (Coşgel and Miceli 2009). As society modernized, governments changed rent and share contracts of tax farming as incentive-based contracts to a wage contract of tax bureaucracy as a control-based contract.

2.4.1 Historical Evidences of Bureaucratization

In the late modern period, tax farming was replaced with government-administrated bureaucracy for tax collection. In Europe, most countries bureaucratized their tax collection system in the nineteenth century. England began to bureaucratize tax collection with starting to abolish tax farming of customs in 1671 (Kiser and Schneider 1994) and completed it with the ending of tax farming of stamp taxes in 1837 (Binney 1958). In particular, England intensively developed tax bureaucracy from 1688 to 1789 (Brewer 1988). In France, bureaucratization of tax collection began with starting to abolish tax farming of aids and stamp taxes in 1780 and completed it with ending of tax farming of indirect taxes in 1898 (Kiser and Schneider 1994). In Prussia, bureaucratization of tax systems began during the administrative reform period (1794-1810) with the General Law Code of 1794 where the public employees were referred to as “professional officials of the state,” instead of “royal servants” (Kiser and Schneider 1994: 200; and Rosenberg 1558: 290-91). In Russia, bureaucratization of tax collection was completed after 1862. Sweden and other countries in Europe had bureaucratized their tax collection system since the mid-eighteenth century (Bonney 1995: 443). In addition, the Ottoman Empire centralized tax administration in the nineteenth century. Life-term tax farming was abolished in the 1840s, and short-term tax farming was abolished after World War I (Pamuk 2004). Most of states in Southeast Asia abolished tax farming in the early twentieth century (Butcher and Dick 1993).

2.4.2 Endogenous Mechanism: Control-based Contract

Why have governments developed their own tax bureaucracies since the late modern period? Under the relatively favorable environment—existence of bureaucratic organization of tax farming, developed financial markets, technological innovations, and change of political preference, the government wanted easy-to-control and limited / neutral tax collection system. By using the government-administrated tax bureaucracy, the government can command and control their tax bureaucracy like the military organization, and mitigate brutal tax collection. However, the tax bureaucracy is inefficient in terms of incentive structure, although it is efficient in terms of organizational structure. The shirking as the underlying problem of the fixed wage contract of tax bureaucracy is an on-going issue.

2.4.2.1 Benefits of Tax Bureaucracy: Organizationally Innovative Tax Collection

As a fixed wage contract, the tax bureaucracy is a control-based contract under which the government relies on a monitoring system to mitigate the public employees' low level of effort, rather than incentivize them to input the high level of collection effort. Under the fixed wage contract, the principal's monitoring systems force his agents to input a minimal necessary level of tax collection, rather than maximum level of collection effort. Under the wage contract, the government addresses the shirking resulting from non-incentive-based contract by using organizationally innovative control system.

Bureaucratization is often viewed as a symbol of inefficiency. However, if some level of monitoring capacity is guaranteed, bureaucratization provides managerial efficiency. By mitigating the inherent problem of bureaucracy—shirking—through installing control or monitoring systems, the government could obtain the benefit of managerial efficiency from the centralized and hierarchical government-administrated tax bureaucracy. For this, governments want in-house tax collection organization, rather than outside vendors, and centralized and hierarchical organization, rather than fragmented and flatter organization form. In other words, in terms of organizational aspect, the government can equip itself with an organizational command-

control system of tax bureaucracy, and the centralized and hierarchical organization efficiently implements the government plan.

First, the government's controllability over tax collection processes increases and its dependence on outside contractors decreases by creating its own hierarchical organization. Bureaucracy is an organizational innovation because it provides managerial efficiency and increase controls through the hierarchical structure. Bureaucracy is an instrument of implementing a decision-maker's will. In the early modern period, government took over and benchmarked the centralized and bureaucratized form of tax farming. The government had nation-wide hierarchical apparatuses to collect taxes which increased managerial efficiency like military's command-control type of efficiency.

Second, by using tax bureaucracy, the government may save the compensation cost because usually the levels of fee in the rent and share contracts of tax farmers were higher than the level of wages for tax bureaucracy. In addition, governments can also mitigate agency costs—overzealous collection and underreporting—resulting from tax farming contracts. In short, by owning tax bureaucracy, the government can control entire tax collection processes and save costs resulting from outsourcing tax collection, such as high compensation costs and agency costs of tax farming.

2.4.2.2 Costs of Tax Bureaucracy: Shirking

Tax bureaucracy is not costless. The government has to spend the resources on developing and maintaining tax bureaucracy. Governments first have to spend large amounts of start-up costs to create tax bureaucracy. In addition, governments have to be able to afford to pay fixed wage to their tax collection agents regardless of their collection performance and fluctuation of tax revenue stream. Such a rigidity of cost structure of developing and running tax bureaucracy is costly. The government may save the compensation cost because the absolute amount of compensation cost for tax bureaucracy is lower than one for tax farmers. However, compensation in wage contract is fixed regardless of public tax collectors' performance and exogenous changes. Usually, fixed wage is not adjusted to revenue fluctuation. Thus, the principal has to assume

entire tax revenue risks. The government may address such financial risk by borrowing money from a financial market, but it also ultimately leads to increased costs of operating tax bureaucracy because the principal has to pay a capital cost, such as interests.

However, a more critical cost of tax bureaucracy is its agency cost of shirking. The nature of non-incentive-based contract reduces agency costs of tax farming, but leads to another type of agency cost of tax bureaucracy. Thus, the government confronts shirking of public tax collectors under the fixed wage contract. To address the problem of shirking without incentive-based compensation, the government has to spend their resources on increasing the capacity of control or monitoring. Before the late modern era, bureaucracies were far from efficient (Kiser 1994). In the early modern period, bureaucratization occurred, but it was not operated efficiently, for example in England (Sayer 1992) and in Russia and France (Armstrong 1972). Under the lack of monitoring capacity, governments continuously suffered from corruptions and shirking. Although during the late modern period, the government's monitoring capacity improved, but it does not mean that the government perfectly solved the bureaucracy's inherent inefficiency because of non-incentive contract. In even contemporary governments, the shirking in government bureaucracy is an on-going issue. In short, Tax bureaucracy is an organizationally innovative structure, but it is inefficient in terms of incentive structure.

The government confronts the underlying problem of shirking of bureaucracy and the problem of rigid cost structure because the government adopted non-incentive structure—fixed wage contract. However, exogenous factors made governments able to partly offset revenue loss from the agency problem resulting from fixed wage contract, and made governments able to tolerate the cost of tax bureaucracy.

2.4.3 Exogenous Factors

Tax bureaucracy has its own relative comparative superiority to tax farming. However, to adopt tax bureaucracy as a fixed wage contract, the government needs the following two conditions. The government has improved monitoring capacity to address the shirking issue, and risk-handling capacity to deal with risks assumed by the government. Exogenous factors surrounding

the government allowed governments to equip these capacities. Bureaucratization had first occurred in tax farming. Technological innovation allows the government to adopt nationwide tax bureaucracy under fixed wage contract as maintaining an acceptable level of agency problem. Revolution provided government with political power to take over tax farmer's bureaucratized tax organization and innovative tax-collection related techniques. Bureaucratization is often viewed as a symbol of inefficiency and anti-democracy. However, bureaucratization provides managerial efficiency and was one of the results partially from democratic movements. These exogenous factors contributed to agency costs being politically acceptable.

2.4.3.1 Heritage of Tax Farming: Bureaucratized Organization and Tax Collection Techniques

Bureaucratization and centralization as organizational structures for tax collection had already occurred in tax farming systems, in particular in England and France (Kiser 1994) although in the Netherlands ('T Hart 1989 and 1991) and Spain (Thompson 1976) tax farmers were fragmented. Until the early modern period, tax farmers consisted of lots of local merchants, each who run their own tax farming organization, and governments chose tax farmers through a bidding process. However, in the late modern period, tax farmers merged together, developed monopolistic tax farming syndicates, such as the "General Farm" in England (1604) and the "*Ferme Gererale*" in France (1681) (Kiser 1994), and developed military-like-hierarchy to run gigantic organizations for tax collection. It looks like a large "financial police (White 2004)" organization. In the late modern period, tax farming was an institution organizationally bureaucratized. Under this situation, governments contract with these syndicates through negotiation rather than comparative bidding processes. In short, tax farming was more efficient to collect taxes than kings or rulers until eighteenth century not only because tax farming was an incentive-based contract, but also because tax farmers have their own bureaucratic organization to implement their interests to collect taxes.

White (2004) views that centralized tax farms make it easy for the government to monitor the tax farmers. Also, the centralized tax farm was a benchmark model for creating tax bureaucracy. In England, state took over tax farming, and adopted innovative collection techniques, such as an

instruction manual for collection staff and accounting process (Chandaman 1975; and Kiser 1994). Governments took over not only organizational structure of tax farming but also innovative techniques for tax collection. Until the early modern period, fiscal manuals of most states were the same as medieval methods, and financial supervision and accounting practices was really poor (Webber and Wildavaky 1986: 280-281) although double-entry bookkeeping had already been used in business since the late Middle Ages (Webber and Wildavaky 1986: 279).

2.4.3.2 Technological Innovation: Increased Monitoring Capacities

If rulers want to collect taxes efficiently under the fixed wage contract, their monitoring capacities should increase. Governments' monitoring capacity in financial administration was increased by improving financial infrastructure and social infrastructure. In the nineteenth century, technologies of communication and transportation, and accounting had improved tremendously, which increased governments' monitoring capacity (Weber 1992; Ardant 1975; and Braudel 1949).

First, since the eighteenth century, financial control, such as accounting control and centralized audits, had significantly improved (Bosher 1970; Binney 1958; and Torrance 1978). In other words, financial management techniques, such as "double-entry accounting and the publication of accounts" (Hicks 1969), consolidated fund/account management, public accountants and audits (Webber and Wildavsky 1986), lead to a financially informed government and ultimately contributed to shifts toward the wage contract (Azabou and Nugent 1988). Improved accounting procedures had already been used in the private sector since the early modern period but governments adopted it in the late modern period.

Second, since the eighteenth century, technological developments in communication and transportation had improved monitoring capacities of governments exponentially. Communications and transportation significantly improved since the late eighteenth century in Europe (Braudel, 1949; Barker and Savage 1962; Ville 1990). Such technological infrastructures led to increased monitoring capacity under the bureaucracy (Weber 1992 and Kaiser 1994).

2.4.3.3 Developed Financial Market: Decreased Financial Risk

Under the wage contract, the government assumes all financial risks due to the fluctuated revenue stream. Thus, the government has to address such risks. Developed financial market provided government with financial instruments to manage financial risks, and so government's dependence on tax farming decreased. Completely developed financial markets allowed governments to choose wage contract rather than tax farming for tax collection (White 2004).

In early modern Italy, the Bank of Venice as the origin of the banking system was organized in 1157. However, until the sixteenth century in Europe, most banking systems were deposit and transfer banking. In the seventeenth century, the Amsterdam Wisselbank in Dutch Republic (Netherlands) in 1609 and the Bank of England in 1694 were organized and started loan services and bond issues for governments. These two pioneering banks opened modern banking and capital market, but these banking systems and capital markets were still rudimentary. Even in other European nations and other nations beyond Europe, modern types of banking and capital market had been organized during the eighteenth and nineteenth centuries (Homer and Sylla 2005; and Webber and Wildavsky 1986). For example, in France, financial markets for public debts began to be developed in the mid-seventeenth century (White 2004). Most financial markets, including government borrowing and bonds, in Europe fully developed since the nineteenth century.

In terms of financial risk, increased accessibility to financial markets leads to shifting government's attitude to financial risk from risk-averse to risk-neutral because capital market provided governments with risk-diversification instruments and liquidity. Because of developed capital markets, the role of financial intermediary of tax farming reduced. Developed capital market leads to the abolishment of tax farming, especially in the Ottoman Empire.

2.4.3.4 Revolutions: Political Power, Preference Shift, and Concept of the Taxpayer

Revolutions, such as civic revolutions (bourgeois revolutions), communist revolutions (proletariat revolutions), and other reforms, played a critical role to shift tax collection systems

from tax farming to tax bureaucracy. Based on Skocpol (1979) and Goldstone's (1999) idea of the relation between revolutions and bureaucratization, in particular in England and France, Kiser and Kane (2001) argue for the indirect effects of revolutions on bureaucratization, which means that revolutions provided reformists with the opportunity to remove resistances to reform. In short, revolutions tended to abolish old political economic systems and set up new systems. Thus, revolutions indirectly contributed to shift tax collection systems from tax farming to tax bureaucracy during the transition period of overall political economic systems (Kiser and Kane 2001).

However, we can observe more important and direct relations between revolutions and changes in the tax collection system. Most principal-agent analysis assumes that the principal's preference (or the principal) does not change, but in the real world, the principal's preference changes. Even though monitoring capacity and risk-handling capacity are not improved meaningfully, the change of the principal's preference would contribute to shifting contract form.

In terms of principal-agent analysis, revolutions during the nineteenth century shifted political power from rulers to taxpayers, and changed the principal's preference. The change of principal's preference results in changes in both tax collectors and taxpayers. The tax collection contract form shifted from tax farming to tax bureaucracy, and the concept of the taxpayer changed from the common people to constituents.

First, in terms of theory of agency, revolutions directly contributed to shifting the contract form of tax collection from tax farming to tax bureaucracy. For example, according to Dincecco's (2009 and 2011) works, fiscal centralization occurred from the late eighteenth century to the early nineteenth century with revolutions and administrative reforms, which lead to state bureaucracies in Europe. During the nineteenth century, the so-called Revolution era, principals' fiscal powers were limited by parliaments and constitutions, and existing principals (e.g. kings and rulers) were even replaced with new citizen-based principals. Therefore, through revolutions, previous single king-based preferences were limited or replaced by citizen-based preferences.

Second, revolutions changed the concept of the taxpayer from common people to constituents. Under tax farming, the taxpayers were viewed as politically powerless and passive subjects while rulers or kings were not benevolent and even “predatory” (Levi 1981 and 1988). Until the nineteenth century, taxpayers had no political power to protect themselves from their rulers’ predatory extraction of taxes, except for riot. However, after revolutions, the taxpayers have been considered constituents. Since the 1990’s, through the Clinton Administration’s reinventing government initiative in the United States, taxpayers have even been viewed as customers or clients like in the business sector although there have been debates about the customer concept of citizens (or taxpayers) (Schachter 1995 and Pagnato 1997). Under the bureaucratic tax collection system, taxpayers have the voting power by which they can indirectly reveal their political preferences to their representatives and indirectly control bureaucracy.

As the constituent, the taxpayer gave weight to the neutral tax collection entity rather than efficient entity. The contract form of tax collection reflects the change of the principal’s preference. Taxpayers’ needs for a fair and impartial tax collection lead to bureaucratization (Ertman 1997; and Anderson and Anderson 1968). Taxpayers preferred a wage contract to tax farming contracts. In other words, the principal of government was more concerned about private tax collector’s overzealous collection rather than the public tax collector’s shirking in terms of agency costs. Thus, the wage contract for tax collection would simply reflect taxpayers’ preference. In taxation, it is a realistic explanation in that the taxpayer wants to pay taxes as low as possible. Taxpayers would want to develop not only “efficient” but also “procedurally fair” tax collection systems to protect themselves. In short, from the standpoint of the taxpayer, shirking of bureaucracy is more tolerable than the overzealous tax collection of tax farmers. The shift of the tax collection method from tax farming to tax bureaucracy would not be due to economic efficiency, but due to political preference.

2.5 Conclusion

In this essay, I attempted to answer the questions of why governments contracted out tax collection with tax farmers until the eighteenth century, and why governments have developed their own tax bureaucracy since the nineteenth century. To explore these questions, I focus on

identifying generalizable underlying mechanisms of tax collection contracts and key exogenous factors affecting the government's contractual choice in tax collection history, rather than providing detailed descriptions of a single country's tax collection history during certain periods or concentrating the variation among countries over time. My financial interpretation of the tax collection history through the lens of theory of agency suggests following two implications.

First, in terms of the underlying mechanism, each contract of tax collection has its own relative costs and benefits. Tax farming as an incentive-based contract is a financially innovative tax collection method because it is a self-fundable and self-motivated tax collection system. Thus, it provided the government with stable revenue at low collection cost and risk. Tax farming solves the public employee shirking under the fixed wage contract, but it leads to brutal tax collection. Meanwhile, tax bureaucracy as a control-based contract is an organizationally innovative tax collection method in that it provides governments with command-control systems over whole tax collection processes and provides taxpayers with procedurally fair collection process. Tax bureaucracy solves tax farmers' overzealous tax collection, but it leads to its shirking. In addition, the government confronts the problem of rigid cost structure of tax bureaucracy, and has to assume all of the tax revenue risks. In short, both tax farming and tax bureaucracy have their own relative comparative superiority and inferiority to each other due to the tradeoff among agency costs for tax collection contracts.

Second, governments' choice of contracts of tax collection is a product of interactions between endogenous mechanisms of contracts and exogenous factors surrounding these contracts. In contractual choice, the preference of the principal is constrained by exogenous factors surrounding contractual relation between the principal and the agent. Until the eighteenth century, the bureaucracy, monitoring infrastructure, and capital markets were underdeveloped. These unfavorable exogenous factors encouraged governments to choose the fixed rent and revenue share contracts of tax farming to collect taxes. However, since the nineteenth century, the bureaucracy, monitoring infrastructure, and capital markets have enormously been developed. In addition, in this period, principals' political preference was changed. These exogenous factors allowed governments to shift contract forms of tax collection from tax farming to tax bureaucracy.

Even though this historical review of tax collection does not provide a clear answer which contract form is absolutely better than another, the implications of this essay may be a base for developing a formal model to theorize tax collection contracts, and for empirically testing propositions from the model in the contemporary context.

CHAPTER 3

A FORMAL MODEL OF TAX COLLECTION AND AN APPLICATION TO CONTRACTING OUT FEDERAL DELINQUENT INCOME TAX COLLECTION

3.1 Introduction

The purpose of this chapter is to analyze the relative costs and benefits of tax collection contracts through the development of a formal model to answer the question of what conditions is each tax collection contract optimized under the agency problem, and what the expected values of optimal tax collection contracts. The formal models of tax collection are underpinned by the historical review and theory of agency. I focus on modeling underlying endogenous mechanisms of tax collection contracts, rather than exogenous factors. The government's contractual choice of tax collection is a product of endogenous mechanisms of tax collection contracts and exogenous constraints where endogenous mechanisms do not change over time like the law of nature, but exogenous conditions change over time. Thus, I believe that to theorize generalizable mechanism of tax collection contracts should be first, and to examine the environments which the mechanism works should be second. Therefore, this chapter focuses on modeling endogenous mechanisms of tax collection contracts. For the simplification in modeling, I assume that the government wants to maximize its tax revenue. However, such revenue maximization is conditional. In real world, the government may want to maximize social welfare or other values. In addition, to maximize revenue may not optimal theoretically. Some degree of tax evasion and delinquency may be socially optimal results. In this essay, I do not address such complicated conditional revenue maximization issue. However, my model partly captures the conditional aspect of revenue maximization by considering inter-temporal change of tax base and monitoring costs. The monitoring cost is the cost to address the agency problem or agency cost. Thus, the terms of monitoring cost and agency cost are used interchangeably.

The motivation of this study is that there is relatively limited research on tax collection and delinquent tax although tax collection is an important issue from theoretical and practical policy standpoints. Even if tax revenue is a function of tax base, tax rate, and collection effort, much of taxation literature has focused on modeling optimal tax rates and tax bases. In addition, most theoretical literature on tax collection tends to be limited to tax evasion issues. Hence, I will develop a model of optimal tax collection efforts. The dynamic and static optimization processes will be used to generate comparative statics, such as optimal conditions and relative value—the net effect of costs and benefits—of tax collection contracts.

The model shows the optimal conditions of contracts derived by optimization processes. However, it is not straightforward in comparing the relative values of contracts. Seven important comparative statics are driven by the formal analysis. It is relatively straightforward to compare each level of the agent's collection effort, compensation cost, and gross tax revenue among contracts. Meanwhile, it is hard to compare each net tax revenue, agency cost, agency cost adjusted net tax revenue, and change of tax base for contracts.

The model gives rise to the following implications. The government can indirectly choose the level of effort of the tax collection agent by offering each a different compensation scheme to maximize its tax revenue. However, compensation-to-effort mapping leads to a trade-off among agency costs. Therefore, when choosing a contractual form of tax collection, the government needs to consider not only the simple compensation-to-effort mapping issue but also agency costs resulting from such a mapping. Furthermore, the government needs to consider not only revenue and cost in the short-run, but also the impacts of the level of collection efforts and agency costs on the change of tax base over time in the long-run.

Furthermore, I apply the implications of the model to a contemporary case: Federal delinquent income tax collection outsourcing. One of the current problems in governmental finance has been growing delinquent taxes. In the fiscal year 2007, the federal unpaid tax debt inventory totaled \$ 290.1 billion (U.S. Government Accountability Office, 2008). This figure is about 1.6 times the collective budget deficits of all U.S. states which totals \$ 180 billion in 2011, or about 4 times the state of Florida's budget of \$ 70.4 billion for fiscal year 2011. To address growing

delinquent taxes, since the 1990s, the federal government has considered contracting out delinquent income tax collection with private debt collection companies. However, the federal government confronts a dilemma between efficient collection and protection of delinquent taxpayers' rights due to potentially invasive collection behavior of private debt collection companies. The model implies that federal delinquent income tax collection outsourcing may increase gross tax revenue and tax collection rate, but these benefits of an incentive-based contract may be partly offset by increasing compensation cost and social costs associated with taxpayer's harassment.

Section II reviews related research to identify the limitations of previous taxation literature and to provide the theoretical framework for the modeling. Section III provides a static model of tax collection, and section IV shows a dynamic model of tax collection. Section V shows an application of the model to a current case. Finally, Section VI provides a conclusion.

3.2 Related Research

3.2.1 Tax Administration

Tax revenue is produced through combining the tax base, tax rate, and the tax administrator's collection effort. Tax revenue is not automatically generated only by determining tax bases and imposing tax rates. This process should be followed by a tax collection effort. However, most taxation literature has focused on issues of tax base and tax rate and tended to overlook administrative issues of the tax system. Since the 1960s, optimal taxation, which is to find optimal rates of tax through formal models, has been a dominant theme in taxation literature (Slemrod and Yitzhaki, 1996).

Even though a social planner optimally chooses tax rates and tax bases, it is possible that an optimally chosen tax system could be implemented imperfectly because of taxpayers cheating their tax bases and tax collectors' shirking their delegated tasks. Until the 1950s, the studies on tax administration, including compliance and enforcement, were limited to verbal description rather than analysis. Since Allingham and Sandmo's (1972) and Srinivasan (1973) work on the

formal model on tax evasion, which is built on Becker's (1968) "Crime and Punishment: An Economic Approach," formal models of tax administration have been developed and focused on the relation between tax collectors (auditors) and taxpayers (tax evader). In particular, this tax evasion literature concentrates on the taxpayer's behavior conditional on audit rate and the level of punishment in tax collection.

However, there has been relatively limited tax administration literature on modeling the relation between the government (principal) and tax collectors (agent). Government can increase tax revenue (or tax compliance) not only by increasing audit rate and the level of punishment, but also by increasing the level of collection effort. To analyze the tax collector's behavior conditional on the level of compensation in tax collection, I adopt the theory of agency, which focuses on the level of collection effort and level of compensation, instead of theory of crime and punishment, which focuses on detection rate and the level of punishment.

3.2.2 Theory of Agency

To develop a model of the contractual relation between the government and the tax collector, I adopt the theory of agency (Ross, 1973). Ross provides a baseline model to formalize and map different compensation schemes to different agency costs in the tax collection contract. The theory of agency focuses on selecting a compensation system as a monetary incentive system in a contract situation. In the model, the agent's problem is to choose an "optimal act," which is the level of effort conditional on the particular fee schedule. Ross's baseline model of agency theory was based on the assumption of a zero agency cost, which leads to the first-best perfect-information equilibrium. However, under the asymmetric information between principal and agent, any optimal contracts entail agency costs, relative to the first-best perfect-information equilibrium (Bernanke and Gertler 1989).

