A COMPARATIVE STUDY OF PERFORMANCE MEASUREMENT IN KOREAN LOCAL GOVERNMENTS USING DATA ENVELOPMENT ANALYSIS AND STOCHASTIC FRONTIER ANALYSIS

by

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DEDICATION

To my parents and my family, who have endlessly loved and supported me.

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ABSTRACT

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This study examines efficiency as a key component of performance, applies new performance measurement techniques to the measurement of local government performance, and verifies theoretical debates on economic, financial, political, and environmental factors related to performance in local government. Improving performance and promoting efficiencies in local government are important issues in both academic and practical public administration. Despite the remarkable development of performance measurement in local government since the 1990s, empirical evidence is still limited on the extent of the utility and practicability of performance measurement in local government.

Results of this research are developed from a study of Korean local governments which have common central government funding, characteristics, and required expenditure record keeping. The results of the research study findings: 1) higher levels of employment of citizens relates to more efficient local governments; 2) local governments having lower expenditures and more independent revenue sources are more efficient local governments; 3) political factors such as mayors' political preferences and citizens' participation in voting during mayors' elections are not related to the efficiency of local government; 4) as the population size of a Korean city increases, the efficiency of the Korean city government increases until the range of population reaches 800,000; 5) increased numbers of public employees in Korean city governments results in decreased efficiency; and 6) consolidated Korean city governments are less efficient than non-consolidated city governments. Findings from this study suggest that in order to improve the performance of any local government there should be the following: smaller size of governments; competition between city governments; economies of scales in government; independent revenue sources; the application of benchmarks; and more performance measurements.

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CHAPTER 1

INTRODUCTION

1.1 Statement of the Problem

Most governments in the world have conducted administrative reform to make 'better government' to operate in the most efficient and effective way. A common phenomenon or explanation of administrative reform at the global level since the 1990s is New Public Management (NPM), which is a market driven management philosophy derived from public choice theory. Typical examples of administrative reform in developed countries are the United Kingdom's Next Steps initiatives, Canada's Public Service 2000 program, Australia's Commonwealth Public Services, the United States' National Performance Review, and New Zealand's Contract State (OECD 2001).

New Public Management theorists believe that market driven reforms can improve the efficiency of government by enhancing competition among public agencies and public employees through several reform tools: budget cuts, personnel reductions, and performance management (Kaboolian 1998). For example, The National Performance Review (NPR), established by the Clinton-Gore administration in order to improve the performance of the federal government, suggests common characteristics for successful government: "(1) cutting red tape; (2) putting customers first; (3) empowering employees to get results; and (4) cutting back to basics: producing better government for less" (NPR 1993, 16-17).

The ideas of New Public Management (NPM) also strongly influence the activities of local governments as well as central governments. In particular, financial constraint in local government requires continuous efforts for improving performance in producing public services and managing local government (Kopczynski and Lombardo 1999; Worthington and Dollery 2002).

One of the most meaningful NPM movements or efforts for improving government performance is performance measurement. It has been used as a useful tool for restructuring local government organizations and improving their overall government performance (Poister and Streib 1999). In particular, a significant amount of research regarding the use of performance measurement in local governments has been expanded since the mid-1990s (Ammons 1995a; Swiss 1995; Foltin 1999; Kopczynski and Lombardo 1999).

Despite the remarkable development of performance measurement in local government since the 1990s (Hatry 1999), empirical evidence on the extent of the utility and practicability of performance measurement in local governments is still somewhat limited and an open question. Moreover, most performance measurement techniques used tend to be simple input and output measures. They do not meaningfully connect to the decision making process, and do not typically involve external parties in improving performance in local government (Poister and Streib 1999; Kopczynski and Lombardo 1999).

Therefore, more systematic, practical, and empirical studies are needed to accurately measure performance in local government. This study will be an attempt to examine performance components such as efficiency, to apply newer performance measurement techniques to the measurement of local government performance, and to verify theoretical debates on several political and economic factors related to performance in local government.

1.2 Purpose of the Study

Improving performance and promoting efficiencies in local government are extremely important issues in the academic public administration field as well as among practical professionals. The degree of improvement of performance and the promotion of efficiency in local government can be identified through accurately measuring or evaluating performance inside government organizations or among local governments.

In particular, comparing performance among local governments is also a useful means to assess the degree of performance in local government. In other words, the empirical application or systematic comparisons of performance among local governments enable us to comparatively evaluate performance in local government more easily and clearly shows whether or not a specific local government is doing well for citizens in the most efficient way. Ammons (1996) argues that comparing performance among local government is one of the best ways to ascertain the best practice local governments by identifying management techniques or service delivery strategies that bring the best performance.

With regard to the technical measurement methods of performance in government, there is much academic and professional debate about identifying, measuring, and analyzing appropriate performance and efficiency variables, which is due to a scarcity of information and techniques. Current improvements in developing data sets and analysis methods for measuring performance by related disciplines (i.e., economics, management, engineering, etc., rather than public administration) may well provide important directions and conclusions for better performance measurement.

The main purpose of this study is to measure and compare "the performance of local government" and to find out the best practices local government and the related factors that influence government performance. In order to do this, this study, as for its main methodologies, uses Data Envelopment Analysis (DEA), Stochastic Frontier Analysis (SFA), and Tobit Regression Analysis, which have been heretofore successfully applied to comparative governments, marketing, engineering, and logistics problems and topics.

1.3 Research Questions

One of the most important reasons for comparing or measuring performance in local government is to diagnose the present performance *status quo* of each local government, and furthermore, to remove inefficient elements of local government by learning management skills and organization composition from the the best practice or the best performance local governments, and finally, to become the best performance local government (Osborne and Plastrik 2000; Nyhan and Martin 1999a). Here the best practice or the best performance local government refers to the local government which can deliver or produce public services of local government and achieve or accomplish the ultimate goals of local government in the most efficient way (Kanigel 1997).

Although since the 1990s performance measurements of local governments have been developed remarkably, systematic attempts for comparing performance among local governments are somewhat limited and are, in a meaningful way, still an open question (Kopczynski and Lombardo 1999; Poister and Streib 1999).

This study compares and measures performance in local government using comparable data and utilizing commonalities of structure and functions among local governments. This study will focus on Korean city governments as subjects of study for the following reasons: First, there are few differences in the structures, tax systems, and functions between city governments in Korea. Most previous studies focus on municipalities having a unitary government system, not a federal government system, because local governments having unitary government systems are relatively more homogeneous than federal government systems in terms of their tax systems, functions, and structures of government for providing public services. Second, there are few prior comparative studies of performance that have examined Korean local governments. Finally, few studies on Korean local government performance are found in the international literature of public administration.

Most studies related to performance study of local governments come from European countries, Australia, and the Untied States. In this study, performance theories and hypotheses based upon previous studies will be tested again through studying Korean local governments. This study will also contribute to making a more applicable theory to other countries' local governments. In other words, findings and information developed in this research will extend beyond the boundaries of specific Korean local governments.

For these reasons, the main research questions of this study that use Korean local governments as study subjects are:

(1) How do local governments vary in their performance in providing public services (via Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA)?

(2) What variables and/or factors relate to the performance or efficiency of local governments in providing public services (via ANOVA and Tobit Regression Analysis)?

1.4 Importance of the Study

Measuring performance (often called 'performance measurement') in local governments is important for both academic and practical reasons. First, academics have long discussed performance as an important concept since the American Progressive political movement and the scientific management movement (Fry 1989; Light 1997; McGregor 2000). Performance in and of government has been a most important value as well as a major issue. Woodrow Wilson, a founding father of public administration, in his article "The Study of Administration" (1887) argues that "the objective of the study of administration is to discover what government can properly and successfully do and to do these things in the most efficient way with least costs and energy" (Wilson 1887, 197).

Frederick Taylor (1911), the father of scientific management, argues for the establishment of objective performance standards through rigorous systematic investigation. More substantial studies of performance measurement have also been identified, published, and accepted by Hatry and his colleagues at the Urban Institute since the 1970s (Epstein 1992). In addition, the 1990s reinventing government movement renewed or reinvigorated interest in performance measurement (Poister and Streib 1999). Even though performance measurement has been discussed, reviewed, studied, and accepted as a professional and academic issue for decades, measuring government performance needs more empirical studies.

Second, in practical terms, more accurate predictors of measuring performance in government are needed to set more achievable goals and objectives, as well as for planning and other program activities. In order to accomplish any governmental goals and objectives, or allocate resources to programs, better monitoring methods and evaluations are needed which suggest whether progress is being made, and if modifications in plans and programs are needed (Hatry et al. 1990).

Put simply, Osborne and Gaebler, in their book ***Reinventing Government*** (1992), point out the need and importance of performance measurement as: “If you don’t measure results, you can’t tell success from failures” (p 147), and likewise, “If you can’t see success, you can’t reward it” (p 198), and “If you can’t recognize failure, you can’t correct it.” (p 152) Therefore, the study of performance measurement is the most essential part for managers to know “how things stand” in order to improve performance in their organizations (Osborne and Gaebler 1992). Ammons (1996) asserts that more sophisticated measurement systems can strengthen management processes, better inform resource allocation decisions, enhance legislative oversight, and increase accountability. Osborne and Plastrik (2000) argue that performance measurement enables officials to hold organizations accountable and introduces consequences for performance. It helps citizens and customers judge the value that government creates for them, and it provides managers with the data they need to improve performance. Behn (2003) maintains that performance measurement can be used for multiple purposes in government: evaluation, control, budget, motivation, promotion, celebration, learning and improvement.

1.5 Organization of the Study

This study is organized into eight chapters. Chapter 1 is the introduction. It provides an overview of this study. It is composed of research problems, the purpose of the study, the importance of the study, research questions, and the organization of the study.

Chapter 2 reviews the background for performance and efficiency in public administration, the major literature of performance measurement in local government, its approaches, and the conceptual framework.

Chapter 3 presents theories of economic efficiency and introduces the background of Korean local governments. More specifically, this chapter deals with major theories of economic efficiency[1] and public choice models, and major factors

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[1] In particular, Farrell's technical efficiency (1957) and Leibenstein's X-efficiency (1966) are most important literature in terms of measurement of efficiency and explanation of cause of efficiency.

which may influence government efficiency. Later, Korean local governments' structure, function, and revenue are reviewed.

Chapter 4 discusses research questions and hypotheses to be answered and tested in this study. Research questions are concerned with the degree of variation of performance among local governments and the major factors related to government performance. Research questions will be answered through testing research hypotheses associated with variation of performance and related performance factors in local government.

Chapter 5 deals with the focus of the study, selection of data, indicators, independent and dependent variables, and statistical methods. This chapter also explains the basic logic and characteristics of Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) as analytic methods for measuring performance in government.

Chapter 6 empirically measures the performance of Korean local governments, answers research questions, and finally verifies research hypotheses to be tested in this study. As main methodologies for analyzing these questions, this chapter uses Data Envelopment Analysis, Stochastic Frontier Analysis, ANOVA, and Tobit Regression Analysis.

Chapter 7 reviews and discusses the findings of the study with regard to government performance and efficiency and its related major factors. Later, it discusses policy issues and the implications related to the improvement of performance in local government.

Finally, Chapter 8 deals with four key issues: the major theme of the study, the summary of findings, limitations of the study, and suggestions for further study.

CHAPTER 2

LITERATURE REVIEW OF PERFORMANCE MEASUREMENT AND THE CONCEPTUAL FRAMEWORK

This chapter discusses public administration theory and public choice theory related to the performance and efficiency of government. Later, it reviews the performance measurement literature and its approaches, and in addition, it contrasts the efficiency concept in public administration and in economics. Finally, in the conceptual framework section each use of the term “efficiency” is examined in detail to develop research questions related to empirical measurement.

2.1 Background for Performance and Efficiency in Public Administration Theory

2.1.1 Public Administration Theory: Managing Government Efficiently

Since the origin of the public administration field, the efficiency of government has been the most important value as well as an important issue. Woodrow Wilson, a founding father of public administration, in his article “The Study of Administration” (1887), argues that “the objective of the study of administration is to discover what government can properly and successfully do, and to do these things in the most efficient way with least costs and energy.” (p 197) To better manage and know the operation of government efficiently and effectively, Wilson (1887) believes that administration must be studied systematically, that government should be operated like a business, and that administration should be a science. In the first text book, ***Introduction to the Study of Public Administration*** (1926), Leonard D. White also agrees that public administration should be the center of modern government, a field of management, and a science. According to White (1926), the objective of public administration is to conduct a public business.

As for the management and principles for improving the efficiency of public administration, Frederick W. Taylor (1911) states that there is a 'one best way' to perform administrative work, and that scientific management can replace the old rule-of-thumb knowledge. Taylor believes that the efficiency of an organization will increase if organizational operations can be planned and controlled systematically by experts using scientific management. Taylor's four principles of scientific management are as follows: (1) management must gather all knowledge of management, and put them into rules, laws, and procedures; (2) management should find the way of the scientific selection and the progressive development of the workmen; (3) management should bring science and the scientifically selected and trained workmen together; and (4) the work duties between management and the workmen should be equal so as to promote harmony between the two groups (Taylor 1911).

Furthermore, Luther Gulick, in his essay "Notes on the Theory of Organization Theory" (1937), applies Taylor's concept of scientific management to the work of the chief executive. Gulick (1937) believes that in order to manage an organization efficiently the role of the chief executive is very important, and that the important task of the chief executive is to deal with POSDCORB (Planning, Organizing, Staffing, Directing, Co-ordinating, Reporting, and Budgeting).

As illustrated above, to traditional public administration theorists, the ultimate goal of public administration is to find a way of managing public organizations efficiently and effectively. However, traditional public administration theorists believe that public administration can improve the efficiency of the public sector by just adopting scientific management and rules from business and private organizations. Traditional public administration theorists also view citizens and public servants as the public-spirited citizen and the neutrally competent public servant (Frederickson and Smith 2003). In other words, to traditional public administration theorists, the efficiency of public organizations is a problem related to the structure of an organization, not individuals and their behaviors.

2.1.2 Public Choice Theory: Managing Bureaucrats Efficiently

The assumptions and theories of traditional public administration, however, are challenged by public choice theory. Public choice theory (often called 'rational choice theory') is a neoclassical economic theory applied to the public sector. To public choice theorists, the efficiency issue of a public organization is not a problem of the structure and function of an organization, but a matter of individual preferences and behaviors. In other words, public choice theorists assume that the efficiency of public organizations can be improved by managing individual preferences and behaviors rather than the structure of an organization.

The intellectual root of public choice theory traces back to Adam Smith's ***The Wealth of Nations*** (1776). According to Smith (1776), people acting in pursuit of their own self-interest can, through the mechanism of the "invisible hand," produce collective benefits that profit all society. Smith's classical economic theory is connected to the public sector by Anthony Down's ***An Economic Theory of Democracy*** (1957), and James Buchanan and Gordon Tullock's ***The Calculus of Consent*** (1962). One of the key features distinguishing these works within traditional public administration theory is that they view citizens and public servants as rational and self-interested actors. In this framework, both the public-spirited citizen and the neutrally competent public servant are replaced with the rational utility maximizer (Frederickson and Smith 2003).

According to James Buchanan and Gordon Tullock (1962), public choice theory has two key assumptions. First, the average individual is a self-interested utility maximizer (called an 'individual's utility function'). This means that an individual knows his/her preferences, can rank his/her preferences, and will choose those expected to maximize individual benefits and minimize individual costs. Second, only an individual, not collectives, makes decisions. This is well known as 'methodology individualism,' and it assumes that collective decisions are the aggregation of individual choices, not a unique property of the group (Buchanan and Tullock 1962).

Buchanan and Tullock's public choice framework is extended into a model of bureaucratic behavior by Gordon Tullock's ***The Politics of Bureaucracy*** (1965), Anthony Down's ***Inside Bureaucracy*** (1967), and William Niskanen's ***Bureaucracy and Representative Government*** (1971). Tullock (1965) argues that the bureaucrat maximizes his or her utility through career advancement, while Down (1967) maintains that bureaucrats' utility can be various according to the typology of the bureaucratic personality. Niskanen (1971) asserts that bureaucrats seek to maximize their budgets.

These scholars again demonstrate that bureaucrats are self-interested utility maximizers rather than neutrally competent public servants.

As for the efficiency of public organizations, traditional public administration theorists focus on the structure and functions of public organizations, while public choice theorists emphasize individuals' preferences, behaviors, and characteristics within public organizations. In terms of a means for improving the efficiency of public organizations, traditional public administration theorists believe that the efficiency of public organizations can be improved through restructuring the structure and function of public organizations, while public choice theorists believe that the improvement of efficiency of public organizations can be achieved by fitting individuals' preference and behaviors into the goals of the organization.

Although it is a debatable issue which theory better explains the efficiency phenomena of public organizations, the most obvious thing is the improvement of the efficiency of government in the public administration field has been and will be the most essential task, topic, and value. In other words, the history of public administration is a history of efficiency. In addition, both public administration theory and public choice theory contribute not only to a better understanding of the efficiency of government, but also to the development of the ways of improving the efficiency of the public sector.

2.2 Performance Measurement in Public Administration

2.2.1 Performance Measurement: Past and Present

Performance measurement is not a new concept but a renewed concept in the current context of public management (Poister 2003). Modern performance measurement in government can be traced back to the turn-of-the-century Progressive political movement and the scientific management movement. Frederick Taylor (1911), the father of scientific management, rejects subjective means of defining work and stresses the importance of using objective measures to describe work. Taylor (1911) argues for the establishment of objective performance standards through rigorous systematic investigation. Objective measures of work are means, not ends, because the descriptions are used to improve the production process (Taylor 1911). Early public administration theorists assume that the appropriate approach to effective decision making is rationality. However, these early efforts in public-sector performance measurement are sidetracked by World War II, but interest and enthusiasm for performance measurement is revived with the social indicator movement (Fry 1989).

During the mid-1960s, social scientists such as Daniel Bell believed that social indicators (e.g., economic indicators) should be compiled and reported. One of the early benchmark publications was Bauer's Social Indicators (1966), the result of a study commissioned by the National Aeronautics and Space Administration (NASA) to examine the impact of the space program on society. Afterwards, Bauer's report,

Toward a Social Report (1966),[2] presented a set of social indicators for measuring government's effectiveness at meeting social needs. Thus, public-sector performance was measured and judged in terms of its effect on society as well as its efficiency. However, initial optimism about the benefits of systematic measurement was replaced by the reality that reporting by itself cannot solve problems or improve performance (Innes 1990).

During the 1970s, tightened budgets, pressures from citizens demanding accountability, and drives to achieve efficiency instigated a search for practical methods of collecting and analyzing performance data (Hatry 1980). The Urban Institute helped to develop a measurement system geared toward local officials' needs. During the 1980s, a number of initiatives in the private sector such as total quality management (TQM) emphasized the importance of performance measurement, quality service, customers' satisfaction, and management by results (Epstein 1992; Wholey and Hatry 1992).

During the 1990s, a number of events in the public administration field renewed or reinvigorated the interest of performance measurement. Taxpayers' revolts, pressure to privatize public services, legislation to control "runaway" spending, and the devolution of many public services required more accountability of government to the public and legislatures in terms of what governments spend and the performance they make. Moreover, the reinventing government movement, mainly dominated by Osborne

[2] President Lyndon B. Johnson directs the Department of Health, Education, and Welfare to develop the necessary social statistics and indicators to supplement those prepared by the Bureau of Labor Statistics and Council of Economic Advisers. With these yardsticks, we can better measure the distance we have come and plan for the way ahead (Bauer 1966).

and Gaebler's ***Reinventing Government*** (1992) and Vice President Al Gore's National Performance Review (NPR), called for a new direction and way for how performance in public agencies could be defined and measured (Poister and Streib 1999).

One of the most important emphases on performance measurement in the 1990s was the 1993 Government Performance and Results Act: This law requires strategic planning and performance reporting by all federal government agencies. Some state governments implement performance measurement, strategic budgeting, and planning such as Texas Tomorrow, Minnesota Milestones, and Oregon Benchmark programs. A few states are more advanced than the federal government's performance measurement systems (Broom and McGuire 1995).

2.2.2 Performance Measurement in Local Government

Notwithstanding no legal requirement for local governments to utilize performance measurement systems, a significant amount of research regarding the use of performance measurement in local governments has been expanded since the mid-1990s (Ammons 1995a; Swiss 1995; Foltin 1999; Kopczynski and Lombardo 1999). Local governments with exemplary performance measurement initiatives have been identified; for example, by Sunnyvale, Palo Alto, New York, Phoenix, Portland, Dayton, and Charlotte, in terms of more scientific and systematic performance measurement systems in the budgeting and management processes through using cutting edge performance management techniques.

Reviews of the extent of performance measurement, however, are somewhat mixed. For example, Ammons (1995a) notes performance measurement and monitoring rates as high as 70-80 percent reported in his surveys. However, Poister and Streib (1999) show that only 38 percent of the cities surveyed make use of performance measurement systems. GASB and the National Academy of Public Administration (1997) argue that the usage rates may have been overestimated in some surveys due to the inclusion of only large municipalities.

Despite the remarkable development of performance measurement in local government since the 1990s (Hatry 1999), empirical evidence on the extent of the utility and practicability of performance measures in local governments is still somewhat limited and contradictory. Moreover, the measures used tend to be low-level input and workload measures, and not available for all programs. They do not meaningfully connect to the decision making process, and do not report to external parties (Poister and Streib 1999; Kopczynski and Lombardo 1999).

Unlike performance measurement, comparing performance among local governments, known as 'comparative performance measurement,' is comparatively new. In other words, the empirical application or systematic comparisons of performance measurement among local governments is a more recent phenomenon. The main reasons for using comparative performance measurement are to find out the best practice local government and to benchmark the local government by comparing performances among comparable local governments and by identifying management techniques or service delivery strategies that bring the best results (Ammons 1996).

One of the earliest efforts for comparing performance measurement among local governments was the Denver Regional Council of Governments in 1978. At that time, the National Center for Productivity and Quality of Working Life compared and examined the performance of local government public services within the Denver metropolitan area, such as police service, fire services, crime prevention services, and general management services. The purpose of that study was to know how managers and administrators were perceived and to uncover main factors in using productivity data by collecting and presenting data in selected public services of local governments (Kopczynski and Lombardo 1999).

The 1980s were somewhat inactive in the field of comparative performance measurement, but in the 1990s the interest and commitment of comparative performance measurement were revived or reinvigorated by a number of local governments (Kopczynski and Lombardo 1999).

Although studies of performance measurement in local government tend to increase, there are still few and limited studies for comparing performance (comparative performance measurement) among local governments (Urban Institute and ICMA 1997; Pollanen 2005). However, there are comparatively more studies on comparing performance among European and Australian local governments at the macro level (Lovell 2000).

2.3 Performance Measurement and Its Approaches

Perhaps the simplest definition of "performance" is "the way in which someone or something functions." This meaning of the term appears to have emerged during the industrial revolution, where it was initially associated with the capabilities and functioning of mechanical devices (Oxford English Dictionary 1989, 544). But within the context of government operations, performance is defined as activities and services of public agencies and programs to the demands of the community and to the community's ability to pay (Epstein 1988). Performance measurement put simply means methods for measuring performance (activities, programs, or services) that governments provide.

But the performance measurement features a number of definitions (Greiner 1996). For instance, performance measurement in the public sector is concerned with the assessment of performance in organizations, organizational units, and programs (Poister 2003). Nyhan and Martin (1999b) define it as "the regular collection and reporting of information about the efficiency, quality, and effectiveness of governmental programs." (p 348) More generally, performance measurement in the public sector is frequently defined as the systematic and continuous assessment of public services that public agencies provide (Epstein, 1988; Holzer and Halachimi 1996; Ammons 1996; Hatry 1999).

Although there are several approaches to performance measurement, such as effectiveness, operating efficiency, productivity, service quality, customer satisfaction, and cost-effectiveness (Hatry 2001; Poister 2003), a common approach to performance measurement is based on a process-oriented model which views performance as an input, process, output, and outcome process. Performance measurement can be largely categorized into input, output, efficiency, and effectiveness measures (Ammons 1995b; Swiss 1995; Foltin 1999). For example, input measures quantify resources used in providing public services; output measures indicate the amount of work completed;

efficiency measures mean the relation between inputs and outputs; and effectiveness measures relate to the intended outcomes or effects of services provided (Greiner 1996).