Therefore, for a more realistic approach, we need to relax the assumption of a zero-agency cost and have to find a second-best imperfect equilibrium. Likewise, under the zero-agency cost situation, tax administration does not matter because any type of tax administration is costless and thus, the choice of a tax collection method is not a critical issue. However, in the real world,

agency costs always exist, and thus the choice of a tax collection contract form matters. Tax collection is not costless. In practice different methods of tax collection produce different financial and non-financial results. To analyze key issues of both tax farming and tax bureaucracy, we need a model of agency under the non-zero agency cost situation. Hence, one of the most important inquiries is what mode of tax administration is optimal under the non-zero agency cost situation. Therefore, a formal model of the relationship of agency should have to incorporate not only different payment schedules but also trade-off among agency costs into the optimal design of a contract. For specification of agency costs, I partially follow Lueck's (1995) specification of monitoring.

3.2.3 Static Model

My formal model built on agency theory is partially motivated by a static model of tax collection as proposed by Coşgel and Miceli (2009). Coşgel and Miceli (2009) develop a static model of tax collection implicitly based on the transaction cost framework. The difference between my model and Coşgel and Miceli's model is that my model focuses on agency costs due to different levels of effort of agency while their model emphasizes measurability of information on tax. They argue that a government's contractual choice of tax collection depends on what information on tax is easily measurable. According to their model, when the government can easily observe tax revenue collected by the agent, it chooses a share contract. In addition, when the government can easily measure tax bases, it chooses a rent contract, and when the government can easily monitor the effort of agents, the government adopts a wage contract.

However, their model is incomplete. Because of ignoring agency costs in tax collection contracts, Coşgel and Miceli's model does not address costs and benefits of both tax farming and tax bureaucracy. Information matters in tax collection, but the most critical information is the level of effort of tax collection agencies and related agency costs when the principal chooses a contractual type of tax collection. In tax collection history, the government chooses different contractual forms of tax collection by considering different agency costs, such as shirking and over-enforcement, rather than information about taxes. Also, the contemporary government's problem is the dilemma between effective enforcement and procedural fairness on choosing the

level of effort of the tax collection agency in the tax collection process given tax rates and bases. I address limitations of Coşgel and Miceli's model by developing a static model driven by the theory of agency.

3.2.4 Dynamic Model

The static model is useful to analyze tax collection contracts, but the model can be improved by adding a complexity, such as the dynamic nature of the tax base. Each tax collection method has a different impact on tax bases in the long-run. Thus, I develop a dynamic model to capture intertemporal changes in the tax base due to different tax collection contracts. In this dynamic model, when trying to reach a contract with an agent, the government has to consider not only agent's participation and incentive comparability constraints, but also the long-run impact of a contract on tax base as a type of capital or resource stock. Such a constraint associated with the intertemporal changes in tax base is specified by a differential equation of state variable or stock variable in dynamic modeling (Huckfeldt, Kohfeld, and Likens 1982; and Brown 2007), and the optimization process is to solve the Hamiltonian function for the maximization problem with the constraint of intertemporal changes in the stock variable (LaFrance and Barney 1991). For the specification of the change of the tax base, I partially follow the specification of the change of capital in the Ramsey-Cass-Koopmans' optimal economic growth model (Ramsey 1928; Koopmans 1963; and Cass 1965). Also, for specification of tax collection and the change of the tax base, I was inspired by the literature on dynamic optimal use of renewable natural resources (Levhari and Mirman 1980; Huhtala 1999; Sandler and Sterbenz 1990; and Caputo and Lueck 1994).

3.3 A Static Model of Tax Collection

3.3.1 Tax Revenue Production Function: Fixed Tax Bases

Tax revenue is a function of the tax base, tax rate, and collection effort. If we know taxes levied, which is calculated by the tax base multiplied by tax rates, or if we assume that taxes levied are fixed, the amount of tax revenue only depends on the tax collector's effort. The government can

indirectly choose the level of effort of the tax collection agent by offering different compensation schemes to maximize its tax revenue. However, a compensation-to-effort mapping leads to a trade-off among agency costs. Therefore, when choosing a contractual form of tax collection, the government needs to consider not only simple compensation-to-effort mapping issues but also agency costs resulting from such a mapping.

Suppose the amount of gross tax revenue, G , collected by the agent can be expressed by following production function as follows:

$$G = f(e)R, \quad (1)$$

where e is the level of effort of the agent to collect taxes levied, $f(e)$ is the effort function, and R is the fixed amount of tax levied, tax receivables. With the fixed tax receivables, R , the government can increase the gross tax revenue, G , by inducing the tax collection agent to choose the high level effort for tax collection.

3.3.2 Wage Contract: Shirking

Under the wage contract, the government's problem is to choose the level of effort of the agent, e , and a fixed wage payment, w , to maximize its return subject to the agent's participation constraint

$$\text{maximize } V_w = f(e_w^L)R - w - m(e_w^L) \quad (1.1)$$

e, w

subject to

$$w - e_w^L \geq U_0 \quad (1.2)$$

In the wage contract, the government maximizes a wage contract value function, V_w . The government collects the revenue, $f(e_w^L)R$, by using the public employee, and pays a fixed wage.

Meanwhile, the public employee's return is a fixed wage, w , minus his costs of labor, e_w^L , to input for tax collection as follows

$$U_w = w - e_w^L. \quad (1.3)$$

I denote the high level of effort of the agent as e^H implying the high cost to the agent, and denote the low level of effort of the agent as e^L implying the low cost to the agent. The tax farmer's costs may be associated with not only his labor cost but also costs of capital, facilities, and raw materials. However, in this paper, I assume that the labor cost includes all other costs to input for tax collection. Under the fixed wage contract, the public employee chooses the low level of effort thereby *shirking*, because there is no direct functional relation between the agent's level of effort and the fixed wage. With the fixed wage, the agent even have disincentive to choose the high level of effort because the high effort reduces his return. To mitigate his shirking, the government monitors the level of effort of the public employee at cost, $m(e)$, which is not a fixed cost but a variable cost because such a monitoring cost varies with the level of shirking. As the agent shirks more, the monitoring cost increases. If there is no shirking, then the monitoring cost is zero. However, in the real world, the shirking exists.

In the wage contract, the government's problem is subject to participation constraint only, which means that through the contract with the principal, the agent has to receive at least his reservation utility, U_0 . The reservation utility is the utility that the agent can receive from his best option among others than the contract if the agent reject the contract. Meanwhile, in the wage contract, the government's problem is not subject to incentive comparability constraint, which means that under a contract, the return which the agent gets by choosing the high level of effort, e^H , is greater than the return which the agent gets by choosing the low level of effort, e^L .

Thus, the Lagrangian function for the government's optimization problem is

$$L(e_w^L, w, \lambda_w) = f(e_w^L)R - w - m(e_w^L) + \lambda_w [w - e_w^L - U_0] \quad (1.4)$$

, where λ_w is the lagrangia multiplier for participation constraint.

First order conditions are as follows.

First, differentiate the Lagrangian with respect to e_w^L , then

$$\frac{\partial L}{\partial e_w^L} = f'(e_w^L)R - m'(e_w^L) - \lambda_w = 0 \quad (1.5)$$

$$\therefore f'(e_w^{L*})R = \lambda_w^* + m'(e_w^{L*}) \quad (1.6)$$

Second, differentiate the Lagrangian with respect to w , then

$$\frac{\partial L}{\partial w} = -1 + \lambda_w = 0 \quad (1.7)$$

$$\therefore \lambda_w^* = 1. \quad (1.8)$$

(1.5) and (1.6) imply optimal effort level of agent, e_w^{L*} , solves

$$\therefore f'(e_w^{L*})R = 1 + m'(e_w^{L*}). \quad (1.9)$$

Third, differentiate the Lagrangian with respect to λ_w then

$$\frac{\partial L}{\partial \lambda_w} = w - e_w^L - U_0 = 0 \quad (1.10)$$

Given the optimal level of effort of agent, e_w^* , the government offers the agent $U_0 + e_w^*$ as the optimal wage, w^*

$$\therefore w^* = U_0 + e_w^{L*} \quad (1.11)$$

Under the optimal wage contract, the return to the government is

$$\therefore V_w^* = f(e_w^{L*})R - w^* - m(e_w^{L*}) \quad (1.12)$$

, where $w^* = U_0 + e_w^{L*}$

or

$$\therefore V_w^* = f(e_w^{L*})R - (U_0 + e_w^{L*}) - m(e_w^{L*}). \quad (1.13)$$

Under the fixed wage contract, the expected cost of compensation is the optimal fixed wage, w^* , which is $U_0 + e_w^{L*}$.

3.3.3 Rent Contract: Strong Over-enforcement

Under the rent contract, the government's problem is to choose the level of effort of agent, e , and a fixed fee, F , to maximize its return subject to the agent's participation constraint and incentive comparability constraint

$$\text{maximize } V_R = F - k(e_r^H), \quad (2.1)$$

$$e, F$$

subject to

$$f(e_r^H)R - F - e_r^H \geq U_0 \text{ and} \quad (2.2)$$

$$f(e_r^H)R - F - e_r^H \geq f(e_r^L)R - F - e_r^L \quad (2.3)$$

Under the fixed rent contract, the government maximizes a fixed rent contract value function, V_R . The government sells off tax receivables to tax farmers for a fixed rent fee, F . The fixed rent fee, F , is a discounted price of the face value of tax receivables, R , with the tax farmer's personal discount rate because the government transfers all risks to the tax farmer under the fixed rent contract. Thus, the selling price of tax receivable, F , is lower than face value of tax receivable, R .

$$F < R \quad (2.4)$$

The fixed rent contract is an investment contract to the tax farmer. The tax farmer's return is observed by subtracting both purchase price of tax receivable, F , and his labor costs, e_r^H , from the gross tax revenue, $f(e_r^H)R$.

$$U_R = f(e_r^H)R - F - e_r^H. \quad (2.5)$$

The fixed rent contract induces the tax farmer to choose high effort, e_r^H , to make his investment profitable. The tax farmer's return function, U_R , shows that the direct relation between his effort, e_r^H , and his gross return, $f(e_r^H)R$ although his marginal return decreases as his level of effort increases. Thus, unlike the fixed wage contract, under the fixed rent contract, the government's problem is subject not only to the participation constraint but also to the incentive comparability constraint. Under such incentive contracts, the government may save the costs to monitor bureaucracy shirking but needs to monitor and mitigate the tax farmer's over-enforcement at cost, $k(e_r^H)$. The cost associated with over-enforcement is not a fixed cost but a variable cost because the cost depends on the degree of over-enforcement of the tax farmer.

Then, the Lagrangian for government's optimization problem is

$$L(e_r^H, e_r^L, F, \lambda_r, \pi_r) \quad (2.6)$$

$$= F - k(e_r^H) + \lambda_r [f(e_r^H)R - F - e_r^H - U_0] + \pi_r \{f(e_r^H)R - F - e_r^H - [f(e_r^L)R - F - e_r^L]\},$$

where λ_r is lagrangia multiplier for the participation constraint and π_r is the lagrangia multiplier for the incentive comparability constraint.

First order conditions are as follows.

First, differentiate the Lagrangian with respect to e_r^H , then

$$\frac{\partial L}{\partial e_r^H} = -k'(e_r^H) + \lambda_r f'(e_r^H)R - \lambda_r + \pi_r f'(e_r^H)R - \pi_r = 0$$

$$\Leftrightarrow (\lambda_r + \pi_r)f'(e_r^H)R = k'(e_r^H) + \lambda_r + \pi_r \quad (2.7)$$

The first order conditions imply that optimal effort level of agent, e_r^{H*} , solve

$$\therefore f'(e_r^{H*})R = \frac{k'(e_r^{H*}) + \lambda_r^* + \pi_r^*}{(\lambda_r^* + \pi_r^*)}. \quad (2.8)$$

Second, differentiate the Lagrangian with respect to e_r^L , then

$$\frac{\partial L}{\partial e_r^L} = -\pi_r f'(e_r^L)R + \pi_r = 0 \quad (2.9)$$

The first order conditions imply that optimal effort level of agent, e_r^{L*} , solve

$$\therefore f'(e_r^{L*})R = 1 \quad (2.10)$$

Third, differentiate the Lagrangian with respect to F , then

$$\frac{\partial L}{\partial F} = 1 - \lambda_r - \pi_r + \pi_r = 0 \quad (2.11)$$

$$\therefore \lambda_r^* = 1 \quad (2.12)$$

Thus, we can rewrite (2.8) as follows

$$\begin{aligned} \therefore f'(e_r^{H*})R &= \frac{k'(e_r^{H*}) + 1 + \pi_r^*}{(1 + \pi_r^*)} \\ &= 1 + \frac{k'(e_r^{H*})}{(1 + \pi_r^*)}. \end{aligned} \quad (2.13)$$

Fourth, differentiate the Lagrangian with respect to λ_r , then

$$\frac{\partial L}{\partial \lambda_r} = f(e_r^H)R - F - e_r^H - U_0 = 0 \quad (2.14)$$

Given optimal level of the effort of the agent, the government received fixed rent, F^* , from the tax farmer

$$\therefore F^* = f(e_r^{H*})R - U_0 - e_r^{H*} \quad (2.15)$$

Fifth, differentiate the Lagrangian with respect to π_r , then

$$\frac{\partial L}{\partial \pi_r} = f(e_r^H)R - F - e_r^H - f(e_r^L)R + F + e_r^L = 0 \quad (2.16)$$

$$\therefore f(e_r^{H^*})R - f(e_r^{L^*})R = e_r^{H^*} - e_r^{L^*} \quad (2.17)$$

Under this optimal contract the return to the government is

$$\therefore V_R^* = F^* - k(e_r^{H^*}), \quad (2.18)$$

$$, \text{ where } F^* = f(e_r^{H^*})R - U_0 - e_r^{H^*}$$

or

$$\therefore V_R^* = f(e_r^{H^*})R - (U_0 + e_r^{H^*}) - k(e_r^{H^*}). \quad (2.19)$$

Under the fixed rent contract, the government does not compensate the tax farmer directly. Instead, the government indirectly compensates the agent by selling tax receivables to him at a discounted price. Thus, the expected cost of compensation would be $R - F^*$ or $R - [f(e_r^{H^*})R - (U_0 + e_r^{H^*})]$, which is the difference between the face value of tax receivables, R , and discounted value of tax receivables, $F^* = f(e_r^{H^*})R - (U_0 + e_r^{H^*})$. As the tax farmer increase his level of effort, $f(e_r^{H^*})R$ is close to R . Thus, under the rent contract, at the highest level of effort of tax farmer, the expected cost of compensation is $U_0 + e_r^{H^*}$.

3.3.4 Share Contract: Modest Over-enforcement and Underreporting

Under the revenue share contract, the government's problem is to choose the level of effort of the agent, e , proportional fee rate, s , and the degree of underreporting, r , to maximize its return subject to participation constraint and incentive comparability constraint

$$\text{maximize } V_S = (1-s) f(e_s^M) R (1-r) - d(e_s^M) - h(r), \quad (3.1)$$

$$e, s, r$$

subject to

$$sf(e_s^M)R(1-r) - e_s^M + f(e_s^M)Rr \geq U_0 \text{ and} \quad (3.2)$$

$$sf(e_s^M)R(1-r) - e_s^M + f(e_s^M)Rr \geq sf(e_s^L)R(1-r) - e_s^L + f(e_s^L)Rr \quad (3.3)$$

Under the share contract, the government maximizes a revenue share contract value function, V_S . Suppose a sharing rule is $f(e_s^M)R = sf(e_s^M)R + (1-s)f(e_s^M)R$, where $0 \leq s \leq 1$. Under this sharing rule, the tax farmer retains $sf(e_s^M)R$, which is a percentage, s , of total tax revenue, $f(e_s^M)R$, collected by him. The tax farmer's return function is

$$U_s = sf(e_s^M)R(1-r) - e_s^M + f(e_s^M)Rr \quad (3.4)$$

Meanwhile, the government receives $(1-s)f(e_s^M)R$, which is other portion, $(1-s)$, of total tax revenue, $f(e_s^M)R$. If the tax farmer's portion, s , is equal to zero, the share contract become similar to the fixed wage contract. If the s is equal to one, the share contract becomes similar to the fixed rent contract. The share contract exists between the wage and rent contract. Under the share contract, the level of effort of the agent for tax collection is modest, e_s^M . It is lower than the effort level under the rent contract but higher than the effort level of the wage contract.

Like the rent contract, the share contract leads to over-enforcement issue. This is because the tax farmer's compensation is not fixed amount but a function of his performance according to the sharing rule. However, over-enforcement under the share contract is relatively modest to one under the fixed rent contract because the level of effort of the tax farmer is relatively modest to one under the fixed rent contract. If under the share contract, the government concerns about not only tax revenue but also the taxpayer, then it need to monitor and mitigate the tax farmer's over-enforcement at cost, $d(e_r^H)$. However, the cost is relatively lower than the cost associated with over-enforcement under the rent contract, $k(e_r^H)$.

Another unique nature of the share contract is that the tax farmer has the incentive to report a lower amount of tax revenue than true amount collected by him to the government, an *underreporting issue*. This is because in the tax farmer final share, $sf(e_s^M)R$, a percentage, s , is determined by sharing rule before collecting tax but the total tax revenue, $f(e_s^M)R$, collected by him is determined by his reporting after collecting tax. Thus, the tax farmer has an incentive to manipulate the true amount of revenue collected to maximize his return. The tax farmer reports $f(e_s^M)R(1 - r)$, where $0 \leq r \leq 1$, rather than the true tax revenue collected, $f(e_s^M)R$. The r is the degree of underreporting. If r is equal to zero, then the tax farmer reports the true amount of revenue and follows sharing rule. If r is equal to one, then the tax farmer does not report any amount of revenue and keep whole amount of tax revenue. By underreporting, the tax farmer obtains an additional return, $f(e_s^M)Rr$, which is $f(e_s^M)R$ times r . Meanwhile his portion based on sharing rule decrease by replacing $sf(e_s^M)R$ with $sf(e_s^M)R(1 - r)$.

Under the share contract with underreporting issue, the government obtains tax revenue, $(1-s)f(e_s^M)R(1 - r)$, which is lower amount than the government's share based on true reporting, $(1-s)f(e_s^M)R$. Thus, the government needs to monitor and mitigate this underreporting issue at cost, $h(r)$. The cost associated with underreporting is not a fixed cost but a variable cost because such a monitoring cost depends on the degree of underreporting.

The Lagrangian for government's optimization problem is

$$\begin{aligned}
 L(e_s^M, e_s^L, s, r, \lambda_s, \pi_s) & \hspace{15em} (3.5) \\
 & = (1-s)f(e_s^M)R(1 - r) - d(e_s^M) - h(r) + \lambda_s[sf(e_s^M)R(1 - r) - e_s^M + f(e_s^M)Rr - U_0] \\
 & \quad + \pi_s[sf(e_s^M)R(1 - r) - e_s^M + f(e_s^M)Rr - \{sf(e_s^L)R(1 - r) - e_s^L + f(e_s^L)Rr\}]
 \end{aligned}$$

The first order conditions are as follows.

First, differentiate the Lagrangian with respect to e_s^M , then

$$\frac{\partial L}{\partial e_s^M} = (1-s) f'(e_s^M) R(1-r) - d'(e_s^M) + \lambda_s s f'(e_s^M)(1-r) - \lambda_s + \lambda_s f'(e_s^M) Rr$$

(3.6)

$$+ \pi_s s f'(e_s^M) R(1-r) - \pi_s + \pi_s f'(e_s^M) Rr = 0$$

$$\Leftrightarrow f'(e_s^M) R[1-s-r+sr+\lambda_s s - \lambda_s sr + \lambda_s r + \pi_s s - \pi_s sr + \pi_s r] = d'(e_s^M) + \lambda_s + \pi_s$$

The first order conditions imply that optimal effort level of agent, e_s^{M*} , solves

$$\therefore f'(e_s^{M*}) R = \frac{d'(e_s^{M*}) + \lambda_s^* + \pi_s^*}{1-s^*-r^*+s^*r^*+\lambda_s^* s^* - \lambda_s^* s^*r^* + \lambda_s^* r^* + \pi_s^* s^* - \pi_s^* s^*r^* + \pi_s^* r^*}$$

(3.7)

Second, differentiate the Lagrangian with respect to e_s^L , then

$$\frac{\partial L}{\partial e_s^L} = -\pi_s s f'(e_s^L) R(1-r) + \pi_s - \pi_s (e_s^L) Rr = 0$$

(3.8)

$$\Leftrightarrow f'(e_s^L) R[s(1-r) + r] = 1. \quad (3.8)$$

The first order conditions imply that optimal effort level of agent, e_r^{L*} , solves

$$\therefore f'(e_r^{L*}) R = \frac{1}{s^*(1-r^*)+r^*}.$$

(3.9)

Third, differentiate the Lagrangian with respect to s , then

$$\frac{\partial L}{\partial s} = -(e_s^M) R(1-r) + \lambda_s f(e_s^M) R(1-r) + \pi_s f(e_s^M) R(1-r) - \pi_s f(e_s^L) R(1-r) = 0$$

$$\Leftrightarrow \lambda_s (e_s^M) = (e_s^M) - \pi_s (e_s^M) + \pi_s (e_s^L)$$

(3.10)

$$\therefore \lambda_s^* = 1 - \pi_s^* + \frac{\pi_s f(e_s^{L*})}{f(e_s^{M*})}$$

(3.11)

Fourth, differentiate the Lagrangian with respect to r , then

$$\begin{aligned} \frac{\partial L}{\partial r} = & -(e_s^M)R + sf(e_s^M)R - h'(r) - \lambda_s sf(e_s^M)R + \lambda_s f(e_s^M)R - \pi_s s f(e_s^M)R + \pi_s f(e_s^M)R \\ & + \pi_s s(e_s^L)R - \pi_s f(e_s^L)R = 0 \end{aligned} \quad (3.12)$$

$$\therefore h'(r^*) = f(e_s^{M*})R[-1 + s^* - \lambda_s^* s^* + \lambda_s^* - \pi_s^* s^* + \pi_s^*] + f(e_s^L)R[\pi_s^* s^* - \pi_s^*]. \quad (3.13)$$

Fifth, differentiate the Lagrangian with respect to λ_s , then

$$\frac{\partial L}{\partial \lambda_s} = sf(e_s^M)R(1-r) - e_s^M + f(e_s^M)Rr - U_0 = 0 \quad (3.14)$$

$$\therefore s^* = \frac{U_0 + e_s^{M*} - f(e_s^{M*})Rr^*}{f(e_s^{M*})R(1-r^*)}. \quad (3.15)$$

Given optimal level of effort of the agent, the government allows the tax farmer to retain s^* percentage of tax revenue collected by him.

Sixth, differentiate the Lagrangian with respect to π_s , then

$$\frac{\partial L}{\partial \pi_s} = s(e_s^M)R(1-r) - e_s^M + f(e_s^M)Rr - \{sf(e_s^L)R(1-r) - e_s^L + f(e_s^L)Rr\} = 0 \quad (3.16)$$

$$\begin{aligned} \therefore r^* &= \frac{e_s^{M*} - e_s^{L*} - s^* f(e_s^{M*})R + s^* f(e_s^{L*})R}{-s^* f(e_s^{M*})R + s^* f(e_s^{L*})R + f(e_s^{M*})R - f(e_s^{L*})R} \\ &= \frac{(e_s^{M*} - e_s^{L*}) - s^* [f(e_s^{M*})R - f(e_s^{L*})R]}{-s^* [f(e_s^{M*})R - f(e_s^{L*})R] + [f(e_s^{M*})R - f(e_s^{L*})R]} = \frac{(e_s^{M*} - e_s^{L*}) - s^* [f(e_s^{M*})R - f(e_s^{L*})R]}{(1-s^*) [f(e_s^{M*})R - f(e_s^{L*})R]} \\ &= \frac{(e_s^{M*} - e_s^{L*})}{[f(e_s^{M*})R - f(e_s^{L*})R](1-s^*)} + \frac{-s^*}{(1-s^*)}. \end{aligned} \quad (3.17)$$

Under the optimal contract, the return to the government is

$$\therefore V_S^* = (1-s^*) f(e_s^{M*})R(1-r^*) - d(e_s^{M*}) - h(r^*) \quad (3.18)$$

$$, \text{ where } s^* = \frac{U_0 + e_s^{M^*} - f(e_s^{M^*})Rr}{f(e_s^{M^*})R(1-r)}$$

or

$$V_S^* = \left(1 - \frac{U_0 + e_s^{M^*} - f(e_s^{M^*})Rr}{f(e_s^{M^*})R(1-r)}\right) f(e_s^{M^*})R(1-r^*) - d(e_s^{M^*}) - h(r^*) \quad (3.19)$$

$$\therefore V_S^* = f(e_s^{M^*})R(1-r^*) - [(U_0 + e_s^{M^*}) - f(e_s^{M^*})Rr^*] - d(e_s^{M^*}) - h(r^*) . \quad (3.20)$$

Under the revenue share contract, the expected cost of compensation is the tax farmer's portion of tax revenue reported, is $s^* f(e_s^{M^*})R(1 - r^*)$, where $s^* = \frac{U_0 + e_s^{M^*} - f(e_s^{M^*})Rr^*}{f(e_s^{M^*})R(1-r^*)}$, and thus,

$$\begin{aligned} & \left[\frac{U_0 + e_s^{M^*} - f(e_s^{M^*})Rr^*}{f(e_s^{M^*})R(1-r^*)} \right] f(e_s^{M^*})R(1 - r^*) \\ & = (U_0 + e_s^{M^*}) - f(e_s^{M^*})Rr^* \end{aligned} \quad (3.21)$$

3.3.5 Comparative Statics and Propositions

The following propositions show the conditions under which each tax collection contract is optimal under agency problems.