Generally, efficiency and effectiveness measures among performance measurements are the most common measures (Ammons 1995b). Efficiency measures are explained as the ratio of outputs to inputs; while effectiveness measures are described as the comparisons of outputs to expectations or standards (Collahan 2004; Berman 2006). However, due to difficulties in identifying and measuring outcomes for many typical public services (Kloot 1999; de Bruijn 2002), most scholars today (in particular, most economists) tend to prefer to use efficiency measures rather than effectiveness measures (Mayne and Zapico-Goni 1997).

This study uses the concept of efficiency and its measures as the method for measuring the performance of local government in providing public services for the following reasons: first, efficiency measures are simple and clear to understand because they are based upon the direct relationship between inputs and outputs. Effectiveness measures, in contrast, do not fit this simple input-output model as well as direct outputs because the process by which inputs are converted into consequences is not clear and direct (Worthington and Dollery 2000). Second, efficiency measures may be perceived as being fairer in public organizations because public organizations have more control over inputs that lead to direct outputs, and thus can influence their efficiency more than their effectiveness. Finally, from a practical perspective, it is usually easier to measure efficiency than effectiveness (Pollanen 2005). Effectiveness is much harder to measure because effectiveness (e.g., the outcome of services) is sometimes intangible and it requires social impact analysis.

2.4 Conceptual Framework for This Study

2.4.1 Efficiency in Public Administration

As mentioned above, performance is a much broader concept than efficiency. Efficiency is a component of performance. All performance concepts used in this study are analyzed as efficiency measure (not effectiveness measures) because efficiency measure is the most measurable piece among the whole of performances. More precisely, performance in this study means 'efficiency performance' as a narrow definition of performance.

In order to to use 'efficiency' as a concept and a component method for measuring performance in local government, it is first necessary to clarify what is exactly meant by efficiency. Like performance, efficiency has numerous definitions. A number of scholars explain the concept of efficiency in the public administration and organization fields.

Frederick Taylor (1911), for example, believes that efficiency can be achieved by applying his 'scientific management' concept to the man-machine system in industry. Luther Gulick (1937) describes efficiency as "the accomplishment of the work in hand with the least expenditures of man-power and materials." (p 192) Etzioni (1964) defines efficiency as the "amount of resources needed to produce a unit of output." (p 8) More specifically, efficiency is concerned with how to use resources in an economic way (Etzioni 1964). Epstein (1984) mentions that efficiency is "the ratio of the quantity of service provided (e.g., tons of refuse collected), to the cost, in dollars or labor, required to produce the service." (p 11) In measuring efficiency, a government looks inward to its own operations to determine whether it is producing a reasonable amount of services for each tax dollar (Epstein 1984).

In a simple sense, Gortner et al. (1997) argues that efficiency equals the maximization of productivity, or the greatest possible output for the least input. Hatry (1999) explains efficiency as the ratio of the quantity of input to the quantity of output (or outcomes). It is often called 'technical efficiency' by economists (Hatry 1999). Ammons (2001) describes it as the relationship between the outputs performed and the inputs required to perform it.

More generally, Berman (2006) explains efficiency as "the ratio of outputs (and outcomes) to inputs." (p 7) It describes the cost per activity to achieve given outputs (e.g., the number of counseled clients per counselor who find employment or the number of graduating students per teacher). In this sense, efficiency is very important because it helps stretch budgets further and thereby allows organizations to be more effective (Berman 2006). In sum, the general definition of efficiency is simply the comparison of total outputs to total inputs in an organization (Richman and Farmer 1975). Efficiency measures are generally defined as the ratio of output to input (Collahan 2004).

2.4.2 Efficiency in Economics

In economics, the meaning of efficiency is almost synonymous with the public administration literature, but it comprises various components. Basically, economic efficiency is a concept typically related to the production process in microeconomics. Economic efficiency means that a unit of goods is produced at the lowest cost possible in the production of a unit of goods. In other words, economic efficiency can be achieved when the input cost for producing goods or outputs is as low as possible (Mankiw 2007).

There are several component measures of economic efficiency: Pareto efficiency; Kaldor-Hicks efficiency; X-efficiency, technical efficiency, etc. (Welch et al. 2006). Pareto efficiency and Kaldor-Hicks efficiency are more philosophical concepts. For example, Pareto efficiency or Pareto optimality is an important idea in neoclassical economics applied to engineering, game theory, and the social sciences. The term 'Pareto efficiency' is named after Vilfredo Pareto, an Italian economist who used this term in his research of income distribution and economic efficiency. Given an alternative allocation for individuals, an allocation shift from one individual to another can make the former better without worsening the latter. This is often called a 'Pareto optimization' or 'Pareto improvement.'

The Kaldo-Hicks efficiency, named after Nicholas Kaldor and John Hicks, is another concept of economic efficiency that starts as an effort to explain the limitation of an unrealistic Pareto efficiency. Kaldo and Hicks's concept of efficiency is more applicable to normal environments with less restricted criteria. Under the notion of Pareto efficiency, that one person is made better off without worsening anybody, an outcome can be achieved efficiently. This Pareto efficiency looks like a rational method for determining the extent of outcome. However, Kaldo and Hicks argue that Pareto efficiency is almost impossible in practice because most economic policies tend to bring about one person being better off and simultaneously another person being worse off (Sowell 2007).

X-efficiency and technical efficiency, in contrast, are more practical and measurable concepts. For example, Lebenstein's X-efficiency means that if a company produces the maximum output, given available input resources such as workers, and machinery, and technology, it is called 'X-efficiency.' X-inefficiency happens in the case where X-efficiency is not accomplished (Leibenstein 1966). Farrell (1957) explains that technical efficiency takes place when given a set of inputs, a maximum quantity of outputs are produced or when given a set of outputs, a minimum quantity of inputs are required.

2.4.3. Conceptual Framework for This Study

In more practical and measurable terms, Leibenstein (1978) and later Lovell (1993) define 'efficiency' as the difference between 'observed' and 'optimum' values of the production unit's output and input.

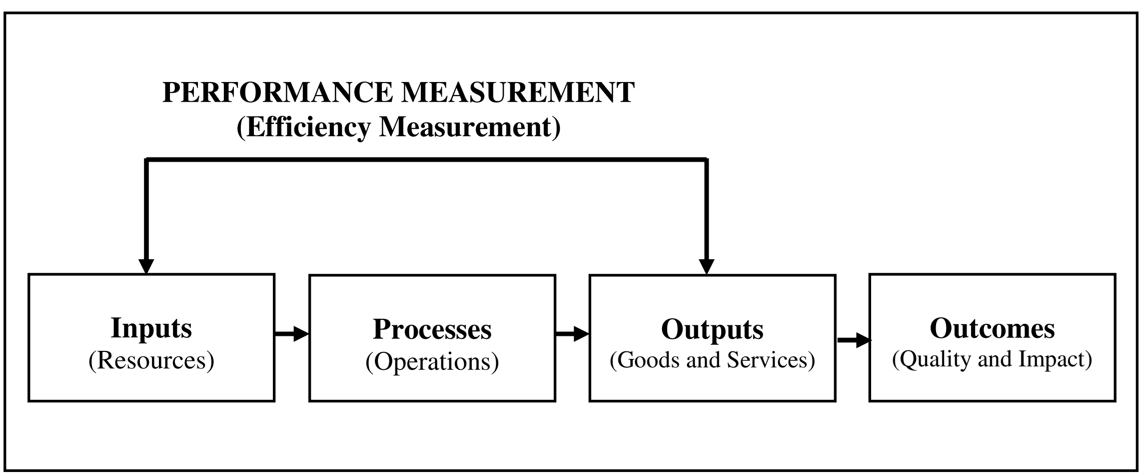


Figure 2.1 Conceptual Framework for This Study

Based upon the conceptual framework of a process-oriented model (Balk 1996) in figure 2.1, this study defines ‘efficiency’ in government as the discrepancy between optimum and observed values of government’s outputs and inputs through using Leibenstein’s economic X-efficiency and Farrell’s technical efficiency concepts. The economic literature not only provides more detailed and diverse measurement techniques and theories related to efficiency and its causes, but also presents a somewhat similar efficiency concept within the public administration literature.

CHAPTER 3

LITERATURE REVIEW: THEORIES OF ECONOMIC EFFICIENCY AND KOREAN LOCAL GOVERNMENT

This chapter briefly discusses the most important economic efficiency theory to measure and explain efficiency—Ferrell's technical efficiency theory and Leibenstein's X-efficiency theory—and comparisons of the two efficiency theories. Later, it deals with public choice models for explaining government efficiency and it also discusses factors influencing government efficiency. Finally, the literature review of the subject of this study, Korean local governments, is presented that describes in some detail its structure, functions and public local revenues.

3.1 Theories of Economic Efficiency

Most economists use only the term 'efficiency' instead of the broder term 'performance.' As mentioned earlier, the term efficiency used by economists includes more diverse concepts than the one used in public administration. However, public administration scholars use the term 'performance' rather than the term 'efficiency' because they believe that performance is a broader concept than efficiency. In other words, efficiency is just a component of performance. In this sense, in order to apply an economic efficiency concept to the public administration field and to better explain 'the efficiency of local government' in economics and 'the performance of local government' in public administration, this study will sometimes use the economic term 'efficiency' and the public administration term 'performance' interchangeably. Again, all performance concepts used in this study mean the performance measured by efficiency measures, not effectiveness measures. In order to develop and explain notable theories of economic efficiency, this literature review section will primarily use the term ‘efficiency’ rather than performance.

The efficiency literature can be largely separated into two broad parts. One is a focus of the measurement of efficiency; the other is an explanation of the cause and effect of efficiency (Button and Weyman-Jones 1992). The intellectual root of the theory of efficiency traces back Farrell’s technical efficiency (1957) in terms of measurement, and Leibenstein’s X-efficiency (1966) that relates to the aspect of the causes.

3.1.1 Farrell’s Technical Efficiency

Farrell (1957) substantiates the concept of efficiency through measuring efficiency empirically. He uses cost-minimizing behaviors as a basic efficiency criterion for measuring efficiency. Farrell’s model focuses the efficiency of organizations as the results of individuals’ behavior in the organization. In other words, Farrell’s focus of efficiency is organizations rather than individuals. Under this assumption, Farrell (1957) introduces the concept of ‘overall efficiency’ which is composed of two components: allocative and technical efficiency. The more specific Farrell’s efficiency model is illustrated in figure 3.1.

In the figure 3.1 let’s assume that there are two inputs, X_i and $X_{j.}$ and that EffX(q) represents the isoquant or best line of the set of all input combinations yielding at least output level X(q). Given input prices as reflected in WW', the cost-minimizing input combination for output X(q) is at point D. Suppose that we observe a firm employing the input combination at point C, yet producing only output level X(q). Clearly that firm 'C' is not minimizing costs.

Farrell (1956) proposes measuring the deviation of this firm from cost minimization as the ratio of efficient input usage to actual input usage, given observed input proportion. In the figure 3.1, this overall efficiency (OE) of the firm operating as C can be OA/OC, which is less than one. One minus this measure tells us by how much (in percentage terms) the observed firm could reduce input proportionately if they were minimizing costs.

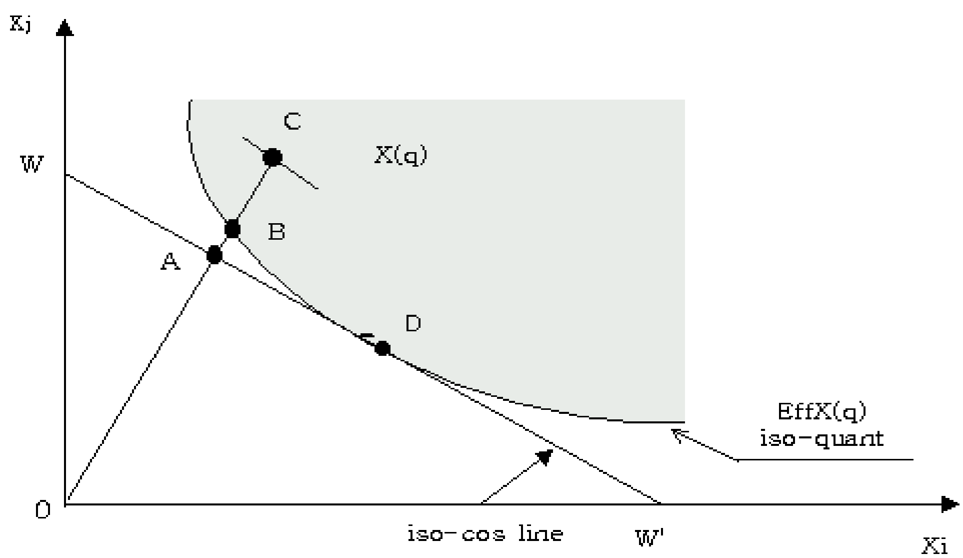


Figure 3.1 Farrell's Overall, Allocative, and Technical Efficiency

The technical component of this overall measure is OB/OC in figure 3.1. Essentially, this technical efficiency (TE) component show us the distance of a firm from the isoquant line. Allocative efficiency (AE) is measured as OA/OB. Even though firm B is on the isoquant line, firm B does not have the best input combination among input combinations in EffX(q).

To summarize:

Overall Efficiency (OE) = Technical Efficiency (TE) × Allocative Efficiency (AE), which is confirmed for our example, since

OE=OA/OC, TE=OB/OC, AE=OA/OB.

Therefore, OE=TE•AE, OA/OC= (OB/OC) • (OA/OB).

In its original formulation, Farrell's measure of technical efficiency explains inefficiency derived from deviation from optimal long-run scale of operation.

3.1.2 Leibenstein's X-Efficiency

The literature related to the cause of efficiency has focused individuals' behavior in public and private organizations. Leibenstein (1966), one of the most notable scholars on efficiency, provides one of the first conceptual efforts to explain causes of efficiency. According to Leibenstein (1966), firms do not necessarily operate on the maximum production level as postulated by neoclassical economics. Leibenstein (1978a) labels such deviation as 'X-inefficiency'. The basic proposition of X-inefficiency theory is that employees do not always act in a maximizing manner in their productive activities (Leibenstein 1978a). Rather, employees selectively determine the extent to which they work with a rational level of effort that can achieve a compromise between their personal motives and the goals of the firm.

Leibenstein (1978b) argues that inefficiency comes from the presence of a principal-agent problem in organizations, due to incomplete labor contracts and differences in objectives between owners (principal) and employees (agent). He also asserts that the level of effort by employees depends on three factors: their motivation and sense of responsibility to owners' objectives; the completeness of the labor contract; and the internal and external pressures placed on employees to exert full effort (Leibenstein 1978b).

3.1.3 Comparisons of Technical Efficiency and X-Efficiency

Both Farrell and Leibenstein explain why firms may not be maximizing their costs of production. Although people sometimes have the tendency to use the terms 'technical efficiency' and 'X-efficiency' interchangeably (Shapiro and Muller 1977), there are significant distinctions in the economic theories underlying technical efficiency and X-efficiency. Farrell's concept of technical efficiency has to do with the techniques of an input called management, while Leibenstiein's X-efficiency is about the nature of human organization (Leibenstein 1977, 1980).

More specifically, Leibenstein (1966) identifies nonmaximizing behavior—such as, delay, breakdown, and a general strike—as the key to the idea of X-efficiency. His X-inefficiency depends on pressures from the external environment on individual decision-makers to call for maximal effort on any task. Leibenstein's X-efficiency theory is the first theory to mention principal-agent relationships as an important source of inefficiency. Examples of a principal-agent relationship[3] are the shareholder-CEO relationship, the CEO-manager relationship, and the manager-employee relationship.

Both Farrell's technical efficiency and Leibenstein's X-efficiency also show differences in terms of the objectives of their work. Farrell (1957) considers empirical measurement issues to provide a satisfactory measure of technical efficiency and to show how it can be measured in practice. In contrast, Leibenstein (1966) offers some explanations about the degree of X-inefficiency by better understanding the ways that decisions are arrived at and by examining relevant psychological and physiological aspects of human nature (Perlman 1990).

In terms of basic assumptions, Farrell (1957) is more interested in measuring certain observed phenomena, but within an essentially well-established neoclassical economic modeling framework. In contrast, Leibenstein (1966) challenges and at the same time enlarges the basic assumptions of neoclassical economics, in which individuals are self-interest maximizers. Although the two parts of the efficiency literature—such as the measurement and cause of efficiency—lack a systematic and logical connection, numerous attempts at understanding causes and effects related to efficiency have been examined using a number of theoretical and applied models (Button and Weyman-Jones 1992).

[3] In the classical principal-agent model there are two parties: a principal and an agent. The principal has some authority over the agent. However, the principal's power over the agent is limited by the presences of alternative employers who could hire the agent. The agent works for the principal and undertakes some task that the principal cannot undertake. The principal-agent model assumes that the objectives of the principal and the agent are not the same and that the principal can not perfectly monitor the action undertaken by the agent (Hutter and Power 2006).

3.2. Public Choice Models for Explaining Government Efficiency

3.2.1 Median Voter Model

The most common public choice model for explaining the efficient provision of public services is the median voter model (Bergstrom and Goodman 1973). This model assumes that elected officials (politicians) behave to represent the interest of the median voter in a competitive political environment. According to Inman (1979), the median voter model is the best way to represent the voter preference of majorities in the form of a single-peaked and symmetric distribution. As a result, the median voter model can maximize cost and allocative efficiency. The median voter model is based upon a tax price which is partially a function of the marginal cost of providing a public service. In other words, median voter theorists believe that the efficiency of public services can be improved by minimizing production cost. The assumptions of the median voter model, however, have been criticized as unrealistic hypotheses in achieving cost and allocative efficiency in the public sector (Duncombe et al. 1997).

3.2.2 Budget Maximization Model

Another alternative public choice model for incorporating more "realism" into the public choice process is developed by Niskanen (1971). Niskanen, in his book ***Bureaucracy and Representative Government*** (1971), explains why public bureaucrats attempt to maximize their budget and their monopolistic power. For the explanation of these kind of public bureaucrats' behaviors, Niskanen (1971) utilizes a principal-agent framework to examine the relation between elected officials (principal) and public bureaucrats (agent) to explain inefficiency in the public sector.

According to Niskanen's theory, public bureaucrats have an incentive to maximize their budgets because this would enhance both their monetary compensation and their power derived from asymmetric information[4] and the institutional features of the budgetary process. Therefore, budget maximization generally would lead to an over-production of public services. In most situations, budget maximization is equivalent to output maximization, which implies that there is allocative but not cost inefficiency (Niskanen 1971).

3.2.3 Slack Maximization Model

Niskanen's budget maximization model is challenged by Migue and Belanger (1974) who contend that the model does not explain the discretion of bureaucrats in the mix process of producing public services. In response to criticism by Migue and Belanger (1974), Niskanen (1975) revises his budget maximization model to allow for inefficiency both at the budget process and the slack input maximization level. Here 'slack' represents the difference between actual expenditure and true minimum cost for producing public services; it is likely to be caused in part by technical inefficiency. This excess expenditure (or slack) is used for non-productive activities which give utility to the bureaucrat. In other words, if public bureaucrats seek slack maximization, this will lead to a cost inefficiency provision. Although Niskanen (1975) does not empirically estimate inefficiency, he suggests a set of factors similar to Leibenstein's inefficiency. For example, the less competition in an environment of larger government units where

[4] Asymmetric information is explained in contract theory. Contract theory shows how the parties (purchaser and seller) to the contract are informed differently or asymmetrically. This asymmetric information may bring a number of phenomena as follows: moral hazard, adverse selection, signaling, and screening (Schwalbe 1999).

monitoring performance would be more difficult, the more bureaucratic inefficiencies increase.

3.2.4 Expense Preference Model

As an alternative model against the slack maximization model which can not explain the expenditure spending below minimum costs, several theorists suggest the expense preference model. For example, Williamson (1964) and Orzechowski (1977) argue that bureaucrats over-utilize staff in order to enhance their salaries and security. According to Williamson (1964), public managers do not have a neutral attitude toward all kinds of expenses. Instead, they have positive values on some types of expenses. In other words, they behave not only for their contributions to production but also for the manner in which they enhance the individual and collective objectives of managers. The most typical form of expense preference is that public managers over-utilize staff. Williamson's (1964) expense preference model assumes that bureaucrats tend to maximize their utility through more staff, emoluments, and discretionary budgets.

De Alessi (1969), on the other hand, argues that government decision makers have their own career incentives to increase the current overall expenditures of their organization beyond the optimum point. All other things being equal, decision makers have a higher time preference if they share public property rights to some resources than if they own private property rights. That is, decision makers have an incentive to shift expenditure from the future toward the present. Edwards (1977) and Wyckoff (1990a), in the same vein, argue that bureaucrats with financial discretion tend to expend in a less competitive market.

3.3 Factors Influencing Government Efficiency

This section briefly reviews endogenous and exogenous factors associated with the efficiency of government in the public choice literature.

3.3.1 Competition

Public goods have non-exclusion and non-exhaustion characteristics such as national defense and pollution control, while private goods are the opposite, such as food and clothing (Mikesell 2003). For this reason, public goods are traditionally supplied by the government because they are not sufficiently profitable for the private sector to do so. This means that one government should provide public goods or services, and that vital public services are available to all citizens without the duplication of public services.

One issue with this line of reasoning is that some goods and services fall into a gray area between public and private goods and services. For instance, education and garbage services are provided by both the public and the private sectors. However, the fuzzy line between public and private goods sometimes provides an intellectual leverage point for arguing that the private sector can provide more efficient and responsive public services than the public sector (Frederickson and Smith 2003).

This argument was first articulated in Charles Tiebout's "A Pure Theory of Local Expenditures" (1956). Tiebout (1956), as other public choice theorists, views the citizen as the customer to consume public services. In other words, in the public choice framework, citizens consume public services as follows: the patterns and motivations of their consumption on public services can become a rough equivalent of consumption patterns in markets for such items as cars or soft drinks. Furthermore, the citizen as a consumer of public services tends to find out the best community or jurisdiction to reflect their preference or to be able to provide high quality public services at a lower price (Tiebout, 1956).

Public choice scholars believe that, like in the private market, competition between local governments tends to provide external pressure for public managers in providing public services. Competition is presumed to result in productive and allocative efficiency for private goods as well as public goods. The political process in the public sector has an inherently sequential process of negotiations between public managers and political officials. Therefore, competition between local governments can be the best solution in order to overcome a problem of the principal-agent relationship among voters, elected officials, and bureaucrats (Duncombe et al. 1997).

3.3.2 Government Size

One of the central issues related to delivering public service efficiently is whether or not smaller or fragmented governments within metropolitan areas are more efficient and effective providers than larger or consolidated governments. For example, Ostrom (1972) supports this argument as follows: “increasing the size of urban government units will be associated with decreased responsibility of local officials and decreased participation by citizens.” (p 487) Therefore, small is beautiful; small organizations are easier to manage and monitor and are more responsive to their principals (voters) (Niskanen 1975). That is, there is an appropriate level of span of control[5] in terms of the size of government. In the same vein, fragmented systems stimulate sufficient competition among local governments to provide citizens more responsive and efficient public service in metropolitan areas (Ostrom et al. 1988).

Metropolitan reform advocates, on the other hand, emphasize the potential economies of size which may result from consolidating small units of government (Kirp and Cohen 1972; Committee for Economic Development 1970). Lyons and Lowery (1989), however, in their empirical study argue that there is no discernable difference in the levels of satisfaction with pubic services between residents in consolidated and fragmented government settings, and that in reality there are too few informed consumers to drive a competitive market for public services. Nonetheless, the size of government is one of the central issues in delivering public services efficiently to citizens.

3.3.3 Internal Factors

Internal factors associated with efficiency include internal characteristics of government, such as the political preference of elected officials (Bartel and Schneider 1991), local tax rates and the size of intergovernmental grants (De Groot and Van der Sluis 1987), For example, DeAlessi (1969) proposes that inefficiency takes the form of overuse of capital. Williamson (1964), Orzechowski (1977), and Chubb and Moe (1990), on the other hand, suggest that public managers tend to unduly expand the

[5] Span of control is defined as the number of employees supervised by the manager. Graicunas (1937) develops the theory of span of control. According to their theory, there is a certain size of span of control for reaching its maximum capacity to be effective. For example, Gittell's study (2001) shows that groups with wide span of control (average span of control of 34) are significantly related with lower performance compared to the groups with narrow span of control (average span of control of nine).

bureaucracy of public organizations, especially administrators and supporting staff. DeAlessi (1969) suggests a capital bias because bureaucrats tend to spend a larger capital budget over a shorter period of time than with an operating budget. Orzechowski (1977) and Williamson (1964) hypothesize a higher labor usage because increased staff tends to lead to higher monetary compensation and security for bureaucrats.