Proposition 1: The following contract is optimal for a fixed wage contract for tax collection:

$$e: e_w^{L^*}, \text{ which solves } f'(e_w^{L^*})R = 1 + m'(e_w^{L^*})$$

$$w: w^* = U_0 + e_w^{L^*}$$

$$\text{Expected cost of compensation: } U_0 + e_w^{L^*}.$$

Under the optimal fixed wage contract, the public tax collector inputs the optimal level of effort, e_w^{L*} , to realize tax receivable, R , and the effort level is determined by the level of monitoring to mitigate shirking, m . The government pays the optimal wage, w^* , which covers the public tax collector's reservation utility, U_0 , —a kind of opportunity cost—and his effort (or labor), e_w^{L*} . Therefore, the government's compensation cost is equal to w^* or $U_0 + e_w^{L*}$.

Proposition 2: The following contract is optimal for a fixed rent contract for tax collection:

$$e: e_r^{H*}, \text{ which solves } f'(e_r^{H*})R = 1 + \frac{k'(e_r^{H*})}{(1+\pi_r^*)}$$

$$F: F^* = f(e_r^{H*})R - U_0 - e_r^{H*}$$

$$\text{Expected cost of compensation: } U_0 + e_r^{H*}.$$

Under the optimal fixed rent contract, the tax farmer inputs the optimal level of effort, e_r^{H*} , to realize tax receivable, R , and the effort level is determined by the level of monitoring to mitigate overzealous collection, k , and an incentive to hard work, π_r^* , which is the lagrangia multiplier for the incentive comparability constraint. The government receives the optimal fixed rent fee from the tax farmer, F^* , which is a discounted price of the face value of tax receivables, R . It can be viewed as a type of zero coupon bonds. The government indirectly compensates the tax farmer for $U_0 + e_r^{H*}$.

Proposition 3: The following contract is optimal for a revenue share contract for tax collection:

$$e: e_s^{M*}, \text{ which solves } f'(e_s^{M*})R = \frac{d'(e_s^{M*}) + \lambda^* + \pi^*}{1 - s^* - r^* + s^*r^* + \lambda^*s^* - \lambda^*s^*r^* + \lambda^*r^* + \pi^*s^* - \pi^*s^*r^* + \pi^*r^*},$$

$$s: s^* = \frac{U_0 + e_s^{M*} - f(e_s^{M*})Rr^*}{f(e_s^{M*})R(1-r^*)}$$

$$r: r^* = \frac{(e_s^{M*} - e_s^{L*})}{[f(e_s^{M*})R - f(e_s^{L*})R](1-s^*)} + \frac{-s^*}{(1-s^*)}$$

Expected cost of compensation: $(U_0 + e_s^{M*}) - f(e_s^{M*})Rr^*$.

Under the optimal revenue share contract, the tax farmer inputs the optimal level of effort, e_s^{M*} , to realize tax receivable, R . The effort level is a function of the level of monitoring to mitigate overzealous collection, d , proportional fee rate, s^* , the degree of underreporting, r^* , the lagrangia multiplier for the participation constraint, λ_s^* , and the lagrangia multiplier for the incentive comparability constraint, π_s^* . The optimal proportional fee rate is s^* , which is the compensation, $(U_0 + e_s^{M*}) - f(e_s^{M*})Rr^*$, divided by reported tax revenue, $f(e_s^{M*})R(1 - r^*)$. Basically, the compensation cost is $U_0 + e_s^{M*}$, but it should be adjusted to r^* .

Table 1 Summary of Objective Functions, Constraints, and Optimal Conditions in Static Models

Wage Contract:

$$\text{Maximize } V_w = f(e_w^L)R - w - m(e_w^L)$$

e, w

Subject to

$$w - e_w^L \geq U_0$$

Optimal conditions:

$$e_w^{L*}, \text{ which solves } f'(e_w^{L*})R = 1 + m'(e_w^{L*})$$

$$w^* = U_0 + e_w^{L*}$$

Rent Contract:

$$\text{Maximize } V_R = F - k(e_r^H)$$

e, F

Subject to

$$f(e_r^H)R - F - e_r^H \geq U_0, \text{ and}$$

$$f(e_r^H)R - F - e_r^H \geq f(e_r^L)R - F - e_r^L$$

Optimal conditions:

$$e_r^{H*}, \text{ which solves } f'(e_r^{H*})R = 1 + \frac{k'(e_r^{H*})}{(1+\pi_r^*)}$$

$$F^* = f(e_r^{H*})R - U_0 - e_r^{H*}$$

Table 1-Continued

Share Contract:

$$\text{Maximize } V_S = (1-s) f(e_s^M)R(1-r) - g(e_s^M) - h(r)$$

e, s, r

Subject to

$$\begin{aligned} sf(e_s^M)R(1-r) - e_s^M + f(e_s^M)Rr &\geq U_0 \\ f(e_s^M)R(1-r) - e_s^M + f(e_s^M)Rr &\geq sf(e_s^L)R(1-r) - e_s^L + f(e_s^M)Rr \end{aligned}$$

Optimal conditions:

$$e_s^{M*}, \text{ which solves } f'(e_s^{M*})R = \frac{d'(e_s^{M*}) + \lambda^* + \pi^*}{1 - s^* - r^* + s^*r^* + \lambda^*s^* - \lambda^*s^*r^* + \lambda^*r^* + \pi^*s^* - \pi^*s^*r^* + \pi^*s^* + \pi^*r^*}$$

$$s^* = \frac{U_0 + e_s^{M*} - f(e_s^{M*})Rr^*}{f(e_s^{M*})R(1-r^*)}$$

$$r^* = \frac{(e_s^{M*} - e_s^{L*})}{[f(e_s^{M*})R - f(e_s^{L*})R](1-s^*)} + \frac{-s^*}{(1-s^*)}$$

Even though optimal conditions of contracts are derived by the optimization process, it is still difficult to compare relative values of contracts. However, we can get intuitions about the relative value of contracts from the results above. To compare each return to the government, I initially wrote each value function of the contracts as follows:

$$\text{wage contract: } V_w^* = f(e_w^{L*})R - w^* - m(e_w^{L*})$$

$$\text{share contract: } V_s^* = (1-s^*)f(e_s^{M*})R(1-r^*) - d(e_s^{M*}) - h(r^*)$$

$$\text{rent contract: } V_r^* = F^* - k(e_r^{H*}).$$

We can easily identify each component of agency cost in each value function. However, except for the value function of the wage contract, it is hard to identify gross tax revenue and compensation cost components in value functions of share and rent contracts. For share and rent contracts, we can divide net tax revenue into components of gross tax revenue and compensation cost. Therefore, alternatively, based on (1.13), (2.19), and (3.20), I can rewrite each value function of the contracts comparable formats more easily as follow:

$$\text{wage contract: } V_w^* = f(e_w^{L*})R - (U_0 + e_w^{L*}) - m(e_w^{L*})$$

$$\text{share contract: } V_s^* = f(e_s^{M*})R(1-r^*) - [(U_0 + e_s^{M*}) - f(e_s^M)Rr] - d(e_s^{M*}) - h(r^*)$$

$$\text{rent contract: } V_r^* = f(e_r^{H*})R - (U_0 + e_r^{H*}) - k(e_r^{H*}).$$

Based on these rewritten value functions, Table 2 shows the components of each optimal contract value function: gross tax revenue, compensation cost, net tax revenue, agency costs, and agency-cost adjusted net tax revenue.

Table 2 Components of Optimal Contract Value Function in Static Models: Costs and Benefits

Contract	[(Net Tax revenue	= Gross tax revenue	- Compensation Cost)	- Agency cost]	= Agency-cost Adjusted Net Tax Revenue
Wage	$f(e_w^{L*})R - w^*$	$= f(e_w^{L*})R$	$- (U_0 + e_w^{L*})$	$- m(e_w^{L*})$	$= V_w^*$
Share	$(1-s^*)f(e_s^{M*})R(1-r^*)$	$= f(e_s^{M*})R(1-r^*)$	$- [(U_0 + e_s^{M*}) - f(e_s^M)Rr]$	$- [d(e_s^{M*}) + h(r^*)]$	$= V_s^*$
Rent	F^*	$= f(e_r^{H*})R$	$- (U_0 + e_r^{H*})$	$- k(e_r^{H*})$	$= V_r^*$
Contract	[(Net Tax revenue	= Gross tax revenue	- Compensation Cost)	- Agency cost]	= Agency-costs Adjusted Net Tax Revenue
Wage	N_w	G_w	C_w	A_w	Adj. N_w
Share	N_s	G_s	C_s	A_s	Adj. N_s
Rent	N_r	G_r	C_r	A_r	Adj. N_r

Note: (1) N: net tax revenue, G: gross tax revenue, C: compensation cost, A: agency cost, and Adj. N: agency-cost adjusted net tax revenue. (2) $N = G - C$. (3) Adj. N is the government's ultimate return.

Optimal conditions consist of two fundamental elements in the contract: the level of efforts and the corresponding compensations. First, Table 2 shows that the three levels of efforts can be ordered, $e_w^{L*} < e_s^{M*} < e_r^{H*}$. The corresponding compensations can be ordered as three ways. If the tax farmer reports the true amount of revenue, $r^* = 0$, the compensations can be ordered, $C_w < C_s < C_r$. If the tax farmer does not report any revenue, $r^* = 1$, the compensations can be ordered, $C_s < C_w < C_r$. If the tax farmer underreports the true amount of revenue, $0 < r^* < 1$, the compensations can be ordered as follows. The order between C_w and C_s is not obvious. However, r^* increases, C_s gets lower than C_w . In every situation, C_r is always higher than the others. The government chooses the level of effort of the tax collector by choosing the compensation scheme.

In the government's contract value function, the effort level of the agent is involved in the gross tax revenue, G , and the compensation to the agent means the official cost for the contract: *compensation costs*. Furthermore, the government considers the unofficial costs of the contract: *agency costs*.

Second, the gross tax revenues can be ordered as follows. If the tax farmer report true amount of revenue, $r^* = 0$, the government's revenues can be ordered, $G_w < G_s < G_r$. If the tax farmer does not report any revenue, $r^* = 1$, the revenues can be ordered, $G_s < G_w < G_r$. If the tax farmer underreport the true amount of revenue, $0 < r^* < 1$, the revenues can be ordered as follows. The order between G_w and G_s is not obvious. However, r^* increases, G_s gets lower than G_w . In every situation, G_r is always higher than the others.

Third, the order of net tax revenues is not obvious. In spite of uncertain orders in revenues and compensation costs, the basic implication is that the order among compensation costs is the same to the order among the government's revenues. In other words, as the compensation cost increase, the gross tax revenue increases. However, it is not easy to order the net effects of gross tax revenues and compensation costs on tax revenue among contracts although we can know the order of gross tax revenue and order of compensation costs.

Fourth, it is harder to compare agency costs among contracts. It is straightforward to compare over-enforcements between rent and share contract. The over-enforcement under the rent contract, $k(e_r^{H*})$, is more serious than under the share contract, $d(e_s^{M*})$. However, it is not obvious to compare shirking, $m(e_w^*)$, underreporting, $h(r^*)$, and over-enforcements, such as $d(e_s^{M*})$ and $k(e_r^{H*})$. Therefore, the results of comparison of relative values of each contract based on comparative statics without numeric values are not straightforward.

3.4 A Dynamic Model of Tax Collection: An Extended Model

3.4.1 Tax Revenue Production Function: Variable Tax Bases

Suppose the amount of gross tax revenue, G , is the function of tax base, B , tax rate, σ , and the collection agent's level of collection effort, e . The tax receivable is calculated as multiplying tax rate by tax base, σB . The government has to input the tax collection effort to realize tax receivable, an asset on books, as tax revenue, cash. Given tax rates and tax bases, the government controls tax revenue by choosing the level of collection effort. Therefore, the production function of tax revenue can be expressed as follows:

$$G = f(e)\sigma B, \quad (1)$$

where $f(e)$ is the effort function. In previous section of static model, the production of tax revenue was as follows:

$$G = f(e)R, \quad (2)$$

where e is the level of effort of the agent to collect taxes levied, $f(e)$ is the effort function, and R is the fixed amount of tax levied, tax receivables. The tax receivable, R , is calculated as multiplying tax base by tax rate, $B\sigma$ or σB . In this section, I use revenue production function with variable tax base, (1).

In reality, tax base and tax rate change over time. The dynamic model captures intertemporal changes in the tax base. However, to concentrate impacts of different tax collections contract on tax base, I assume that tax rate is fixed over time. In this dynamic model, the government has to consider agent's participation, incentive comparability constraints, and the stock variable constraint. I specify the differential equation of change of tax base over time as follows:

$$\dot{B}(t) = gB(t) - f(e)\sigma B(t) - A(t), \quad (3)$$

$$\text{where } \dot{B}(t) = \frac{dB}{dt}. \quad (4)$$

In this formal dynamic model all variables are functions of time (e.g. $B = B(t)$) but I omit this convention to make the notion clearer. Thus, (3) can be rewritten as follows:

$$\dot{B} = gB - f(e)\sigma B - A. \quad (5)$$

The change of tax base, \dot{B} , at a time point, t , is the growth of tax base, gB , where g is the growth rate of tax base, minus the extraction of tax revenue, $f(e)\sigma B$, and minus a deadweight loss of taxation, which is agency costs, A .

The government's spending of tax revenue has the impact on the growth of tax base, for example, economic stimulation effect. However, in this differential equation of the motion of tax base, I do not explicitly specify the effect of the spending of tax revenue on the growth of tax base. Instead, the growth rate of tax base, g , implicitly captures the tax base growth resulting from all tax base growth factors. In addition, to concentrate agency costs according to contractual forms of tax collection, I do not consider the deadweight loss due to the distorted economic behavior of taxpayers resulting from taxation. In this dynamic model, I consider the dynamic optimization problem under continuous time in a finite time horizon with a given initial state and a free endpoint as follows:

$$B(0) = B_0 \text{ and } B(T) \text{ Free}, \quad (6)$$

where B_0 is the given initial tax base and $B(T)$ is the freely chosen terminal tax base, T is the length of the contract period.

3.4.2 Wage Contract: Shirking

During the fixed wage contract, the government's problem is to choose the level of effort of agent, e , and a fixed wage payment, w , to maximize its discounted return, where the market discount rate is ρ over the contract period, subject to the agent's participation constraint, (1.2), and stock variable constraint, (1.3), as follows:

$$V_w \equiv \underset{e, w}{\text{maximize}} \int_0^T [f(e_w^L)\sigma B_w - w - m(e_w^L)] e^{-\rho t} dt \quad (1.1)$$

subject to

$$w - e_w^L \geq U_0 \quad (1.2)$$

$$\dot{B}_w = g_w B_w - f(e_w^L)\sigma B_w - m(e_w^L), \quad (1.3)$$

$$\text{where } B(0) = B_0 \text{ and } B(T) \text{ Free.} \quad (1.4)$$

During the wage contract period, from $t = 0$ to $t = T$, the government collects the discounted gross revenue stream, $\int_0^T f(e_w^L)\sigma B_w e^{-\rho t} dt$. However, to calculate net tax revenue, the government has to consider the following two costs: compensation cost and agency cost. The government pays a discounted fixed wage stream, $\int_0^T w e^{-\rho t} dt$, to their own public employees and confronts the bureaucrat shirking as a discounted agency cost stream, $\int_0^T m(e_w^L) e^{-\rho t} dt$. For simplicity, I omit the term “discounted” from the following paragraph.

Meanwhile, the public employee’s return is a fixed wage, w , minus his costs of labor, e_w^L , to input for tax collection as follows:

$$U_w = w - e_w^L. \quad (1.5)$$

In dynamic model of the wage contract, the government’s problem is subject to participation constraint and stock variable constraint. For the dynamic optimization, I incorporate the Hamiltonian into the Lagrangian. The current value Hamiltonian, taking into account the dynamic of stock variable, (1.3), is as follows:

$$H = f(e_w^L)\sigma B_w - w - m(e_w^L) + \varphi_w [g_w B_w - f(e_w^L)\sigma B_w - m(e_w^L)], \quad (1.6)$$

where φ_w is current value Hamiltonian multiplier, so called co-state variable, for stock variable constraint. φ_w represents the change in the maximum value of objective function resulting from

the availability of one more unit of tax base. φ_w is always positive because tax base is a good to the government. Thus, φ_w is the shadow price of tax base, B , evaluated at time t . In other words, φ_w is the marginal user cost of decreasing the tax base or a marginal value of tax base. In short, φ_w is a social costs.

Finally, the Lagrangian, taking into account the agent's participation constraint, (1.2), is as follows:

$$L = f(e_w^L)\sigma B_w - w - m(e_w^L) + \varphi_w[g_w B_w - f(e_w^L)\sigma B_w - m(e_w^L)] + \lambda_w[w - e_w^L - U_0], \quad (1.7)$$

where λ_w is a Lagrangia multiplier for the agent's participation constraint.

Therefore, the optimal dynamic solution must satisfy the following first order conditions:

$$\frac{\partial L}{\partial e_w^L} = 0 \quad (1.8)$$

$$\frac{\partial L}{\partial w} = 0 \quad (1.9)$$

$$\frac{\partial L}{\partial \lambda_w} = 0 \quad (1.10)$$

$$\frac{\partial L}{\partial B_w} = -\dot{\varphi}_w + \rho\varphi_w \quad (1.11)$$

$$\frac{\partial L}{\partial \varphi_w} = \dot{B}_w. \quad (1.12)$$

(1.8) through (1.10) are optimal conditions for reaching a contract, and (1.11) and (1.12) are optimal conditions for considering the change of tax base over time.

First, differentiate the Lagrangian with respect to e_w^L , (1.8), then

$$f'(e_w^{L*})\sigma B_w^* = \frac{\lambda_w^* + (1+\varphi_w^*) m'(e_w^{L*})}{(1-\varphi_w^*)}. \quad (1.13)$$

Thus, optimal effort level of agent, e_w^{L*} , solves (1.13).

Second, differentiate the Lagrangian with respect to w , (1.9), then

$$\lambda_w^* = 1. \quad (1.14)$$

Thus, (1.13) and (1.14) imply optimal effort level of agent, e_w^{L*} , solves

$$f'(e_w^{L*})\sigma B_w^* = \frac{1 + (1+\varphi_w^*) m'(e_w^{L*})}{(1-\varphi_w^*)}. \quad (1.15)$$

Third, differentiate the Lagrangian with respect to λ_w , (1.10), then

$$w^* = U_0 + e_w^{L*}. \quad (1.16)$$

Given the optimal level of effort of agent, e_w^{L*} , the government offers the agent $U_0 + e_w^{L*}$ as the optimal wage, (1.16).

Fourth, differentiate the Lagrangian with respect to B_w , (1.11), then

$$\dot{\varphi}_w = [\rho - g_w + f(e_w^{L*})\sigma]\varphi_w - f(e_w^{L*})\sigma. \quad (1.17)$$

According as the solution for $\dot{x}(t) = ax(t) + b$ is $x(t) = x(0)e^{at} + \int_0^t b e^{a(t-s)} ds$, the solution for (1.17) is as follows:

$$\varphi_w^* = \varphi_w(0) e^{[\rho - g_w + f(e_w^{L*})\sigma]t} - \int_0^t f(e_w^{L*})\sigma e^{[\rho - g_w + f(e_w^{L*})\sigma](t-s)} ds. \quad (1.18)$$

Fifth, differentiate the Lagrangian with respect to φ_w , (1.12), then

$$\dot{B}_w = [g_w - f(e_w^L)\sigma] B_w - m(e_w^L). \quad (1.19)$$

The solution for (1.19) is as follows:

$$B_w^* = B_w(0) e^{[g_w - f(e_w^{L*})\sigma]t} - \int_0^t m(e_w^{L*}) e^{[g_w - f(e_w^{L*})\sigma](t-s)} ds. \quad (1.20)$$

We also rewrite (1.21) as follows:

$$B_w^* = B_w(0) e^{[g_w - f(e_w^{L*})\sigma]t} + \frac{m(e_w^{L*})}{g_w - f(e_w^{L*})\sigma} \left[1 - e^{[g_w - f(e_w^{L*})\sigma]t} \right]. \quad (1.21)$$

(1.20) states that the current tax base, B_w , equal the initial tax base, $B_w(0)$, minus the entire time path of the agency cost, $m(e_w^{L*})$, both compounded at the rate of $[g_w - f(e_w^{L*})\sigma]$. During the wage contract period, both components exponentially grow if $[g_w - f(e_w^{L*})\sigma] > 0$, which means $g_w > f(e_w^{L*})\sigma$. Meanwhile, both components exponentially decrease if $[g_w - f(e_w^{L*})\sigma] < 0$, which means $g_w < f(e_w^{L*})\sigma$. φ_w^* , (1.18), captures marginal benefit of increase in tax base or marginal cost of decrease in tax base. In short, given natural growth rate of tax base, g , and given tax rate, σ , the increases in agency cost and the level of collection effort have negative impact on tax base.

Under the optimal wage contract, the return to the government is as follows:

$$V_w^* = \int_0^T [f(e_w^{L*})\sigma B_w^* - w^* - m(e_w^{L*})] e^{-\rho t} dt, \quad (1.22)$$

$$\text{where } w^* = U_0 + e_w^{L*}.$$

Thus, the value function, (1.22), can be rewritten to compare to other contract value functions as follows:

$$V_w^* = \int_0^T [f(e_w^{L*})\sigma B_w^* - (U_0 + e_w^{L*}) - m(e_w^{L*})] e^{-\rho t} dt. \quad (1.23)$$

During the optimal fixed wage contract, the government collects the gross tax revenue, $\int_0^T f(e_w^{L*})\sigma B_w^* e^{-\rho t} dt$. However, the net tax revenue is calculated by subtracting the expected cost of compensation, which is the optimal fixed wage, $\int_0^T w^* e^{-\rho t} dt$ or $\int_0^T [U_0 + e_w^{L*}] e^{-\rho t} dt$, and the agency cost resulting from shirking, $\int_0^T m(e_w^{L*}) e^{-\rho t}$, from the gross tax revenue.

3.4.3 Rent Contract: Strong Over-enforcement

During the rent contract period, the government's problem is to choose the level of effort of agent, e , and a fixed fee, F , to maximize its discounted return subject to participation constraint, (2.2.), incentive comparability constraint, (2.3), and stock variable constraint, (2.4),

$$V_R \equiv \text{maximize } \int_0^T [F - k(e_r^H)] e^{-\rho t} dt \quad (2.1)$$

e, F

subject to

$$f(e_r^H)\sigma B_r - F - e_r^H \geq U_0 \quad (2.2)$$

$$f(e_r^H)\sigma B_r - F - e_r^H \geq (e_r^L)\sigma B_r - F - e_r^L \quad (2.3)$$

$$\dot{B}_r = g_r B_r - f(e_r^H)\sigma B_r - k(e_r^H), \quad (2.4)$$

$$\text{where } B_r(0) = B_0 \text{ and } B_r(T) \text{ Free.} \quad (2.5)$$

During the rent contract period, from $t = 0$ to $t = T$, the government sells off tax receivables to tax farmers for a fixed rent fee, $\int_0^T F e^{-\rho t} dt$. During the rent contract, the government confronts an agency cost of the strong over-enforcement of the tax farmer, $\int_0^T k(e_r^H) e^{-\rho t} dt$.

The fixed rent fee, F , is a discounted price of the face value of tax receivables, σB_r , because the government transfers all risks to the tax farmer under the fixed rent contract. Thus, the selling price of tax receivable, F , is lower than face value of tax receivable, σB_r , as follows:

$$F < \sigma B_r. \quad (2.6)$$

The fixed rent contract is an investment contract from the tax farmer's standpoint. The tax farmer's return is as follows:

$$U_R = f(e_r^H)\sigma B_r - F - e_r^H, \quad (2.7)$$

where the return is tax revenue by subtracting both purchase price of tax receivable, F , and his labor costs, e_r^H , from the gross tax revenue, $f(e_r^H)\sigma B_r$.