3.3.4 External Factors

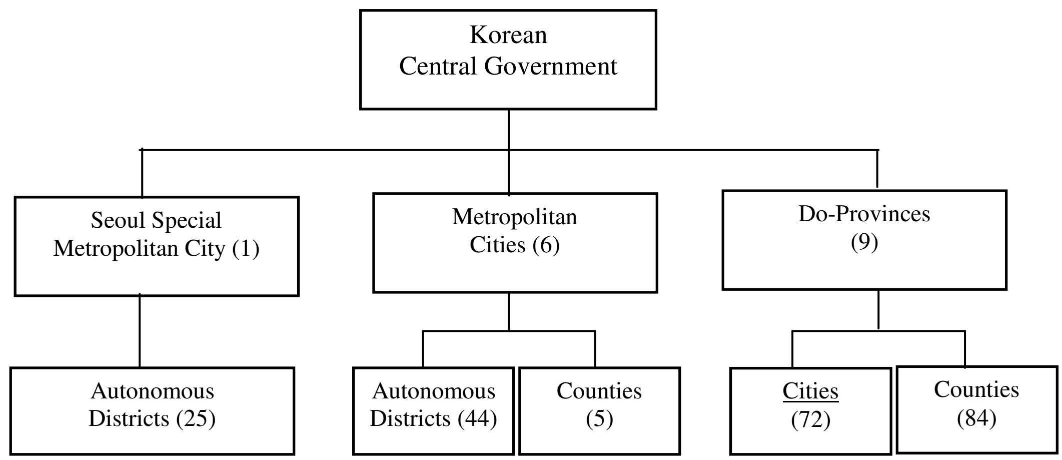
External factors related to efficiency encompass several socioeconomic environments surrounding public organizations, such as the level of incomes, the wealth of citizens, the level of economic growth (Silkman and Young, 1982; Wyckoff 1990b), political participation (Mueller 1989), the demographic composition of residents, and particularly, the educational level of adult population (Schwab and Oates 1991), and the population density (Athanassopoulos and Triantis 1998). Furthermore, Leibenstein (1980) argues that there is a reverse relationship between the fiscal capacity of government and external pressure from citizens on public officials. In other words, citizens in local governments with high community wealth (income or property) may exert less external pressure on local governments because of their greater tolerance for inefficiency associated with larger resources (Ruggiero et al. 1995).

3.4 Korean Local Governments’ Structure, Function, and Revenue

3.4.1 Korea’s Socio-Economic Profile and the Local Administration Structure

This research uses Korean local governments as subjects of study because Korean local governments have uniformity and similarity in terms of the structure, function, and revenue of government. 'The Republic of Korea’ (often called ‘South

Korea' or 'Korea') is sited in the southern area of the Korean Peninsula located in the northeastern fringe of the Asian continent. The Korean population was around 48 million in 2002. About 87 percent lived in urban areas. In 2002, the size of the Korean economy was in the top 12th largest economies in the world (KRILA 2002).



Source: MOGAHA (2002)

Figure 3.2 Structures of Korean Local Governments

In terms of the structure of Korean local administration, there are two kinds of local governments: general-purpose; and special purpose. The general-purpose local government is comprised of both the upper-level local governments (e.g., Seoul Special Metropolitan City, Metropolitan Cities and Do-Provinces) and the lower-level local governments (i.e., autonomous districts, cities, and counties). Special-purpose local governments consist of both local government associations and local public enterprises associations (KRILA 1999).

Among the lower-level (basic) local governments there are city governments (cities in the above figure 3.2), which are the subjects of this study. As of 2002, there were 72 cities in South Korea. City governments in Korea are the basic jurisdiction of local autonomy similar with autonomous districts and counties. They deal with civil services directly and are closely related to the citizen's life. In Korea, city governments have necessary organizations and budgets to meet the demands of their citizens in their jurisdictions (KLILA 2002).

3.4.2 Characteristics and Functions of Korean Local Governments

As prescribed in the Local Autonomy Act (LAA) of 1995, local governments have an obligation to improve the citizen's welfare by providing quality public services at opportune times. And at the same time, local governments have a responsibility to manage administrative affairs that directly influence the citizens.

Korean local governments are nominally autonomous, but substantially less than the European and U.S. local governments. For these reasons, the system of Korean local autonomy legally started in 1995 with only the election of mayors, not of council members (later elected in 1998). In other words, the meaning of 'local autonomy' in Korea is limited to the election of mayors and council members by their citizens. In his sense, Korean local autonomy is just at a beginning stage. Before 1995, all mayors were appointed by the central government and there were no municipal or local councils and council members. Although the Local Autonomy Act of 1995 requires the election of mayors and council members as an important component of the local autonomy system, most laws and regulations for operating and managing local governments are still under the status of the prior 1995 central government's control system. In other words, the roles and responsibility of mayors and councils are very limited. In this regard, Korean local autonomy is nominal (KRILA 2002).

The characteristics of Korean local governments and their autonomy system can be summarized as threefold. First, there is a uniformity of the local government and autonomy system. The Local Autonomy Act of 1995 regulates the rights, organizations, and powers of local governments. Due to this single law system in the Local Autonomy Act, local governments operate in a uniform way. Therefore, this uniformity of Korean local governments tends not to consider each local government's uniqueness in operating local governments.

Second, Korean local governments have a two-tier system. That is, the upper-level local governments have Seoul Special Metropolitan City, Metropolitan Cities and Do-Provinces, while the lower-level local governments are autonomous districts, cities, and counties.

Finally, the local revenues and finances of Korean local governments are unequal among local governments and dependent upon the central government. For example, the Korean tax system focuses on the national tax system rather than local taxes. Hence, the local taxes levied by local governments in 1997 were 23.6 percent of total national tax revenue. In order to overcome the inequity of local revenues and finances among local governments and to provide the same level of public service to citizens regardless of local resources, the central government attempts to equitably transfer tax revenues (KRILA 2002).

Article 9 (2) of the Local Autonomy Act of 1995 mandates several functions and responsibilities of local governments for the following public activities:

(1) Activities related to the organization, jurisdiction, territory, and administrative management of local governments;
(2) Activities for promoting the citizen's welfare;
(3) Activities for increasing local economic industries such as agriculture, manufacturing, and service sectors;
(4) Activities for developing, establishing, and managing the environments and facilities for citizens' good life;
(5) Activities for increasing education, culture, art, and sport activities; and
(6) Activities for promoting social safety and fire services (KRILA, 2002).

3.4.3 Size and Structure of Korean Local Revenues

During the period of nine years (1992-2001), the total revenue size of Korean local governments expanded from 34.6 trillion won ($1.00=970 won) to 93.9 trillion won—an almost 270 percent increase. The amount of local revenue is approximately 14.4 to 17.3 percent of the GDP in Korea.

Table 3.1 Revenues of Korean Local Governments

Local Revenue Items	1980	1990	1995	2000	2001
Local Tax (%)	33.0	32.9	33.6	28.6	28.3
Non-Tax Revenue (%)	21.5	23.9	23.6	24.8	38.3
Transfer Financial Resources (%)	45.7	41.5	38.3	44.9	29.8
Local Borrowings (%)	2.2	3.7	1.9	1.6	3.4

Source: MOGAHA (1990-2002)

The composition of local finance in 2001 is as follows: the amount of tax revenues is 26.6 trillion won (28.3 percent of the total revenue); the amount of non-tax revenue is 35.9 trillion won (38.3 percent of the total revenue); the amount of grants from the central government are approximately 28.0 trillion won (29.3 percent of the total revenue); and local borrowing is 3.2 trillion won (3.4 percent of the total revenue) (MOGAHA 1990-2002).

CHAPTER 4

RESEARCH QUESTIONS AND HYPOTHESES

4.1 Research Questions for This Study

4.1.1 Background Research Issues: Administrative Reform in Government

Most countries in the world are making an effort to make 'better government' through improving their efficiency and effectiveness. One of the best ways for making better government is to make government be more responsive to its rapidly changeable internal and external environments. The current international trend of administrative reform is 'globalization.' In particular, most developed nations are conducting administrative reform to cope with the rapid globalization of economy, the so-called "borderless economy" and to maintain their international competitiveness (OECD 2001).

A common explanation of administrative reform at the global level since the 1990s is New Public Management (NPM)—a market driven management philosophy derived from public choice theory. NPM has strongly influenced administrative reform of developed and developing countries. Current developed initiatives are United Kingdom's Next Steps initiatives, Canada's Public Service 2000 program, Australia's Commonwealth Public Services, United States' National Performance Review, and New Zealand's Contract State. Along with the line of central governments' efforts to improve the performance of government, most local governments in developed countries are also striving to make the operation of government efficient and effective (OECD 2001).

According to Christopher Hood's article, "A Public Management for All Seasons?" (1991), the rise of New Public Management (NPM) links to four administrative 'mega-trends': (1) attempts to reverse government growth; (2) a shift toward privatization; (3) the development of information technology; and (4) the development of general issues of public management. NPM was started in the Westminster countries, such as New Zealand and Australia, in the early 1980s. According to Linda Kaboolian in her article "The New Public Management" (1998), the main premise of NPM is based upon market driven-reforms such as customer service, performance measurement, contracting out, competition, and deregulation. New Public Management theorists believe that market driven reforms can improve the performance of public agencies and public employees by enhancing competition between agencies or employees (Kaboolian 1998).

The idea of New Public Management (NPM) was later adopted in the U.S by David Osborne and Ted Gaebler's ***Reinventing Government*** (1992) and it was also substantiated by the National Performance Review (NPR) which the Clinton-Gore administration established in order to improve the performance of the federal government. According to a NPR's report, ***From Red Tape to Results*** (1993), the central issue that the government faces is not what government does, but how it works. NPR (1993) suggests the following common characteristics for the successful government: "(1) cutting red tape, (2) putting customers first, (3) empowering employees to get results, and (4) cutting back to basics: producing better government for less." (pp 16-17)

Basically, New Public Management (NPM) advocates a business-like model of governance that recasts public managers as entrepreneurs and citizens as customers. A primary emphasis of NPM is to improve the performance of government through budget cuts, personnel reductions, and performance management. NPM also favors competition, the use of market mechanisms, and alternative service delivery techniques—user fees, public lotteries, contracting out, and privatization (Hood 1991; Brewer 2001; Worthington and Dollery 2000).

The ideas of New Public Management (NPM) have strongly influenced the activities of local governments. The spending of local governments in the most efficient manner has been definitely an important issue to most local governments. In order to know the degree of performance in local governments, central governments and local governments themselves often measure or evaluate performance in local governments (EC 2004).

4.1.2 Research Questions for This Study

An ultimate goal of measuring local government performance is to uncover how to improve performance by removing inefficient factors and by benchmarking the 'best practice' local government, and to enhance responsibility to citizens or taxpayers (Osborne and Plastrik 2000). Best practice is a management concept, which means there are the best methods, techniques, and activities for delivering or producing outputs or outcomes. Best practice can also be referred as the most efficient and effective way for achieving or accomplishing goals of an organization in more simple or repeatable procedure workplaces (Kanigel 1997). The concept of this best practice can be seen as Taylor's (1911) "one best way." Therefore, a crucial precondition for improving performance in local government is to measure performance in local government as accurately as possible and to know what factors can influence performance in local governments. For these reasons, the main research questions of this study that focuses on Korean local governments as study subjects are:

(1) How do local governments vary in their performance in providing public services (via Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA))?

(2) What variables and/or factors relate to the performance of local governments in providing public services (via ANOVA and Tobit Regression Analysis)?

4.2 Primary Research Hypotheses

The improvement of the performance of local government in providing public services is also one of the most important issues which local governments face because of both continuous reform pressures from citizens and financial constraints. Although the enhancement of performance in local government is an important topic, the dilemma is how to measure the performance. Even though local governments conduct several administrative reforms for improving performance, it is difficult to know if the administrative reforms are successes or failures. Therefore, by measuring performance in local government accurately and appropriately, local government will be able to know the degree of performance of each local government. In this consideration, the primary research hypothesis for this study is to uncover the degree of variation in performance between Korean local governments as follows:

> **H1-1**: There are differences in the efficiency variables of performance among local governments in providing public services.

The secondary research hypotheses are to uncover factors that relate to the performance of local governments. For a better explanation, this study categorizes factors of performance into four different factors: economic, financial, political, and environmental.

4.3 Secondary Research Hypotheses

4.3.1 Economic Factors: Economic Level of Citizens

It is well known that the annual average household income of citizens has closely to do with the performance of local governments (Spann 1977). The general argument is that citizens' higher income tends to decrease performance (efficiency) in local governments because these citizens with higher opportunity costs[6] may be less motivated to effectively monitor expenditures of their local governments. Another reason is that higher incomes of citizens increase the fiscal capacity of local governments and foster featherbedding by politicians and public managers (Silkman and Young 1982; Athanassopoulos and Triantis 1998). In the same vein, Wyockoff (1990) and De Groot et al. (1987), in their study of university departments, argue that

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[6] Opportunity cost in economics refers to the next best alternative, which is foregone whenever an economic decision is made. Scarcity of resources is one of the more basic concepts of economics. Scarcity necessitates trade-offs, and trade-offs result in an opportunity cost. Opportunity cost is useful when evaluating the cost and benefit of choices. Opportunity cost is expressed in a relative price. That is, the price of one choice relates to the price of another (McEachern 2006). In this case, higher opportunity costs means that higher income citizens tend to be more interested in other topics rather than local governments.

technical efficiencies of organizations decrease as the income of organizations increases.

De Borger and Kerstens (1996a), however, in their study of Belgium municipalities, maintain that the citizens' demand for local public services may vary according to the level of citizens' income. For instance, richer local residents may pressure local governments to provide local public services in the most efficiency way. Likewise, poorer residents may also be interested in better and more efficient local services (Hayes et al. 1998).

> **H2-1**: The performance of local governments relates to the economic level of citizens. (Measured by percent of economically active population [7]; percent of employees in the manufacturing industry; percent of low income households).

4.3.2 Financial Factors: Financial Structure of Local Government

The financial structure of local government is a very important issue to citizens, public officials, and government itself. For example, given the level of public service provisions, higher taxes may increase the citizens' awareness about controlling public expenditures, especially if citizens know the differences between local tax rates or costs between local governments (Spann 1977). Davis and Hayes (1993) argue that there is a positive relation between tax rates and monitoring the activities of local governments.

Hamilton (1983), furthermore, introduces the well-known concept of the 'flypaper effect,' which means that intergovernmental grants partly funded by the central government tend to bring about the inefficiency of local government. Silkman

[7] Economically active population is defined as all persons age 16 to 65 who "provide the supply of labor for producing economic services and goods as defined by the United Nations System of National Accounts during a specified time-reference period" (ILO 1982).

and Young (1982) also assert that there is a negative relationship between the amount of grants and technical efficiency because grants can encourage public officials' inefficient behavior as outside funding increases. Similarly, Wyckoff (1990a) and De Groot and Van Der Sluis' (1987) studies support Silkman et al.'s argument (1982) that the amount of a local government's budget derived from the central government's intergovernmental grants has a negative relationship with technical efficiency.

> **H2-2**: The performance of local governments relates to financial independence and the amount of intergovernmental grants. (Measured by percent of independent revenue sources; per capita expenditures; percent of intergovernmental grants).

4.3 3 Political Factors: Political Preference and Political Participation

De Borger and Kerstens (1996a) in their study of Belgium municipalities, show that political indicators have closely to do with the performance of local governments. Generally, both the public choice model and bureaucracy inefficiency literature argues that the inefficiency of local government officials comes from the behaviors of public bureaucrats who are self-interested maximizers (Niskanen 1975: Muller 2003). More specifically, Mueller (1989) states that local politicians and public managers do not have appropriate incentives to effectively control or manage expenditures. In other words, the process of political decision making itself may impede the effective management of local governments, leading to overall inefficiency. Bartel and Schneider' study (1991), in particular, shows that government performance may be affected by the size and composition of political coalitions. In the same vein, De Borger and Kerstens (1996a) assert that in Belgium a high number of coalition parties may have negative effects on government performance, and the existence of the socialist party has positive effects on performance of local governments.

Mueller (1989) argues that the performance of local governments has closely to do with the amount of citizens' political participation. More specifically, citizens' political participation can improve the costs and technical efficiencies of local governments, and furthermore, enhance the overall performance of local governments (Schwab and Oates 1991). Similarly, Hamilton (1983) and Hayes et al. (1998) assert that the performance of local governments may rest upon the ability of citizens to be able to pressure local representatives. In addition, Milligan et al. (2004) suggest that as a means to increase citizens' political participation, an improvement of the educational level of citizens is needed.

H2-3: The performance of local governments relates to mayors' political preference (political preference of mayors' party). (Measured by Likert five-scale (very liberal = 1; liberal = 2; middle = 3; conservative = 4; and very conservative = 5).

H2-4: The performance of local governments relates to the amount of citizens' political participation. (Measured by the citizen's voting percent in mayors' election).

4.3.4 Environmental Factors: Population Size, Population Density, Consolidation, Competition, and Government Size.

Population size and population density are related to the performance of local governments in providing public services. Greater numbers of people per square mile leads to high cost efficiency. More specifically, lower population density brings cost inefficiency of local governments (De Borger and Kerstens 1996a; Grossman et al. 1999). Athanassopoulos and Triantis (1998), however, argue the opposite: higher population density affects cost efficiency of local governments negatively due to the diseconomies of scale from over-crowdedness.

Liner (1994) provides evidence on the performance of local governments and the role of institutional restrictions such as annexation or consolidation. In Liner's study (1994) of cities from 43 US states, he shows that the performance of local government can vary ccording to the forms of restrictive versus nonrestrictive annexation laws. In other words, annexation or consolidation influences the amount of expenditures and the number of public employees.

Heikkila (1996) argues that competition between local governments can enhance the performance of local governments. According to the Tiebout model (1956), citizens or customers can move from community to community freely to search for best places in order to reflect their preferences. This citizens' mobility can become a big pressure to local governments for providing citizens with better public services in the most efficient manner. Similarly, Loikkanen and Susiluoto's empirical study (2005) shows that suburban local governments spend more money than inside-metropolitan local governments in providing public services in metropolitan areas because suburban local governments are less competitive than inside-metropolitan local governments. However, Hayes et al. (1998) and Grossman et al. (1999) argue that intra-metropolitan competition between local governments does not necessarily improve the performance of local government.

One of the central issues related to delivering public service efficiently is whether or not smaller local governments within metropolitan areas are more efficient and effective providers than larger local governments. For example, Ostrom (1972) supports this argument as follows: "increasing the size of urban government units will be associated with decreased responsibility of local officials and decreased participation by citizens." (p 487) That is, small organizations are easier to manage and monitor and are more responsive to their principals (voters) (Niskanen 1975; Ostrom et al. 1988). Metropolitan reform advocates, on the other hand, emphasize the potential economies of size which may result from consolidating small units of government (Kirp and Cohen 1972; Committee for Economic Development 1970). Based upon the environmental factor literature related to the performance of local governments, this study makes five hypotheses to be tested as follows:

H2-5: The performance of local governments relates to population size.

H2-6: The performance of local governments relates to population densities (Measured by (total population ÷ per km^2)).

H2-7: The performance of local government relates to the degree of consolidation of jurisdictions between local governments. (Measured by dummy variable: non-consolidated cities = 0; consolidated cities = 1).

H2-8: The performance of local government relates to the degree of competition between local governments. (Measured by dummy variable: non-competition cities = 0; competition cities = 1).

H2-9: The performance of local government relates to the total number of public employees in local government. (Measured by the total number of public employees).

CHAPTER 5

DATA, VARIABLES, AND STATISTICAL METHODS

This chapter discusses the focus of this study, the variables or indicators to measure performance (efficiency) in local government. Later, it selects input/output indicators and independent/dependent variables for explaining variations of performance between local governments. Finally, it briefly explains the main logics, advantages or disadvantages, and comparisons of two methodologies—Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA)—as main statistical tools for measuring performance in local government.

This study will use a two stage method to measure the performance of local governments in providing public services. In the first stage, this study will use Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) in a comparison as a main method for measuring performance (efficiency) in local governments. In the second stage, in order to uncover main variables or factors that influence the performance (efficiency) of local governments, this study will use Analysis of Variance (ANOVA) and Tobit Regression Analysis. More specifically, the first stage measures and obtains efficiency coefficient scores through the DEA and SFA analyses. The second stage uncovers factors related with the efficiency coefficient scores by using ANOVA and Tobit Regression Analysis.

5.1 Focus and Data of This Study

5.1.1 Focus of This Study

The local governments subject for this study are the existing 77 Korean city governments in 2005 and the extant 72 Korean city governments in 2001, respectively. In other words, this study focuses on Korean city governments with two cross-sectional years' data in 2005 and 2001. The reasons for studying Korean city governments are:

First, there are few differences in the structures, tax systems, and functions between city governments in Korea. Local governments in the United States and other federal system countries, such as Australia and Canada, have different structures, tax systems, and functions of government. Local governments in the unitary government systems are relatively more homogeneous than federal government systems in terms of the tax systems, functions, and structures of government for providing public services.

The Korean central government and local governments operate as a unitary government system. Therefore, there is logic in selecting Korean municipalities in comparing performance (efficiency) between local governments, in finding the 'best practice' local government for benchmarking, and in understanding the international policy implications for improving overall performance or efficiency in local governments.

Second, there are few prior comparative studies of performance which examine Korean local governments. Although Korean local governments have conducted several administrative reforms such as privatization, contracting out, and restructuring to improve their performance, systematic studies on the effects of their administrative reforms have been rare. Indeed, unless one measures the performance of administrative reform accurately using truly comparative data (i.e., Korean local government data), administration reforms could be just political slogans or statements to support politicians. Therefore, the measurement of performance in Korean local government will provide important information on effects of administrative reform or diagnoses of activities of local governments.

Finally, few studies on Korean local government performance are found in the international literature of public administration. Most studies related to performance of local governments come from European countries, Australia, and the Untied States (Balaguer-Coll et al. 2002; Bartel and Schneider 1991; Kalseth and Rattso 1995; De Borger and Kerstens 1996a, b, 2000; Grossman et al. 1999; Athanassopoulos and Triantis 1998; Afonso and Fernandes 2006).

Even though several Korean researchers[8] have been studying the performance of government in public administration, their studies are limited and need more sophisticated empirical analysis. Moreover, these studies are published locally in Korean and are therefore not readily available to international scholars. This study will provide more systematic evidence using the general uniformity of the Koran local government structure, and also introduce new and important findings and beneficial conclusions.

[8] Major studies on Korean local government performance (efficiency) are found at Park and Lee's (1996) public service efficiency in Korean local governments, Lim and Kim's (2001) evaluation of Korean local public service, and Park's (2007) measurement of performance on fragmentation and consolidation in Korean local governments.

5.1.2. Data and Sources of This Study

This study will use two years' cross-sectional data from the years 2005 and 2001. The reasons are: first, two year periods of cross-sectional data will decrease the problems of validity and reliability[9] brought from a single year of cross-sectional data, although most previous studies have used only single year cross-sectional data.

Second, the 2005 year data offers the most current data. In addition, the four year term from 2005 to 2001 is an appropriate period to determine the extent and trend of variation of performance in local government. A two year term tends to show similar patterns without a large variation.

Finally, the four year term also reflects the tenure of elected mayors and council members' official position in Korean local governments. The election years for mayors and council members were 2002 and 1998. Two year period (2005 and 2001) data encompasses the third year of mayors and council members' temrs of office. Therefore, the four year period shows the change in politicians' positions (e.g., elected mayors and council members) and it is also a period when mayors and council members can demonstrate their managerial ability for operating government efficiently.

The data used in this study was obtained from several sources: Municipal Yearbook of Korea (MOGAHA 2005, 2001), Financial Yearbook of Korea (MOGAHA

[9] In statistics 'reliability' refers to repeatability or accuracy, which means how measures have consistency in measuring the same thing each time, while 'validity' is about whether or not a researcher measures true targets which he/she wants to measure. Measurement of validity should be reliable. However, measurement of reliability does not guarantee validity (Nachimias and Frank-Nachimias 1987).