In the dynamic model of the fixed rent contract, the government's problem is subject the participation constraint, incentive comparability constraint, and the stock variable constraint. The current value Hamiltonian, taking into account the dynamic of stock variable, (2.4), is as follows:

$$H = F - k(e_r^H) + \varphi_r[g_r B_r - f(e_r^H)\sigma B_r - k(e_r^H)]. \quad (2.8)$$

Finally, the Lagrangian, taking into account the agent's participation constraint, (2.2), and incentive comparability constraint, (2.3), is as follows:

$$\begin{aligned} L = & F - k(e_r^H) + \varphi_r[g_r B_r - f(e_r^H)\sigma B_r - k(e_r^H)] + \lambda_r[f(e_r^H)\sigma B_r - F - e_r^H - U_0] \\ & + \pi_r\{f(e_r^H)\sigma B_r - F - e_r^H - [f(e_r^L)\sigma B_r - F - e_r^L]\}, \end{aligned} \quad (2.9)$$

, where λ_r is the Lagrangia multiplier for the agent's participation constraint and π_r is the Lagrangia multiplier for the agent's incentive comparability constraint.

Therefore, the optimal dynamic solution must satisfy the following first order conditions:

$$\frac{\partial L}{\partial e_r^H} = 0 \quad (2.10)$$

$$\frac{\partial L}{\partial e_r^L} = 0 \quad (2.11)$$

$$\frac{\partial L}{\partial F} = 0 \quad (2.12)$$

$$\frac{\partial L}{\partial \lambda_r} = 0 \quad (2.13)$$

$$\frac{\partial L}{\partial \pi_r} = 0 \quad (2.14)$$

$$\frac{\partial L}{\partial B_r} = -\dot{\varphi}_r + \rho\varphi_r \quad (2.15)$$

$$\frac{\partial L}{\partial \varphi_r} = \dot{B}_r \quad (2.16)$$

First, differentiate the Lagrangian with respect to e_r^H , (2.10), then

$$\begin{aligned} f'(e_r^{H*})\sigma B_r^* &= \frac{k'(e_r^{H*}) + \lambda_r^* + \pi_r^* + \varphi_r^* k'(e_r^{H*})}{(\lambda_r^* + \pi_r^* - \varphi_r^*)} \\ &= \frac{(\lambda_r^* + \pi_r^*) + (1 + \varphi_r^*)k'(e_r^{H*})}{(\lambda_r^* + \pi_r^* - \varphi_r^*)}. \end{aligned} \quad (2.17)$$

The first order conditions imply that optimal effort level of agent, e_r^{H*} , solve (2.17).

Second, differentiate the Lagrangian with respect to e_r^L , (2.11), then

$$f'(e_r^{L*})\sigma B_r^* = 1. \quad (2.18)$$

The first order conditions imply that optimal effort level of agent, e_r^{L*} , solve (2.18).

Third, differentiate the Lagrangian with respect to F , (2.12), then

$$\lambda_r^* = 1. \quad (2.19)$$

Thus, we can rewrite (2.17) as follows:

$$f'(e_r^{H*}) \sigma B_r^* = \frac{(1 + \pi_r^*) + (1 + \varphi_r^*) k'(e_r^{H*})}{(1 + \pi_r^* - \varphi_r^*)}. \quad (2.20)$$

Hence, (2.17) and (2.19) imply optimal effort level of agent, e_r^{H*} , solve (2.20).

Fourth, differentiate the Lagrangian with respect to λ_r , (2.13), then

$$F^* = f(e_r^{H*}) \sigma B_r^* - U_0 - e_r^{H*}. \quad (2.21)$$

Given optimal level of the effort of the agent, the government received optimal fixed rent, F^* , from the tax farmer.

Fifth, differentiate the Lagrangian with respect to π_r , (2.14), then

$$f(e_r^{H*}) \sigma B_r^* - (e_r^{L*}) \sigma B_r^* = e_r^{H*} - e_r^{L*}. \quad (2.22)$$

Sixth, differentiate the Lagrangian with respect to B_r , (2.15), then

$$\dot{\varphi}_r = [\rho - g_r + f(e_r^H) \sigma] \varphi_r - [\lambda_r f(e_r^H) \sigma + \pi_r f(e_r^H) \sigma - \pi_r f(e_r^L) \sigma]. \quad (2.23)$$

The solution for (2.23) is as follows:

$$\varphi_r^* = \varphi_r(0) e^{[\rho - g_r + f(e_r^{H*}) \sigma] t} \quad (2.24)$$

$$- \int_0^t [\lambda_r^* f(e_r^{H*}) \sigma + \pi_r^* f(e_r^{H*}) \sigma - \pi_r^* f(e_r^{L*}) \sigma] e^{[\rho - g_r + f(e_r^{H*}) \sigma] (t-s)} ds.$$

Seventh, differentiate the Lagrangian with respect to φ_r , (2.16), then

$$\dot{B}_r = [g_r - f(e_r^H) \sigma] B_r - k(e_r^H). \quad (2.25)$$

The solution for (2.25) is as follows:

$$B_r^* = B_r(0) e^{[g_r - f(e_r^{H^*})\sigma]t} - \int_0^t k(e_r^{H^*}) e^{[g_r - f(e_r^{H^*})\sigma](t-s)} ds. \quad (2.26)$$

We also rewrite (2.26) as follows:

$$B_r^* = B_r(0) e^{[g_r - f(e_r^{H^*})\sigma]t} + \frac{K(e_r^{H^*})}{g_r - f(e_r^{H^*})\sigma} \left[1 - e^{[g_r - f(e_r^{H^*})\sigma]t} \right]. \quad (2.27)$$

(2.26) states that the current tax base, B_r , equal the initial tax base, $B_r(0)$, minus the entire time path of the agency cost, $K(e_r^{H^*})$, both compounded at the rate of $[g_r - f(e_r^{H^*})\sigma]$. During the rent contract period, both components exponentially grow if $[g_r - f(e_r^{H^*})\sigma] > 0$, which means $g_r > f(e_r^{H^*})\sigma$. Meanwhile, both components exponentially decrease if $[g_r - f(e_r^{H^*})\sigma] < 0$, which means $g_r < f(e_r^{H^*})\sigma$. φ_r^* , (2.24), captures marginal benefit of increase in tax base or marginal cost of decrease in tax base.

Under this optimal contract the return to the government is as follows:

$$V_R^* = \int_0^T [F^* - k(e_r^{H^*})] e^{-\rho t} dt, \quad (2.28)$$

$$\text{where } F^* = f(e_r^{H^*})\sigma B_r^* - U_0 - e_r^{H^*}.$$

Thus, the value function, (2.28), can be rewritten to compare to other contract value functions as follows:

$$V_R^* = \int_0^T [f(e_r^{H^*})\sigma B_r^* - (U_0 + e_r^{H^*}) - k(e_r^{H^*})] e^{-\rho t} dt. \quad (2.29)$$

During the optimal rent contract, the government collects tax revenue, $\int_0^T F^* e^{-\rho t} dt$. However, according to (2.29), we know that the tax revenue collected is equal to the gross tax revenue, $\int_0^T f(e_r^{H^*})\sigma B_r^* e^{-\rho t} dt$ minus the expected cost of compensation, which $\int_0^T [U_0 + e_r^{H^*}] e^{-\rho t} dt$.

Under the fixed rent contract, the government does not compensate the tax farmer directly. Instead, the government indirectly compensates the agent by selling tax receivables to him at the discounted price. Thus, the expected cost of compensation would be $\sigma B_r^* - F^*$ or $\sigma B_r^* - [f(e_r^{H^*}) \sigma B_r^* - (U_0 + e_r^{H^*})]$, which is difference between the face value of tax receivables, σB_r^* , and discounted value of tax receivables, $F^* = f(e_r^{H^*}) \sigma B_r^* - (U_0 + e_r^{H^*})$. As the tax farmer increase his level of effort, $f(e_r^{H^*}) \sigma B_r^*$ is close to σB_r^* . Thus, under the rent contract, at the highest level of effort of tax farmer, the expected cost of compensation is $U_0 + e_r^{H^*}$. Finally, the government's return is equal to the tax revenue minus the agency cost resulting from strong over-enforcement, $\int_0^T k(e_r^{H^*}) e^{-\rho t}$.

3.4.4 Share Contract: Modest Over-enforcement and Underreporting

During the revenue share contract, the government's problem is to choose the level of effort of the agent, e , proportional fee rate, s , and the degree of underreporting, r , to maximize its discounted return subject to participation constraint, (3.2), incentive comparability constraint, (3.3.), and stock variable constraint, (3.4),

$$V_S \equiv \text{maximize } \int_0^T [(1-s) f(e_s^M) \sigma B_s (1-r) - d(e_s^M) - h(r)] e^{-\rho t} dt \quad (3.1)$$

e, s, r

subject to

$$s f(e_s^M) \sigma B_s (1-r) - e_s^M + f(e_s^M) \sigma B_s r \geq U_0 \quad (3.2)$$

$$s f(e_s^M) \sigma B_s (1-r) - e_s^M + f(e_s^M) \sigma B_s r \geq s f(e_s^L) \sigma B_s (1-r) - e_s^L + f(e_s^L) \sigma B_s r \quad (3.3)$$

$$\dot{B}_s = g_s B_s - f(e_s^M) \sigma B_s - d(e_s^M) - h(r), \quad (3.4)$$

$$\text{where } B_s(0) = B_0 \text{ and } B_s(T) \text{ Free.} \quad (3.5)$$

Over the share contract period, from $t = 0$ to $t = T$, the government receives $\int_0^T (1-s)f(e_s^M)\sigma B_s(1-r)e^{-\rho t} dt$ while the tax farmer retains $\int_0^T sf(e_s^M)\sigma B_s(1-r)e^{-\rho t} dt$. During the share contract, the government confronts the agency cost of the modest over-enforcement, $\int_0^T d(e_s^M)e^{-\rho t} dt$, and the agency cost of underreporting, $\int_0^T h(r)e^{-\rho t} dt$.

Suppose a sharing rule is $f(e_s^M)\sigma B_s = sf(e_s^M)\sigma B_s + (1-s)f(e_s^M)\sigma B_s$, where $0 \leq s \leq 1$. Under this sharing rule, the tax farmer retains $sf(e_s^M)\sigma B_s$, which is a percentage, s , of total tax revenue, $f(e_s^M)\sigma B_s$, collected by him. The tax farmer's return function is as follows:

$$U_s = sf(e_s^M)\sigma B_s(1-r) - e_s^M + f(e_s^M)\sigma B_s r. \quad (3.6)$$

Meanwhile, the government receives $(1-s)f(e_s^M)\sigma B_s$, which is other portion, $(1-s)$, of total tax revenue, $f(e_s^M)\sigma B_s$. The share contract leads to modest level of over-enforcement. Furthermore, under the share contract, the tax farmer has the incentive to report a lower amount of tax revenue than true amount collected by him to the government, an *underreporting issue*. This is because in the tax farmer's final share, $sf(e_s^M)\sigma B_s$, a percentage, s , is determined by sharing rule before collecting tax but the total tax revenue, $f(e_s^M)\sigma B_s$, collected by him is determined by his reporting after collecting tax. Thus, the tax farmer has an incentive to manipulate the true amount of tax revenue collected to maximize his return. The tax farmer reports $f(e_s^M)\sigma B_s(1-r)$, where $0 \leq r \leq 1$, rather than the true tax revenue collected, $f(e_s^M)\sigma B_s$. The r is the degree of underreporting. If r is equal to zero, then the tax farmer reports the true amount of revenue and follows sharing rule. If r is equal to one, then the tax farmer does not report any amount of tax revenue and keep whole amount of tax revenue. By underreporting, the tax farmer obtains an additional return, $f(e_s^M)\sigma B_s r$, which is $f(e_s^M)\sigma B_s$ times r . Meanwhile his portion based on sharing rule decrease by replacing $sf(e_s^M)\sigma B_s$ with $s(e_s^M)\sigma B_s(1-r)$.

Under the share contract with underreporting issue, the government obtains tax revenue, $(1-s)f(e_s^M)\sigma B_s(1-r)$, which is lower amount than the government's share based on true reporting, $(1-s)f(e_s^M)\sigma B_s$. Thus, the government needs to monitor and mitigate this underreporting issue at

cost, $h(r)$. The cost associated with underreporting is not a fixed cost but a variable cost because such a monitoring cost depends on the degree of underreporting.

The current value Hamiltonian, taking into account the dynamic of state variable, (3.4), is as follows:

$$H = (1-s) f(e_s^M) \sigma B_s (1-r) - d(e_s^M) - h(r) + \varphi_s [g_s B_s - f(e_s^M) \sigma B_s - d(e_s^M) - h(r)] \quad (3.7)$$

Finally, the Lagrangian, taking into account the agent's participation constraint, (3.2), and the agent's incentive comparability constraint, (3.3), as follows:

$$\begin{aligned} L = & (1-s) f(e_s^M) \sigma B_s (1-r) - d(e_s^M) - h(r) + \varphi_s [g_s B_s - f(e_s^M) \sigma B_s - d(e_s^M) - h(r)] \\ & + \lambda_s [s f(e_s^M) \sigma B_s (1-r) - e_s^M + f(e_s^M) \sigma B_s r - U_0] \\ & + \pi_s [s f(e_s^M) \sigma B_s (1-r) - e_s^M + f(e_s^M) \sigma B_s r - \{s f(e_s^L) \sigma B_s (1-r) - e_s^L \\ & + f(e_s^L) \sigma B_s r\}] \end{aligned} \quad (3.8)$$

Therefore, the optimal dynamic solution must satisfy the following first order conditions:

$$\frac{\partial L}{\partial e_s^M} = 0 \quad (3.9)$$

$$\frac{\partial L}{\partial e_s^L} = 0 \quad (3.10)$$

$$\frac{\partial L}{\partial s} = 0 \quad (3.11)$$

$$\frac{\partial L}{\partial r} = 0 \quad (3.12)$$

$$\frac{\partial L}{\partial \lambda_s} = 0 \quad (3.13)$$

$$\frac{\partial L}{\partial \pi_s} = 0 \quad (3.14)$$

$$\frac{\partial L}{\partial B_s} = -\dot{\varphi}_s + \rho \varphi_s \quad (3.15)$$

$$\frac{\partial L}{\partial \varphi_s} = \dot{B}_s \quad (3.16)$$

First, differentiate the Lagrangian with respect to e_s^M , (3.9), then

$$\begin{aligned} f'(e_s^{M*})\sigma B_s^* &= \frac{d'(e_s^{M*}) + \lambda_s^* + \pi_s^* + \varphi_s^* d'(e_s^{M*})}{1 - s^* - r^* + s^* r^* + \lambda_s^* s^* - \lambda_s^* s^* r^* + \lambda_s^* r^* + \pi_s^* s^* - \pi_s^* s^* r^* + \pi_s^* r^* - \varphi_s^*} \\ &= \frac{\lambda_s^* + \pi_s^* + (1 + \varphi_s^*) d'(e_s^{M*})}{1 - s^* - r^* + s^* r^* + \lambda_s^* s^* - \lambda_s^* s^* r^* + \lambda_s^* r^* + \pi_s^* s^* - \pi_s^* s^* r^* + \pi_s^* r^* - \varphi_s^*}. \end{aligned} \quad (3.17)$$

The first order conditions imply that optimal effort level of agent, e_s^{M*} , solves (3.17).

Second, differentiate the Lagrangian with respect to e_s^L , (3.10), then

$$f'(e_s^{L*})\sigma B_s^* = \frac{1}{s^*(1-r^*) + r^*}. \quad (3.18)$$

The first order conditions imply that optimal effort level of agent, e_r^{L*} , solves (3.18).

Third, differentiate the Lagrangian with respect to s , (3.11), then

$$\lambda_s^* = 1 - \pi_s^* + \frac{\pi_s^* f(e_s^{L*})}{f(e_s^{M*})}. \quad (3.19)$$

Fourth, differentiate the Lagrangian with respect to r , (3.12), then

$$h'(r^*) = \frac{f(e_s^{M*})\sigma B_s^* [-1 + s^* - \lambda_s^* s^* + \lambda_s^* - \pi_s^* s^* + \pi_s^*] + f(e_s^{L*})\sigma B_s^* [\pi_s^* s^* - \pi_s^*]}{(1 + \varphi_s^*)}. \quad (3.20)$$

Fifth, differentiate the Lagrangian with respect to λ_s , (3.13), then

$$s^* = \frac{U_0 + e_s^{M^*} - f(e_s^{M^*})\sigma B_s^* r^*}{f(e_s^{M^*})\sigma B_s^* (1-r^*)}. \quad (3.21)$$

Given optimal level of effort of the agent, the government allows the tax farmer to retain s^* percentage of tax revenue collected by him.

Sixth, differentiate the Lagrangian with respect to π_s , (3.14), then

$$\begin{aligned} r^* &= \frac{e_s^{M^*} - e_s^{L^*} - s^* f(e_s^{M^*})\sigma B_s^* + s^* f(e_s^{L^*})\sigma B_s^*}{-s^* f(e_s^{M^*})\sigma B_s^* + s^* f(e_s^{L^*})\sigma B_s^* + f(e_s^{M^*})\sigma B_s^* - f(e_s^{L^*})\sigma B_s^*} \\ &= \frac{(e_s^{M^*} - e_s^{L^*}) - s^* [f(e_s^{M^*})\sigma B_s^* - f(e_s^{L^*})\sigma B_s^*]}{-s^* [f(e_s^{M^*})\sigma B_s^* - f(e_s^{L^*})\sigma B_s^*] + [f(e_s^{M^*})\sigma B_s^* - f(e_s^{L^*})\sigma B_s^*]} \\ &= \frac{(e_s^{M^*} - e_s^{L^*}) - s^* [f(e_s^{M^*})\sigma B_s^* - f(e_s^{L^*})\sigma B_s^*]}{(1-s^*) [f(e_s^{M^*})\sigma B_s^* - f(e_s^{L^*})\sigma B_s^*]} \\ &= \frac{(e_s^{M^*} - e_s^{L^*})}{[f(e_s^{M^*})\sigma B_s^* - f(e_s^{L^*})\sigma B_s^*](1-s^*)} + \frac{-s^*}{(1-s^*)}. \end{aligned} \quad (3.22)$$

Seventh, differentiate the Lagrangian with respect to B_s , (3.15), then

$$\begin{aligned} \dot{\varphi}_s &= [\rho - g_s + f(e_s^M)\sigma] \varphi_s - [(1-s)f(e_s^M)\sigma(1-r) + \lambda_s s f(e_s^M)\sigma(1-r) + \lambda_s f(e_s^M)\sigma r \\ &\quad + \pi_s s f(e_s^M)\sigma B_s(1-r) + \pi_s f(e_s^M)\sigma r - \pi_s s f(e_s^L)\sigma(1-r) - \pi_s f(e_s^L)\sigma r]. \end{aligned} \quad (3.23)$$

The solution for (3.23) is as follows:

$$\begin{aligned} \varphi_s^* &= \varphi_s(0) e^{[\rho - g_s + f(e_s^{M^*})\sigma]t} \\ &\quad + \int_0^t [(1-s^*)f(e_s^{M^*})\sigma(1-r^*) + \lambda_s^* s^* f(e_s^{M^*})\sigma(1-r^*) + \lambda_s^* f(e_s^{M^*})\sigma r^* \\ &\quad + \pi_s^* s^* f(e_s^{M^*})\sigma B_s^*(1-r^*) + \pi_s^* f(e_s^{M^*})\sigma r^*] e^{[\rho - g_s + f(e_s^{M^*})\sigma](t-\tau)} d\tau \end{aligned} \quad (3.24)$$

$$- \pi_s^* s^* f(e_s^{L*}) \sigma (1 - r^*) - \pi_s^* f(e_s^{L*}) \sigma r^*] e^{[\rho - g_s + f(e_s^{M*}) \sigma](t-s)} ds.$$

Eighth, differentiate the Lagrangian with respect to φ_s , (3.16), then

$$\dot{B}_s = [g_s - f(e_s^M) \sigma] B_s - d(e_s^M) - h(r). \quad (3.25)$$

The solution for (3.25) is:

$$B_s^* = B_s(0) e^{[g_s - f(e_s^{M*}) \sigma]t} - \int_0^t [d(e_s^{M*}) + h(r^*)] e^{[g_s - f(e_s^{M*}) \sigma](t-s)} ds. \quad (3.26)$$

We also rewrite (3.26) as follows:

$$B_s^* = B_s(0) e^{[g_s - f(e_s^{M*}) \sigma]t} + \frac{d(e_s^{M*}) + h(r^*)}{g_s - f(e_s^{M*}) \sigma} [1 - e^{[g_s - f(e_s^{M*}) \sigma]t}]. \quad (3.27)$$

(3.26) states that the current tax base, B_s , equal the initial tax base, $B_s(0)$, minus the entire time path of the agency costs, $d(e_s^{M*})$ and $h(r^*)$, both compounded at the rate of $[g_s - f(e_s^{M*}) \sigma]$. During the share contract period, both components exponentially grow if $[g_s - f(e_s^{M*}) \sigma] > 0$, which means $g_s > f(e_s^{M*}) \sigma$. Meanwhile, both components exponentially decrease if $[g_s - f(e_s^{M*}) \sigma] < 0$, which means $g_s < f(e_s^{M*}) \sigma$. φ_s^* , (3.24), captures marginal benefit of increase in tax base or marginal cost of decrease in tax base.

Under the optimal contract, the return to the government is:

$$V_S^* = \int_0^T [(1-s^*) f(e_s^{M*}) \sigma B_s^* (1-r^*) - d(e_s^{M*}) - h(r^*)] e^{-\rho t} dt, \quad (3.28)$$

$$\text{where } s^* = \frac{U_0 + e_s^{M*} - f(e_s^{M*}) \sigma B_s^* r^*}{f(e_s^{M*}) \sigma B_s^* (1-r^*)}.$$

Thus, the value function, (3.29), can be rewritten to compare to other contract value functions as follows:

$$V_S^* = \int_0^T \{f(e_s^{M^*})\sigma B_s^*(1 - r^*) - [(U_0 + e_s^{M^*}) - f(e_s^{M^*})\sigma B_s^*r^*] - d(e_s^{M^*}) - h(r^*)\} e^{-\rho t} dt. \quad (3.29)$$

During the optimal share contract, the government collects the net tax revenue, $\int_0^T (1-s^*)f(e_s^{M^*})\sigma B_s^*(1 - r^*) e^{-\rho t} dt$. However, according to (3.30), we know that the net tax revenue is equal to the gross tax revenue, $\int_0^T f(e_s^{M^*})\sigma B_s^*(1 - r^*) e^{-\rho t} dt$ minus the expected cost of compensation, which $\int_0^T [(U_0 + e_s^{M^*}) - f(e_s^{M^*})\sigma B_s^*r^*] e^{-\rho t} dt$.

During the revenue share contract, the expected cost of compensation is the tax farmer's portion of tax revenue reported,

$$\int_0^T [s^* f(e_s^{M^*})\sigma B_s^*(1 - r^*)] e^{-\rho t} dt, \quad (3.30)$$

$$\text{where } s^* = \frac{U_0 + e_s^{M^*} - f(e_s^{M^*})\sigma B_s^*r^*}{f(e_s^{M^*})\sigma B_s^*(1 - r^*)}. \quad (3.31)$$

Thus, the value function, (3.31) can be rewritten as follows:

$$\begin{aligned} & \int_0^T \left\{ \left[\frac{U_0 + e_s^{M^*} - f(e_s^{M^*})Tr}{f(e_s^{M^*})(1-r)} \right] f(e_s^{M^*})T(1 - r^*) \right\} e^{-\rho t} dt \\ & = \int_0^T \{(U_0 + e_s^{M^*}) - f(e_s^{M^*})\sigma B_s^*r^*\} e^{-\rho t} dt. \end{aligned} \quad (3.32)$$

Finally, the government's return is equal to the net tax revenue minus the agency costs resulting from modest over-enforcement, $\int_0^T d(e_s^{M^*}) e^{-\rho t}$, and underreporting, $\int_0^T h(r^*) e^{-\rho t}$.

3.4.5 Comparative Statics and Propositions

The following propositions show the conditions under which each tax collection contract is dynamic optimal under agency problems.