2005, 2001), Economic Yearbook of Korea (MOPE 2005, 2001), and Local Election Yearbook of Korea (NEC 2002, 1998).

5.2 Selection of Indicators and Variables

5.2.1 Literature Review for Selecting Indicators and Variables

Table 5.1 shows the major literature related to authors, samples, methods, and indicators (input and output) in measuring performance in local governments. The selected research authors and samples are as follows: Van den Eeckaut, Tulkens, and Jamar (1993)—235 Belgium municipalities; De Borger and Kerstens (1996a, b)—589 Belgium municipalities; Athanassopoulos and Triantis (1998)—172 Greek municipalities; Sousa and Ramos (1999)—701 Brazilian municipalities; Worthington (2000)—166 Australian municipalities; Prierto and Zofio (2001)—209 Spanish municipalities; Loikkanen and Susiluoto (2005)—353 Finnish municipalities; and Afonso and Fernandes (2006)—51 Lisbon municipalities.

The methods that these major research authors use are Data Envelopment Analysis (DEA), Free Disposal Hull (FDH)[10], and Stochastic Frontier Analysis (SFA). As previously mentioned, this study will use DEA and SFA as the main methods for measuring efficiency in local governments.

It is crucial to select input and output indicators in the first stage for measuring performance in local government. Most scholars use ‘total current expenditures over a

[10] Free Disposal Hull (FDH) analysis is a special model of the DEA model. That is, FDH is a technique of the DEA model. Briefly explaining, the FDH model does not assume convexity and hence does not permit such linear input substation. Instead, in the FDA model the production possibility sets connecting the DEA vertices are not included in the frontier but are composed only of the DEA vertices. Therefore, free disposal hull points are interior to these vertices (Berger and Humphrey 1997).

single year' or 'number of full-time workers' data over a single year as input indicators in order to measure performance (efficiency) in local governments. As output indicators, most researchers use various public service data from waste collection to road surface area.

Table 5.1 Major Literature for Selecting Indicators and Variables

Author(s)	Samples	Methods	Performance (Efficiency) Measurement Indicators	
			Input Indicators	Output Indicators
Van den Eeckaut, Tulkens & Jamar (1993)	235 Belgium municipalities (cross-section)	FDH, DEA.	Total current Expenditures.	Total population; Share of age group with more than 65 years on total population; Number of subsistence beneficiaries; Number of students in primary school; Municipal road's surface; Number of local crimes
De Borger & Kerstens (1996a)	589 Belgium Municipalities (cross-section)	DEA, FDH, SFA	Total current expenditures.	Total population; Share of age group with more than 65 years on total population; Number of unemployment subsidy beneficiaries; Number of student in primary school; Leisure areas and park surface.
Athanassopo ulos & Triantis (1998)	172 Greek Municipalities (cross-section)	DEA, SFA	Total current expenditures	Number of resident families; Average residential area; Building area; industrial; Tourism area.
Sousa & Ramos (1999)	701 Brazilian Municipalities from Minas Gerais and 402 from Baia (Cross-section)	FDH, DEA	Total current expenditures	Resident population; Homes with clean water; Homes with solid waste collection; illiterate population; number of enrolled students in primary and secondary local schools.
Worthington (2000)	166 Australian municipalities (cross-section)	DEA, SFA	N. of full-time workers; financial expenditures; Other expenditures	Total population; Number of properties acquired to provide the Following services: Potable water; Domestic water collection; Surface of rural and urban roads (km).
Prieto & Zofio (2001)	209 Spanish municipalities from Castilla and Leon with less 20,000 residents (cross-section)	DEA	Budgetary Expenditure (estimation)	Portable water; Domestic waste collection; Road surface area; Lighting street points; cultural and sportive infrastructure; parks.
Loikkanen & Sussiluoto (2005)	353 Finnish municipalities (panel data)	DEA	Total expenditures	Children's day care centers; Children's family day care; Open basic heal care; Dental care; Bed wards in basic health care; Institutional care of the elderly; Institutional care of the handicapped; Senior secondary schools (hours of teaching); Municipal libraries (total loans).
Afonso & Fernandes (2006)	51 Lisbon region Municipalities	DEA	Total per capita expenditures	Performance sub-indicators grouped in: General administration; Education; Social services; Cultural services; Domestic waste collection; Environment protection.

Source: Afonso and Fernandes (2006)

5.2.2 Selection of Indicators and Variables

Based upon the major literature above, this study selects two input variables and seven output variables as follows. Input variables are (1) per capita expenditures in the 2005 and 2001 years; (2) 1,000 citizens per capita public employees in the 2005 and 2001 years, while seven output indicators in the 2005 and 2001 years are (1) per capita revenue; (2) percent of water services; (3) percent of sewage services; (4) percent of road surface; (5) number of social welfare facilities; (6) number of public parks; (7) number of cultural facilities.

Table 5.2 Input and Output Indicators for Measuring Performance

Input Indicators	Output Indicators
(1) Per Capita Expenditures (EXPEN) (2) 1,000 Citizens Per Capita of Public Employees (EMPY)	(1) Per Capita Revenue (REVEN) (2) Percent of Water Services (WATER) (3) Percent of Sewage Services (SEWAG) (4) Percent of Road Surface (ROAD) (5) Number of Social Welfare Facilities (SOWEL) (6) Number of Public Parks (PARK) (7) Number of Cultural Facilities (CULFA)

In the second stage of analysis, this study will use ANOVA and Tobit Regression Analysis. For multiple regression analysis, this study will use 13 independent (explanatory) variables and four dependent variables. Based upon the literature review and research hypotheses, the independent variables of this study are categorized under four dimensions: (1) economic; (2) financial; (3) political; and (4) environmental.

More specific independent variables are as follows: first, economic factors include (1) Percent of Economically Active Population (ECOPOP); (2) Percent of Employees in the Manufacturing Industry (MANUEMPY); and (3) Percent of low

Income Households (LOWINCOM); second, financial factors have (4) Percent of Independent Revenue Sources (REVEN); (5) Per Capita Expenditure (EXPEN); and (6) Percent of Intergovernmental Grants (GRANT); third, political factors include (7) Mayors' Political Preference (POLPARTY); (8) Voting Percent of Mayors' Election (VOTE); and finally, environmental factors contain (9) Population Size (POP); (10) Population Density (DENSITY); (11) Degree of Consolidation (CONSOL); (12) Degree of Competition (COMPETI); and (13) Total Number of Public Employees (PUEMPY).

Table 5.3 Independent and Dependent Variables for Explaining Efficiency

Independent Variables	Dependent Variables
(I) Economic Factors: (1) Percent of Economically Active Population (ECOPOP) (2) Percent of Employees in Manufacturing Industry (MANUEMPY) (3) Percent of low Income Households (LOWINCOM)	(1) Technical Efficiency Scores (TECHEF) (2) Cost Efficiency Scores (COSTEF) (3) Scale Efficiency Scores (SCALEEF) (4) Stochastic Frontier Efficiency Scores (STOCHEF)
(II) Financial Factors: (4) Percent of Independent Revenue Sources (INDSOUR) (5) Per Capita Expenditure (EXPEN) (6) Percent of Intergovernmental Grants (GRANT)	
(III) Political Factors: (7) Mayors' Political Preference (POLPARTY) (8) Voting Percent of Mayors' Election (VOTE)	
(IV) Environmental Factors: (9) Population Size (POP) (10) Population Density (DENSITY) (11) Degree of Consolidation (CONSOL) (12) Degree of Competition (COMPETI) (13) Total Number of Public Employees (PUEMPY)	

The independent variables of this study include as many factors or variables that influence or relate to performance (efficiency) in local government as possible.

Table 5.4 Definitions of Variables

Variables	Definition and Explanation
Percent of Economically Active Population (ECOPOP)	ECOPOP = (number of economically active population ÷ the total number of populations) × 100.
Percent of Employees in the Manufacturing Industry (MANUEMPY)	MANUEMPY = (number of employees in the manufacturing industry ÷ total population) × 100.
Percent of Low Income Households (LOWINCOM)	LOWINCOM = (number of low income households ÷ total population) × 100.
Percent of Independent Revenue Source (INDSOUR)	INDSOUR = (total independent revenue sources ÷ total of all revenue sources) × 100 = (local tax + non-tax revenue) ÷total general account.
Per Capita Expenditure (EXPEN)	EXPEN = (total expenditures ÷ total population)
Percent of Intergovernmental Grants (GRANT)	GRANT = (total intergovernmental grants ÷ the total amount of all revenue sources)×100
Mayors' Political Preference (POLPARTY)	POLPARY = Likert five-scale (very liberal = 1, liberal = 2; middle = 3; conservative = 4; very conservative = 5)
Voting Percent of Mayors' Election (VOTE)	VOTE = (total number of voting in political election ÷ total number population over age 19) × 100
Population Size (POP)	POP = total population
Population Density (DENSITY)	DENSITY = (total population ÷ per km^2)
Degree of Consolidation (CONSOL)	CONSOL = dummy variable (non-consolidated cities=0, consolidated cities=1)
Degree of Competition (COMPETI)	COMPETI = dummy variable (non-competition cities=0, competition cities=1)[11]
Total Number of Public Employees (PUEMPY)	PUEMPY = number of total public employees
Technical Efficiency Scores (TECHEF)	Calculations from technical efficiency analysis in DEA based upon input and output data.
Cost Efficiency Scores (COSTEF)	Calculations from cost efficiency analysis in DEA based upon input and output data.
Scale Efficiency Scores (SCALEEF)	Calculations from scale efficiency analysis in DEA based upon input and output data.
Stochastic Efficiency Scores (STOCHEF)	Calculations from efficiency in SFA based upon input and output data.

[11] In the literature of planning and urban affairs, the terms "independent" and "dependent" cities substitute for "non-competition" and "competition" cities.

Four dependent variables, on the other hand, include: (1) Technical Efficiency Scores (TECHEF); (2) Cost Efficiency Scores (COSTEF); (3) Scale Efficiency Scores (SCALEEF); and (4) Stochastic Frontier Efficiency Scores (STOCHEF). These four efficiency scores come from the DEA and SFA efficiency calculation of input and output variables in the first stage. More specific definitions of variables are substantiated in table 5.4.

5.3 Statistical Methods: DEA and SFA

As mentioned previously, the main methods that most economists use for measuring performance (efficiency) in local government are Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA). These two methods are popular and powerful tools in the economics field. They have commonalities and differences to some extent. In other words, each method has advantages and disadvantages to measure efficiency. Simultaneously, the two methods complement each other. Despite the methodological difference of the two methods, the differences are not significant to the degree of changing statistical meaning (De Borger and Kerstens 1996a). This section will briefly introduce and compare the DEA and SFA methods to better understand the logic and concepts.

5.3.1 Data Envelopment Analysis (DEA)

Data envelopment analysis (DEA) is a linear program model introduced by Charnes, Cooper, and Rhodes (1978) to measure efficiency under the assumption of constant returns to scale and extended by Banker, Charnes, and Cooper (1984) to allow variable returns to scale. The technique envelopes observed production possibilities to obtain an empirical frontier and measures efficiency as the distance to the frontier.

This DEA model can be illustrated in the figure 5.1. Figure 5.1 shows how to measure technical and scale efficiencies through the single-input (*x*) and single-output (*y*) case. This DEA model has two lines: one is a linear line with the constant returns to scale (CRS) case; the other is a convex line with returns to scale (VRS) case. More specifically, in the figure 5.1 the CRS case is the straight line 0ICM, and the VRS case is the convex line *GABCDEF*.

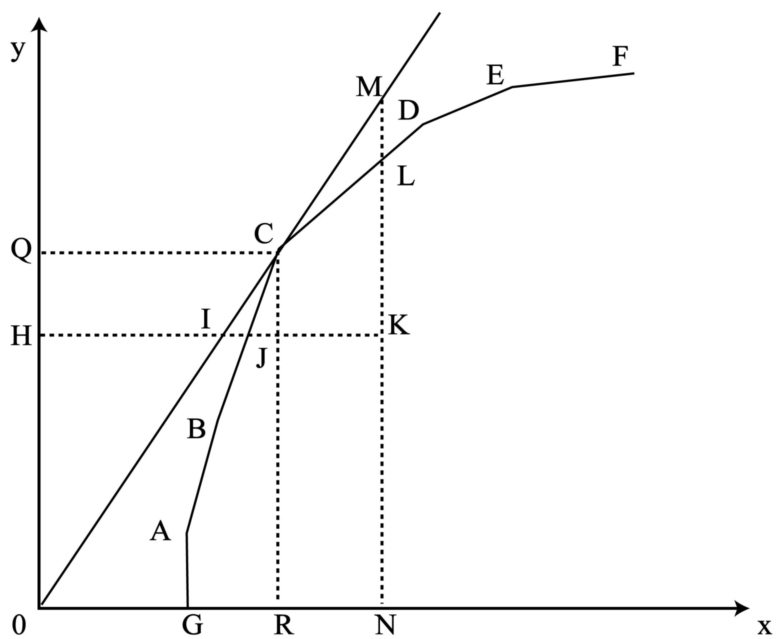

Figure 5.1 Measurements of Technical and Scale Efficiencies

In terms of measurement of technical and scale efficiencies, organization K is represented by an inefficient organization because the degree of the inefficiency of organization K is indicated by the distance between organization I and itself. Under an input orientation model, the technical efficiency of organization K is *hi/hk* in the CRS case and *hj/hk* in the VRS case. The scale efficiency of organization K is provided by the ratio *hi/hj*. In contrast, in the case of the output orientation model, the technical efficiency of organization K would be given provided by *nl/nm*. The scale efficiency would be provided by *nl/nm*. In the case of organization C, the technical efficiency of organization C would be *qc/qc* under both VRS and CRS cases with an input orientation. The scale efficiency measure in this case would also be *qu/qc* (Worthington and Dollery 2000).

The DEA model has been used in a number of empirical applications that include the following: Greek municipalities (Athnanssopoulos and Triantis 1990); Australian municipalities (Worthington 2000); Finish municipalities (Loikkanen and Susiluoto 2005); Chinese cities (Charnes, Cooper, and Li 1989); highway maintenance services (Cook, Roll, and Kazakov 1990); California municipalities (Grosskopt and Yaisawarng 1990); Illinois municipal public services (Deller, Nelson, and Walzer 1992); and Belgian municipalities (Van den Eeckaut, Tulkens, and Jamar 1993; De Borger and Kerstens, 1996a).

The popularity of the DEA model comes from two advantages. First, the DEA model can handle multiple inputs and outputs in the production processes of the public sector. Second, the DEA model can incorporate the difference of efficiency in operating environments beyond management control into the purposes of comparative performance assessment and process benchmarking (Steering Committee for the Review of Commonwealth/State Service Provision 1997).

5.3.2 Stochastic Frontier Analysis (SFA)

Stochastic frontier analysis (SFA) was independently introduced by Aigner, Lovell, and Schmidt (1977), Battese and Corra (1977), and Meeusen and Van den Broeck (1977), as a measure of production efficiency. The original SFA model involved a production function had two components: one was to account for random effects; the other was to account for technical inefficiency. This model can be expressed in the equation 5.1:

(5.1) $y_i = x_i \beta + \varepsilon_i, \quad \varepsilon_i = (v_i + u_i), \qquad i=1, 2, 3,\ldots, N,$ where,

y_i is the production (or the logarithm of the production) of the i-th organization;
x_i is a k×1 vector of (transformations of the) input quantities of the i-th organization;

β is an vector of unknown parameters;

v_i is random variables which are assumed to be $i$id N $(0, \sigma_v^2)$, and

u_i is non-negative random variables which are assumed to account for technical inefficiency in production and are often assumed to be $i$id $|N(0, \sigma_u^2)|$.

The SFA model assumes a composite disturbance ε_i, which is a sum of two independent components v_i, u_i. The error component v_i is a normally distributed random disturbance representing specification or measurement errors. Thus, v_i is the counterpart of the OLS disturbance. The error component u_i is a one-sided disturbance, mostly assumed to follow half-normal or truncated normal distribution. It represents any type of inefficiency. It is assumed to be distributed independently of v_i and the regressor x_i.

This original SFA model has been used in such a vast number of empirical applications as the following: the manufacturing industry (Suh 1992); the agricultural industry (Chiao 1986; Pitt and Lee 1981; Ramirez 1987; Rawlins 1984); the banking industry (Kaparakis et al. 1994; Yang 1990); the airline industry (Bauer 1986; Gallegos-Monteagudo 1992); the health and mental health area (Toren 1993; Vitaliano and Toren 1994); hospitals (Zuckerman et al. 1994); and the insurance industry (Cummins and Weiss 1993; Gardner and Grace 1993; Kumbhakar and Hjalmarsson 1995).

These extensions of the SFA model include a specification of more general distributional assumptions for the u_i, such as the truncated normal or two-parameter gamma distributions; the consideration of panel data and time-varying technical efficiencies; the extension of the methodology to cost functions, and also to the estimation of system of equation; etc (Forsund et al. 1980; Schmidt 1986; Bauer 1990).

The most fundamental advantage of the SFR model over the deterministic DEA model is this composite distribution structure. Using this error specification, the SFA model allows for a distinction of the effect of inefficiency from non-inefficiency related factors that may cause deviation from the frontier (Green 1993).

5.3.3 Comparisons of DEA and SFA

Data envelopment analysis (DEA) is a non-parametric approach to the measurement of efficiency. Simply, DEA measures the efficiency of an organization by calculating the distance from the input and output data. With the DEA technique, organizations in the frontier line are classified as efficient organizations, while organizations under the frontier line are referred to inefficient organizations (Ruggiero 2007). In figure 5.2 based upon the DEA measurement, organizations A, B, and E on the dotted frontier line are efficient, while organizations C, D, and F below the dotted frontier line are inefficient.

Stochastic frontier analysis (SFA), in contrast, is a parametric method to fit a frontier like the solid curve for the measurement of efficiency in figure 5.2. The idea of the SFA model is assumed to have two types of deviation from the relationship between inputs and outputs. In other words, there are two types of errors; one is statistical noise; the other is inefficiency. First, statistical noise or error means random variations caused from the inaccuracy of measurement. In statistics, this type of deviation is assumed to be random zero on average. A second type of error is seen as a measure of inefficiency (Ruggiero 2007). Based upon the SFA measurement, in figure 5.2 organizations B and E above the solid frontier line are efficient, while organizations A, C, D, and F under the solid frontier line are inefficient to a certain extent.

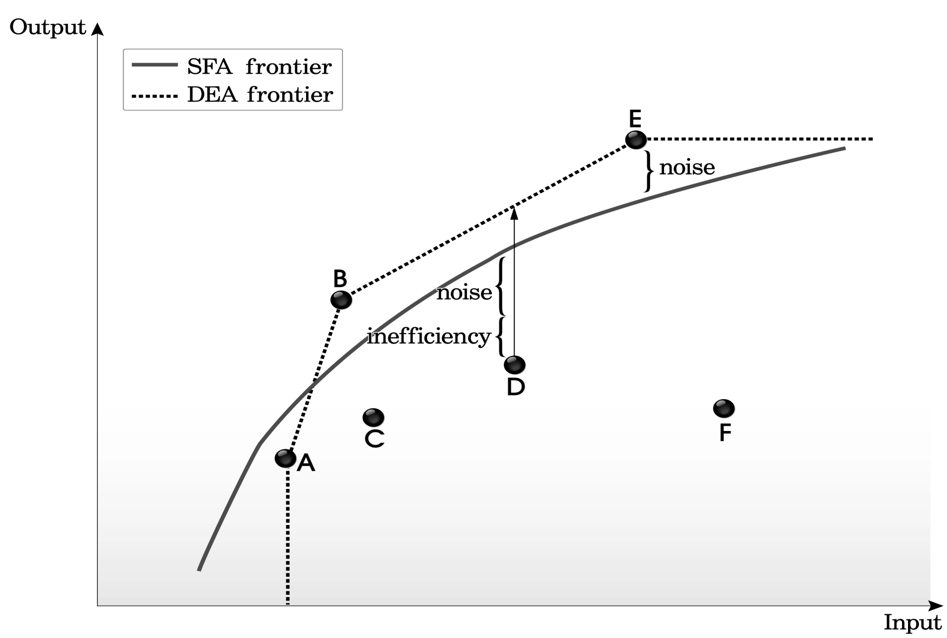

Figure 5.2 Comparisons of DEA and SFA

The basic idea behind both DEA and SFA techniques is the same. The common objective of the two techniques is to construct a best practice envelopment of data describing the economic activities of organizations, and to measure the efficiency for each provider in the sample. Both DEA and SFA techniques accommodate multiple resources and multiple services. Both can also incorporate prices and service prices, as well as operating budgets or revenue targets, if they are available and deemed to be both reliable and relevant (Lovell 2000).

There, however, are differences between DEA and SFA. DEA achieves envelopment by solving a sequence of linear programs. Since the programs are linear, the DEA best practice service delivery frontier is piecewise linear. Since the programs are deterministic, all providers are located on or beneath the DEA frontier. SFA, in contrast, achieve envelopment by means of statistical estimation of a single regression model. Since the regression model is parametric, the SFA best practice service delivery frontier is smooth. Since SFA is regression-based, it is stochastic (De Borger and Kerstens 1996a). Simply speaking, the main advantage of DEA is the main disadvantage of SFA, while the main advantage of SFA is the main disadvantage of DEA (Lovell, 2000).

CHAPTER 6

DATA ANALYSIS: MEASURING THE PERFORMANCE OF KOREAN CITY GOVERNMENTS

This chapter focuses the measurement and evaluation of performance (efficiency) in Korean city governments using Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA). The first section deals with descriptive analysis over input and output data which will be used to measure the efficiency of Korea city government. The technical, cost, scale, and stochastic efficiency of Korean city governments based upon input and output data is measured and evaluated by using Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA). More specifically, in order to measure and analyze performance more accurately, this study uses the slacks-based model[12] among several DEA models and the Battese and Coelli model[13] (1995) among SFA models. Finally, the efficiency scores obtained from DEA and SFA methods are utilized to uncover factors influencing the performance (efficiency) of local government by using Tobit Regression Analysis.

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[12] Both CCR (Charnes-Cooper-Rhodes) model and BCC (Banker-Charnes-Cooper) models are one of the most representative DEA models. But these two models do not take account of the input excesses and output shortfalls that are represented by non-zero slacks (Cooper, Seiford, and Tone 2007). To make up this deficiency, Tone (2003) introduces a slacks-based measure of efficiency (SBM), which can deal with the input excesses and output shortfalls and it can also discriminate efficient and inefficient DMUs.

[13] Stochastic frontier production function was proposed by Aigner, Lovell, and Schmidt (1977) and Meeusen and Van Den Broeck (1977). This original model has some limitations for using data (i.e., only cross-sectional data). The Battese and Coelli model (1995) is a kind of more upgrading model to make up deficiency of the original SFA model.

6.1 Descriptive Analysis of the Input and Output Data

To understand the basic information and characteristics of the input and output data [14] set of Korean city governments, this study conducts descriptive statistical analyses. In 2005 there are77 Korean city governments; in 2001 thre are 72 city governments. The reason for the increase in the number of Korean city governments between 2005 and 2001 is that five county governments—Yangju, Pocheon, Hwaseong, Gwangju, and Gyeryong—have changed their legal status from county governments to city governments based upon Korean administration law.

As for the population of Korean city governments, in 2005 the average population of Korean city governments is 278,000 people, while in 2001 the average population of Korean city government is 269,014 people. In addition, in 2005 the average local revenue source of Korean city governments is 36.77%, while in 2001 it is 39.87%. This indicates that Korean city governments are gradually becoming more dependent on the central government in terms of revenue sources.

As for major characteristics of input and output data to be used for measuring efficiency, table 6.1 shows basic descriptive statistic information. The data to be used to measure performance (efficiency) is two input and seven output data sources. The two input data includes variable 'EXPEN' and 'EMPLY.' Here, EXPEN means 'per capital expenditure of city government, while EMPY designates '1,000 citizens per capita full-

[14] The data to be used in this study can be obtained from several sources such as Municipal Yearbook of Korea (MOGAHA 2005, 2001), Financial Yearbook of Korean Local Government (MOGAHA 2005, 2001), Economic Yearbook of Korea (MOPE 2005, 2001), and Local Election Yearbook of Korea (NEC 2002, 1998). All data to be used is also attached in the appendix part.

time public employees. In 2005, the mean of per capital expenditure of Korean city governments is 1.68 millions won ($1680.00), while in 2001 the average of the per capita expenditure is 0.93 million won ($930.00). This means that the per capita expenditure of Korean city governments is slowly increasing.

Table 6.1 Descriptive Statistics of Input-Output Variables (2005, 2001)

Variables	2005 (N=77)				2001 (N=72)			
	Mean	St. D.	Min.	Max.	Mean	St. D.	Min.	Max.
EXPEN[a]	1.68	0.98	0.61	6.27	0.93	0.37	0.40	2.03
EMPY	5.11	2.50	2.01	13.25	5.21	2.69	1.94	17.72
REVEN[b]	694,396	935,713	101,075	8,590,631	409,576	492,679	34,632	4,369,764
WATER	84.12	14.48	48.0	100.0	80.05	15.98	43.50	100.0
SEWAG	75.03	19.08	29.0	100.0	67.28	21.24	14.70	100.0
ROAD	76.57	14.66	45.5	100.0	76.28	15.07	36.30	100.0
SOWEL	0.03	0.02	0.00	0.10	0.02	0.02	0.00	0.13
PARK	10.44	13.76	0.00	98.31	2.93	11.07	0.00	94.06
CULFA	0.06	0.04	0.00	0.25	0.03	0.01	0.01	0.09
POP	278,200	221,736	31,174	1,042,132	269,014	201,635	57,067	951,253
INDSOUR	36.77	16.57	12.80	70.20	39.87	18.16	14.70	75.3

INPUT VARIABLES: (I) [15] EXPEN (million won[16]) = per capita expenditure; (I) EMPY = 1,000 citizens per capita public employees. OUTPUT VARIABLES: (O) REVEN (won) = per capita revenue; (O) WATER (%) = percent of water-supply services; (O) SEWAG (%) = percent of sewage services; (O) ROAD (%) = percent of road paved; (O) SOWEL (n) = 1,000 citizens per capita social welfare facility number; (O) PARK (km^2) = 1,000 citizens per capital public park squares; and (O) CULFA (n) = 1,000 citizens per capita cultural facility numbers. SOCIO-ECONIMIC VARIABLES: POP (n) = population; INDSOUR (%) = percent of independent revenue source.
Source: (MOGAHA 2005; 2001)

In terms of the 1,000 citizens per capita full-time public employees, in 2005 the average number of public employees of Korean city governments is 5.11 persons, while in 2001 it is 5.21 persons. This data shows that the average number of public employees decreased in Korean city government between 2001 and 2005.

Seven output variables include ‘REVEN,’ ‘WATER,’ ‘SEWAG,’ ‘ROAD,’ ‘SOWEL,’ ‘PARK,’ and ‘CULFA.’ First of all, variable REVEN means per capita

[15] Here, ‘(I)’ represents ‘input variable,’ while ‘(O)’ represents ‘output variables.’
[16] A money unit, one million won is approximately one thousand dollars (1,000,000 won = $1,000.00).

revenue in each city government. In 2005 the mean of per capita revenue in Korean city governments is 694396.10 won ($694.39), while in 2001 the average of per capita revenue is 409576 won ($409.57). Variable 'WATER' means the percent of water-supply services provided from Korean city governments. In 2005 the mean of water services is 84.12%, while in 2001 the average of water services in Korean city governments is 80.05%. Comparing 2005 with 2001, average water services of Korean city government have increased by approximately 4%.

The variable 'ROAD' means the percent of road paved. In 2005 the average of road paved in Korean city government is 76.57%, while in 2001 it is 76.28%. Road services provided by Korean city governments are almost the same in the period of 2005 and 2001. Variables 'PARK', 'CULFA' means 1,000 citizens per capital public parks squares, and 1,000 citizens per capita cultural facility number respectively. In 2005 the average square of public parks in Korean city governments is 10.4 km^2, while in 2001 it is 2.93 km^2. In 2005 the average 1,000 citizens per capita cultural facility number of Korean city governments is 0.06, while in 2001 it is 0.03.

6.2 Efficiency Analysis of Korean City Governments Using Data Envelopment Analysis

This section measures and evaluates technical, cost, and scale efficiency of Korean city governments by using Data Envelopment Analysis (DEA). And then it describes analysis results and the meanings of each efficiency score for improving Korean city government performance. Finally, the degree of difference of Korean city government efficiency will be analyzed through four criteria: population size, employee size, the degree of independent revenue source, and expenditure.

6.2.1 Technical, Cost, and Scale Efficiency of Korean City Governments

As a statistical method to measure and evaluate the efficiency of Korean city governments, DEA is able to separate general efficiency into three different efficiencies: technical, cost, and scale and it can also obtain each efficiency scores from the analysis. This study uses Data Envelopment Analysis (DEA) to measure the efficiency of Korean city governments.

Table 6.2 shows technical, cost, and scale efficiency scores of Korean city governments based upon 2005 data. In terms of technical efficiency, the average technical efficiency score[17] of Korean city governments is 0.7048. The number of efficient Decision Making Units[18] (DMUs, here means Korean city governments) is 26, while the number of inefficient DMUs is 51. In 2001[19] the average technical efficiency score of Korean city governments is 0.7016. Comparing 2005 with 2001 technical efficiency of Korean city governments, the changes of average technical efficiency are very small. The numbers of efficient and inefficient DMUs are almost same.

With regard to cost efficiency, the average cost efficiency of Korean city governments in 2005 is 0.6142. The numbers of efficient and inefficient DMUs are 11 and 66 respectively. In contrast, in 2001 the cost efficiency score is 0.6515, while the

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[17] Most efficiency score under the DEA model belongs from 0 to 1. '1' means the most efficient DMU, while '0' represents the most inefficient DMU.

[18] In Data Envelopment Analysis (DEA), a DMU (often called, Decision Making Unit) is called an organization or an entity under the study. Generally, a DMU is regarded as the entity or organization responsible for converting inputs into outputs and it can be evaluated their performances. So, the examples of DMUs may be included numerous organizations such as banks, department stores, car makers, hospitals, schools, public libraries and so forth (Cooper, Seiford, and Tone 2007).

[19] More detailed data of technical, cost, and scale efficiency in 2005 as well as in 2001 is attached in the appendix part of this dissertation.

numbers of efficient and inefficient DMUs are 9 and 63 respectively. In terms of the change of cost efficiency of Korean city governments, results show that the 2001 cost efficiency of Korean city governments is much higher than the 2005 cost efficiency. This means that cost efficiency of Korean city governments has decreased somewhat.

As for scale efficiency, the average scale efficiency of Korean city governments in 2005 is 0.6941. The numbers of efficient and inefficient DMUs are 19 and 58 respectively. In 2001, the average scale efficiency score of Korean city governments is 0.6405. The numbers of efficient and inefficient are 12 and 60 individually. Comparing 2005 with 2001 in terms of scale efficiency score, the 2005 scale efficiency of Korean city governments is more improved than in 2001. Overall, the technical and scale efficiency of Korean city governments has improved, while cost efficiency has decreased during the period of 2005 and 2001.

Efficiency analysis of specific city governments provides more information about how to manage and operate government for improving their government performance (efficiency). As for the results of DEA analysis, the most efficient city government (all efficiency score is '1') in terms of technical, cost, and scale efficiency consists of the nine city governments of Bucheon, Ansan, Goyang, Gwangju, Cheongju, Jeonju, Mokpo, Gumi, and Jeju. In other words, all other things being equal (*ceteris paribus*[20]), these nine city governments are operated in the most efficient manner in terms of technical, cost, and scale efficiency.

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[20] *Ceteris Paribus* is an economic concept that does not consider external conditions or factors. For example, if many people want to buy IBM computers, the supply of the IBM computers will be increased. Most economists use a *ceteris paribus* concept to analyze two

Table 6.2 DEA Summary in Scores and Rank of Technical, Cost, and Scale Efficiency in Korean City Governments[21], 2005

Input Items: (1) EXPEN; (2) EMPLY
Output Items: (1) REVEN; (2) WATER; (3) SEWAG; (4) ROAD; (5) SOWEL; (6) PARK; (7) CULFA

No.	DMUs (2005) (Korean City Govn't)	Technical Efficiency Score	Tech Rank	Cost Efficiency Score	Cost Rank	Scale Efficiency Score	Scale Rank
1	Suwon	1	1	0.72057496	25	1	1
2	Seongnam	1	1	0.91024798	15	1	1
3	Uijeongbu	1	1	0.66664904	30	1	1
4	Anyang	1	1	1	1	1	1
5	Bucheon	1	1	1	1	1	1
6	Gwangmyeong	1	1	0.9143365	14	0.91785291	23
7	Pyeongtaek	0.60682714	47	0.56541885	41	0.56551031	49
8	Dongducheon	1	1	0.51282664	50	0.8972745	24
9	Ansan	1	1	1	1	1	1
10	Gwacheon	1	1	1	1	1	1
11	Guri	1	1	0.55878337	42	0.74183443	33
12	Namyangju	0.87156989	30	0.92758673	13	0.92758673	22
13	Osan	0.89056762	28	0.84324389	17	0.84324389	27
14	Siheung	1	1	0.86495927	16	1	1
15	Gunpo	0.91732926	27	0.72019352	26	0.94615472	21
16	Uiwang	0.62030595	43	0.45206808	55	0.72659954	34
17	Hanam	0.63406095	40	0.66554747	31	0.66784276	40
18	Goyang	1	1	1	1	1	1
19	Yongin	1	1	0.61074483	36	1	1
20	Paju	0.62028596	44	0.49318488	52	0.54757131	51
21	Icheon	0.60148631	49	0.52764502	48	0.55076243	50
22	Yangju	0.66981102	39	0.58838281	39	0.68381081	39
23	Pocheon	0.7102484	34	0.64551375	35	0.75328268	31
24	Hwaseong	0.58483153	51	0.43067186	60	0.49806135	58
25	Gwangju	1	1	1	1	1	1
26	Anseong	0.62524464	42	0.60107672	38	0.63783176	43
27	Gimpo	0.5424043	53	0.31408951	71	0.48658809	59
28	Chuncheon	0.60306449	48	0.66462903	32	0.66462903	41
29	Wonju	0.60061606	50	0.53408558	46	0.62812685	45
30	Gangreung	0.44047592	63	0.2475634	75	0.62369248	46
31	Donghae	0.449067	61	0.32750329	67	0.5430697	53
32	Taebaek	0.3489103	71	0.2544925	73	0.43849387	66
33	Sokcho	0.34546125	72	0.25083075	74	0.38127052	71
34	Samcheok	0.18434892	77	0.11306087	77	0.23060205	76
35	Cheongju	1	1	1	1	1	1
36	Chungju	0.50539024	58	0.5285649	47	0.5285649	56
37	Jecheon	0.40773155	67	0.44047775	58	0.44047775	65
38	Cheonan	1	1	0.96145784	12	1	1
39	Gongju	0.45502235	60	0.44372338	57	0.4443413	64
40	Boryeong	0.33120326	73	0.32068246	69	0.32068246	74

close cause-effect relationships without considering the other conditions. Otherwise, it would be impossible to make any accurate economic theory (Schlicht 1985).

[21] More detailed information about technical, cost, and scale efficiency scores in 2005 and 2001 years is attached in the appendix part of this dissertation. Basically, 2001 data and results of efficiency scores are almost similar with 2005. Due to the limited space, this section focuses more results of 2005 data than 2001.

Table 6.2 - *Continued*

41	Asan	0.51457969	57	0.36888284	63	0.61502705	47
42	Seosan	0.46662299	59	0.47373786	54	0.47373786	61
43	Nonsan	1	1	0.66316476	33	0.68913688	38
44	Gyeryong	0.61293363	46	0.77133695	19	0.77133695	29
45	Jeonju	1	1	1	1	1	1
46	Gunsan	0.79897441	32	0.73668618	23	0.85926918	26
47	Iksan	0.6929818	37	0.7631359	20	0.7631359	30
48	Jeongeup	0.44577035	62	0.44647747	56	0.44647747	63
49	Namwon	1	1	0.47750463	53	0.47860644	60
50	Gimje	0.42670368	65	0.35925513	65	0.3889302	69
51	Mokpo	1	1	1	1	1	1
52	Yeosu	0.42522184	66	0.31624607	70	0.44887784	62
53	Suncheon	0.54221399	54	0.54718462	43	0.54718462	52
54	Naju	0.43872111	64	0.4231324	61	0.4231324	67
55	Gwangyang	0.6141811	45	0.60387657	37	0.60389249	48
56	Pohang	0.68928954	38	0.70054426	28	0.70054426	37
57	Gyeongju	0.52908564	56	0.52731568	49	0.52731568	57
58	Gimcheon	0.82673581	31	0.56812892	40	0.63531147	44
59	Andong	1	1	0.54149977	44	0.65777114	42
60	Gumi	1	1	1	1	1	1
61	Yeongju	0.53526394	55	0.53546427	45	0.53546427	54
62	Yeongcheon	0.38052733	69	0.36668456	64	0.38241685	70
63	Sangju	0.31880701	74	0.3241449	68	0.3241449	73
64	Mungyeong	0.27591879	75	0.27426426	72	0.27441775	75
65	Gyeongsan	0.54868051	52	0.49646152	51	0.53280945	55
66	Changwon	1	1	0.68484576	29	1	1
67	Masan	0.72821509	33	0.79940049	18	0.79940049	28
68	Jinju	0.69883444	36	0.72538773	24	0.72538773	35
69	Jinhae	0.69913682	35	0.66237882	34	0.70681745	36
70	Tongyeong	0.3789474	70	0.33001967	66	0.34510219	72
71	Sacheon	0.3987553	68	0.37197752	62	0.3996642	68
72	Gimhae	1	1	0.73764847	22	1	1
73	Miryang	0.19723123	76	0.17514241	76	0.18527009	77
74	Geoje	0.63221507	41	0.43627868	59	0.75314068	32
75	Yangsan	0.88939063	29	0.75976387	21	0.9495895	20
76	Jeju	1	1	1	1	1	1
77	Seogwipo	1	1	0.7069908	27	0.86922419	25

(1) Technical Efficiency Statistics Summary: Average Technical Efficiency Score = 0.70483381; No. of DMUs = 77; SD = 0.25347525; Maximum = 1; Minimum = 0.18434892; No. of efficient DMUs = 26; No. of inefficient DMUs = 51.
(2) Cost Efficiency Statistics Summary: Average Cost Efficiency Score = 0.61423092; No. of DMUs = 77; SD = 0.23931291; Maximum = 1; Minimum =0.11306; No. of efficient DMUs = 11; No. of inefficient DMUs = 66.
(3) Scale Efficiency Statistics Summary: Average Scale Efficiency Score = 0.69413372; No. of DMUs = 77; SD = 0.23890964; Maximum = 1; Minimum = 0.18527009; No. of efficient DMUs = 19; No. of inefficient DMUs = 58.
Source: Calculations Based Upon Appendix A.1

In contrast, the most inefficient city government (here inefficient city government means less than 0.4000) in terms of technical, cost, and scale efficiency are ten city governments: Taebaek (0.3489); Sokcho (0.3454); Samcheok (0.1843), Boryeong (0.3312); Yeongcheon (0.3805); Sangju (0.3188); Mungyeong (0.2759); Tongyeong (0.3789); Sacheon (0.3987); and Miryang (0.1972). These DEA results mean that these ten city governments are operated in the most inefficient manner, all other conditions being equal (*ceteris paribus*). Additional efficiency information about other Korean city government is in table 6.2.

6.2.2 Inefficiency Analysis through Measuring Input Excess

Where does the inefficiency of Korean city governments come from? Inefficiency decomposition analysis provides an answer to this question. Table 6.3 exhibits the inefficient causes of Korean city governments. This inefficiency decomposition analysis assumes that inefficient elements or components can be decomposed by comparing efficient city governments with inefficient city governments. Inefficiency decomposition analysis provides more specific reduction information for inefficient city governments in order to operate their city governments in a more technical, cost, and scale efficient manner. For example, the most efficient city governments do not use extra excess input resources in comparison with inefficient city governments, while inefficient city governments use more extra excess resources to produce the same amount of outputs as efficient governments.

Inefficient city governments can improve their efficiency by reducing extra resource inputs to produce outputs. For example, the city of Taebaek inputs 37.18% extra per capita expenditure and employes 27.92% extra public employees in order to produce the same outputs of the most efficient city governments, all other conditions being equal (*ceteris paribus*). The city of Sokcho (No.33) can be reduced per capita expenditure by 36.63% and 1,000 citizens per capital public employees by 28.82% compared with the most efficient city governments. As another example, the city of Samcheock (No.34) is the most inefficient Korean city government (the technical efficiency score is 0.1843). In the case of Samscheok, 43.95% per capital expenditure and 37.60% public employees can be reduced in order to become the most efficient city government.

Inefficiency decomposition analysis also suggests that the best benchmarking city government (reference set) for inefficient city governments to be able to benchmark to improve their efficiency. For instance, the reference set of Sokcho is Bucheon. The model city government for Samcheock is also Bucheon. This reference set indicates that Sokcho and Samcheock can be improved by knowing how to mange and operate Bucheon which is the most efficient city government. The best benchmarking model city govovernment for inefficient city governments is Gwacheon, and Bucheon is second.

Table 6.3 Inefficiency Analysis through Measuring Input Excess, 2005

Input Items: (1) EXPEN; (2) EMPLY Output Items: (1) REVEN; (2) WATER; (3) SEWAG; (4) ROAD; (5) SOWEL; (6) PARK; (7) CULFA: (SBM-I-V Model)					
No.	DMUs (2005) (Korean City Govn't)	Technical Efficiency Score	Reference Set (Bench Marking)	Input Excess EXPEN Inefficiency	Input Excess EMPLY Inefficiency
1	Suwon	1	Suwon	0	0
2	Seongnam	1	Seongnam	0	0
3	Uijeongbu	1	Uijeongbu	0	0
4	Anyang	1	Anyang	0	0
5	Bucheon	1	Bucheon	0	0
6	Gwangmyeong	1	Gwangmyeong	0	0
7	Pyeongtaek	0.60682714	Anyang	0.1853999	0.20777296
8	Dongducheon	1	Dongducheon	0	0
9	Ansan	1	Ansan	0	0
10	Gwacheon	1	Gwacheon	0	0
11	Guri	1	Guri	0	0
12	Namyangju	0.87156989	Bucheon	1.93E-02	0.10909557
13	Osan	0.89056762	Bucheon	8.97E-03	0.10046354
14	Siheung	1	Siheung	0	0
15	Gunpo	0.91732926	Seongnam	8.27E-02	0
16	Uiwang	0.62030595	Ansan	0.26436989	0.11532416
17	Hanam	0.63406095	Gwacheon	0.15893304	0.207006
18	Goyang	1	Goyang	0	0
19	Yongin	1	Yongin	0	0
20	Paju	0.62028596	Gwacheon	0.20330883	0.1764052
21	Icheon	0.60148631	Gwacheon	0.19125272	0.20726097
22	Yangju	0.66981102	Cheonan	0.18168958	0.14849939

Table 6.3 - *Continued*

23	Pocheon	0.7102484	Gwacheon	0.1742965	0.1154551
24	Hwaseong	0.58483153	Goyang	0.22312699	0.19204148
25	Gwangju	1	Gwangju	0	0
26	Anseong	0.62524464	Gwacheon	0.19830419	0.17645117
27	Gimpo	0.5424043	Gwacheon	0.27386609	0.18372961
28	Chuncheon	0.60306449	Gwacheon	0.15714263	0.23979288
29	Wonju	0.60061606	Gwacheon	0.21725008	0.18213386
30	Gangreung	0.44047592	Jeonju	0.37267261	0.18685147
31	Donghae	0.449067	Gwacheon	0.33485521	0.21607779
32	Taebaek-	0.3489103	Bucheon	0.37181282	0.27927688
33	Sokcho	0.34546125	Bucheon	0.36633543	0.28820333
34	Samcheok	0.18434892	Bucheon	0.4395654	0.37608568
35	Cheongju	1	Cheongju	0	0
36	Chungju	0.50539024	Gwacheon	0.19936255	0.29524722
37	Jecheon	0.40773155	Jeonju	0.27106304	0.32120541
38	Cheonan	1	Cheonan	0	0
39	Gongju	0.45502235	Cheonan	0.27102317	0.27395448
40	Boryeong	0.33120326	Cheonan	0.33079359	0.33800315
41	Asan	0.51457969	Gwacheon	0.29442391	0.1909964
42	Seosan	0.46662299	Gwacheon	0.24043881	0.2929382
43	Nonsan	1	Nonsan	0	0
44	Gyeryong	0.61293363	Ansan	0.10902139	0.27804499
45	Jeonju	1	Jeonju	0	0
46	Gunsan	0.79897441	Gwacheon	0.13084292	7.02E-02
47	Iksan	0.6929818	Gwacheon	9.80E-02	0.20900358
48	Jeongeup	0.44577035	Gwacheon	0.27018205	0.2840476
49	Namwon	1	Namwon	0	0
50	Gimje	0.42670368	Goyang	0.25358883	0.31970749
51	Mokpo	1	Mokpo	0	0
52	Yeosu	0.42522184	Gwacheon	0.32448887	0.2502893
53	Suncheon	0.54221399	Goyang	0.20179455	0.25599147
54	Naju	0.43872111	Gwacheon	0.2786319	0.28264699
55	Gwangyang	0.6141811	Gwacheon	0.17219398	0.21362492
56	Pohang	0.68928954	Ansan	0.11677071	0.19393975
57	Gyeongju	0.52908564	Gwacheon	0.21426255	0.25665181
58	Gimcheon	0.82673581	Dongducheon	5.46E-02	0.11870579
59	Andong	1	Andong	0	0
60	Gumi	1	Gumi	0	0
61	Yeongju	0.53526394	Gwacheon	0.21492256	0.2498135
62	Yeongcheon	0.38052733	Gwacheon	0.31270475	0.30676792
63	Sangju	0.31880701	Gwacheon	0.31335428	0.3678387
64	Mungyeong	0.27591879	Gwacheon	0.35464085	0.36944036
65	Gyeongsan	0.54868051	Gwacheon	0.23412631	0.21719318
66	Changwon	1	Changwon	0	0
67	Masan	0.72821509	Bucheon	8.17E-02	0.19011947
68	Jinju	0.69883444	Gwacheon	0.11604712	0.18511844
69	Jinhae	0.69913682	Gwacheon	0.16032719	0.140536
70	Tongyeong	0.3789474	Anyang	0.33413283	0.28691977
71	Sacheon	0.3987553	Gwacheon	0.30339521	0.2978495
72	Gimhae	1	Gimhae	0	0
73	Miryang	0.19723123	Goyang	0.38956455	0.41320422
74	Geoje	0.63221507	Gwacheon	0.26861945	9.92E-02
75	Yangsan	0.88939063	Gwacheon	9.19E-02	1.87E-02
76	Jeju	1	Jeju	0	0
77	Seogwipo	1	Seogwipo	0	0

Returns to Scale = Variable (Sum of Lambda = 1)
Source: Calculations Based Upon Appendix A.1

6.2.3 Population Size of City and Efficiency of Government

Table 6.4 shows the relationship between the population size of cities and the efficiency of city governments based upon Korean 2005 and 2001 data. The population size of Korean cities is divided into ten categories from under 100,000 to over 900,001.