Proposition 1: The following contract is optimal for a fixed wage contract for tax collection:

$$e: e_w^{L*}, \text{ which solves } f'(e_w^{L*})\sigma B_w^* = \frac{1 + (1 + \varphi_w^*) m'(e_w^{L*})}{(1 - \varphi_w^*)},$$

$$w: w^* = U_0 + e_w^{L*},$$

Expected cost of compensation: $U_0 + e_w^{L*}$.

Under the dynamic optimal fixed wage contract, the public tax collector inputs the optimal level of effort, e_w^{L*} , to realize tax receivable, σB_w^* , and the effort level is determined by not only the level of monitoring to mitigate shirking, m , but also the change of tax base, φ_w^* , which is marginal cost of decrease in tax base. The government pays the optimal wage, w^* , which covers the public tax collector's reservation utility, U_0 , —a kind of opportunity cost—and his effort (or labor), e_w^{L*} . Therefore, the government's compensation cost is equal to w^* or $U_0 + e_w^{L*}$.

Proposition 2: The following contract is optimal for a fixed rent contract for tax collection:

$$e: e_r^{H*}, \text{ which solves } f'(e_r^{H*})\sigma B_r^* = \frac{(1 + \pi_r^*) + (1 + \varphi_r^*)k'(e_r^{H*})}{(1 + \pi_r^* - \varphi_r^*)},$$

$$F: F^* = f(e_r^{H*})\sigma B_r^* - U_0 - e_r^{H*},$$

Expected cost of compensation: $U_0 + e_r^{H*}$.

Under the dynamic optimal fixed rent contract, the tax farmer inputs the optimal level of effort, e_r^{H*} , to realize tax receivable, σB_r^* , and the effort level is determined by the level of monitoring to mitigate overzealous collection, k , an incentive to hard work, π_r^* , and marginal cost of decrease in tax base, φ_r^* . The government receives the optimal fixed rent fee, F^* , from the tax farmer which is a discounted price of the face value of tax receivables, σB_r^* . The government indirectly compensates the tax farmer for $U_0 + e_r^{H*}$.

Proposition 3: The following contract is optimal for a revenue share contract for tax collection:

$$e: e_s^{M*}, \text{ which solves } f'(e_s^{M*})\sigma B_s^* = \frac{\lambda_s^* + \pi_s^* + (1+\varphi_s^*)d'(e_s^{M*})}{1-s^*-r^*+s^*r^*+\lambda_s^*s^*-\lambda_s^*s^*r^*+\lambda_s^*r^*+\pi_s^*s^*-\pi_s^*s^*r^*+\pi_s^*r^*-\varphi_s^*}$$

$$s: s^* = \frac{U_0 + e_s^{M*} - f(e_s^{M*})\sigma B_s^* r^*}{f(e_s^{M*})\sigma B_s^* (1-r^*)}$$

$$r: r^* = \frac{(e_s^{M*} - e_s^{L*})}{[f(e_s^{M*})\sigma B_s^* - f(e_s^{L*})\sigma B_s^*](1-s^*)} + \frac{-s^*}{(1-s^*)}$$

Expected cost of compensation: $(U_0 + e_s^{M*}) - f(e_s^{M*})\sigma B_s^* r^*$.

Under the dynamic optimal revenue share contract, the tax farmer inputs the optimal level of effort, e_s^{M*} , to realize tax receivable, σB_s^* . The effort level is a function of the level of monitoring to mitigate overzealous collection, d , proportional fee rate, s^* , the degree of underreporting, r^* , the lagrangia multiplier for the participation constraint, λ_s^* , the lagrangia multiplier for the incentive comparability constraint, π_s^* , and marginal cost of decrease in tax base, φ_s^* . The optimal proportional fee rate is s^* , which is the compensation, $(U_0 + e_s^{M*}) - f(e_s^{M*})\sigma B_s^* r^*$, divided by reported tax revenue, $f(e_s^{M*})\sigma B_s^* (1-r^*)$. Basically, the compensation cost is $U_0 + e_s^{M*}$, but it should be adjusted to r^* .

Table 3 Summary of Objective Functions, Constraints, and Optimal Conditions in Dynamic Models

Wage Contract:

$$\text{Maximize } V_w = \int_0^T [f(e_w^L)\sigma B_w - w - m(e_w^L)] e^{-\rho t} dt$$

e, w

Subject to

$$w - e_w^L \geq U_0, \text{ and}$$

$$\dot{B}_w = g_w B_w - f(e_w^L)\sigma B_w - m(e_w^L)$$

Optimal conditions:

$$e_w^{L*}, \text{ which solves } f'(e_w^{L*})\sigma B_w^* = \frac{1 + (1+\varphi_w^*)m'(e_w^{L*})}{(1-\varphi_w^*)}$$

$$w^* = U_0 + e_w^{L*}$$

Table 3-Continued

Rent Contract:

$$\text{Maximize } V_R = \int_0^T [F - k(e_r^H)] e^{-\rho t} dt$$

e, F

Subject to

$$\begin{aligned} f(e_r^H) \sigma B_r - F - e_r^H &\geq U_0, \\ f(e_r^H) \sigma B_r - F - e_r^H &\geq f(e_r^L) \sigma B_r - F - e_r^L, \text{ and} \\ \dot{B}_r &= g_r B_r - f(e_r^H) \sigma B_r - k(e_r^H) \end{aligned}$$

Optimal conditions:

$$\begin{aligned} e_r^{H*}, \text{ which solves } f'(e_r^{H*}) \sigma B_r^* &= \frac{k'(e_r^{H*}) + 1 + \pi_r^* + \varphi_r^* k'(e_r^{H*})}{(1 + \pi_r^* - \varphi_r^*)} \\ F^* &= f(e_r^{H*}) \sigma B_r^* - U_0 - e_r^{H*} \end{aligned}$$

Share Contract:

$$\text{Maximize } V_S = \int_0^T [(1-s) f(e_s^M) \sigma B_s (1-r) - d(e_s^M) - h(r)] e^{-\rho t} dt$$

e, s, r

Subject to

$$\begin{aligned} s f(e_s^M) \sigma B_s (1-r) - e_s^M + f(e_s^M) \sigma B_s r &\geq U_0 \\ s f(e_s^M) \sigma B_s (1-r) - e_s^M + f(e_s^M) \sigma B_s r &\geq s f(e_s^L) \sigma B_s (1-r) - e_s^L + f(e_s^L) \sigma B_s r \\ \dot{B}_s &= g_s B_s - f(e_s^M) \sigma B_s - d(e_s^M) - h(r) \end{aligned}$$

Optimal conditions:

$$\begin{aligned} e_s^{M*}, \text{ which solves } f'(e_s^{M*}) \sigma B_s^* &= \frac{\lambda_s^* + \pi_s^* + (1 + \varphi_s^*) d'(e_s^{M*})}{1 - s^* - r^* + s^* r^* + \lambda_s^* s^* - \lambda_s^* s^* r^* + \lambda_s^* r^* + \pi_s^* s^* - \pi_s^* s^* r^* + \pi_s^* r^* - \varphi_s^*} \\ s^* &= \frac{U_0 + e_s^{M*} - f(e_s^{M*}) \sigma B_s^* r^*}{f(e_s^{M*}) \sigma B_s^* (1 - r^*)} \\ r^* &= \frac{(e_s^{M*} - e_s^{L*})}{[f(e_s^{M*}) \sigma B_s^* - f(e_s^{L*}) \sigma B_s^*] (1 - s^*)} + \frac{-s^*}{(1 - s^*)} \end{aligned}$$

To compare each return to the government, I initially wrote each value function of the contracts as follows:

$$\text{wage contract: } V_w^* = \int_0^T [f(e_w^{L*})\sigma B_w^* - w^* - m(e_w^{L*})] e^{-\rho t} dt$$

$$\text{share contract: } V_s^* = \int_0^T [(1-s^*)f(e_s^{M*})\sigma B_s^*(1-r^*) - d(e_s^{M*}) - h(r^*)] e^{-\rho t} dt,$$

$$\text{rent contract: } V_r^* = \int_0^T [F^* - k(e_r^{H*})] e^{-\rho t} dt.$$

To compare each value function of contracts easily, I rewrite them in alternative form based on (1.23), (2.29), and (3.29) as follows:

$$\text{wage contract: } V_w^* = \int_0^T [f(e_w^{L*})\sigma B_w^* - (U_0 + e_w^{L*}) - m(e_w^{L*})] e^{-\rho t} dt.$$

$$\text{share contract: } V_s^* = \int_0^T \{f(e_s^{M*})\sigma B_s^*(1-r^*) - [(U_0 + e_s^{M*}) - f(e_s^{M*})\sigma B_s^*r^*] - d(e_s^{M*}) - h(r^*)\} e^{-\rho t} dt$$

$$\text{rent contract: } V_r^* = \int_0^T [f(e_r^{H*})\sigma B_r^* - (U_0 + e_r^{H*}) - k(e_r^{H*})] e^{-\rho t} dt.$$

Based on these rewritten value functions, Table 4 shows each component of the optimal contract value functions: the level of agent's collection effort, gross tax revenue, compensation cost, net tax venue, agency costs, agency-cost adjusted net tax revenue, and change of tax base.

Table 4 Components of Optimal Contract Value Function in Dynamic Models: Costs and Benefits

Contract [(Net Tax revenue	= Gross tax revenue	- Compensation Cost)	- Agency cost]	= Agency-cost Adjusted Net Tax Revenue
Wage	$\int_0^T [f(e_w^{L*})\sigma B_w^* - w^*] e^{-\rho t} dt$	$= \int_0^T f(e_w^{L*})\sigma B_w^* e^{-\rho t} dt$	$- \int_0^T [U_0 + e_w^{L*}] e^{-\rho t} dt$	$- \int_0^T m(e_w^{L*}) e^{-\rho t} dt = V_w^*$
Share	$\int_0^T (1-s^*)f(e_s^{M*})\sigma B_s^*(1-r^*) e^{-\rho t} dt$	$= \int_0^T f(e_s^{M*})\sigma B_s^*(1-r^*) e^{-\rho t} dt$	$- \int_0^T [U_0 + e_s^{M*} - f(e_s^{M*})\sigma B_s^*r^*] e^{-\rho t} dt$	$- \int_0^T [d(e_s^{M*}) + h(r^*)] e^{-\rho t} dt = V_s^*$
Rent	$\int_0^T F^* e^{-\rho t} dt$	$= \int_0^T f(e_r^{H*})\sigma B_r^* e^{-\rho t} dt$	$- \int_0^T [U_0 + e_r^{H*}] e^{-\rho t} dt$	$- \int_0^T k(e_r^{H*}) e^{-\rho t} dt = V_r^*$
Contract [(Net Tax revenue	= Gross tax revenue	- Compensation Cost)	- Agency cost]	= Agency-costs Adjusted Net Tax Revenue
Wage	N_w	G_w	C_w	A_w
Share	N_s	G_s	C_s	A_s
Rent	N_r	G_r	C_r	A_r
				Adj. N_w
				Adj. N_s
				Adj. N_r

First, Table 4 shows that the three levels of efforts can be ordered, $e_w^{L*} < e_s^{M*} < e_r^{H*}$. Rent contract induces the highest level of the tax collection agent's effort and wage contract induces the lowest level of the tax collection agent's effort.

Second, if the wage contract changes to an incentive-based contract, the corresponding compensation level increases. The corresponding compensations can be ordered as if the tax farmer reports the true amount of revenue, $r^* = 0$, the compensations can be ordered, $C_w < C_s < C_r$; if the tax farmer does not report any revenue, $r^* = 1$, the compensations can be ordered, $C_s < C_w < C_r$; if the tax farmer underreports the true amount of revenue, $0 < r^* < 1$, the compensations can be ordered based on the assumption that as r^* increases, C_s gets lower than C_w . In every situation, C_r is always higher than the others. In short, the implication of these results is that the government can increase gross tax revenue by increasing the collection effort. Correspondingly, compensation cost and the level of extraction of tax base also increase.

Third, as the level of collection effort increases, the gross tax revenue increases if tax bases are fixed and the possibility of the tax collection agent's underreporting is zero, $r^* = 0$. However, if tax bases change over time and the underreporting rate is not zero, $r^* \neq 0$, ordering gross tax revenues for each contract is not straightforward. Given the tax base, $B_w^* = B_s^* = B_r^*$, if the tax farmer report the true amount of revenue, $r^* = 0$, the government's gross tax revenues can be ordered, $G_w < G_s < G_r$. If the tax farmer does not report any collected tax revenue, $r^* = 1$, gross tax revenues can be ordered, $G_s < G_w < G_r$. If the tax farmer underreport the true amount of revenue, $0 < r^* < 1$, the order between G_w and G is not obvious. However, r^* increases, G_s gets lower than G_w . In every situation, the gross tax return in the rent contract, G_r , is always higher than the others. However, if tax bases change over time, the potential exploitation of the tax base from the excessive collection efforts of incentive-based contracts will offset the marginal increase of gross tax revenues corresponding to an increase of the level of effort.

Fourth, the order of net tax revenues is not obvious. It is because compensation cost increases as the gross tax revenue increases. These two variables vary in the same direction. Another difficulty is that we do not know the exact differences among gross tax revenues for each contract and the differences among each compensation cost although we can know the order of gross tax revenues and order of compensation costs.

Fifth, agency costs resulting from overzealous collection of tax farming contracts can be ordered, $\int_0^T d(e_s^{M^*}) e^{-\rho t} dt < \int_0^T k(e_r^{H^*}) e^{-\rho t}$ because the over-enforcement under the share contract is less serious than under the rent contract. However, it is difficult to compare overall agency costs

among contracts, such as the agency cost resulting from shirking under the wage contract, A_w , the agency cost resulting from overzealous collection under the rent contract, A_r , and the agency costs resulting from overzealous collection and underreporting under the share contract, A_s .

Sixth, Table 5 shows that the level of tax collection effort and agency cost have negative effects on the tax base. However, it is difficult to order magnitudes of the impact of agency costs on the tax base among contracts because it is difficult to compare overall agency costs among contracts. However, we can think of the simplest case. Given the order of collection efforts, $e_w^{L*} < e_s^{M*} < e_r^{H*}$, the tax base under the wage contract decreases slowest, and the tax base under the rent contract decreases quickest if other factors, such as magnitudes of agency costs among the contracts, are the same. Under that situation, decreases in tax bases among contracts due to tax extraction can be ordered, $B_w^* < B_s^* < B_r^*$.

Table 5 Impacts of Collection Efforts and Agency Costs on the Change of Tax Base in Dynamic Models

Contract	Net Tax Base	Impact of Collection Efforts	Impact of agency costs
Wage	B_w^*	$= B_w(0) e^{[g_w - f(e_w^{L*})\sigma]t}$	$- \int_0^t m(e_w^{L*}) e^{[g_w - f(e_w^{L*})\sigma](t-s)} ds$
Share	B_s^*	$= B_s(0) e^{[g_s - f(e_s^{M*})\sigma]t}$	$- \int_0^t [d(e_s^{M*}) + h(r^*)] e^{[g_s - f(e_s^{M*})\sigma](t-s)} ds$
Rent	B_r^*	$= B_r(0) e^{[g_r - f(e_r^{H*})\sigma]t}$	$- \int_0^t k(e_r^{H*}) e^{[g_r - f(e_r^{H*})\sigma](t-s)} ds$

Although the results of the comparison of the relative values of each contract based on comparative statics without numeric values are not straightforward, the model implies that increased net tax revenue is smaller than increased gross tax return because the increased compensation cost and extraction level of the tax base partly offsets the increased gross tax revenue. Furthermore, the net tax revenue should be adjusted to agency costs. Finally, agency-cost adjusted net tax revenue, which is the final return of government, is smaller than the net tax revenue. To choose a contractual type of tax collection, we have to compare each agency-cost

adjusted net tax revenue for the contractual forms. Results and implications of the model may help in thinking about the current tax collection issue.

3.5. An Application: Contracting Out Federal Delinquent Income Tax Collection

The contemporary contracting out delinquent tax collection is not identical to tax farming in history. The contemporary contracting out delinquent tax collection is a part-privatized tax collection while tax farming was a full privatization of tax collection. The current outsourcing of delinquent tax collection is to supplement the public tax collection agencies while the tax farming was to substitute for the bureaucratic collection system. In addition, the current contracting out tax collection is different from historical tax farming in terms of the extent to which the taxpayer is protected by legal and administrative system. However, implications of the model are useful to investigate contemporary issues associated with using private debt collection agencies for collection of delinquent taxes.

3.5.1 A Public Financial Problem: Growing Amount of Delinquent Taxes

Tax collection, especially growing amount of delinquent taxes, is a critical issue. During times of financial crisis or fiscal hardship, such as the Credit Crisis of 2007 or the Government Debt Crisis of 2011, public policy makers usually think about two basic financial options, tax increases and budget cuts, to overcome such tough financial situations. However, there is the third financial option, delinquent tax collection, which has not been receiving attention. This option will “raise revenues without raising taxes” (U. S. Senate Republican Policy Committee, 2006). In the fiscal year 2010, the federal delinquent non-tax debt, such as administrative debt (e.g. fine, penalties and overpayments), defaulted guaranteed loan (e.g. rehabilitated loan), and direct loan (e.g. student loan), totaled \$ 103.6 billion. However, the status of federal delinquent tax debts is more serious. In the fiscal year 2007, the federal unpaid tax debt inventory totaled \$ 290.1 billion (U.S. Government Accountability Office, 2008). This figure is about 1.6 times the collective budget deficits of all U.S. states which totals 180 billion in 2011, or about 4 times the state of Florida’s budget of \$ 70.4 billion for the fiscal year 2011.

Tax delinquency has destructive effects on the government's fiscal health in terms of revenue and equity. First, tax delinquency leads to loss of revenue and higher cost of collection. The government is compelled to implement enforcement collection processes which are more costly to both the government and the taxpayer. Furthermore, every year the IRS writes off an average of 35 percent of delinquent taxes from unpaid tax inventory due to statutory limits on the IRS collection period (U.S. Government Accountability Office, 2008). Second, tax delinquency reduces the taxpayer voluntary compliance rate. Tax delinquency encourages the honest taxpayer not to comply with the tax system and leads violation of the equity as one of key principals of taxation. Reduced compliance rate decreases tax revenue and increases tax collection cost in the long-run. Blough mentions "But a more important source of inequity is the failure of administrators to collect taxes from those who owe them. Such taxpayers receive financial subsidy, while the tax loads of other taxpayers must be increased to make up the resulting revenue deficiency" (1952, p. 389). Therefore, it is critical for the government to effectively collect the taxes already imposed, not just to find new tax bases or raise tax rates. In other words, the government's contractual choice of tax collection is critical.

3.5.2 IRS's Current Collection Method: A Fixed Wage Contract

The model implies that the most prominent characteristic of the fixed wage contract is that there is no direct and indirect functional relation between the tax collection agent's collection performance and its wage. Correspondingly, the wage contract leads low compensation cost but also leads to tax collection agent's low level of collection effort. Most contemporary governments adopt a fixed wage contract with public employees for tax collection. Although the wage may increase or change in the long run, it is rare for the public agent to immediately receive a financial compensation corresponding to his performance. Although recently the compensation structure to incentivize the public employee in the government has become similar to outcome-based compensation in private firms, it has not observed that the public tax collector receives a direct financial compensation based on his tax collection performance in IRS and state governments. The public employee may have some indirect or non-monetary incentives, such as low powered individual incentives in government, for example, career concern or promotion, (Tirole 1994) and public service motivation, which may lead to the public employee's high level

of effort. However, such possibilities are not considered to highlight the underlying difference among tax collection contracts. Hence, under the fixed wage contract, the public employee chooses the low level of effort.

The IRS's tax collection staff receives a fixed wage, regardless of the amount of taxes collected through its efforts. According to the section 1204 (a) of the *IRS Restructuring and Reform Act of 1998*, "the Internal Revenue Service shall not use records of tax enforcement results (1) to evaluate employees; or (2) to impose or suggest production quotas or goals with respect to such employees" (Guenther 2006, p. 14). Prior to the *IRS Restructuring and Reform Act of 1998*, the *Technical and Miscellaneous Revenue Act of 1988* and before 1988 the *IRS Policy Statement P-1-20* had prohibited the IRS from using tax collection performance, including enforcement data, to evaluate employees' performance and wages (U.S. Government Accountability Office, 2008). Also, no state government uses incentive pay for collection staff based on workload performance measures (e.g. dollars collected or number of cases closed).

Under the current prohibitions and contractual form against performance-based compensation in IRS, it is difficult to expect the IRS tax collection employee to choose a high level of effort to collect delinquent taxes. Thus, the growing amount of delinquent taxes is partly due to the inefficiency of current bureaucratic tax collection system if we fix macro-economic conditions. Congress has not endorsed repeated budget requests for hiring IRS tax collection staffs because Congress has questioned effectiveness of IRS's delinquent tax collection. That is why Congress and Clinton Administration started to consider alternative way to collect federal delinquent income tax which is contracting out the collection activities with private debt collection companies.

3.5.3 An Innovative Solution: Contracting Out Delinquent Tax Collection

To address the growing amount of delinquent debts, since the 1980s, many local and state governments have been using private debt collection agencies to collect their delinquent taxes. Also, federal agencies, except for the IRS, have been using private debt collection companies to collect their non-tax debts, such as penalties, fees, and student loans. Internationally, Australia

and Japan have already used private debt collectors to collect delinquent taxes, and South Korea plans to implement similar program in 2012.

The *Federal Claims Collection Act of 1966* first allowed federal agencies to use private debt collection agencies to contract out the collection of federal non-tax debts in United States, and the Department of Education began to use private debt collectors to collect student loan debt (Resnick, 2005). Furthermore, the *Debt Collection Act of 1982*, as amended by the *Debt Collection Improvement Act of 1996*, permitted most federal agencies, except the Internal Revenue Service (IRS), to use private collection companies to collect non-tax debts (U.S. Government Accounting Office, 1993). Currently, the U.S. Department of Education, the Department of Health and Human Services, and Department of Treasury's Bureau of Financial Management Service have been using private collection agencies (U.S. Department of Treasury, 2011). In particular, Treasury's Bureau of Financial Management Service (FMS) has been implementing federal government-wide delinquent non-tax debt collection program since 1996 to collect non-tax debts referred from other federal agencies (U.S. Department of Treasury, 2011). In fiscal year 2010, private collection agencies under contract with federal agencies collected \$ 777 million of federal non-tax delinquent debts, and additionally reduced \$ 1.7 billion of federal delinquent debts by arranging student loan consolidations and rehabilitations (U.S. Department of Treasury, 2011)

As Vice President Al Gore suggested the expansion of using private debt collection agencies in his *National Performance Review* report in 1993, the Clinton Administration initiated private tax collection to contract out the collection of federal delinquent taxes. A pilot program—known as the Contracting Out Collection Activities Project—was implemented in 1996 and 1997 for private tax collection in 1995 (Guenther, 2006). Under the Bush Administration, the *American Jobs Creation Act of 2004* finally permitted the Internal Revenue Service (IRS) to hire private debt collection agencies to assist in collection of delinquent taxes. IRS planned to implement a private debt collection program since 2006 (U.S. General Accountability Office, 2006), but until now Congress has not allowed any appropriation for the program (U.S. Government Accounting Office, 2010). Furthermore, a series of legislations, such as H.R. 1621 and H.R. 1583 in 2005, and H.R. 796 in 2009, were introduced in the House to repeal the authority of IRS to contract out

delinquent tax collection with private debt collection agencies, and these legislations were referred to the House Committee on Ways and Means. The IRS finally announced that they will not contract out any tax collection process with private debt collection agencies (U.S. Government Accountability Office, 2010). Congress has hesitated to endorse budgets for implementing delinquent tax collection contract although they provided the IRS with legal bases for contracting out. It is because Congress is concerned about the potential negative impact of incentive-based contracts for tax collection.

3.5.4 Contracting Out Tax Collection: A Revenue Share Contract

The formal model implies that under the revenue share contract, there is a direct functional relation between agency's tax collection performance and its share. Thus, this contract leads to higher compensation costs but induces the higher level of effort of tax collection agency than wage contract. However, the share contract leads to agent's overzealous collection. In the current debt collection industry in U.S., most of third party debt collection contracts are the share revenue contract under which the private debt collector receives a commission. In many private debt collection companies, "to motivate staff, private collectors routinely use collection performance statistics as a basis for evaluating their collectors and for determining compensation and incentive awards" (U.S. Government Accounting Office 1993). "A 1987 survey by the American Collectors Association found that 80 percent of the private collection companies that responded paid their collectors a salary plus incentives. Eleven percent of the companies paid collectors straight commissions, and 7 percent paid collectors salaries without any commissions" (U.S. Government Accounting Office, 1993). Also, governments pay "commission" to private debt collection companies to collect non-tax and tax receivables, and the average "commission" rate is about 28.5 percent of receivables collected by the private collection agencies in 2006 (ACA International, 2007). We can expect that under such a commission-based contract, the private collection agent inputs a higher level of effort to collect taxes to maximize its share.

According to the model, IRS's 1996 and 1997 pilot program, the Contracting Out Collection Activities Project, was not an incentive-based contractual form of tax collection, but just a fixed wage contract. IRS's pilot program is commonly perceived as an exemplary case of the failure of

contracting out tax collection (U.S. Department of the Treasury, 2003). However, we cannot expect that the private collection agent's high level of performance under the pilot program because private collection agencies received a fixed fee, not commission. Thus, the pilot program looks like a tax farming contract, but actually the contract is just a fixed wage contract. Another characteristic of the pilot program, which differs from the model, is the funding structure of the contract. In the model, revenue share contract is based on self-financing. However, the compensation in the pilot program was funded by appropriations, not from collected tax revenue. In short, the pilot program was not a tax farming contract.

In contrast, IRS's plan for hiring private collection agencies to collect delinquent individual taxes in 2006 fits the revenue share contract model. Under this plan, the IRS planned to pay the commission of 25 percent of collected delinquent tax revenue to the private collection agencies. Furthermore, all collected delinquent tax revenues go into a revolving fund and the compensation for the collection effort of private collection agencies is paid from the revolving fund (Guenther, 2006), self-financing structure. Thus, IRS's plan in 2006 was a typical revenue share contract of tax farming.

Such an incentive-based contract may make private debt collection companies more efficient than IRS. State governments and federal agencies would agree that private debt collection companies are efficient to collect delinquent debts. According to a 1994 U.S. General Accounting Office's (GAO) report on state tax administrators' views on delinquent tax collection methods, 32 of the 43 states, which responded to GAO's survey, contracted out delinquent tax collection with private debt collection agencies. Of 28 states that responded to the question about effectiveness of private collection agencies, 14 states answered "effective," 8 states answered "neutral," and 6 states answered "ineffective." For federal delinquent non-tax debts, in 1999 U.S. Department of Treasury report that "There have been no substantiated debtor complaints and collections have been steadily increasing" (U.S. Department of Treasury, 1999, p. 17).

The formal model implies that the efficient nature of incentive-based contracts mitigate a shirking problem but leads other moral hazard issues. Private debt collection agencies' overzealous collection tactics can lead to the issue of delinquent taxpayer protection. Debt collection complaints reported to the Federal Trade Commission consist of following nine

categories: (1) harassing the alleged debtor or others, (2) demanding a larger payment than is permitted by law, (3), failing to send required consumer notice, (4) threatening dire consequences if consumer fails to pay, (5) failing to identify self as debt collectors, (6) revealing alleged debt to third parties, (7) impermissible calls to consumer's place of employment, (8) failing to verify disputed debts, and (9) continuing to contact consumer after receiving "cease communication notice" (Federal Trade Commission, 2011). In 2010, 77.8 percent of total debt collection complaints reported to Federal Trade Commission, or 108,997 complaints, were about the third-party debt collection while 22.8 percent of total debt collection complaints, or 31,952 complaints, were about the in-house debt collection (Federal Trade Commission, 2011). Therefore, the number of debtors' complaints about the third party collectors is over 3 times the number of debtors' complaints about the in-house collectors. To address violations of the debtor or taxpayers' rights by the third party collection, governments limit collection activities contracted with private debt collection agencies to non-discretionary collection activities, and require private debt collection agencies to abide by laws associated with fair collection processes.

3.5.5 Delinquent Tax Collection Activities Assigned to Private Debt Collectors

IRS's delinquent tax collection process consists of following three phases: notice phase, phone contact phase, and in-person contact phase. In notice phase, IRS sends a series of balance due notices. In telephone and in-person contact phases, IRS reminds the delinquent taxpayer balance due and takes enforcement action, such as a levy of financial assets, a lien against property, and a seizure of property (U.S. Government Accountability Office, 2008). IRS's plan is to contract out notice and phone contract phases, excluding discretionary enforcement actions, with private debt collection companies. Under the IRS's plan, private debt collection agencies (1) track down the correct address, (2) contact the delinquent taxpayer by a letter reminding delinquent taxes, (3) contact and request to pay the delinquent taxes by telephone, (4) suggest payment options (e.g. installment payments), (5) gather financial information and hand it to the IRS for discretionary enforcement (e.g. seizures) (Guenther 2006).

The limited outsourcing of tax collection processes is due to current legal constraints on the IRS. The *Federal Activities Inventory Reform Act of 1998 (FAIR)* and the *Office of Management and*

Budget's (OMB) Circular A-76, which is OMB's instruction about performance of commercial activities, prohibits the government from contracting out its own inherent functions to private agencies. The IRS only contracts out a limited amount of its collection activities to private companies. However, private debt collection companies contracted with other federal agencies "establish repayment agreements and resolving debts administratively by determining that a debtor is deceased, disabled, bankrupt or out of business" (U.S. Department of Treasury, 2011, p. 17). In particular, the Department of Education's private collection agencies have implemented "cash payment, administrative wage garnishment (AWG) payments, and Consolidations and Rehabilitations of loans (U.S. Department of Treasury, 2011, p. 17).

IRS's outsourcing plan of delinquent tax collection is not to substitute for the whole process of tax collection, like historical tax farming, but to supplement the public tax collection agencies. Under the plan, private debt collection companies implement non-discretionary and non-enforcement activities while the IRS collection staff implements more complex discretionary enforcement activities. Therefore, under the IRS's current plan, agency costs, such as over-enforcement and underreporting, may be lower than the agency costs in the model.

3.5.6 Protection of the Taxpayer Right and Privacy

There are legal protections to prevent the collector from mistreating the taxpayer and misusing the taxpayer's information. The *Fair Debt Collection Practice Act of 1977* regulates third party collection business and the Federal Trade Commission enforces it. This act prohibits "abusive, deceptive, and other improper collection practices by the third-party collection" (Federal Trade Commission, 2006, p. 1). The *Debt Collection Improvement Act of 1996* not only enhances federal debt collection but also "provides greater safeguards for debtor's due process right" (Resnick, 2005, p. 131). Furthermore, section 1203 of the *IRS Restructuring and Reform Act of 1998* also addresses taxpayer harassment. In IRS's plan, the private debt collection agencies are subjected to two sections of the *Internal Revenue Code*. Section 6303 rules civil and criminal penalties for the unlawful disclosure of taxpayer information, and section 7811 requires tax collectors to inform the taxpayer to seek assistance from the IRS National Taxpayer Advocate (Guenther 2006).

In addition, in IRS plan, there is another administrative process to mitigate the possibility of illegal activities of private collectors. IRS require private debt collection employees to undergo a background investigation to prevent misusing taxpayer information (IRS, 2005). In particular, private debt collectors do not “handle actual payments because all payments are routed directly to the IRS” (U. S. Senate, Republican Policy Committee, 2006, p. 7). Thus, underreporting issue under the revenue share contract may be not serious, $r = 0$. Finally, IRS’s plan requires the private collector to report key data and information which are needed for IRS to effectively oversee the private collector. In short, under the current legal protections of taxpayers, the contracted collection activities are limited to non-discretionary collection processes, and private debt collectors are subject to other existing collection and privacy regulation applying to the public employee, IRS. Therefore, we can expect that under the current situation, negative effects of contracting out federal delinquent income tax with private debt collection agencies on the taxpayer would be relatively lower than the model.

3.6 CONCLUSION

Prior literature on taxation relatively focus on finding optimal tax rates and determining tax bases rather than tax collection efforts although tax revenue is a function of a tax base, a tax rate, and the tax administrator’s collection effort. In addition, much of tax collection literature focuses on the tax evasion issue rather than the tax collection process itself. Prior literature on tax collection history has implicitly established the importance of agency costs in both bureaucratic tax collection and tax farming by identifying lessons and features of tax collection contracts. However, such previous studies tend to focus on historical description about tax collection methods and agency costs, rather than theorizing underlying mechanisms of tax collection contracts, offering an analysis, and applying it to modern tax collection cases. In this paper, I theorize tax collection methods by developing a dynamic model to explicitly incorporate the trade-off of agency costs among tax collection contracts.

My key argument is that the government can indirectly choose the level of effort of the tax collection agent by offering each a different compensation scheme to maximize its tax revenue. However, a compensation-to-effort mapping leads to a trade-off among agency costs. Therefore,

when choosing a contractual form of tax collection, the government needs to consider not only simple compensation-to-effort mapping issue but also agency costs resulting from such a mapping. Also, the government needs to consider not only revenue and cost in the short-run, but also the impacts of the level of collection efforts and agency costs on the change of tax base over time in the long-run. Thus, I develop a model of tax collection as incorporating trade-off among agency costs and the dynamic nature of tax base into the model.

Even though dynamic optimal conditions of contracts are derived by optimization processes, it is not straightforward to compare relative values of contracts. Seven important comparative statics are driven by the formal analysis. It is relatively straightforward to compare each level of agent's collection effort, compensation cost, gross tax revenue among for contracts. However, it is hard to compare each net tax revenue, agency cost, agency cost adjusted net tax revenue, and change of tax base for contracts.

My formal model is not enough to compare relative values among contracts and to select the best tax collection contract among them but provides useful theoretical implications about relative value of each contract. The basic implication is that as the government increases the compensation for the tax collector, level of effort of the tax collection agent will increase and correspondingly, the gross tax revenue will increase. However, aggressive collection behavior of agent motivated by incentive compensation offsets benefits of an incentive contract by increasing other types of agency costs than shirking and decreasing tax base in long run.

Implications of the model may help in thinking about the current issue of contracting out delinquent tax collection with private debt collection companies. Contracting out delinquent tax collection may increase gross tax revenue and tax collection rate. However, these benefits of an incentive-based contract may be partly offset by increasing compensation cost and social costs associated with the taxpayer's harassment. In the current legal and administrative constraints on private debt collectors, agency costs may be relatively lower than agency costs in the model.

CHAPTER 4

MEASURING THE AGENCY COST OF TAX COLLECTION: AN EMPIRICAL TEST OF EFFECTS OF STATE DELINQUENT TAX COLLECTION OUTSOURCING ON ADMINISTRATIVE EFFECTIVENESS AND PROCEDURAL FAIRNESS

4.1 Introduction

Since the 1980s, state governments in the U.S. have reintroduced tax farming, which was replaced with tax bureaucracy during the nineteenth century, to facilitate and expedite the collection of delinquent taxes. In 1979, New Mexico first started to contract out delinquent tax collection with private collection agencies. Currently, more than thirty states (e.g. Colorado, New Jersey and Illinois) use private debt collection companies for delinquent tax collection, but other states (e.g. Arizona, Tennessee, and Washington) have never outsourced delinquent tax collection to private collection agents. From this recent trend of contemporary governments' reintroducing tax farming, the following question is raised: what results can be observed from state governments' contracting out delinquent tax collection with private debt collection companies during the last decade? The expected answer is that the outsourcing of delinquent tax collection may be administratively and financially effective, but it may have negative impacts on the procedural fairness in tax collection.

The effects of tax collection outsourcing in contemporary governments have not been sufficiently studied empirically. Under the name of privatization, there has been much literature about contracting out diverse functions and services of the government, such as garbage collection, education, defense, police and prison. However, such privatization literature focuses on the contracting out associated with the spending aspect of public finance. It is relatively rare to find studies of contracting out associated with the revenue aspect of public finance.

To find the effects of the tax collection outsourcing on administrative effectiveness and procedural fairness in tax collection during the last decade, I analyze state panel data for the years 2000 to 2011. The empirical test concentrates on comparing the fixed wage contract as the conventional collection method with the revenue share contract as the innovative collection method in the contemporary context. To compare these two tax collection methods, I measure two types of agency costs, shirking and overzealous collection. It is difficult to measure each absolute magnitude of agency costs. Alternatively, I measure the difference of shirking between wage and share contracts, and also measure the difference of overzealous collections between wage and share contracts.

Given data and chosen empirical technique, the empirical results are mixed. In terms of administrative effectiveness, first, the use of a private collection agency reduces tax administration cost but has no statistical effect on delinquent tax inventory. In terms of procedural fairness, tax collection outsourcing increases the number of tax appeals (e.g. informal conferences and hearings) filed in the tax appeal division within state tax departments while it decreases tax appeals filed in outside-independent tax appeal agency (e.g. tax courts).

4.2 Measures of Agency Costs: Analytic Criteria in Tax Collection

4.2.1 Analytic Criteria in Optimal Taxation

Traditionally, in the theory of taxation, optimal taxation and tax policy literature focuses on “economic efficiency” (Ramsey 1927; and Auerbach and Hines Jr. 2001) and “social equity” (Mirrlees 1971, 1976; and Diamond and Mirrlees 1971a, 1971b) as analytic criteria to evaluate a tax system. Economic efficiency of taxation refers to minimization of the excess burden resulting from distortion of economic decisions due to taxes. Social equity refers to the distributional effect of taxes. The theoretical literature on optimal taxation and tax policy focuses on finding optimal tax rates and bases in terms of economic efficiency and tax equity, while the empirical literature concentrates on measuring the extent to which a tax system is economically efficient and socially equitable. In short, the arguments about optimal taxation are narrowed down to the trade-off between economic efficiency and social fairness.

While optimal taxation literature focuses on economic and social results of the chosen tax system, public choice literature on taxation emphasizes the political process of choosing a tax system. Public choice theory on taxation views the political costs of taxation as a critical analytic criterion to evaluate a tax system (Buchanan 1967, 1975, 1976; and Holcombe 2002). The political costs of taxation refer to taxpayers' (e.g. interest groups) lobbying costs, the government's cost in interacting with taxpayers, and the government's cost of political decision making on determining and changing tax codes (Holcombe 2002).

I, however, concentrate on administrative or managerial aspects of taxation. Even though a social planner optimally chooses a tax system in terms of economic efficiency, social equity, and political cost considerations, the chosen tax system may not work perfectly. Literature on tax evasion argues that such imperfect implementation of an optimally chosen tax system is due to taxpayers' cheating. However, most literature on taxation ignores that such imperfect implementation of a tax system is also due to inefficient tax administration, such as public tax collectors' shirking. To concentrate on administrative aspects of taxation, I assume that tax bases and rates are properly chosen in terms of economic efficiency, social equity, and political cost. In addition, I assume that taxpayers report their true tax. Therefore, the remaining issue is how to administrate an optimally chosen tax system with honest taxpayers. Specifically, the issue is to collect taxes—tax receivables—determined by optimally chosen tax rates and bases.

4.2.2 Analytic Criteria in Optimal Tax Administration

In this research, I focus on “administrative effectiveness” and “procedural fairness” as analytic criteria to evaluate tax administration, in particular, tax collection. First, administrative effectiveness of tax administration refers to collection of the taxes at the lowest possible cost. Thus, administrative effectiveness also refers to cost-effectiveness. Some scholars (Musgrave and Musgrave 1989; Azabou and Nugent 1988) use the terms “administrative effectiveness,” “cost-effectiveness,” and “administrative efficiency” interchangeably. Second, “procedural fairness” refers to collection of taxes through legal and due processes. The administratively effective tax collection process may lead to negative externalities for the taxpayer. To abide by

legal requirements to minimize the taxpayer's loss in utility from overzealous collection may require a sacrifice of administrative effectiveness.

I highlighted these two analytic criteria to assess tax collection contracts through reviewing historical tax farming and developing formal models of tax collection. Like the trade-off between economic efficiency and social equity in optimal taxation, the core issue in optimal tax administration is the trade-off between administrative effectiveness and procedural fairness as I formalized trade-off among agency costs under each tax collection contract. Blough (1952: 389) defines the objective of tax administration as "to collect every dollar due the government and no more." However, this objective is subject to cost constraint and procedural constraint. The U.S. Department of the Treasury also defines its outcome of collection as "revenue collected when due through a fair and uniform application of the law at the lowest possible cost" in the Treasury Department's Strategic Framework (U. S. Department of the Treasury 2010). In short, the objective of tax collection is to maximize tax revenue at the minimum cost and through a fair procedure given tax bases and rates. While tax administration literature takes account of taxpayer's compliance cost, I ignore that to focus on administrative cost. To evaluate which tax collection method is more administratively effective and procedurally fair, I compare agency costs of a fixed wage contract with an incentive-based contract in tax collection.

4.2.3 Measures of Agency Costs

First, to measure tax collector shirking, I use input-output ratios based on the analytic criterion of administrative effectiveness in tax collection. To measure a cost (or an input) and a benefit (or an output), most economic literature suggests a marginal cost and benefit, instead of an average cost and benefit. Thus, literature on the optimal level of tax collection costs suggests the marginal principle. The most ideal and rigorous idea about the measure of the cost and benefit in tax administration is that the government increases the tax administrative cost until the marginal cost is equal to the marginal benefits, including added tax revenue, long-run impact on a compliance rate in the future, and taxpayers' loss in expected utility (Alm 1999). However, it is extremely difficult to measure such marginal costs and benefits empirically. A more modest and realistic idea is that the government increases the tax administrative cost until marginal tax administration

expenditure is equal to the marginal dollar of tax revenue (Goods 1981). Goods's idea of the optimal level of collection costs in tax administration is more practical than Alm's idea, but it is also difficult to measure Goods's idea empirically as he mentioned in the following:

“In practice, most governments appear to spend less, perhaps substantially less, than the marginal principle would indicate. This impression is also hard to verify, because in only a few countries has information on marginal cost and marginal revenue been made public. When statistical comparisons are made, they usually relate total administrative expenditures to total revenue for all taxes combined or for all the taxes assigned to a particular administrative organization. Such data tell nothing about the relation between costs and revenue at the margin and are of limited value in appraising efficiency.” (Goods 1981: 252)

Marginal cost-benefit or marginal expenditure-revenue is theoretically the appropriate measure of the cost and benefit in tax administration, but it is difficult to obtain related data. Therefore, I use an average measure of cost-benefit, such as an input-output measure, as a feasible alternative to marginal measures. In corporate finance literature, Ang and Cox (1997), Ang, Cole, and Lin (2000); and Henry (2010) use the following four ratios for agency cost measurements: the ratio of operating expenses to sales, the ratio of sales to assets, ratios of cash flow to assets, and Tobin's Q ratio, which refers to “the sum of the market capitalization of equity plus the book value of preference shares plus the book value of long-term debt, divided by the book value total assets” (Henry 2010). The ratio of operating expenses to sales in a firm is applicable to measure the agency cost of shirking in tax collection by viewing tax administration expenditure as operating expenses in terms of the input and viewing tax revenues as sales in terms of the output. The ratio would be viewed as the tax collector's productivity (or performance). However, other ratios, such as the ratio of sales to assets, ratios of cash flow to assets, and Tobin's Q ratio, may not be applicable to the government because of the differences between government accounting and corporate accounting principles.

The input-output measure is not only feasible but also is a realistic proxy to measure shirking. Employee shirking in organizations—both governments and private firms—results in a high level of input and a low level of output. In other words, shirking leads to a high level of cost

given a performance level and a low level of performance given a cost. Such an input-output ratio has limitations, but this would be a useful proxy to evaluate the administrative effectiveness of tax collection. To measure the effectiveness of delinquent tax collection (or the agency cost of shirking), I use the following two proxies: the ratio of state tax department expenditures to tax revenue collected and the ratio of taxes receivable to tax revenue collected.

Second, I use the number of tax appeals to measure the tax collector's overzealous collection behavior. The most ideal measure of the cost resulting from the tax collector's overzealous collection behavior is to measure the taxpayer's loss in utility from overzealous collection. However, it is difficult to measure the taxpayer's loss in utility in terms of monetary value because utility is a subjective value. In the economics and policy analysis literature, in particular benefit-cost analysis literature, for example Zerbe and Dively (1994), the concept of "willing to pay" is used to measure subjective benefits and the concept of "willing to accept" is used to measure subjective costs and benefits in survey. I may ask taxpayers, "How much money do you want to receive as the compensation for accepting an overzealous collection behavior of a tax collector?" However, it is also difficult to collect data and validate subjective valuations.

Alternatively, I may use the number of taxpayers' complaints to measure the tax collector's improper collection behavior, instead of attempting to convert the taxpayer's utility loss to a monetary value. According to the Fair Debt Collection Practice Act, consumers file complaints involving improper collection practices by federal agencies and private collection agencies hired by federal agencies with the Federal Trade Commission (FTC) via toll-free hotline, online complaint forms, or physical mail. Consumer complaints that the FTC receives are summarized and reported to Congress each year. However, the FTC does not receive complaints involving state tax collection agencies. State tax department, state-level taxpayer advocates, or other groups, such as Problem Resolution Officer or Taxpayer Ombudsman, receive taxpayers' complaints involving improper collection practices by state and state-hired private collection agencies. However, state tax departments usually do not have these records.

In this study, I use the number of tax appeals as a proxy to measure the procedural unfairness due to overzealous collection. State tax departments and tax appeal agencies usually have the records

of tax appeals caseloads because tax appeals are more formal than tax complaints. In practice, it is more feasible to collect the data on tax appeals than tax complaints. In addition, taxpayers' complaints are the perception measure, but the number of tax appeals is the relatively more objective measure. There are two types of tax appeals: the tax appeals outside of state tax departments and the tax appeals within state tax department. The first type of tax appeals is informal conferences or hearings which is filed and conducted by an appeal and hearing related division within the state tax department. The second type of tax appeals is appeals filed with the non-judicial independent tax appeal forums, such as state tax courts or board of tax appeals.

4.3 Hypotheses and Data

In this research, the unit of analysis is state governments in the U. S. from 2000 to 2011. I do not focus on a special kind of delinquent tax, such as delinquent income tax, but instead observe the aggregated amount of delinquent taxes. State taxes exclude non-tax revenues, such as fees, charges, or revenues related child support enforcement program. Also, state taxes exclude property tax. For two decades, at the federal level there has been a debate about federal delinquent income tax collection outsourcing. Meanwhile, state governments have already used private debt collection companies to recover all kinds of delinquent tax debts and non-tax debts, such as fees. I postulate the following two testable hypotheses:

Hypothesis 1: The agency cost resulting from shirking under the fixed wage contract is larger than the agency cost under the incentive-based contract in tax collection.

Hypothesis 2: The agency cost resulting from over-enforcement under the incentive-based contract is larger than the agency cost under the fixed wage contract in tax collection.

The tests of these hypotheses as stated above are conducted separately by the following regression equation:

$$\text{Agency cost}_{it} = \alpha + \beta \text{ Private Collection Agency Dummy}_{it} + \delta X_{it} + \varepsilon_{it}.$$

, where the i indexes states, and t indexes each year. Table 6 shows each variable, its description, and data sources used in the equations above.

Table 6 Variable Description and Data Sources

	Variables	Descriptions	Sources
Dependent variables	Agency cost (Shirking)	Tax administration cost per tax revenue (in thousand)	<ul style="list-style-type: none"> Each state's <i>Comprehensive Annual Financial Report (CAFR)</i> Each state tax department's Annual Report
		Taxes receivable (= delinquent tax inventory) per tax revenue (in thousand)	<ul style="list-style-type: none"> U.S. Bureau of Census
	Agency cost (Overzealous collection)	Number of tax appeals (outside tax dept.) per capita (in thousand)	<ul style="list-style-type: none"> Data and Information provided by state tax departments and tax courts collected by emails and telephones
		Number of tax appeals (inside tax dept.) per capita (in thousand)	
Explanatory variable	Private agent dummy	1: Tax collection outsourcing 0: In-house tax collection	<ul style="list-style-type: none"> Data and Information provided by state tax departments and tax courts collected by emails and telephones
Control variables	Tax base	Gross State Product (GSP) per capita (in thousand)	<ul style="list-style-type: none"> U.S. Bureau of Economic Analysis (BEA) U.S. Bureau of Census
	Tax Burden	Tax-payments per capita (in thousand)	<ul style="list-style-type: none"> U.S. Bureau of Census
	Size of state	Population (in thousand)	<ul style="list-style-type: none"> U.S. Bureau of Census' <i>Statistical Abstract of the United States</i>
	Economic fluctuation	Annual unemployment rate (%)	<ul style="list-style-type: none"> U.S. Bureau of Labor Statistics (BLS)
	Political attitude	Governor's party: 0: Democrat 1: Republican 2: Independent	<ul style="list-style-type: none"> Council of State Government's <i>The Book of the States</i>

The key explanatory variable is Private Collection Agency Dummy_{it}, which indexed whether or not a state government contracts out delinquent tax collection with private debt collectors. This variable is ideally measured by identifying the contract periods based on each state's contract documents associated with delinquent tax collection over time. However, it is difficult to access such contract documents. Alternatively, I requested each state tax department to provide information on the use of private debt collection agencies and the legal bases by email and telephone contacts. Table 7 shows each state's agency responsible for tax collection.