Table 6.4 ANOVA Analysis of Population Size and Efficiency of Government (2005, 2001)

Size of City (Population)	N		Technical Efficiency		Cost Efficiency		Scale Efficiency	
	'05	'01	2005	2001	2005	2001	2005	2001
Under 100,000	9	7	0.6408	0.6358	0.4845	0.4901	0.5934	0.5821
100,001-200,000	28	31	0.5769	0.5785	0.4891	0.5386	0.5465	0.5180
200,001-300,000	17	11	0.6845	0.7753	0.6099	0.7522	0.7032	0.6781
300,001-400,000	7	11	0.7748	0.7740	0.7356	0.7152	0.7743	0.7257
400,001-500,000	4	2	0.8999	0.7841	0.7828	0.7690	0.9317	0.6228
500,001-600,000	3	5	0.8964	0.9048	0.7822	0.8739	0.9001	0.8973
600,001-700,000	5	1	1.0000	1.0000	0.9221	1.0000	1.0000	1.0000
700,001-800,000	-	1	-	1.0000	-	0.8838	-	0.8629
800,001-900,000	2	1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Over 900,001	2	2	1.0000	1.0000	0.8154	0.9246	1.0000	0.9743
Total (mean)	77	72	0.7048	0.7016	0.6142	0.6515	0.6941	0.6405

ANOVA (2005)[22]		Sum of Squares	Degree of Freedom	Mean Square	F	Sig.
Technical Efficiency	Between Groups	1.583	8	0.198	3.998	0.000
	Within Groups	3.364	68	0.049		
	Total	4.947	76			
Cost Efficiency	Between Groups	1.744	8	0.218	5.560	0.000
	Within Groups	2.666	68	0.039		
	Total	4.410	76			
Scale Efficiency	Between Groups	1.943	8	0.243	6.733	0.000
	Within Groups	2.452	68	0.036		
	Total	4.395	76			

For example, in 2005 Korean city governments having populations fewer than 100,000 have 0.6408, 0.4845, and 0.5934 efficiency scores respectively in terms of technical, cost, and scale efficiency. However, in 2005 Korean city governments having populations over 600,000 are the most efficient city governments because all technical,

[22] Due to limited space, the ANOVA summaries of 2001 data are attached in the appendix part of this dissertation.

cost, and scale efficiency scores are '1' or nearly '1,' which means the most efficient DMUs. This trend in the change of city government efficiency in 2005 is very similar to 2001. In other words, as the population size of a city increases, the efficiency of the city government also rises in the same direction.

These different efficiency scores of Korean city government according to the population size of cities are supported by a statistical analysis. The analysis of variance (ANOVA) shows there is a statistical difference between the groups (different population size cities) and within the groups at a 99.99% statistically significant level. In other words, the population size of a city has a close relationship with the efficiency of city government in terms of technical, cost, and scale efficiency. This means that the larger population size of a city tends to become a more efficient city government.

6.2.4 Employee Size of Government and Efficiency of Government

Table 6.5 displays the relationship between size of government (numbers of public employees) and efficiency of city government based upon Korean 2005 and 2001 data. Here, the employee size of city governments means 1,000 citizens per capita public employees. The employee size of city governments is divided into ten categories from under four public employees to over ten public employees. As a result of analysis, the average technical, cost, and scale efficiency of Korean city governments having fewer than four public employees is 0.8913, 0.7830, and 0.8854 in 2005, and in 2001 it is 0.8813, 0.8113, and 0.8149 respectively. However, the average technical, cost, and scale efficiency of Korean city governments having over ten public employees is 0.3952, 0.2728, and 0.2986 in 2005, and in 2001 it is 0.3232, 0.4092, and 0.1706 respectively. As a result, Korean city governments having fewer than four public employees in terms of 1,000 citizens per capita public employees are the most efficient city government, because all technical, cost, and scale efficiency scores are higher than any other city government. In other words, this result shows that as the number of employees in city government increases, the efficiency of city governments decreases. This evidence supports the argument that small government is more efficient than big government.

Table 6.5 ANOVA Analysis of Employee Size and Efficiency of Government (2005, 2001)

1,000 Citizens Per Capita Public Employees	N		Technical Efficiency		Cost Efficiency		Scale Efficiency	
	’05	’01	2005	2001	2005	2001	2005	2001
2.0000-3.9999	32	29	0.8913	0.8813	0.7830	0.8149	0.8854	0.8501
4.0000-5.9999	20	20	0.6234	0.6753	0.5538	0.6221	0.6524	0.6070
6.0000-7.9999	16	14	0.6056	0.5868	0.5191	0.5361	0.5550	0.4921
8.0000-9.9999	4	7	0.4034	0.3703	0.3726	0.3586	0.4226	0.2993
Over 10.0000	5	2	0.3952	0.3232	0.2728	0.4092	0.2986	0.1706
Total (mean)	77	72	0.7048	0.7016	0.6142	0.6515	0.6941	0.6405

ANOVA (2005)		Sum of Squares	Degree of Freedom	Mean Square	F	Sig.
Technical Efficiency	Between Groups	2.245	4	0.561	14.955	0.000
	Within Groups	2.702	72	0.038		
	Total	4.947	76			
Cost Efficiency	Between Groups	1.946	4	0.487	14.219	0.000
	Within Groups	2.464	72	0.034		
	Total	4.410	76			
Scale Efficiency	Between Groups	2.593	4	0.648	25.895	0.000
	Within Groups	1.802	72	0.025		
	Total	4.395	76			

These different efficiency scores of city governments depending upon the employee size of city governments are also supported by a statistical analysis. The analysis of variance (ANOVA) shows that there is a statistical difference between the groups (different employees size of city governments) and within the groups at a

99.99% statistically significance level. In other words, the employee size of city government closely relates to the efficiency of city government in terms of technical, cost, and scale efficiency. A smaller number of employees in a city government are more efficient.

6.2.5 Expenditure and Efficiency of Government

Table 6.6 shows the relationship between the expenditure level of Korean city government and the efficiency of government based upon Korean 2005 and 2001 data. More specifically, per capita expenditures of Korean city governments are separated into four categories from under 0.999 million won ($1,000.00) to more 3.000 million won ($3,000.00) for the purpose of statistic analysis. As results of DEA analysis, Korean city governments having less than 0.9999 million won ($999.99) in a per capita expenditure aspect have the highest technical, cost, and scale scores, such as 0.9468, 0.9036, 0.9491 in 2005 and 0.7936, 0.7514, 0.7320 in 2001 respectively.

In contrast, Korean city governments having higher than 3.0000 million won ($3,000.00) in a per capita expenditure term are the most inefficient city government, as the following technical, cost, and scale scores: 0.2927, 0.1975, and 0.3695 in 2005 respectively. This analysis result shows that as the expenditure of city governments increases, the efficiency of city governments decreases. This empirical evidence supports the argument that city government having lower expenditures is more efficient than city government having higher expenditures.

These different efficiency scores between city governments depending upon employee size of city governments are also proven by a statistical method. The analysis of variance (ANOVA) shows there is a statistical difference between the groups (different expenditure city governments) and within the groups at a 99.99% statistically significant level. In other words, per capita expenditures in city governments have a close relationship to the efficiency of city government in terms of technical, cost, and scale efficiency. This demonstrates that the lower expenditures of city government will bring more efficient government.

Table 6.6 ANOVA Analysis of Expenditure and Efficiency of Government (2005, 2001)

Per Capita Expenditure (million won)	N		Technical Efficiency		Cost Efficiency		Scale Efficiency	
	'05	'01	2005	2001	2005	2001	2005	2001
Under 0.9999	17	46	0.9468	0.7936	0.9036	0.7514	0.9491	0.7320
1.0000-1.9999	37	25	0.6984	0.5204	0.6156	0.4734	0.6929	0.4661
2.0000-2.9999	19	1	0.5874	1.0000[23]	0.4402	0.5095	0.5366	0.7949
Over 3.0000	4	0	0.2927	-	0.1975	-	0.3695	-
Total (mean)	77	72	0.7048	0.7016	0.6142	0.6115	0.6941	0.6405

ANOVA (2005)		Sum of Squares	Degree of Freedom	Mean Square	F	Sig.
Technical Efficiency	Between Groups	1.938	3	0.646	15.677	0.000
	Within Groups	3.009	73	0.041		
	Total	4.947	76			
Cost Efficiency	Between Groups	2.694	3	0.898	38.210	0.000
	Within Groups	1.716	73	0.024		
	Total	4.410	76			
Scale Efficiency	Between Groups	1.998	3	0.646	15.677	0.000
	Within Groups	2.397	73	0.041		
	Total	4.395	76			

6.2.6 Independent Revenue Source and Efficiency of government

Table 6.7 shows the relationship between the independent revenue source of Korean city government and the efficiency of government. The percent of independent

[23] Here, 1.0000 means city Seogwip's technical efficiency score. However, the efficiency score looks like an outlier in a statistical term. For the reasons, in 2001 the sample of range from 2.0000 to 2.9999 is only 'one.' In addition, compared with 2005's efficiency score and the size of samples, 2001 efficiency score can not have a meaningful interpretation.

revenue source[24] of Korean city governments is divided into six categories depending upon the degree of independent revenue source from under 20% to over 60%. As for the results of DEA analysis, Korean city governments having less than 20% in local revenue sources have low technical, cost, and scale efficiency scores, as follows: 0.5744, 0.4524, 0.4980 in 2005 and 0.4564, 0.4323, 0.3826 in 2001 respectively.

In contrast, Korean city governments having over 60% independent revenue sources have much higher technical, cost, and scale efficiency scores than Korean city governments having under-20% independent revenue sources as follows: 0.9584, 0.8222, 0.9498 in 2005, and 0.9621, 0.8969, 0.9369 in 2001 respectively. That is, as the independent degree of revenue source increases, the efficiency of city governments increases. This empirical result supports the argument that local government which is more dependent upon outside sources (e.g., the federal or central governments) will tend to be more inefficient in operating government.

The argument that an independent degree of revenue source in local government has closely to do with the efficiency of local government is also supported by a statistical analysis. The analysis of variance (ANOVA) shows there is a statistical difference between the groups (city governments having different independent revenue sources) and within the groups at a 99.99% statistically significant level. In other

[24] Percent of independent revenue source (INDSOUR) is an indictor to show the degree of independent revenue source in loal government. In other words, local governments having higher independent revenue source have more freedom in using their budgets than local governments having lower independent revenue source. Therefore, local governments with higher independent revenue source do not need to receive intergovernmental grants from the central government. Percent of independent revenue source is calculated by the following formula. Percent of independent revenue source = [(local tax + nontax revenue) ÷ total general account].

words, in a statistical aspect, independent revenue source has a close relationship with the efficiency of city government in terms of technical, cost, and scale efficiency. Furthermore, this demonstrates that local government having more independent revenue sources is likely to be more efficient government.

Table 6.7 ANOVA Analysis of Independent Revenue Source and Efficiency of Government (2005, 2001)

Percent of Independent Revenue Sources	N		Technical Efficiency		Cost Efficiency		Scale Efficiency	
	'05	'01	2005	2001	2005	2001	2005	2001
Under 20.000%	14	13	0.5744	0.4564	0.4524	0.4323	0.4980	0.3826
20.001-30.000	16	12	0.5508	0.5719	0.4850	0.5112	0.5445	0.4936
30.001-40.000	15	16	0.6098	0.6441	0.5387	0.6151	0.6517	0.5594
40.001-50.000	13	10	0.8127	0.8359	0.7384	0.7475	0.7964	0.7950
50.001-60.000	9	6	0.9019	0.7708	0.8107	0.7305	0.9038	0.7130
Over 60.001%	10	15	0.9584	0.9621	0.8222	0.8969	0.9498	0.9369
Total (mean)	77	72	0.7048	0.7016	0.6142	0.6515	0.6941	0.6605

ANOVA (2005)		Sum of Squares	Degree of Freedom	Mean Square	F	Sig.
Technical Efficiency	Between Groups	1.897	5	0.379	8.833	0.000
	Within Groups	3.050	71	0.043		
	Total	4.947	76			
Cost Efficiency	Between Groups	1.700	5	0.340	8.906	0.000
	Within Groups	2.710	71	0.038		
	Total	4.410	76			
Scale Efficiency	Between Groups	2.109	5	0.422	13.098	0.000
	Within Groups	2.286	71	0.032		
	Total	4.395	76			

6.3 Stochastic Efficiency Analysis of Korean City Governments Using Stochastic Frontier Analysis

This section will review the brief literature about the Stochastic Frontier Model as an analytic tool for measuring performance (efficiency). Later, it will measure and evaluate stochastic technical efficiency (called 'stochastic efficiency') of Korean city governments by using Stochastic Frontier Analysis (SFA). Finally, it will analyze and discuss the relationship between stochastic efficiency and four characteristics of city governments, such as population size, employee size, expenditure, and independent revenue sources.

6.3.1 Stochastic Frontier Model

One of the most important assumptions of the stochastic frontier model is that there exists technical inefficiency in the production of outputs in firms. Since this stochastic frontier model (often called 'stochastic frontier production function') has been proposed by Aigner, Lovell, and Schmidt (1977) and Meesun and Van Den Broeck (1977), there have been numerous applications and extensions to various academic and practical fields (Forsund, Lovell, and Schimidt 1980; Schmidt 1986; Greene 1993).

Most initial empirical studies use a two-stage approach, which in the first stage measures the stochastic frontier production estimation and in the second stage predicts technical inefficiency effects (Battese and Coelli 1995). This two-stage approach is integrated by Kumbhakar, Ghosh, and McGuckin (1991) and Battese and Coelli (1995), who suggest a stochastic frontier function model to be able to estimate and at the same time predict technical inefficiency with cross-sectional data.

As an analytic tool for measuring efficiency in government, this study also uses Battese and Coelli's (1995) stochastic frontier model to be able to measure technical inefficiency estimation and predict the technical inefficiency effects simultaneously. The Battese and Coelli (1995) model specification[25] is expressed as follows:

[25] Here, stochastic frontier model means the 'Cobb-Douglas Production Model,' which is a production model to be needed a logged dependent variables and one more logged independent variables for measuring production efficiency (Battese and Coelli 1995).

(6.1) $Y_{it} = f(x_{it}; \beta) + (V_{it} - U_{it})$, ,i = 1, 2, 3,…N, t=1, 2, 3,…T, where,

Y_{it} = the logarithm of the production for the *i*th firm or organization at the *t*th period of observation.

x_{it} = a k×1 vector of (transformations of the) input quantities of the *i*-th organization in the *t*th time period;

β = an vector of unknown parameters;

V_{it} = unknown random variables which are assumed to be *i*id N $(0, \sigma_v^2)$, and independent of the

$U_{it} = (U_i \exp(-\eta(t-T)))$, where

the U_{it} = non-negative random variables which are assumed to account for technical inefficiency in production and are often assumed to be *i*id as truncations at the zero the N (μ, σ_u^2) distribution; and

η = a parameter to be estimated.

Based upon above the Battese and Coelli (1995) model, this study creates a stochastic frontier production model for estimating the efficiency of Korean city governments as follows:

(6.2) $\text{Log}(Y_{it}) = \beta_0 + \beta_1 \log(\text{EXPEN}) + \beta_2 \log(\text{EMPY}) + V_{it} - U_{it},$

Where the subscripts i and t means the *i*th city government and the *t*th observation, respectively.

Y represents REVEN[26], which means per capital revenue in Korean city governments sampled;

EXPEN represents per capita expenditure in Korean city governments;

[26] As mentioned above, this study has seven output variables, but stochastic frontier analysis can only use one dependent variable. Therefore, as a dependent variable for SFA analysis, this study uses variable 'REVEN' among seven output variables because the other six output variables represent specific public services areas, while REVEN represents more overall output in government. In other words, REVEN can be a comprehensive proxy variable to indicate the overall output of Korean city governments.

EMPY represents 1,000 citizens per capita public employees in Korean city governments;

the V_{it} are assumed to be independent and identically distributed N(0, σ_v^2) random the errors;

the U_{it} are assumed to be independent and identically distributed non-negative truncations of the N(μ, σ_u^2) distribution.

6.3.2 Stochastic Efficiency Analysis of Korean City Governments Using Stochastic Frontier Analysis

Table 6.8 shows the stochastic efficiency scores of Korean city governments based upon 2005 and 2001 data. It also provides the DEA technical efficiency scores of Korean city governments for a better comparison of stochastic technical efficiency scores in 2005 and 2001 years.

As for the results of SFA analysis, in 2005 the average of stochastic technical efficiency scores is 0.6981, while in 2001 it is 0.3761. Comparing 2005 with 2001, the average of stochastic technical efficiency in 2005 is much higher, but the standard deviation is much narrower than 2001, such as 0.0064 in 2005 and 0.2757 in 2001. In addition, in the comparison of DEA technical efficiency in 2005 and 2001 years, the scores of stochastic technical efficiency is much lower than that of DEA.

More specifically, in terms of stochastic efficiency scores of each Korean city government, the following cities are the most efficient (the highest stochastic efficiency score) top ten city governments in 2005: 'Seongnam' (no. 2, score = 0.7814); 'Anyang' (no. 4, score = 0.7820); 'Ansan' (no. 9, score = 0.7762); 'Gwacheon' (no. 10, score = 0.8059); 'Siheung' (no. 14, score = 0.7791); 'Goyang' (no. 18, score = 0.7770);

‘Yongin’ (no. 19, score = 0.7731); ‘Gwangju’ (no. 25, score = 0.7700); and ‘Chenan’ (no. 38, score = 0.7728).

In contrast, the following cities are the most inefficient (the lowest stochastic efficiency score) top ten city governments based upon the stochastic frontier analysis: ‘Hwaseong’ (no. 24, score = 0.5910); ‘Gangreung’ (no. 30, score = 0.5972); ‘Taebaek’ (no. 32, score = 0.5251); ‘Samcheok’ (no. 34, score = 0.5133); ‘Namwon’ (no. 49, score = 0.5966); ‘Naju’ (no. 54, score = 0.6035); ‘Sangju’ (no. 63, score = 0.6053); ‘Mungyeong’ (no. 64, score = 0.5841); ‘Sacheon’ (no. 71, score = 0.6232); and ‘Miryang’ (no. 73, score = 0.5850).

In the case of 2001, the following cities are the most efficient (the highest stochastic efficiency score) top ten city governments: ‘Suwon’ (no. 1, score = 0.7689); ‘Seongnam’ (no. 2, score = 0.8001); ‘Anyang’ (no. 4, score = 0.9529); ‘Gwangmyeong’ (no. 6, score = 0.8934); ‘Ansan’ (no. 9, score = 0.9088); ‘Gwacheon’ (no. 10, score = 0.9958); ‘Gunpo’ (no. 15, score = 0.9239); ‘Uiwang’ (no. 16, score = 0.9127); ‘Goyang’ (no. 18, score = 0.9999); and ‘Yongin’ (no. 19, score = 0.8734). However, the following cities are the most inefficient (the lowest stochastic efficiency score) top ten city governments: ‘Dongducheon’ (no. 8, score = 0.0067); ‘Taebaek’ (no. 32, score = 0.0564); ‘Samcheok’ (no. 34, score = 0.0634); ‘Gongju’ (no. 39, score = 0.0854); ‘Boryeong’ (no. 40, score = 0.0750); ‘Namwon’ (no. 49, score = 0.0813); ‘Yeosu’ (no. 54, score = 0.0581); ‘Naju’ (no. 54, score = 0.0912); ‘Mungyeong’ (no. 64, score = 0.0533); and ‘Seogwipo’ (no. 77, score = 0.0642).

More interestingly, in comparing SFA efficiency with DEA technical efficiency, there are some commonalities. For example, 'Samcheok' is also the most inefficient city government in both the DEA and SFA measurements for 2005. Likewise, 'Munyeong' is also one of the most inefficient cities in 2005 according to both DEA and SFA methods. This means that even though two methods such as DEA and SFA have different logic and structure in measuring efficiency, the results show a similar and consistent trend. Both SFA and DEA also have estimates from zero to one.

In this study of DEA efficiency estimation, however, there are numerous most efficient scores of '1', while SFA efficiency estimation has 0.999, not '1' even in the case of the highest SFA efficiency score. This difference of estimated DEA and SFA efficiency scores in measuring the efficiency of Korean city governments comes from different statistical logic and calculating formulas derived from both SFA and DEA methods.

Table 6.8 Comparison of Stochastic and DEA Technical Efficiency (2005, 2001)

Independent Variables: (1) EXPEN; (2) EMPLY Dependent Variables: (1) REVEN.					
No.	DMUs (Korean City Govn't)	2005 DEA Technical Efficiency (N=77)	2005 Stochastic Technical Efficiency (N=77)	2001 DEA Technical Efficiency (N=72)	2001 Stochastic Technical Efficiency (N=72)
1	Suwon	1	0.760262	1	0.768919
2	Seongnam	1	0.781477	1	0.800130
3	Uijeongbu	1	0.733549	1	0.493694
4	Anyang	1	0.782094	1	0.952941
5	Bucheon	1	0.770894	1	0.672805
6	Gwangmyeong	1	0.748077	1	0.893411
7	Pyeongtaek	0.60682714	0.736634	0.78037036	0.596564
8	Dongducheon	1	0.658853	1	0.067808
9	Ansan	1	0.776293	1	0.908815
10	Gwacheon	1	0.805997	1	0.995833
11	Guri	1	0.717970	0.69806752	0.459267
12	Namyangju	0.87156989	0.767718	0.74279787	0.421115
13	Osan	0.89056762	0.760323	0.7221005	0.295700
14	Siheung	1	0.779133	1	0.562861
15	Gunpo	0.91732926	0.752993	1	0.923910
16	Uiwang	0.62030595	0.702003	0.75798623	0.912782
17	Hanam	0.63406095	0.758760	1	0.352791
18	Goyang	1	0.777016	1	0.999074
19	Yongin	1	0.773124	1	0.873498

Table 6.8 - *Continued*

20	Paju	0.62028596	0.744759	0.58971842	0.203546
21	Icheon	0.60148631	0.735713	0.78928166	0.297806
22	Yangju	0.66981102	0.726312	-	-
23	Pocheon	0.7102484	0.716841	-	-
24	Hwaseong	0.58483153	0.591011	-	-
25	Gwangju	1	0.770031	-	-
26	Anseong	0.62524464	0.714952	0.6024226	0.275515
27	Gimpo	0.5424043	0.717689	0.72290084	0.400227
28	Chuncheon	0.60306449	0.729129	0.71093365	0.333539
29	Wonju	0.60061606	0.708201	0.71404125	0.410618
30	Gangreung	0.44047592	0.597205	0.60864205	0.267527
31	Donghae	0.449067	0.618217	0.54870499	0.163011
32	Taebaek	0.3489103	0.525199	0.33720198	0.056485
33	Sokcho	0.34546125	0.635599	0.50798045	0.241369
34	Samcheok	0.18434892	0.513332	0.3549092	0.063404
35	Cheongju	1	0.756241	1	0.614224
36	Chungju	0.50539024	0.687330	0.48632023	0.244574
37	Jecheon	0.40773155	0.661052	0.6106363	0.153047
38	Cheonan	1	0.772879	0.74209981	0.293908
39	Gongju	0.45502235	0.657208	0.66053194	0.085460
40	Boryeong	0.33120326	0.651404	0.61636989	0.075007
41	Asan	0.51457969	0.700901	0.54417765	0.280233
42	Seosan	0.46662299	0.716528	0.43644979	0.144000
43	Nonsan	1	0.658432	0.64234284	0.228703
44	Gyeryong	0.61293363	0.699661	-	-
45	Jeonju	1	0.752974	1	0.608779
46	Gunsan	0.79897441	0.708397	1	0.387203
47	Iksan	0.6929818	0.716645	0.60332849	0.346180
48	Jeongeup	0.44577035	0.612597	0.46969327	0.135872
49	Namwon	1	0.596618	0.30033158	0.081394
50	Gimje	0.42670368	0.666693	0.25881036	0.191290
51	Mokpo	1	0.713071	1	0.312672
52	Yeosu	0.42522184	0.655661	0.38764718	0.058115
53	Suncheon	0.54221399	0.701037	0.76229079	0.209464
54	Naju	0.43872111	0.603563	0.40188093	0.091231
55	Gwangyang	0.6141811	0.710172	0.43986624	0.446056
56	Pohang	0.68928954	0.749602	0.62097452	0.464210
57	Gyeongju	0.52908564	0.709675	0.64503685	0.313417
58	Gimcheon	0.82673581	0.643273	0.49112865	0.159301
59	Andong	1	0.640857	1	0.121010
60	Gumi	1	0.760607	0.64466475	0.536445
61	Yeongju	0.53526394	0.634617	0.47667824	0.110804
62	Yeongcheon	0.38052733	0.640524	0.44900489	0.222400
63	Sangju	0.31880701	0.605326	0.30463714	0.084853
64	Mungyeong	0.27591879	0.584173	0.25120243	0.053328
65	Gyeongsan	0.54868051	0.704926	0.6014062	0.398976
66	Changwon	1	0.752410	0.9032729	0.553439
67	Masan	0.72821509	0.710076	0.8261038	0.920770
68	Jinju	0.69883444	0.714811	0.63100584	0.309933
69	Jinhae	0.69913682	0.726109	0.52765403	0.246474
70	Tongyeong	0.3789474	0.651837	0.45002099	0.184098
71	Sacheon	0.3987553	0.623232	0.42709102	0.178175
72	Gimhae	1	0.735853	0.72520975	0.198950
73	Miryang	0.19723123	0.585087	0.41654136	0.114108
74	Geoje	0.63221507	0.658913	0.69479615	0.237937
75	Yangsan	0.88939063	0.742354	0.88397999	0.562935
76	Jeju	1	0.737576	1	0.396997
77	Seogwipo	1	0.659193	1	0.064267
Total (Mean)		Mean: 0.704833 Min: 0.184348 Max: 1 SD: 0.253475	Mean: 0.698148 Min: 0.513332 Max: 0.805997 SD: 0.064235	Mean: 0.701683 Min: 0.251202 Max: 1 SD: 0.234723	Mean: 0.376183 Min: 0.053328 Max: 0.999074 SD: 0.275794
Source: Calculations Based Upon Appendix A.1					

6.3.3 Population Size and Stochastic Efficiency

With regard to the relationship between the population sizes of cities (city population) and the efficiency of city government, the DEA results in the previous section show that the population size of cities has to do with the efficiency of city governments on a significant statistical level in the previous section. If so, what about the SFA results?

Table 6.9 illustrates relationships between the population sizes of cities and the efficiency of Korean city governments based upon the SFA method in 2005 and 2001 years. The population sizes of Korean cities are divided into ten categories from under 100,000 to over 900,001. For example, in 2005 the average stochastic efficiency scores of Korean city governments having a population fewer than 100,000 are 0.6309, which is the lowest average efficiency score. However, in 2005 the average stochastic efficiency score of Korean city governments having a population from 800,000 to 900,000 is 0.7739, which is the highest average efficiency score. This change in Korean city government efficiency in 2005 is very similar to scores in 2001. In other words, as the population size of Korean cities increases, the stochastic efficiency of the city governments increases upward also.

These different stochastic efficiency scores of Korean city governments according to population size are supported by yet another statistical analysis method. The analysis of variance (ANOVA) shows there is a statistical difference between the groups (different population size cities) and within the groups at a 99.99% statistically significant level. In other words, in a statistically significant way, the population sizes of cities have a close relationship with the efficiency of city governments. This empirical evidence again supports the argument that a larger population size of cities tends to become a more efficient city government due to the proper economies of scale in providing public services.

Table 6.9 ANOVA Analysis of Population Size and Stochastic Efficiency (2005, 2001)

Size of City (Population)	N		2005 Stochastic Technical Efficiency		2001 Stochastic Technical Efficiency	
	2005	2001	Mean	Std. D.	Mean	Std. D
Under 100,000	9	7	0.6309	0.0903	0.2203	0.3485
100,001-200,000	28	31	0.6713	0.0497	0.2417	0.1746
200,001-300,000	17	11	0.7068	0.0476	0.3817	0.1920
300,001-400,000	7	11	0.7302	0.0401	0.4809	0.2562
400,001-500,000	4	2	0.7367	0.0236	0.6073	0.4432
500,001-600,000	3	5	0.7582	0.0127	0.6987	0.2190
600,001-700,000	5	1	0.7681	0.0128	0.6087	-
700,001-800,000	-	1	-	-	0.6728	-
800,001-900,000	2	1	0.7739	0.0043	0.9990	-
Over 900,001	2	2	0.7708	0.0150	0.7845	0.0220
Total (mean)	77	72	0.6981	0.0642	0.3761	0.2757

ANOVA (2005, 2001)		Sum of Squares	Degree of Freedom	Mean Square	F	Sig.
2005 Stochastic Efficiency	Between Groups	0.133	8	0.017	6.226	0.000
	Within Groups	0.181	68	0.003		
	Total	0.314	76			
2001 Stochastic Efficiency	Between Groups	2.342	9	0.260	5.274	0.000
	Within Groups	3.059	62	0.049		
	Total	5.400	71			

6.3.4 Employee Size and Stochastic Efficiency of government

With regard to the relationship between the employee size of government (often called, size of government) and the efficiency of city government, in a previous section the DEA results illustrate that the employee size of Korean city governments has a close relationship with the efficiency of government on a significant statistical level. Let's look at the following SFA results regarding the relationship between the employee size and efficiency in Korean city government.

Table 6.10 displays the relationship between the size of government (numbers of public employees) and the stochastic efficiency of Korean city governments based upon 2005 and 2001 data. Here, the employee size of city governments also means '1,000 citizens per capita public employees.' The employee size of Korean city governments is divided into ten categories from under four public employees to over ten public employees. As results of SFA analysis, the average stochastic efficiency of Korean city governments having fewer than four public employees is 0.7449 in 2005 and 0.6116 in 2001 respectively, which are the highest stochastic efficiency scores in each year. However, the average stochastic efficiency of Korean city governments having over ten public employees is 0.5769 and 0.1247 in 2005 and 2001 respectively, which are the lowest stochastic efficiency scores.

Table 6.10 ANOVA Analysis of Employee Size and Stochastic Efficiency (2005, 2001)

1,000 Citizens Per Capita Public Employees	N		2005 Stochastic Technical Efficiency		2001 Stochastic Technical Efficiency	
	2005	2001	Mean	Std. D.	Mean	Std. D
2.0000-3.9999	32	29	0.7449	0.0363	0.6116	0.2380
4.0000-5.9999	20	20	0.6980	0.0403	0.3104	0.1869
6.0000-7.9999	16	14	0.6683	0.4409	0.1592	0.0796
8.0000-9.9999	4	7	0.5954	0.0494	0.0941	0.0610
Over 10.0000	5	2	0.5769	0.0365	0.1247	0.0941
Total (mean)	77	72	0.6981	0.0642	0.3761	0.2757

ANOVA (2005, 2001)		Sum of Squares	Degree of Freedom	Mean Square	F	Sig.
2005 Stochastic Efficiency	Between Groups	0.200	4	0.050	31.671	0.000
	Within Groups	0.114	72	0.002		
	Total	0.314	76			
2001 Stochastic Efficiency	Between Groups	3.036	4	0.759	21.500	0.000
	Within Groups	2.365	67	0.035		
	Total	5.400	71			

Korean city governments having fewer than four public employees in terms of 1,000 citizens per capita public employees are the most efficient city governments because stochastic efficiency scores are higher than any other groups of city governments. In other words, this result also demonstrates that as employee size in Korean city government increases, the stochastic efficiency of city government decreases. This evidence supports the argument which maintains that small government is more efficient than big government.

The different stochastic efficiency scores of Korean city governments depending upon employee size of city governments are also verified. The analysis of variance (ANOVA) shows there is a statistical difference between the groups (different employees size groups of city governments) and within the groups at a 99.99% statistically significant level. In other words, employee size of Korean city governments relates to efficiency of city government in terms of stochastic efficiency. This means that small numbers of employees are likely to be related with efficient government.

6.3.5 Expenditure and Stochastic Efficiency of Government

With regard to the relationship between the level of expenditure in city government and the efficiency of government, in the previous section, the efficiency results by DEA summarize that the expenditure levels of Korean city governments has a close relationship with the efficiency of government at a significantly statistical level (see p. 88, Table 6.6). The following paragraph demonstrates whether or not there is a relationship between the expenditure level and efficiency of government through the analysis of SFA.

Table 6.11 shows the relationship between the expenditure level of Korean city governments and the stochastic efficiency of the governments based upon each 2005 and 2001 data. More specifically, per capital expenditure of Korean city governments is separated into four categories from under 0.999 million won ($1,000.00) to more 3.000 million won ($3,000.00) for statistical analysis.

Table 6.11 ANOVA Analysis of Expenditure and Stochastic Efficiency (2005, 2001)

Per Capita Expenditure (million won)	N		2005 Stochastic Technical Efficiency		2001 Stochastic Technical Efficiency	
	2005	2001	Mean	Std. D.	Mean	Std. D
Under 0.9999	17	46	0.7622	0.0176	0.4927	0.2517
1.0000-1.9999	37	25	0.7116	0.0368	0.1741	0.1830
2.0000-2.9999	19	1	0.6445	0.0480	0.0642	-
Over 3.0000	4	0	0.5552	0.0420	-	-
Total (mean)	77	72	0.6981	0.0642	0.3761	0.2757

ANOVA (2005, 2001)		Sum of Squares	Degree of Freedom	Mean Square	F	Sig.
2005 Stochastic Efficiency	Between Groups	0.213	3	0.071	51.477	0.000
	Within Groups	0.101	73	0.001		
	Total	0.314	76			
2001 Stochastic Efficiency	Between Groups	1.743	2	0.872	16.448	0.000
	Within Groups	3.657	69	0.053		
	Total	5.400	71			

The results of SFA analysis illustrate that Korean city governments having less than 0.9999 million won ($999.99) in a per capita expenditure term have the highest stochastic efficiency scores such as 0.7622, 0.4927 in 2005 and 2001 respectively. In contrast of this result, Korean city governments having higher than 3.0000 million won ($3,000.00) in a per capita expenditure term are the most inefficient city government, such as 0.5552 in 2005. This means that as the expenditure of Korean city governments increases, the efficiency of government decreases. This empirical evidence supports the argument that city governments having lower expenditures are more efficient than those city governments having higher expenditures.

The different stochastic efficiency scores among Korean city governments depending upon the expenditure level of city governments are also examined using the analysis of variance (ANOVA). It shows there is a statistical difference between the groups (different expenditure city governments) and within the groups at a 99.99% statistically significant level. In other words, in a statistically significant way, per capita expenditure in Korean city governments has a close relationship with the efficiency of government in terms of stochastic efficiency. This demonstrates that city governments having lower expenditures are more likely to be efficient governments.

6.3.6 Independent Revenue Source and Efficiency of Government

With regard to the relationship between independent revenue sources in government and the efficiency of government, in the previous section the efficiency results by DEA demonstrate that independent revenue sources have a close relationship with the efficiency of city government in a significant statistical level (see p. 90, Table 6.7). The following will show whether or not there is a relationship between independent revenue sources and efficiency in Korean city government in the measurement of stochastic efficiency.

Table 6.12 indicates the relationship between the independent revenue source of Korean city governments and the efficiency of government. The percent of independent revenue source of Korean city governments is divided into six categories depending upon the degree of independent revenue source from under 20% to over 60%. As for the results of SFA analysis, Korean city governments having fewer than 20% in an independent revenue source term have lower stochastic efficiency scores, as follows: 0.6183, 0.1156 in 2005 and 2001 years respectively.

Korean city governments having over 60% independent revenue source, in contrast, have much higher stochastic efficiency scores than Korean city government having under-20% independent revenue sources, as follows: 0.7543, 0.7411 in 2005 and 2001 years respectively. That is, as the independent degree of revenue source increases, the efficiency of city governments increases. This empirical result also supports the argument that local governments more dependent upon outside sources (e.g., the federal or central governments) will tend to be more inefficient in operating government.

Table 6.12 ANOVA Analysis of Independent Revenue Source and Stochastic Efficiency (2005, 2001)

Percent of Independent Revenue Source	N		2005 Stochastic Technical Efficiency		2001 Stochastic Technical Efficiency	
	2005	2001	Mean	Std. D.	Mean	Std. D
Under 20.000%	14	13	0.6183	0.5282	0.1156	0.0533
20.001-30.000	16	12	0.6673	0.0401	0.1687	0.0737
30.001-40.000	15	16	0.6968	0.0407	0.2897	0.9000
40.001-50.000	13	10	0.7455	0.0268	0.4399	0.2956
50.001-60.000	9	6	0.7481	0.0200	0.5672	0.1907
Over 60.001%	10	15	0.7543	0.0581	0.7411	0.1773
Total (mean)	77	72	0.6981	0.0642	0.3761	0.2757

ANOVA (2005, 2001)		Sum of Squares	Degree of Freedom	Mean Square	F	Sig.
2005 Stochastic Efficiency	Between Groups	0.188	5	0.038	21.130	0.000
	Within Groups	0.126	71	0.002		
	Total	0.314	76			
2001 Stochastic Efficiency	Between Groups	3.776	5	0.755	30.677	0.000
	Within Groups	1.625	66	0.025		
	Total	5.400	71			

The argument that the independent degree of revenue sources in local government closely relates with the efficiency of local government is also supported by a statistical analysis. The analysis of variance (ANOVA) verifies that there is a statistical difference between the groups (city governments having different independent revenue sources) and within the groups at a 99.99% statistically significant level. In other words, the independent revenue source of Korean city governments has a close relationship to the efficiency of government in terms of stochastic efficiency. Furthermore, this empirical finding also demonstrates that local governments having more independent revenue sources are more likely to be efficient governments, which is similar to the results of DEA in the previous section.

6.4 Tobit Regression Analysis for Explaining the Efficiency of Government

This section conducts a descriptive analysis in order to know basic statistic information on independent and dependent variables to be used in multiple regression analysis. And later, it analyzes and discusses the relationship between independent and dependent variables using a Tobit regression[27] analysis.

6.4.1 Descriptive Analysis of Independent and Dependent Variables for Tobit Regression Analysis

To understand the basic information and characteristics of independent and dependent variables as an initial statistical work for executing a Tobit regression analysis, this study conducts descriptive statistical analysis. As mentioned before, this

[27] Tobit regression is a special type of regression analyses which deals with the truncation at zero or certain values. In other words, it assumes that the data is censored or truncated above or below certain values. It also is using one of the procedures in the SAS program. The interpretation of the parameter estimates resulting from a Tobit regression is different with that of a linear regression because the Tobit model decomposes the parameter estimates in two parts: the effect of probability being below zero and above a certain value (Muller and Fetterman 2003). This study uses a Tobit regression model for analyzing parameter estimates more accurately because the possible range of dependent variables of this study is from 'zero' to 'one.' That is, the values being below 'zero' and above 'one' are censored or truncated. This process will prevent overestimating or underestimating the parameter to be estimated.

study has 13 independent variables such as ECOPOP, MANUEMPY, LOWINCOM, INDSOUR, EXPEN, GRANT, POLPARTY, VOTE, POP, DENSITY, CONSOL, COMPETI, and PUEMPY, and four dependent variables such as TECHEF, COSTEF, SCALEEF, and STOCHEF. This study largely separates independent variables into four different factors: economic, financial, political, and environmental.

First, economic factors related to the performance of Korean city governments include three independent variables: percent of economically active population (ECOPOP), percent of total employees in the manufacturing industry (MANUEMPY), and percent of low income households (LOWINCOM). Table 6.13 shows that the average of the economically active population (ECOPOP) is 62.59% and 62.13% in 2005 and 2001 respectively; while, the mean of manufacturing employees (MANUEMPY) is 25.60% and 24.96% in 2005 and 2001 each. The average of low income households (LOWINCOM) has 3.48% and 3.70% in each year. Overall, descriptive statistics related to economic factors show a comparatively similar trend in the comparison of 2005 and 2001.

Second, financial factors related to the performance of Korean city governments are comprised of three independent variables: the percent of independent revenue source (INDSOUR), per capita expenditure (EXPEN), and percent of intergovernmental grant (GRANT). The average percentage of independent revenue source (INDSOUR) in 2005 and 2001 is 36.77% and 39.87% respectively, while the mean of expenditure in 2005 and 2001 is 1.68 million won and 0.93 million won in sequence. The average percentage of intergovernmental grant (GRANT) has increased to some extent from

27.37% in 2001 to 36.67% in 2005. Overall, in the comparison of the two years, financial conditions in Korean city governments have deteriorated because the independence of revenue sources has decreased, while the dependence of grants from the central government has increased.

Table 6.13 Descriptive Statistics for Tobit Regression Analysis (2005, 2001)

Variables	2005 (N=77)				2001 (N=72)			
	Mean	St. D.	Min.	Max.	Mean	St. D.	Min.	Max.
ECOPOP	62.59	2.48	58.50	70.00	62.13	2.37	58.00	68.30
MANUEMPY	25.60	15.76	3.00	66.20	24.96	14.80	2.80	58.90
LOWINCOM	3.48	2.08	0.74	10.33	3.70	2.00	0.98	10.75
INDSOUR	36.77	16.57	12.80	70.20	39.87	18.16	14.70	75.3
EXPEN	1.6868	0.9827	0.6181	6.2760	0.9313	0.3793	0.4029	2.0352
GRANT	36.67	12.60	11.10	66.60	27.34	10.61	10.10	48.80
POLPARTY	3.58	0.83	2.00	5.00	3.14	1.02	2.00	5.00
VOTE	53.30	8.95	36.50	73.20	58.51	8.87	42.30	78.00
POP	278200	221736	31174	1042132	269014	201635	57067	951253
DENSITY	1673.07	2828.12	62.89	16158.90	1644.33	2698.31	69.37	14595.86
CONSOL	0.68	0.47	0.00	1.00	0.65	0.47	0.00	1.00
COMPETI	0.35	0.48	0.00	1.00	0.32	0.47	0.00	1.00
PUEMPY	1061.32	434.59	242	2300	1108.60	572.26	381	3895
TECHEF	0.7048	0.2551	0.1843	1.0000	0.7016	0.2363	0.2512	1.0000
COSTEF	0.6142	0.2408	0.1130	1.0000	0.6515	0.2269	0.2107	1.0000
SCALEEF	0.6941	0.2404	0.1852	1.0000	0.6405	0.2577	0.1334	1.0000
STOCHEF	0.6981	0.0642	0.5133	1.0000	0.3761	0.2757	0.0533	1.0000

INDEPENDENT VARIABLES: ECOPOP (%) = percent of economically active population; MANUEMPY (%) = percent of employees in manufacturing industry; LOWINCOM (%) = percent of low income households; INDSOUR (%) = percent of independent revenue source; EXPEN (million won) = per capita expenditure; GRANT (%) = percent of intergovernmental grants; POLPARTY (%) = mayors' political preference (Likert scale from liberal to conservative, 1-5); VOTE (%) = voting percent of mayors' election; POP (n) = total population; Density (n/ km^2) = total population ÷ per km^2. CONSOL (dummy) = 0 (non-consolidated); COMPETI (dummy) = 0 (non-competition); PUEMPY (n) = total number of public employees. DEPENDENT VARIABLES: TECHEF = technical efficiency score; COSTEF = cost efficiency score; SCALEEF = scale efficiency score; STOCHEF = stochastic efficiency score.
Source: (MOGAHA 2005, 2001; MOPE 2005, 2001; NEC 2002, 1998)

Third, political factors related to the performance of Korean city governments are comprised of two independent variables, such as mayors' political preferences (POLPARTY) and citizens' voting percent of mayors' elections (VOTE). In order to measure mayors' political preference, this study uses the Likert five-scale, such as: '1'

= very liberal; ‘2’ = liberal; ‘3’ = middle; ‘4’ = conservative; and ‘5’ = very conservative on the basis of mayors’ affiliated political parties. The average of mayor’s political preferences (POLIPRE) is 3.58 and 3.14 in 2005 and 2005 respectively. The mean of citizens’ voting in mayors’ elections is 53.30% and 58.51% in each year.

Finally, environmental factors have five independent variables: population size (POP) and density (DENSITY), degree of consolidation (CONSOL), degree of competition (COMPETI), and total number of public employees (PUEMPY). Here, degree of consolidation (CONSOL) represents whether or not a city government is merged with other city or county government. That is, variable CONSOL is a dummy variable such as merged or consolidated city government = 1, non-merged or consolidated governments = 0. Variable COMPETI is also a dummy variable such as competition cities = 1, non-competition cities = 0. Here competition cities denote the city governments which are located around the Seoul metropolitan area because numerous city governments around the Seoul metropolitan area are more competitive in order to attract people and industries to their cities than any other Korean city government. Overall, in the comparison of 2005 and 2001, population size and density is somewhat increased while the number of public employees is decreased to a certain degree.

6.4.2 Tobit Regression Analysis for Explaining the Difference of Efficiency

In order to know the relationship between independent and dependent variables having statistical significance, this study conducts a Tobit regression analysis. As the results of this Tobit analysis, several independent variables relate to dependent variables at the above 90 % statistical significance.

First, in terms of economic factors related to performance in Korean city governments, three independent variables out of the four economic factor independent variables, such as the economically active population [28] (ECOPOP), the size of employees in manufacturing industries (MANUEMPY), and the percent of low income households (LOWINCOM), have a close relationship with the technical efficiency (TECHEF), cost efficiency (COSTEF), and scale efficiency (SCALEEF) of Korean city governments at above a 90% statistically significant level.

In 2005 the percent of economically active population (ECOPOP), for instance, has a close relationship with technical efficiency (TECHEF), while percent of low income households of cities (LOWINCOM) has to do with the stochastic efficiency of Korean city governments at above a 95% statistically significant level. If the economically active population of a city were to increase by one person, the predicted technical efficiency of a city government would increase by 0.002 points, while all other variables are constant. In addition, if low income households of a city were to increase by one point, the stochastic efficiency of a Korean city government would decrease by 0.006 points under the condition of all other variables being equal.

[28] Economically active population is defined as all persons having from 16 to 65 ages who "provide the supply of labor for producing economic services and goods as defined by the United Nations System of National Accounts during a specified time-reference period" (ILO 1982).

In the case of 2001, the economically active population of cities (ECOPOP) has also a very significant relationship with dependent variables such as TECHEF, COSTEF, and SCALEEF at a 95% statistical confidence level. In addition, the size of employees of manufacturing industries (MANUEMPLY) in cities has to do with technical efficiency (TECHEF), cost efficiency (COSTEF), and scale efficiency (SCALEEF) at the 90%, 95%, and 99% statistically significant levels respectively. From a statistical perspective, if the percent of employees in manufacturing industries were to increase by one person, the predicted technical efficiency of a city government would decrease by 0.0044 points while all other variables are constant.

Summarizing these economic factors, an economically active population has a positive relationship with the efficiency of Korean city governments, while employee size in manufacturing industries and low income household size have a negative impact on the efficiency of Korean city governments. In other words, as the economically active population of cities increase, the efficiency of Korean city governments increases. In contrast, the increase of manufacturing employees and low income households results in decreasing the efficiency of Korean city governments.

Second, in terms of financial factors in Korean city governments, two out of three independent financial variables such as percent of independent revenue source (INDSOUR) and per capita expenditure (EXPEN) have to do with the technical efficiency (TECHEF), cost efficiency (COSTEF), scale efficiency (SCALEEF), and stochastic efficiency (STOCHEF) of Korean city governments at above a 90% statistically significant level.

Summarizing 2005, per capita expenditure (EXPEN) in Korean city governments, for example, has to do with technical efficiency (TECHEF), cost efficiency (COSTEF), scale efficiency (SCALEEF), and stochastic efficiency (STOCHEF) at the 90%, 95%, and 99% statistically significant levels respectively, while in 2001 EXPEN has a close relationship with cost efficiency (COSTEF) and stochastic efficiency (STOCHEF) at the 95% and 99% statistical level. In 2001 independent revenue source (INDSOUR) also has to do with cost efficiency (COSTEF), scale efficiency (SCALEEF), and stochastic efficiency (STOCHEF) at the 90%, 95%, and 99% statistically significant levels in sequence.

From these statistical findings of 2005, if the per capita expenditure of a city (EXPEN) were to increase by one million won, the predicted technical efficiency of a Korean city government would decrease by 0.084 points at a 95 % statistically significant level, while all other variables are constant. Likewise, in 2001 if independent revenue source (INDSOUR) of a city government were to increase by one percentage, cost efficiency of a Korean city government would rise by 0.0087 points at a 99% statistically significant level under the condition of all other variables being equal.

To sum up financial factors, independent revenue source has a positive relationship with the efficiency of Korean city governments, while expenditure has a negative impact to the efficiency of Korean city governments. In other words, as the independent revenue sources of Korean city governments increase, the efficiency of Korean city governments increases. In contrast, the increase of per capital expenditure of Korean city governments results in decreasing the efficiency of Korean city governments.

Third, as for political factors regarding the performance (efficiency) of Korean city governments, the two independent variables such as mayors' political preferences (POLPARTY) and citizens' voting percentage in mayors' elections (VOTE) do not have any statistically significant relationship with dependent variables for the efficiency of Korean city governments for both years 2005 and 2001. This suggests that political factors may have nothing to do with the efficiency of government. In other words, mayors' political leanings and citizens' voting rate for the mayors' elections do not have any statistically significance related to efficiency in Korean city governments.

Finally, in terms of environmental factors related to performance (efficiency) in Korean city governments, three variables out of five environmental independent variables, such as total population (POP), degree of consolidation (CONSOL), and total public employees (PUEMPY) have a close relationship with the technical efficiency (TECHEF) and scale efficiency (SCALEEF) of Korean city governments at above a 90% statistically significant level.