Table 7 State Agency Responsible for Tax Collection

State	State Agency Responsible for Tax Collection	State	State Agency Responsible for Tax Collection
ALABAMA	Dept. of Revenue	MONTANA	Dept. of Revenue
ALASKA	Dept. of Revenue	NEBRASKA	Dept. of Revenue
ARIZONA	Dept. of Revenue	NEVADA	Dept. of Taxation
ARKANSAS	Dept. of Finance & Administration.	NEW HAMPSHIRE	Dept. of Revenue Administration
CALIFORNIA	Franchise Tax Board & Board of Equalization	NEW JERSEY	Division of Taxation
COLORADO	Dept. of Revenue	NEW MEXICO	Taxation and Revenue Dept.
CONNECTICUT	Dept. of Revenue Services	NEW YORK	Dept. of Taxation & Finance
DELAWARE	Dept. of Finance	NORTH CAROLINA	Dept. of Revenue
FLORIDA	Dept. of Revenue	NORTH DAKOTA	Office of State Tax Commissioner
GEORGIA	Dept. of Revenue	OHIO	Dept. of Taxation
HAWAII	Dept. of Taxation	OKLAHOMA	Tax Commission
IDAHO	Tax Commission	OREGON	Dept. of Revenue
ILLINOIS	Dept. of Revenue	PENNSYLVANIA	Dept. of Revenue
INDIANA	Dept. of Revenue	RHODE ISLAND	Dept. of Revenue
IOWA	Dept. of Revenue	SOUTH CAROLINA	Dept. of Revenue & Regulation
KANSAS	Dept. of Revenue	SOUTH DAKOTA	Dept. of Revenue
KENTUCKY	Dept. of Revenue	TENNESSEE	Dept. of Revenue
LOUISIANA	Dept. of Revenue	TEXAS	Office of the Texas Comptroller
MAINE	Dept. of Administrative & Financial Services	UTAH	Tax Commission
MARYLAND	Comptroller	VERMONT	Dept. of Taxes
MASSACHUSETTS	Dept. of Revenue	VIRGINIA	Dept. of Taxation
MICHIGAN	Dept. of Treasury	WASHINGTON	Dept. of Revenue
MINNESOTA	Dept. of Revenue	WEST VIRGINIA	Tax Dept.
MISSISSIPPI	Dept. of Revenue	WISCONSIN	Dept. of Revenue
MISSOURI	Dept. of Revenue	WYOMING	Dept. of Revenue

Table 8 shows whether or not each state used private collection agency to collect state delinquent taxes.

Table 8 Use of Private Collection Agency for Tax Collection

State	Private Collection Agency	State	Private Collection Agency
ALABAMA	Never used	MONTANA	from 2004-2007, and from 2009-present
ALASKA	Only from 2006 to 2007	NEBRASKA	Since 2007
ARIZONA	Never used	NEVADA	Unknown
ARKANSAS	Never used	NEW HAMPSHIRE	Unknown
CALIFORNIA	Since 1984	NEW JERSEY	Since 1992
COLORADO	Since the 1990s	NEW MEXICO	Since 1978
CONNECTICUT	Unknown	NEW YORK	Since the 1990s
DELAWARE	Unknown	NORTH CAROLINA	Unknown
FLORIDA	Since the 1990s	NORTH DAKOTA	Unknown
GEORGIA	Since 1996	OHIO	Currently use, but unknown starting year
HAWAII	Used until 2000, but not from 2001	OKLAHOMA	Unknown
IDAHO	Used until 2009, but not from 2010	OREGON	Since 1994
ILLINOIS	Since the 1990s	PENNSYLVANIA	Unknown
INDIANA	Unknown	RHODE ISLAND	Unknown
IOWA	Since the 2000s	SOUTH CAROLINA	Since 1994
KANSAS	Since 1996	SOUTH DAKOTA	Since 2004
KENTUCKY	Used from 1980s-1990s, but not from 2000s	TENNESSEE	Never used
LOUISIANA	Since 1997	TEXAS	Since 2000
MAINE	Since the 1990s	UTAH	Since 1994
MARYLAND	Since 1994	VERMONT	Since 1996
MASSACHUSETTS	Currently use, but unknown starting year	VIRGINIA	Since the 1990s
MICHIGAN	Since 1987	WASHINGTON	Never used
MINNESOTA	Unknown	WEST VIRGINIA	Since the 1990s
MISSISSIPPI	Since the 1990s	WISCONSIN	Since the 1990s
MISSOURI	Since 1983	WYOMING	Never used

The dependent variables are the measures of agency costs resulting from shirking and overzealous collection. I use four dependent variables to measure agency costs. First, as a measure of the cost of shirking, the most accurate and direct way to measure effectiveness of the delinquent tax collection methods is to calculate the ratio of delinquent tax collection costs to collected delinquent tax revenues. However, it is difficult to collect the data on cost for delinquent tax collection and amount of collected delinquent tax revenues. State governments do not report delinquent tax collection costs from overall tax administration costs and also they do not report the amount of collected delinquent tax revenue separately from the total amount of collected tax revenue. Thus, alternatively, to measure the effectiveness of delinquent tax collection (or the agency cost of shirking), I use the following two proxies:

Proxy 1: the ratio of state tax department expenditures to total tax revenue collected, and
Proxy 2: the ratio of taxes receivable to total tax revenue collected.

For proxy 1, state tax department's expenditures are standardized by collected tax revenue. That proxy shows the tax administrative cost for collecting \$ 1,000 of tax revenue. For proxy 2, taxes receivable inventory is standardized by collected tax revenue. That proxy represents the amount of outstanding delinquent taxes per \$ 1,000 of tax revenue.

The data on state tax department expenditures are taken from each state's *Comprehensive Annual Financial Report (CAFR)* recommended by the Governmental Accounting Standards Board (GASB) and annual reports of the state tax department. The expenditure data are also collected by data request email and telephone contacts. The data on tax revenue collected is taken from the U.S. Census data base and CAFR. The information on taxes receivable is also taken from each state's *CAFR* which is the only publicly assessable source of the information on state delinquent taxes, called "taxes receivable" in the report. Usually, since the 2000's, the CAFRs show the information on taxes receivable.

Second, as proxies to measure the fairness of tax collection processes (or the agency cost due to overzealous collection), I use the following two types of annual numbers of tax appeals standardized to the state population:

Proxy 3: the annual number of tax appeals, which were filed in the independent tax appeal forum, per thousand capita, and

Proxy 4: the annual number of tax appeals, which were filed in tax appeal forum in the state tax department, per thousand capita.

The majority of the data on tax appeal caseloads is collected by data request email and telephone contacts, and some data on tax appeal caseloads comes from the tax appeal agency annual reports.

For control variables, X_{it} , are covariates that affect the dependent variables—agency costs—in tax collection. Controls consist of the following variables: gross state product (GSP) per capita,

tax-payment per capita, unemployment rate, and governor's party. First, the annual gross state product (GSP) per capita and the tax-payment per capita are included in regression equations to control inputs in the revenue production function, except for collection effort. The gross state product variable is used as a proxy to measure the tax bases, and the data are taken from the *U.S. Bureau of Economic Analysis*. The tax-payment per capita is used to measure tax burden as a proxy to measure tax rate. The data is taken from the U.S. Census.

Second, population, unemployment rate, and governor's party variables are included in regression equations to control socioeconomic characteristics. The population variable measures the size of the state, and the data are taken from the *U.S. Bureau of the Census, Statistical Abstract of the United States*. The unemployment rate variable captures economic fluctuation over time, and the data are taken from the *U.S. Bureau of Economic Analysis*. The governor's party variable measures political attitude. The data is taken from the Council of State Government's *Book of the States* from 2000 to 2011.

4.4 Models and Estimations

4.4.1 Estimating the Effect of Private Tax Collection on Procedural Fairness

To estimate the effect of collector type on non-financial outcomes, in particular procedural fairness, I use random effect model. I assume that collection method, such as private or public collection, can be strictly exogenous to the number of tax appeals because filing tax appeals in tax courts and complaining tax collector's improper collection behavior can be considered independent of the collector type. Under this strict exogeneity assumption, I employ Prais-Winsten estimation for estimating the effect of private tax collection on the numbers of tax appeals filed in the independent tax appeal agency and tax department. Prais-Winsten estimation is a type of feasible GLS (generalized least squares) to correct for first-order autoregressive, AR (1), which is the most usual type of serial correlation in panel data. The time serial correlation is more important problem than heteroskedasticity "because it usually has a larger impact on standard errors and the efficiency of estimators than does heteroskedasticity" (Wooldridge 2009: 435). The following two regression analyses are conducted to measure procedural fairness of tax

collection method (or overzealous collection):

Tax Appeal (Tax Court) $_{it} = \alpha + \beta$ Private Collection Agency Dummy $_{it} + \delta X_{it} + \varepsilon_{it}$, and

Tax Appeal (Tax Dept.) $_{it} = \alpha + \beta$ Private Collection Agency Dummy $_{it} + \delta X_{it} + \varepsilon_{it}$.

4.4.2 Estimating the Effect of Private Tax Collection on Financial Effectiveness

To estimate the effects of collector type on financial outcomes, in particular financial effectiveness, I use fixed effect model and random effect models with an AR (1). First, I use the fixed effect model with an AR(1) disturbance to estimate the effect of private tax collection on collection cost because collector type on administrative costs is more than likely not exogenous. The type of collector will influence administration costs, and administration costs will influence collector type. Second, I employ the random effect model with an AR(1) disturbance—the Baltagi-Wu(1999) GLS estimator—to estimate the effect of collector type on delinquent tax inventory because I assume that paying taxes can be considered independent of the collector type.

The following two regression analyses are conducted to measure effectiveness of tax collection method (or shirking):

Collection Cost $_{it} = \alpha + \beta$ Private Collection Agency Dummy $_{it} + \delta X_{it} + \varepsilon_{it}$, and

Delinquent Tax $_{it} = \alpha + \beta$ Private Collection Agency Dummy $_{it} + \delta X_{it} + \varepsilon_{it}$.

4.5 Results

4.5.1 Effect of Private Collection on Tax Appeal Filed in Independent Tax Court

Table 9 shows the results of four regressions to estimate the effect of tax collection outsourcing on the number of tax appeals filed in state tax court, which is independent from state tax department. In the first regression, (1), the effect of collector type on tax appeal is estimated without any control variables. In the second regression, (2), the effect of collector type on tax appeal is measured with five control variables, from Gross State Product to Republican Governor,

to control political-socioeconomic factors. In the third regression, (3), I add year dummies to regression (3) to control time-specific (or year-specific) effects. Finally, in the four regression, (4), not only political-socioeconomic factors and control time-specific effect but also the autoregressive (or serial) correlation is controlled. I focus on the fourth regression to interpret the results.

Table 9 Estimates of the Effect of Private Collection on Tax Appeal Filed in Independent Tax Court

Variable	(1)	(2)	(3)	(4)
Private Collection Agency	-0.058 (-1.56)	-0.032 (-1.01)	-0.019 (-0.77)	-0.018 * (-2.50)
Gross State Product (Tax Base)		-0.001 (-0.80)	-0.003 (-1.49)	-0.003 ** (-2.67)
Tax-payment (Tax Burden)		0.004 (0.43)	0.017 (1.58)	0.026 ** (2.85)
Population		-0.000 (-1.02)	-0.000 (-0.38)	0.000 (0.12)
Unemployment rate (%)		0.003 (0.68)	-0.023 ** (-2.90)	-0.032 *** (-4.76)
Republican Governor		-0.012 (-0.78)	-0.026 (-1.37)	-0.033 * (-2.42)
Controls	No	Yes	Yes	Yes
Year Dummies	No	No	Yes	Yes
AR (1)	No	No	No	Yes
R-square	0.020	0.038	0.179	0.190
Number of Observation	175	175	175	175
legend: * p<.05; ** p<.01; *** p<.001				
(): z-value				

The results shows that private collection reduces the number of tax appeals filed in tax court by about 19 cases per thousand people when compared to tax collection by using the public employee over time and across the states. It does not support the second hypothesis, “*the agency cost resulting from over-enforcement under the incentive-based contract is larger than the agency cost under the fixed wage contract in tax collection.*”

4.5.2 Effect of Private Collection on Tax Appeal Filed in State Tax Department

Table 10 shows the results of four regressions to estimate the effect of tax collection outsourcing on the number of tax appeals filed in tax appeal division within state tax department.

Table 10 Estimates of the Effect of Private Collection on Tax Appeal Filed in Tax Departments

Variable	(1)	(2)	(3)	(4)
Private Collection Agency	-0.057 (2.32)	-0.066 * (1.97)	0.093 * (2.54)	0.093 *** (4.19)
Gross State Product (Tax Base)		-0.006 *** (3.31)	0.005 (1.67)	0.005 ** (2.28)
Tax-payment (Tax Burden)		-0.011 (-1.30)	-0.026 (-1.43)	-0.026 ** (-2.95)
Population		0.000 (1.12)	0.000 (0.99)	0.000 * (2.19)
Unemployment rate (%)		0.001 (0.21)	-0.020 (-1.61)	-0.020 (-1.84)
Republican Governor		0.004 (-1.90)	0.132 (3.57)	0.132 *** (3.64)
Controls	No	Yes	Yes	Yes
Year Dummies	No	No	Yes	Yes
AR (1)	No	No	No	Yes
R-square	0.025	0.084	0.297	0.297
Number of Observation	85	85	85	85
legend: * p<.05; ** p<.01; *** p<.001				
(): z-value				

The result of the fourth regression, (4), indicates that private collection increases the number of tax appeals filed in tax department by about 93 cases per thousand people when compared to tax collection by using the public employee over time and across the states. It does support the second hypothesis, “*the agency cost resulting from over-enforcement under the incentive-based contract is larger than the agency cost under the fixed wage contract in tax collection.*”

4.5.3 Effect of Private Collection on Collection Cost

Table 11 shows the results of four regressions to estimate the effect of tax collection outsourcing on collection costs.

Table 11 Estimates of the Effect of Private Collection on Collection Cost

Variable	(1)	(2)	(3)	(4)
Private Collection Agency	-26.109 (-1.00)	-30.686 (-1.23)	-24.970 (-0.98)	-52.206 † (-1.75)
Gross State Product (Tax Base)		3.266 * (2.31)	1.775 (0.66)	-3.285 (-0.97)
Tax-payment (Tax Burden)		-48.336 *** (-5.97)	-47.777 *** (-5.52)	-44.158 *** (-4.90)
Population		-0.011 (-0.81)	-0.014 (-0.98)	-0.002 (-0.08)
Unemployment rate (%)		-0.107 (-0.04)	-5.534 (-0.71)	-4.506 (-0.49)
Republican Governor		4.248 (-0.34)	9.043 (0.70)	-7.490 (-3.48)
Controls	No	Yes	Yes	Yes
Year Dummies	No	No	Yes	Yes
AR (1)	No	No	No	Yes
R-square	0.005	0.179	0.227	0.018
Number of Observation	230	230	230	207
legend: † < .10; * p<.05; ** p<.01; *** p<.001				
(): t-value				

The result of the fourth regression, (4), shows that private collection decreases administrative costs by about \$ 52 per thousand dollar of tax revenue when compared to tax collection by using the public employee over time and across the states. It does support the first hypothesis, “*the agency cost resulting from shirking under the fixed wage contract is larger than the agency cost under the incentive-based contract in tax collection.*”

4.5.4 Effect of Private Collection on Delinquent Tax Inventory

Table 12 shows the results of four regressions to estimate the effect of tax collection outsourcing on collection costs.

Table 12 Estimates of the Effect of Private Collection on Delinquent Tax Inventory

Variable	(1)	(2)	(3)	(4)
Private Collection Agency	-2.496 (-0.25)	0.797 (0.08)	-1.240 (-0.13)	-0.651 (-0.06)
Gross State Product (Tax Base)		-0.220 (-0.33)	-1.506 (-1.71)	-1.031 (-1.12)
Tax-payment (Tax Burden)		-21.368 * (-2.40)	-29.594 ** (-3.16)	-21.748 * (-2.15)
Population		-0.011 (-0.73)	-0.001 (-0.54)	-0.001 (-0.86)
Unemployment rate (%)		2.603 * (-2.40)	1.660 (0.62)	4.079 (3.12)
Republican Governor		6.124 (1.41)	4.727 (1.08)	8.262 (1.65)
Controls	No	Yes	Yes	Yes
Year Dummies	No	No	Yes	Yes
AR (1)	No	No	No	Yes
R-square	0.003	0.019	0.024	0.033
Number of Observation	356	356	356	356
legend: * p<.05; ** p<.01; *** p<.001				
(): t-value				

The result of the fourth regression, (4), indicates that private collection has no statistical effect on the delinquent tax inventory when compared to tax collection by using the public employee over time and across the states, providing a conclusion that private collectors do not statistically reduce the amount of tax receivables. Therefore, it does not support the first hypothesis, “*the agency cost resulting from shirking under the fixed wage contract is larger than the agency cost under the incentive-based contract in tax collection.*”

4.5.5 Comparison and Summary of Regression Results

Table 13 shows the results of four regressions, where political-socioeconomic factors, time-specific effect, and the autocorrelation are controlled, to estimate the effect of tax collection outsourcing on procedural fairness and financial effectiveness.

Table 13 Comparison and Summary of Regression Results

Variable	Appeal(Court)	Appeal(Dept.)	Admin. Cost	Delinquent Tax
Private Collection Agency	-0.018 * (-2.50)	0.093 *** (4.19)	-52.206 † (-1.75)	-0.651 (-0.06)
Gross State Product (Tax Base)	-0.003 ** (-2.67)	0.005 ** (2.28)	-3.285 (-0.97)	-1.031 (-1.12)
Tax-payment (Tax Burden)	0.026 ** (2.85)	-0.026 ** (-2.95)	-44.158 *** (-4.90)	-21.748 * (-2.15)
Population	0.000 (0.12)	0.000 * (2.19)	-0.002 (-0.08)	-0.001 (-0.86)
Unemployment rate (%)	-0.032 *** (-4.76)	-0.020 (-1.84)	-4.506 (-0.48)	4.079 (3.12)
Republican Governor	-0.033 * (-2.42)	0.132 *** (3.64)	-4.490 (-3.48)	8.262 (1.65)
Controls	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
AR (1)	Yes	Yes	Yes	Yes
R-square	0.190	0.297	0.018	0.033
Number of Observation	175	85	207	356
(): z-value		z-value	t-value	t-value
legend: † <.10; * p<.05; ** p<.01; *** p<.001				

For the effect of tax collection outsourcing on procedural fairness, results of tax appeal regressions are mixed. The effect of private collection on case load of tax appeal depends on where a tax appeal is filed. Tax collection outsourcing is more likely than in-house collection to increase the number of tax appeal filed in state tax department, but tax collection outsourcing is more likely than in-house collection to reduce the number of tax appeal filed in independent tax court. One of possible explanation about this mixed result is that private tax collectors increase

the number of tax appeals which are first filed in tax department. However, after most of cases are settled through the informal conference and hearing in appeal division within the state tax department, unsettled cases (more challenging cases) are forwarded to tax court. In short, private collection increase the number of tax appeal but the characteristic of tax appeal is not so serious because most cases can be settled in state tax department without tax court.

For the effect of tax collection outsourcing on financial effectiveness, results of related regressions are also mixed. Tax collection outsourcing is more likely than in-house collection to reduce the tax administrative costs, but tax collection outsourcing have no statistical effect on amount of delinquent tax. We can think of two different impacts of private collection on financial effectiveness separately. While private collection is not financially effective in terms of amount of delinquent taxes, private collection is financially effective in terms of cost-saving.

4.6 Conclusion

Although since the nineteenth century most countries have shifted the tax collection system from tax farming to tax bureaucracy, since the 1980s many state governments in the U.S. have been using private debt collection agencies to recover their tax debts. However, there is no empirical study of this recent practice. In this study, I empirically analyze this recent new trend of tax administration, in particular delinquent tax collection outsourcing. By using state panel data from 2000 to 2011 and regression models, I estimate the effects of tax collection outsourcing on both the effectiveness and fairness in tax administration.

While the results are mixed, there are two implications based on the results. First, tax collection outsourcing leads to negative effect on procedural fairness, but the degree of seriousness of the negative effect is modest. Private tax collectors increase the number of tax appeals which are first filed in the tax appeal division within the state tax department. However, the majority of cases are settled through the informal conferences and hearings within the state tax department, and a few of unsettled cases are forwarded to independent tax court or tax board. In short, most cases are settled in the administrative level, not judicial level.

The contemporary contracting out delinquent tax collection is not identical to tax farming in history. The contemporary contracting out delinquent tax collection is a part-privatized tax collection while tax farming was a full privatization of tax collection. The current outsourcing of delinquent tax collection is to supplement the public tax collection agencies while the tax farming was to substitute for the bureaucratic collection system. In addition, the current contracting out tax collection is different from historical tax farming in terms of the extent to which the taxpayer is protected by legal and administrative system. Therefore, we can expect that under the current situation, negative effects of private collectors on the taxpayer would be relatively lower than did the formal model and ancient practice of tax farming.

Second, private tax collectors reduce the tax administrative costs, but it has no statistical effect on amount of delinquent tax. While private collection is not financially effective in terms of recovery of delinquent taxes, private collection is financially effective in terms of cost-saving.

CHAPTER 5

CONCLUSION

The purpose of this dissertation is to explore the question about the government's contractual choice of tax collection between tax farming and tax bureaucracy. It would be a challenge to the assumption that tax collection is an inherent function of the government. This dissertation will consist of three essays, and the research will be built on the theory of agency and conducted through the following three steps: historical review, formal model, and data analysis.

The first essay shows that the government's contractual choice of tax collection is a product of underlying endogenous mechanisms of tax collection contracts and time-and-country specific exogenous constraints in tax collection history. Under exogenous conditions until the eighteenth century, such as the underdeveloped bureaucracy, monitoring infrastructure, and capital market, the predatory government had chosen tax farming which is a self-fundable and self-motivated tax collection system. Under this unfavorable situation, tax farming provided the government with stable revenue at low collection costs and risks. However, it leads to brutal tax collection which was ultimately costly to both the government and taxpayer. Meanwhile, under exogenous conditions since the eighteenth century, such as the developed bureaucracy, monitoring infrastructure, and capital market, the limited government has chosen a fixed wage contract of tax bureaucracy which is a control-based contract and an organizationally innovative tax collection method. It provides governments with command-control systems over whole tax collection processes and provides taxpayers with procedurally fair collection processes. Tax bureaucracy solves the agency problem of tax farmers' overzealous tax collection, but it leads to shirking. In addition, the government confronts the problem of rigid cost structure of tax bureaucracy, and has to assume all of the tax revenue risks. In short, both tax farming and tax bureaucracy have their own relative comparative superiority and inferiority to each other due to the tradeoff among agency costs for tax collection contracts.

The second essay analyzes the relative superiority of tax collection contracts through the development of a formal model and generating comparative statics. The formal model shows that

the government can indirectly choose the level of effort of the tax collection agent by offering each a different compensation scheme to maximize its tax revenue. However, compensation-to-effort mapping leads to a trade-off among agency costs. Therefore, when choosing a contractual form of tax collection, the government needs to consider not only the simple compensation-to-effort mapping issue but also agency costs resulting from such a mapping. Furthermore, the government needs to consider not only revenue and cost in the short-run, but also the impacts of the level of collection efforts and agency costs on the change of tax base over time in the long-run. For an application to contemporary case, the model implies that Federal delinquent income tax collection outsourcing may increase gross tax revenue and tax collection rate, but these benefits of an incentive-based contract may be partly offset by increasing compensation cost and social costs associated with taxpayer's harassment.

The third essay empirically examines a recent direction in tax collection: reintroduction of tax farming. This study attempts to measure the effects, in particular agency costs, of different contract forms on effectiveness and fairness by using state panel data for the years 2000 to 2011 and the regression method. The key hypothesis is that delinquent tax collection outsourcing is financially effective, but negatively impacts procedural fairness in tax collection. The empirical results are mixed. The results imply two things. In terms of the financial effectiveness, tax collection outsourcing reduces tax administration cost, but it has no statistical effect on the recover delinquent taxes. Meanwhile, in terms of the procedural fairness, tax collection outsourcing increases the number of tax appeals filed in the tax appeal division within state tax department, but the outsourcing does not increase the number of tax appeals filed with outside-independent tax appeal agency. While private tax collectors lead to negative effect on procedural fairness, the degree of seriousness of the negative effect is modest in the contemporary government.

REFERENCES

- ACA International (2007). *Top Collection Markets Survey, For Period: January 1 – December 31, 2006*, Association of Credit and Collection Professionals
- Ackerberg, Daniel A. and Maristella Botticini (2000) “The Choice of Agrarian Contracts in Early Renaissance Tuscany: Risk Sharing, Moral Hazard, or Capital Market Imperfections,” *Explorations in Economic History*, 37: 241-257
- Adams, C. (1999). *For Good and Evil: The Impact of Taxes on the Course of Civilization*, New York: Madison Books
- Afifi, Abdelmonem, Virginia A. Clark, and Susanne May (2004) *Computer-Aided Multivariate Analysis*, 4th Ed., Boca Raton, Florida, Chapman & Hall/CRC
- Alexander, Frank S. (2000) “Tax Lines, Tax Sales, and Due Process,” *Indiana Law Journal*, 75: 747-807
- Allen, Douglas W. and Dean Lueck (1999) “The Role of Risk in Contract Choice,” *Journal of Law, Economics, & Organization*, 15 (3): 704-736
- Allen, Douglas W. and Dean Lueck (1995) “Risk Preferences and the Economic of Contracts,” *American Economic Review*, 85 (2): 447-51
- Allingham, Michael G., and Agnar Sandmo (1972). “Income Tax Evasion: A Theoretical Analysis,” *Journal of Public Economics*, 1 (3-4): 323-338
- Alm, James. (1999). “Tax Compliance and Administration,” In Hildreth, Bartley W., and James A. Richardson (Ed.), *Handbook of Taxation*, New York: Marcel Dekker
- Anderson, Eugene, and Pauline Anderson (1968) *Political Institutions and Social Change in Continental Europe in the Nineteenth Century*, Berkeley: University of California
- Ang, James S. and Don R. Cox. (1997). “Controlling the Agency Cost of Insider Trading,” *Journal of Finance and Strategic Decision* 10 (1): 15-25
- Ang, James S., Rebel A. Cole, and James Wuh Lin (2000). “Agency Costs and Ownership Structure,” *Journal of Finance* 55 (1): 81-106
- Armstrong, John A. (1972) “Old-Regime Governors: Bureaucratic and Patrimonial Attributes,” *Comparative Studies in Society and History*, 14: 2-29
- Ardant, Gabriel (1975) “Financial Policy and Economic Infrastructure in Modern States and Nations,” 164-242 In *The Formation of National States in Western Europe*, edited by C. Tilly, Princeton, NJ: Princeton University

- Arrow, Kenneth J. (1970) *Essays in the Theory of Risk Bearing*, Chicago: Markham Pub. Co.
- Ashley, M. P. (1934) *Financial and Commercial Policy under the Cromwellian Protectorate*, Oxford: Oxford University Press
- Ashton, R. (1956) "Revenue Farming under the Early Stuarts," *Economic History Review*, 8 (3): 310-322
- Auerbach, Alan J., and James R. Hines Jr. (2001). "Taxation and Economic Efficiency," *National Bureau of Economic Research, Working Paper*, No. 8181
- Azabou, Mongi and Jeffrey B. Nugent (1988) "Contractual Choice in Tax Collection Activities: Some Implications of the Experience with Tax Farming," *Journal of Institutional and Theoretical Economics*, 144: 684-705
- Azabou, Mongi and Jeffrey B. Nugent (1989) "Tax farming: Anachronism optimal Contract? An illustration with respect to Tunisia's weekly markets," In *The New Institutional Economics and Development: Theory and Applications to Tunisia*, ed., Mustapha K. Nabli and Jeffrey Nugent, 178-99, Amsterdam: North-Holland
- Badian, Ernst (1972) *Publicans and Sinners: Private Enterprise in the Service of the Roman Republic*, Ithaca, N.Y.: Cornell University Press
- Barker, T. C. and C. I. Savage (1962) *An Economic History of Transportation in Britain*, London: Hutchinson
- Becker, Gray S. (1968) "Crime and Punishment: An Economic Approach," *Journal of Political Economy*, 76: 169-217
- Berry, William D, E. J. Ringquist, R. C. Fording, and R. L. Hanson (1998). "Measuring citizen and government ideology in the American States, 1960-1993," *American Journal of Political Sciences*, 42 (1): 327-348
- Binney, J. E. D. (1958) *British Public Finance and Administration, 1777-92*, Oxford: Clarendon Press
- Blough, Roy, (1952) *The Federal Taxing Process*, Prentice-Hall, Washington.
- Bonney, Richard. (Eds.) (1995) *Economic System and State Finance*, New York: Oxford University Press
- Bosher, J. F. (1970) *French Finances, 1770-1979: From Business To Bureaucracy*, Cambridge: Cambridge University Press

- Brewer, John (1988) "The English State and Fiscal Appropriation, 1688-1789," *Politics and Society*, 16: 335-86
- Braudel, Fernand (1949) *The Mediterranean and the Mediterranean World in the Age of Philip II*, New York: Harper and Row
- Brown, Courtney. (2007). *Differential Equations: A Modeling Approach*, Series: Quantitative Applications In the Social Sciences 150, Thousand Oaks, California: Sage Publication
- Buchanan, James M. (1967). *Public Finance in Democratic Process*, Chapel Hill: University of North Carolina Press
- Buchanan, James M. (1975). "Public Finance and Public Choice," *National Tax Journal* 28 (4): 383-394
- Buchanan, James M. (1976). "Taxation in Fiscal Exchange," *Journal of Public Economics* 6 (1-2): 17-29
- Buchkovich, P. (1978) "Taxation, Tax Farming, and Merchants In Sixth Century Russia," *Slavic Review*, 37: 381-398
- Butcher, J. G., and Dick, H. (Eds.) (1993) *The Rise and Fall of Revenue Farming: Business Elites and the Emergence of the Modern State in Southeast Asia*, New York: St. Martin's Press
- Chandaman, C. D. (1975) *The English Public Revenue, 1660-1688*, Oxford: Clarendon Press
- Caputo, Michael R. and Dean Lueck (1994). "Modeling Common Property Ownership as A Dynamic Contract," *Natural Resource Modeling*, 8 (3): 225-245
- Cass, David. (1965). "Optimum Growth in an Aggregative Model of Capital Accumulation," *Review of Economic Studies*, 32 (3): 233-240
- Cheung, Steven N.S. (1978) *The Myth of Social Cost*, London: Institute of Economic Affairs
- Chow, Chee W. (1983) "Providing Incentives to Limit Budgetary Slack," *Cost and Management*, 57 (September to October): 37-41
- Cizakca, M. (1993) "Tax-farming and Financial Decentralization in the Ottoman Economy, 1520-1697," *The Journal of European History*, 22: 219-250
- Cizakca, M. (1996) *Comparative Evolution of Business Partnerships: The Islamic World and Europe with Specific Reference to the Ottoman Archive*, New York: E. J. Brill

- Copland, Ian, and Michael R. Godley. (1993) "Revenue Farming in Comparative Perspective: Reflections on Taxation, Social Structure and Development in the Early-Modern Period," In *The Rise and Fall of Revenue Farming: Business Elites and the Emergence of Modern State in Southeast Asia*, ed. John G. Butcher and Howard Dick, 45–68. New York: St. Martin's Press
- Coşgel, Metin M. and Thomas J. Miceli (2009) "Tax Collection in History," *Public Finance Review*, 37 (4): 399-420
- Darling, L. (1996) *Revenue Raising and Legitimacy: Tax Collection and Finance Administration in the Ottoman Empire, 1560-1660*, E. J. Brill
- Diamond Peter A., and James. A. Mirrlees. (1971a). "Optimal Taxation and Public Production I: Production Efficiency," *American Economic Review* 61 (1): 8-27
- Diamond Peter A., and James. A. Mirrlees. (1971b). "Optimal Taxation and Public Production II: Tax Rules," *American Economic Review* 61 (3): 261-78
- Dincecco, Mark (2009) "Fiscal Centralization, Limited Government, and Public Revenues in Europe, 1650-1913," *Journal of Economic History*, 69 (1): 48-103
- Dincecco, Mark (2011) *Political Transformations and Public Finances: Europe, 1650-1913*, New York, NY: Cambridge University Press
- Eger III, Robert J and Hai (David) Guo (2008) "Financing Infrastructure: Fixed Price vs. Price Index Contracts," *Journal of Public Procurement*, 8 (3): 289-301
- Eisenhardt, Kathleen M. (1989) "Agency Theory: An Assessment and Review," *Academy of Management Review*, 14 (1): 57-74
- Elvin, M. (1973) *The Pattern of the Chinese Past*, Stanford
- Ertman, Thomas (1997) *Birth of the Leviathan*, Cambridge: Cambridge University
- Goldstone, Jack (1991) *Revolution and Rebellion in the Early Modern World*, Berkeley and Los Angeles: University of California Press
- Goods, Richard. (1981). "Some Economic Aspects of Tax Administration," *IMF Staff Paper* 28 (2): 249-274
- Guenther, Gary. (2006). "The Internal Revenue Service's (IRS) Use of Private Debt Collection Agencies: Current Status and Issues for Congress," CRS Report RL33231, Congressional Research Service, Washington DC
- Habib, Irfan (1967) "Aspects of Agrarian Relations and Economy in a Region of Uttar Pradesh during the 16th Century," *Indian Economic and Society History Review*, 4: 205-232

- Habib, Irfan (1999) *The Agrarian System of Mughal India, 1526-1707*. 2nd Ed. New York: Oxford University Press
- Hart, Oliver, Andrei Shleifer, and Robert W. Vishny (1997) "The Proper Scope of Government: Theory and an Application to Prisons," *Quarterly Journal of Economics*, 112 (4): 1127-1161
- He, Lie (1972) *Lijin System (in Chinese)*, Taipei: Commercial Press
- Henry, Darren. (2010). "Agency Costs, Ownership Structure and Corporate Governance Compliance: A Private Contracting Perspective," *Pacific-Basin Finance Journal* 18 (1): 24-46
- Hicks, J. (1969) *A Theory of Economic History*, London, New York
- Ho, Ping-ti (1959) *Studies on the Population of China, 1368-1953*, Harvard University Press
- Holcombe, Randall G. (2002). "The Ramsey Rule Reconsidered," *Public Finance Review* 30 (6): 562-578
- Holmström, Bengt, and Paul Milgrom (1994) "The Firm as an Incentive System," *American Economic Review*, 84 (4): 972-991
- Holmström, Bengt, and Paul Milgrom (1991) "Multi-Task Principal-Agent Analyses: Incentive Contracts, Asset Ownership and Job Design," *Journal of Law, Economics and Organization*, VII: 24-52
- Homer, Sidney and Richard Sylla (2005) *A History of Interest Rates*, Fourth Eds., New Brunswick, NJ: Rutgers University Press
- Huckfeldt, R. Robert, C. W. Kohfeld, and Thomas W. Likens. (1982). *Dynamic Modeling: An Introduction*, Series: Quantitative Applications In the Social Sciences 27, Newbury Park, California: Sage Publication
- Huhtala, Anni. (1999). "Optimizing Production Technology Choices: Conventional Production vs. Recycling," *Resource and Energy Economics*, 21 (1): 1-18
- Issawi, C. (1982) *An Economic History of the Middle East and North Africa*, New York
- Jensen, Michael C., and William H. Meckling. (1976). "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of Financial Economics*, 3 (4): 305-360
- Kiser, Edgar (1994) "Markets and Hierarchies in Early Modern Tax Systems: A Principal-Agent Analysis," *Politics & Society*, 22 (3): 284-315

- Kiser, Edger, and Joachim Schneider (1994) "Bureaucracy and Efficiency: An Analysis of Taxation in Early Modern Prussia," *American Sociological Review* 59 (2): 187-204
- Kiser, Edgar, and Joshua Kane (2001) "Revolution and State Structure: The Bureaucratization of Tax Administration in Early Modern England and France," *The American Journal of Sociology*, 107 (1): 183-223
- Kiser, Edgar, and Xiaoxi Tong (1992) "Determinants of the Amount and Type of Corruption in State Fiscal Bureaucracies: An Analysis of Late Imperial China," *Comparative Political Studies*, 25 (3): 300-331
- Koopmans, Tjalling C. (1963). "On the Concept of Optimal Economic Growth," *Cowles Foundation Discussion Paper*, 238
- LaFrance, T. Jeffrey and L. Dwayne Barney (1991). "The Envelop Theorem in Dynamic Optimization," *Journal of Economic Dynamics and Control*, 15 (2): 355-385
- Levhari, David, and Leonard J. Mirman (1980). "The Great Fish War: An Example Using a Dynamic Cournot-Nash Solution," *Bell Journal of Economics*, 11(1): 322-334
- Latouche, R (1961) *The Birth of Western Economy*, London
- Levi, Margaret (1981) "The Predatory Theory of Rule," *Political Society*, 10 (4): 431-465
- Levi, Margaret (1988) *Of Rule and Revenue*, Berkeley, CA: University of California Press
- Mackay, A. (1977) *Money, Price, and Politics in Fifteenth Century Castile*, London: Royal Historical Society
- Levitt, Steven D. (1997). "Using Electoral Cycles In Policy Hiring to Estimate the Effect of Police on Crime," *American Economic Review*, 87(3): 270-290
- Løkkegaard, Frede (1950) *Islamic Taxation in the Classic Period, with Special Reference to Circumstances in Iraq*, Copenhagen: Branner and Korch
- Lueck, Dean (1994) "Common Property as an Egalitarian Share Contract," *Journal of Economic Behavior and Organization*, 25 (1): 93-108
- Ma, Jun (2003) "New Public Management in the Early Modern Period: Lessons from Tax Farming History," *Administrative Theory & Praxis*, 25 (4): 435-456
- Marschak, Jacob and Roy Radner (1972) *Economic Theory of Teams*, New Haven and London: Yale University Press
- Mas-Colell, Andreu, Michael Whinston, and Jerry Grees (1995) *Microeconomic Theory*. New York: Oxford University Press

- Maskin, Eric and Jean Tirole (2008) "Public-Private Partnerships and Government Spending Limits," *International Journal of Industrial Organization*, 26: 412-420
- Matthews, George T. (1958) *The Royal General Farms in Eighteenth-century France*. New York: Columbia University Press
- Melita, Adam. (1997). "Much Ado About \$25 Million: Implications of Privatizing the Collection of Delinquent Federal Taxes," *Virginia Tax Review*, 16 (4): 699-726
- Mirrlees, J. A. (1971). "An Exploration in the Theory of Optimum Income Taxation," *Review of Economic Studies* 38 (2): 175-208
- Mirrlees, J. A. (1976). "Optimal Tax Theory: A Synthesis," *Journal of Public Economics* 6 (4): 327-358
- Mirrlees, J. A. (1976) "The Optimal Structure of Incentives and Authority within an Organization," *Bell Journal of Economics*, 7: 105-31
- Musgrave, Richard A., and Peggy B. Musgrave (1989). *Public Finance in Theory and Practice*
- Newton, A. P. (1918) "The Establishment of the Great Farm of the English Customs," *Transactions of the Royal Historical Society*, 1: 129-155
- Pamuk, Sevket (2004) "The Evolution of Financial Institutions in the Ottoman Empire, 1600-1914," *Financial History Review*, 11 (1): 7-32
- Parker, Geoffrey (1974) "The Emergence of Modern Finance in Europe, 1500-1730," *In The Fontana Economic History of Europe*, 2 Vols. Ed. Carlo Cipolla, 527-622, London: Fontana/Collins
- Pegnato, Joseph A. (1997) "Is A Citizen A Customer?" *Public Productivity & Management Review*, 20 (4): 397-404
- Pipes, R. (1974) *Russia under the Old Regime*, New York: Scribner
- Pointdexter, Georgette C., Lizabeth Ann Rogovoy, and Susan Wachter (1997) "Selling Municipal Property Tax Receivables: Economics, Privatization, and Public Policy in an Era of Urban Distress," *Connecticut Law Review*, 30 (1): 157-210
- Ramsey, Frank P. (1927). "A Contribution to the Theory of Taxation," *Economic Journal* 37 (145): 47-61
- Ramsey, Frank P. (1928) "A Mathematical Theory of Saving," *Economic Journal*, 38(152), 543-559

- Resnick, Mark. T. (2005) "Outsourcing Federal Tax Collection," *Huston Business and Tax Law Journal*, 128-159
- Roberts, M. (1967) *Gustavus Adolphus and the Rise of Sweden*, London: English University Press
- Rosenberg, Hans (1958) *Bureaucracy, Aristocracy and Autocracy: The Prussian Experience 1660-1815*. Cambridge, MA: Harvard University
- Ross, Stephen A. (1973) "The Economic Theory of Agency: The Principal's Problem," *The American Economic Review*, 63 (2): 134-139
- Sabine, B (1980) *A Short History of Taxation*, London: Butterworths
- Salzmann, Ariel C. (1993) "An Ancient Regime Revisited: Privatization and Political Economy in the 18th Century Ottoman Empire," *Politics & Society*, 21: 393-423
- Sandler, Todd and Frederic R. Sterbenz (1990). "Harvest Uncertainty and the Tragedy of the Commons," *Journal of Environmental Economics and Management*, 18 (2): 155-167
- Sayer, Derek (1992) "A Notable Administration: English State Formation and the Rise of Capitalism," *American Journal of Sociology*, 97: 1382-1415
- Schachter, Hindy Lauer (1995) "Reinventing Government or Reinventing Ourselves: Two Models for Improving Government Performance," *Public Administration Review*, 55 (6): 530-537
- Scott, F. (1977) *Sweden: A Nation's History*, Minneapolis: University of Minnesota Press
- Slemrod, Slemrod, and Shlomo Yitzhaki (1996). "The Costs of Taxation and the Marginal Efficiency Cost of Funds," *International Monetary Fund (IMF) Staff Paper*, 43 (1): 172-198
- Smith, Adam (2009) *The Wealth of Nations*, Blacksburg VA: Thrifty Books (Original Work published 1776)
- Smith, Christina N. (1997). "The Limits of Privatization: Privacy in the Context of Tax Collection." *Case Western Reserve Law Review*, 47: (2), 627-670
- Spence, M. and R. Zeckhauser (1971) "Insurance, Information and Individual Action," *American Economic Review*, 61: 380-387
- Srinivasan, T. N. (1973) "Tax Evasion: A Model," *Journal of Public Economics*, 2: 339-346
- Stiglitz, Joseph. E. (1974) "Incentives and Risk Sharing in Sharecropping," *Review of Economic Studies*, 41 (2): 219-255

- Skocpol, Theda (1979) *States and Social Revolutions*, Cambridge: Cambridge University
- Stella, Peter. (1993). "Tax Farming: A Radical Solution for Developing Country Tax Problems?" *International Monetary Fund (IMF) Staff Papers*, 40 (1): 217-225
- Stone, L. (1965) *The Crisis of the Aristocracy, 1558-1641*, Oxford: Oxford University Press
- 'T Hart, M. (1989) "Cities and Statemaking in the Dutch Republic, 1580-1680," *Theory and Society*, 18: 663-87
- 'T Hart, M. (1991) "The Devil or the Dutch: Holland's Impact on the Financial Revolution in England, 1643-1694," *Parliaments, Estates, and Representation*, 11 (1): 39-52
- Thompson, I. A. A. (1976) *War and Government in Habsburg Spain, 1560-1620*, London: Athlone
- Tirole, Jean. (2006). *The Theory of Corporate Finance*, 1st ed. Princeton: Princeton University Press
- Tirole, Jean. (1994). "The Internal Organization of Government," *Oxford Economic Papers*, 46 (1): 1-29
- Torrance, John (1978) "Social Class and Bureaucratic Innovation: The Commissioners for Examining the Public Accounts," *Past and Present*, 78: 55-81
- U. S. Federal Trade Commission (2011). "Annual Report 211: Fair Debt Collection Practices Act," Federal Trade Commission, Washington, DC
- U. S. Department of the Treasury (2003). *Efforts to Develop a Successful Collection Contract Support Program Could Be Enhanced*. Treasury Inspector General for Tax Administration, Audit Report 2003-30-075, U. S. Government Printing Office, Washington, DC
- U. S. Department of Treasury (1999). Annual Report To the Congress: U.S. Government Debt Collection Activities of Federal Agencies. Financial Management Service, U. S. Government Printing Office, Washington DC
- U. S. Federal Trade Commission (2011). "Annual Report 2011: Fair Debt Collection Practices Act," Federal Trade Commission, Washington, DC
- U. S. Government Accounting Office. (1993) "Tax Administration: New Delinquent Tax Collection Methods for IRS," GAO/GGD-93-67, USGAO, Washington, DC
- U. S. General Accounting Office. (1994). "Tax Administration: State Tax Administrators' Views on Delinquent Tax Collection Methods," GAO/GGD-94-59 FS, USGAO, Washington, DC

- U. S. Government Accountability Office. (2008). "Tax Debt Collection: IRS Has a Complex Process to Attempt to Collect Billions of Dollars in Unpaid Tax Debt," GAO-08-728, USGAO, Washington, DC
- U. S. Senate, Republican Policy Committee. (2006). "Private Collection Agencies: Addressing a Piece of the Tax GAP Pie," Washington, DC
- U. S. Department of Treasury. (1999). "Annual Report To the Congress: U.S. Government Debt Collection Activities of Federal Agencies," Financial Management Service, U. S. Government Printing Office, Washington DC
- U. S. Department of Treasury. (2011). "Fiscal Year 2010 Report To the Congress: U.S. Government Receivable and Debt Collection Activities of Federal Agencies," Financial Management Service, U. S. Government Printing Office, Washington DC
- U. S. Department of Treasury. (2010). "Performance and Accountability Report," U. S. Government Printing Office, Washington DC
- Ville, Simon (1990) *Transportation and the Development of the European Economy, 1750-1918*, London: Macmillan
- Webber, Carolyn and Aaron Wildavsky (1986) *A History of Taxation and Expenditure in the Western World*, New York, NY: Simon & Schuster
- Weber, Max (1992) *Economy and Society*. New York, Bedminster Press (Original Work published 1922; Berkeley, CA: University of California 1968)
- Weber, Max (1993) *General Economic History*, Glencoe: Free Press (Original Work published 1961)
- White, Eugene N. (2004). "From privatized to government-administered tax collection: tax farming in eighteenth-century France." *Economic History Review*, LVII (4), 636-663
- Williamson, Oliver E. (1975) *Markets and Hierarchies, Analysis and Antitrust Implications: A Study in the Economics of Internal Organization*, New York: Free Press
- Williamson, Oliver E. (1981) "The Economics of Organization: The Transaction Cost Approach," *American Journal of Sociology*, 87 (3): 548-577
- Williamson, Oliver E. (1985) *The Economic Institutions of Capitalism*, New York: Free Press
- Wooldridge, Jeffrey M. (2009) *Introductory Econometrics: A Modern Approach*, Mason, Ohio: South-Western
- Wink, André. (1983) "Maratha Revenue Farming," *Modern Asian Studies*, 17 (4): 591-628

Zerbe, Richard O. and Dwight D. Dively (1994) *Benefit-Cost Analysis in Theory and Practice*,
New York, NY: HarperCollins College Publishers

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Jang, Sungkyu. (2003) "The Wastewater Reclamation and Reusing Systems," In *The Best Reform Practices in Korean Government for Benchmarking*, eds. Knowledge Center for Public Administration and Policy Graduate School of Public Administration Seoul National University, Seoul: Nanam, pp. 57-76

Jang, Sungkyu. (2003) "Citizen Participation and Solid Waste Facility Construction," In *The Best Reform Practices in Korean Government for Benchmarking*, eds. Knowledge Center for Public Administration and Policy Graduate School of Public Administration Seoul National University, Seoul: Nanam, pp. 145-169

Jang, Sungkyu. (2003) "The Local Economic Development," In *The Best Reform Practices in Korean Government for Benchmarking*, eds. Knowledge Center for Public Administration and Policy Graduate School of Public Administration Seoul National University, Seoul: Nanam, pp. 171-187

Jang, Sungkyu. (2003) "The Reform of the National Tax Service," In *The Best Reform Practices in Korean Government for Benchmarking*, eds. Knowledge Center for Public Administration and Policy Graduate School of Public Administration Seoul National University, Seoul: Nanam, pp. 327-344

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