In both 2005 and 2001 years, total population (POP) in Korean city governments, for example, relates to technical efficiency (TECHEF) and scale efficiency (SCALEEF) at the 95% and 99% statistical significance respectively. The total number of public employees (PUEMPY) also has a relationship with the technical and scale efficiency of Korean city governments at a 90%, 95%, and 99% statistical significance in sequence in both years. However, degree of consolidation (CONSOL) has to do with technical and scale efficiency in only 2001 at a 90% statistically significant level.

Table 6.14 Tobit Regression Results Regarding Difference of Efficiency (2005, 2001)

Independent Variables	2005 Dependent Variables (N=77)			
	TECHEF	COSTEF	SCALEEF	STOCHEF
INTERCEPT	-.249 (.872)	.681 (.572)	.353 (.613)	.746 (.092)***
ECOPOP	.020 (.012)*	.089E-1 (.008)	.010 (.008)	.011E-1 (.001)
MANUEMPY	-.002 (.002)	-.026E-1 (.001)	-.018E-2 (.002)	-.004E-1 (.000)
LOWINCOM	.022 (.023)	-.032E-1 (.016)	-.026E-2 (.015)	-.006 (.002)**
INDSOUR	-.003 (.005)	.003E-1 (.003)	.001E-1 (.003)	.007E-1 (.000)
EXPEN	-.084 (.039)**	-.145 (.027)*	-.056 (.028)**	-.038 (.004)***
GRANT	-.005 (.005)	-.032E-1 (.003)	-.014E-2 (.003)	.003E-1 (.000)
POLPARTY	.044 (.036)	.035E-1 (.025)	.16E-1 (.025)	-.004 (.004)
VOTE	.000 (.006)	.-020E-1 (.004)	-.014E-1 (.004)	-.006E-1 (.000)
POP	.01E-4 (.000)***	.000 (.000)	.02E-4 (.000)***	.000 (.000)
DENSITY	.000 (.000)	.000 (.000)	-.000 (.000)	-.000 (.000)
CONSOL	-.128 (.112)	-.108 (.069)	-.125 (.077)	-.007E-1 (.011)
COMPETI	.011 (.087)	-.079 (.055)	-.067 (.062)	-.081E-1 (.009)
PUEMPY	-.04E-2 (.000)**	-.001E-1 (.000)	-.004E-1 (.000)***	-.000 (.000)
Log likelihood[29]	-4.717	20.538	23.230	175.127
Independent Variables	2001 Dependent Variables (N=72)			
	TECHEF	COSTEF	SCALEEF	STOCHEF
INTERCEPT	-.245 (.642)	.102 (.485)	.044 (.537)	-.245 (.438)
ECOPOP	.018 (.009)**	.014 (.007)**	.017 (.007)**	.003E-1 (.006)
MANUEMPY	-.044E-1 (.002)*	-.005 (.001)***	-.048E-1 (.001)**	-.017E-1 (.001)
LOWINCOM	.011E-1 (.019)	.011 (.014)	.055E-1 (.016)	.016E-1 (.013)
INDSOUR	.058E-1 (.004)	.08E-2 (.003)***	.063E-1 (.003)*	.015 (.002)***
EXPEN	.084E-1 (.113)	-.256 (.081)***	-.017 (.091)	-.189 (.074)**
GRANT	.000 (.000)	.029E-1 (.003)	-.017E-1 (.003)	-.092E-1 (.002)
POLPARTY	-.026 (.024)	-.021E-1 (.018)	.016 (.020)	-.012 (.016)
VOTE	-.045E-1 (.005)	-.048E-1 (.003)	-.063E-1 (.004)	.007E-1 (.003)
POP	.02E-4 (.000)**	.000 (.000)	.01E-4 (.000)**	-.000 (.000)
DENSITY	-.000 (.000)	.000 (.000)	-.000 (.000)	.000 (.000)
CONSOL	-.171 (.090)*	-.086 (.058)	-.130 (.068)*	-.029 (.053)
COMPETI	.073 (.079)	-.035 (.057)	-.066 (.064)	-.039E-1 (.052)
PUEMPY	-.001E-1 (.000)*	-.000 (.000)	-.002E-1 (.000)***	-.000 (.000)
Log likelihood	9.867	31.107	23.023	45.556

( ) denotes standard error. * denotes significance of at the 90% level; ** denotes significance of at the 95 % level; *** denotes significance of at the 99% level.

[29] Log likelihood means the log likelihood value to the fitted model. In order to know whether all predictors' regression coefficients are simultaneously zero, Likelihood Ratio Chi-Square is used.

In the year 2005, if total population (POP) were to increase by one person, the technical and scale efficiency of a Korean city government would increase by 0.000001 points at a 95% statistical significance, all other variables being constant. In addition, if the total number of public employees (PUEMPY) in 2005 were to increase by one person, the predicted technical efficiency of a Korean city government would decrease by 0.0004 points at a 95% statistical significance, while all other variables are constant. As for the degree of consolidation (CONSOL), in 2001 a consolidated Korean city government has a lower technical efficiency score than a non-consolidated city government by 0.171 points at a 90% statistical significance.

For environmental factors, the population size of Korean cities has a positive relationship with the efficiency of Korean city governments, while the size of public employees in Korean city governments has a negative impact on Korean city governments. In addition, consolidated Korean city governments are less efficient government than non-consolidated city governments. In other words, as the population size of a Korean city increases, the efficiency of Korean city government increases. In contrast, increases in the public employee size of Korean city governments result in decreasing the efficiency of Korean city governments. In addition, consolidated Korean city governments are less efficient than non-consolidated city governments.

CHAPTER 7

FINDINGS AND POLICY IMPLICATIONS

This chapter reviews and discusses the findings of this study with regard to government performance and its related factors. Later, it discusses policy issues and their implications related to the improvement of performance in local government.

7.1 Findings, Review, and Discussion of This Study

7.1.1 Summary of Measuring Performance Focusing on Korean City Governments

Results of the DEA analysis to measure the performance of Korean city governments (2005 data) indicate that the following cities are the most efficient city governments (all efficiency scores are '1'): Bucheon; Ansan; Goyang; Gwangju; Cheongju; Jeonju; Mokpo; Gumi; and Jeju) in terms of technical, cost, and scale efficiency. In other words, all other things being equal (*ceteris paribus*), these nine city governments are operated in the most efficient manner in terms of technical, cost, and scale efficiency.

In contrast to these nine most efficient, the following cities are the most inefficient city governments (having efficiency scores lower than 0.4000) in terms of technical, cost, and scale efficiency in 2005 are: Taebaek (0.3489); Sokcho (0.3454); Samcheok (0.1843); Boryeong (0.3312); Yeongcheon (0.3805); Sangju (0.3188); Mungyeong (0.2759); Tongyeong (0.3789); Sacheon (0.3987); and Miryang (0.1972). These results from the DEA analysis present ten city governments that are the most inefficient manner all other conditions being equal (*ceteris paribus*). Moreover, the one most efficient city government that could be used as a benchmark for inefficient city government is the city of Gwacheon. The city of Bucheon is second.

7.1.2 Economic Factors and Efficiency of Government

As mentioned previously, this study divided the main factors of government efficiency into four different categories: economic, financial, political, and environmental. This section further explains theoretical contexts and the findings from this study.

The general argument to explain the relationship between economic factors and efficiency of government is that citizens' higher incomes tend to decrease efficiency in local government because it may bring less motivation to monitor their expenditures (Silkman and Young 1982; Athanassopoulos and Triantis 1998). In contrast, another argument can be stated that regardless of citizens' income level, whether high, middle, or low, all citizens have an interest in improving the efficiency of local government (Be Gorger and Kerstens 1996a).

The findings about economic factors and government efficiency are that the size of the economically active population of cities relates positively to the efficiency of Korean city governments, while the number of employees in the manufacturing industries and number of low income households have negative relationships to efficiency in Korean city governments. In other words, as the economically active population[30] of cities increases, the efficiency of Korean city governments increases. By contrast, the increase of both the manufacturing employees and the number of low income households result in decreasing Korean city government efficiency. In summary, the findings of this dissertation support the theoretical argument that the more economically active citizens become, the more interest they have in improving the efficiency of their governments.

7.1.3 Financial Factors and Efficiency of Government

As explained in the literature about financial factors and efficiency of government, Wilson (1887) argues that government should be operated at the least cost and energy. From this Wilson perspective, local governments having lower expenditures, and, at the same time the same level of public services as other local governments, will be more efficient. Davis and Hayes (1993), however, assert that higher expenditures and taxes may connect to the improvement of efficiency in local government because citizens are aware and against higher expenditures and taxes. On the other hand, Silkman and Young (1982) argue that more grants from the central government may result in greater inefficiencies in local government.

From these findings, then, independent revenue sources in Korean city governments have a positive relationship to the efficiency of government, while the per capita expenditures of Korean city governments have a negative impact on the efficiency of government. In other words, as the independent revenue sources of Korean

[30] Economically active population (ECOPOP) is calculated by the following formula. ECOPOP= (number of economically active population ÷ the total number of populations) × 100. For more detailed information about variables, see the Chapter 5.

city governments increase, the efficiency of Korean city governments increases. In contrast, the increase in expenditures by Korean city governments results in decreasing the efficiency of Korean city governments. As a result, the results of this dissertation support the argument that local governments having lower expenditures and more independent revenue sources are more likely to be efficient local governments.

7.1.4 Political Factors and Efficiency of Government

The policy implications from the findings of this research about the relationship between political factors and the efficiency of government are important. Public choice and bureaucratic inefficiency literature explain that the inefficiency of local government comes from the behaviors of public bureaucrats who are self-interested maximizers (Niskanen 1975: Muller 2003). Moreover, De Borger and Kerstens (1996a) argue that politicians' specific political preferences and their political coalitions have a close relationship with the efficiency of local governments in their study of Belgium local governments. On the other hand, with regard to citizens' political participation and the efficiency of government, Mueller (1989) argues that the efficiency of local governments closely relates to the amount of citizens' political participation. Similarly, Hamilton (1983) and Hayes et al. (1998) assert that the efficiency of local government may rest upon the ability of citizens to be able to apply political pressure to their local representatives.

For political factors and government efficiency, the efficiency of Korean city governments is not related to two political factors: mayors' political preferences; and the percent of those voting in mayors' elections. This finding suggests that political factors may have little to do with the efficiency of Korean city governments. Contrary to expectations based upon the previous theoretical arguments, the empirical evidence of this study does not support the argument that political factors such as mayors' political leanings and citizens' participation in mayors' elections are related to the efficiency of local government.

7.1.5 Environmental Factors and Efficiency of Government

Several scholars have argued that there is a close relationship between government efficiency and its environmental factors. First, lower population density tends to bring down the cost inefficiency of local governments (De Borger and Kerstens 1996a; Grossman et al. 1999). Athanassopoulos and Triantis (1998), however, argue that higher population density affects the cost efficiency of local governments negatively due to scale dis-economies from over-crowdedness. Second, in terms of annexation or consolidation, Liner (1994) maintains that annexation or consolidation may influence the amount of expenditures and the number of employees. Third, in light of competition, Heikkila (1996) argues that competition between local governments can enhance the efficiency of local governments. However, Hayes et al. (1998) and Grossman et al. (1999) argue that intra-metropolitan competition does not necessarily improve the efficiency of local government.

From the results of this study there are relationships between environmental factors and government efficiency: the population size of Korean cities has a positive relationship with the efficiency of Korean city governments. That is, the larger the city, the more efficient the government; while, the numbers of public employees in Korean city governments have a negative impact on the efficiency of Korean city governments. Put simply, the more the number of employees, the less efficient governments become. As the population size of a Korean city increases, the efficiency of the Korean city government increases until the range of population reaches from 800,000 to 900,000. And, the increases in the number of the public employees of Korean city governments result in decreases to the efficiency of Korean city governments. On the other hand, consolidated Korean city governments are less efficient than non-consolidated city governments. That is, non-consolidated city governments are more efficient governments. The results of this study support the argument that the population of a city, the number of public employees, and the degree of consolidation is particularly associated with the increased efficiency of local government.

7.2 Policy Implications of the Study

The above findings, reviews, and discussions have policy implications related to the fundamental role of government in improving the performance in local government. For example, the New Public Management (NPM) scholars, who are a new mainstream of the public administration field since the 1990s, believe that government is just like a business. Woodrow Wilson (1887), a founding father of public administration, argued a hundred years ago that government should be operated and managed like a business. However, public interest theorists deny this NPM-Wilsonian argument by asking "can and should government be a business?"

In examining the difference between government and business, Bouckaert (1992) maintains that government seeks to act in the public interest, while business seeks to act for the maximization of private profits. In other words, public interest scholars believe that government cannot be operated like a business because government is different from business in terms of ultimate organization goals. Among these two perspectives, this study's results are closer to the NPM approach in terms of suggesting a prescription for improving government performance. This section examines several policy implications for improving the performance of local governments on the basis of the findings of this study.

7.2.1 Small Government vs. Big Government

Small or big government is an important issue in the public administration field. In particular, government size[31] and government performance have been debated by public choice scholars and economists. One element of the New Public Management philosophy advocates 'small government.' Current many administrative reformists have emphasized the issues of how to make government both small and efficient.

Ostrom (1972), for instance, argues that small governments are more efficient than big governments because they are easier to manage and monitor and are more responsive to citizens. Metropolitan reform advocates, however, maintain that small governments tend to generate cost inefficiencies because there is an appropriate economic size needed to manage government and provide public services. Reform advocates also assert that making a bigger government through consolidating small governments in metropolitan areas is an alternative to make more efficient government

[31] In general, government size refers to the size of public employees working in the government. In other words, a big government refers to the government having large numbers of public employees, while a small government is the government having small numbers of public employees.

(Kirp and Cohen 1972). Lyons and Lowery (1989), however, in their study argue that there is no discernable difference in the levels of citizens' satisfaction with pubic services between big (consolidated) and small (fragmented) government settings, and that in reality there are too few informed consumers (citizens) to drive a competitive market for public services.

As for this debate related to small and big governments, the findings of this study provide more empirical evidence that small government is more efficient. Regarding how to make small and efficient government, this study suggests the decrease of public employment and expenditure until a certain efficient level is reached in comparison with the most efficient government possible.

7.2.2 Competition vs. Non-Competition

New Public Management (NPM) scholars believe that competition is one of the most crucial elements that stimulate improving the performance of government. Competition tends to remove inefficiency in government. Tiebout (1956) and Heikkila (1996) argue that government inefficiency may be related to lack of competition between government, non-market mechanisms, and imperfect information.

Tiebout (1956) views the citizen as a customer who consumes public services. Furthermore, the citizen as a consumer of public services tends to find the best community or jurisdiction that reflects his or her preference or that provides high quality public services at a lower price (Tiebout, 1956). Public choice scholars also believe that competition between local governments tends to provide external pressure on public managers to provide better public services. Competition is presumed to result in productive and allocative efficiency in providing private as well as public goods. Therefore, competition between local governments is stated to be the best way to overcome problems of principal-agent relationships among voters, elected officials, and bureaucrats (Duncombe et al. 1997).

The empirical evidence of this study indicates that most local governments in metropolitan areas are more efficient than rural local governments. In other words, the competition between local governments can encourage the efficient operation of government. In this sense, competition *per se* is still a very important and stimulating tool to improve the performance of local government, as public choice theorists argue.

7.2.3 Scale Economies vs. Scale Diseconomies

An important issue related to local government performance is about whether or not there is a scale economy of local government in providing public services to citizens at minimum cost.

De Borger and Kerstens (1996), for example, argue that local governments that have large populations are more efficient than local governments with small populations. Mavros and Wassmer (1999) also argue that small population cities tend to spend more because small cities do not have appropriate scale economies. They believe that there is an optimal economic size in providing local public services. Spann (1977) asserts that most inefficiency in local government relates to a poor adjustment of local governments' size. In contrast, Athanassopoulos and Triantis (1998) assert that even a large population will not necessarily result in cost efficiency in local government due to diseconomies resulting from over-crowdedness.

The findings of this study suggest that population within 800,000 to 900,000 is an optimal population size for Korean city governments for providing public services at minimum cost. In other words, there is an optimal scale economy in providing public services in the Korean context. Therefore, in providing public services for more than one local jurisdiction, policy makers need to consider optimal economic scale size to be able to minimize the production costs of public services.

7.2.4. Dependent Revenue vs. Independent Revenue

A fundamental issue over grants and other dependent revenue sources from the central government to local government is the inequality of revenue sources between the local governments themselves or between local governments and the central government. So, the central government allocates intergovernmental grants to local governments to supplement insufficient revenues and to support its specific projects and policies. An issue related to dependent revenue sources is that grants or dependent revenue sources may encourage inefficiency in the government sector.

Hamilton (1983), for example, argues that local governments having more dependent revenue sources tend to be more inefficient. Also, Silkman and Young (1982) maintain that as the amount of intergovernmental grants increases, the efficiency of government decreases. In addition, intergovernmental grants and other outside revenue dependency are more likely to bring public officials' inefficient behavior (De Groot and Van Der Sluis 1987). Dependent revenue sources in local government can be related to public bureaucrats' inefficient behaviors, such as moral hazard and adverse selection because they can easily get revenue sources from outside (Wyckoff 1990a).

As for the above theoretical arguments of literature, the findings of this study also arrive at the same conclusions: local governments having more dependent revenue sources are more inefficient.

As for bureaucrats' inefficient behavior in the government sector, some scholars believe that privatization of public services is the best method to remove the inefficiencies (Pestieau and Tulkens 1993). The basic argument that privatization promotes efficiency is based upon financial incentives and competition between outsider providers. However, Blank, Eggink, and Merkies (1998) argue that there is no hard evidence that privatized agencies operate more efficient than public agencies. Byrnes (1991) also argues in his empirical study that even privatized public agencies have the presence of selectivity bias and inefficiency.

If privatization does not guarantee the improvement of local government performance, what can be the next alternative method for improving the performance of local governments? Ammons (1995) argues that performance measurement can be a tool for improving government performance. For the reason, government's measurement over local government performance can promote incentive and competition for operating government efficiently and effectively between their local governments. Consequently local government will be able to use their revenue sources in a more efficient and effective way. In privatization or performance measurement, policy makers should carefully consider how to use intergovernmental grants in order to be able to reduce inefficiency in local government.

7.2.5 Benchmarking

If the policy issues and implications mentioned above are more principled and theoretical approaches to improve the performance of local government, benchmarking is a more practical and useful approach. The ultimate objective of benchmarking is to enhance the performance and accountability of local government by comparing performance over the 'best practice' local government (McAdam and O'Neill 2002).

The basic assumption of benchmarking is: 1) find a local government that is best at what your local government does; 2) study how it achieves such results; 3) make plans to improve your local government performance; 4) implementing the plans; 5) and finally, monitor and evaluate the results (Helgason 1997). As for the usefulness of benchmarking, Bessent, Bessent, Elam, and Long (1984) argue that benchmarking had been a useful tool in improving the performance of 25 Texas school districts.

Benchmarking can also increase the performance of local government by improving the management of information in local government (comparing local governments and explaining performance differences). However, this process of benchmarking has obstacles, such as the low quality of data and poor cooperation between local governments. In order to overcome these problems, a central government or metro central governments may require a high quality of data as a condition for public financing. And it needs to guarantee that the information of benchmarking will be used only for the improvement of public services, not for budget cuts. In addition, a legal system is needed to be developed to be able to benchmark the best practice local government. That is, policy makers need to consider making or chaning laws, ordances, or laws to allow benchmarking for identifying and implementing best practices. The findings of this study also demonstrate that benchmarking is a useful tool for improving the performance of local government. For example, the most efficient city government as bench marking models for inefficient Korean city governments is the city of Gwacheon. In other words, inefficient Korean city governments can improve their performance by benchmarking the management skills of the city of Gawcheon.

7.2.6 Need for a Performance Measurement System

A key to implementing benchmarking is performance measurement (Smith 1993; Ammons 1995a). A performance measurement system is a crucial tool needed to examine and improve the performance of each local government. Performance measurement can be primarily used for internal management of local government, such as decision making for program management, allocation of budgeting and resource, comparing actual performance against targeted performance, or reporting to citizens and elected officials. Despite the importance of performance measurement, the application of performance measurement to local governments is comparatively recent and still rare. For example, in the case of the United States, performance measurement in the public sector has been stimulated since the 1990s by several federal and state regulations such as the Government Performance and Results Act (GPRA) of 1993, the National Performance Review (NPR), and the Governmental Accounting Standard Board's (GASB) Service Efforts and Accomplishment (SEA) program (Nyhan and Martin 1999b). In particular, the GASB contributes to establishing standards for reporting on performance in the US state and local governments (GASB, 1994).

Nonetheless, according to GASB and National Academy of Public Administration (NAPA) (1997) study, only three percent of local governments in the study had laws or ordinances to be able to legitimate performance measurement. In the case of Korea, performance measurement in local government is a much more recent phenomenon and most local governments still do not have the system.

This study shows possible performance measurement techniques and their benefits which a legal performance measurement system may bring in local governments. Therefore, as an important tool for improving the performance of local government continually, not just temporarily, introducting performance measurement is very important in the short run as well as in the long run. In particular, policy makers should consider how to minimize internal and external resistance in the introductory process of the system.

CHAPTER 8

CONCLUSIONS

This concluding chapter deals with four key issues: first, the major theme of the study is reviewed with regard to the performance (efficiency) of local government; second, research findings are summarized; third limitations of the study are discussed; and finally, further research is suggested.

8.1 Major Theme of the Study

Improving performance and promoting efficiencies in local government are extremely important issues in both the academic field as well as the professional practice of public administration. The degree necessary to improve the performance and promotion of efficiency in local government can be identified by accurately measuring or evaluating performance inside government organizations and among local governments. In particular, comparing performance among local governments is also a useful means to be able to know the degree of improving performance in local government. The main reasons for measuring and comparing performance among local governments are to diagnose the present performance *status quo* of each local government, and furthermore, to remove inefficient elements of local government by learning management skills and organization composition from the best practices or the best performance local governments, and finally, to become the best performance local government.

The study and use of performance measurement in local governments has been expanded since the mid-1990s. Nonetheless, empirical evidence on the extent of the utility and practicability of applying performance measures in local governments is still somewhat limited in the literature. In this sense, more systematic, practical, and empirical studies are needed to more accurately measure performance in local government.

As an attempt for more empirical and systematic performance measurement, this study empirically measures local government performance, applies newer performance measurement techniques to measure local government performance (Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA)), and verifies theoretical debates related to performance in local government. More specifically, the main purpose of this study is to measure and compare the performance of local government (using Korean local governments having their similarities in terms of functions, structures, and tax systems) and to find out the best practice of Korean local governments and the related factors able to influence government efficiency and performance. In order to do this, this study, as for its main methodologies, uses Data Envelopment Analysis (DEA), Stochastic Frontier Analysis (SFA), and Tobit Regression Analysis.

8.2. Summary of Findings

First, as for the DEA results of measuring the performance of Korean city governments in 2005, the most efficient Korean city governments (all efficiency scores are '1') are nine city governments: Bucheon; Ansan; Goyang; Gwangju; Cheongju;

Jeonju; Mokpo; Gumi; and Jeju in terms of technical, cost, and scale efficiency. In other words, all other things being equal (*ceteris paribus*), this means that these nine city governments are operated in the most efficient manner in terms of technical, cost, and scale efficiency.

Second, with regard to economic factors and government efficiency, the findings of this study are as follows. The size of the economically active population of cities has a positive relationship with the efficiency of Korean city governments, while employee size in manufacturing industries and number of low income households have a negative impact in this research. In other words, as the economically active population of cities increase, the efficiency of Korean city governments increases. In contrast, the increases in manufacturing employees and low income households result in decreasing the efficiency of Korean city governments. As a result, the empirical evidence of this study supports the argument that more economically active citizens and employee size in manufacturing industries relate to the improved efficiencies of local government.

Third, in terms of financial factors and government efficiency, independent revenue sources in Korean city governments have a positive relationship with the efficiency of government, while the per capita expenditure of Korean city governments has a negative effect on the efficiency of government. In other words, as the independent revenue sources of Korean city governments increase, the efficiency of Korean city governments increases. In contrast, the increase of expenditure of Korean city governments results in decreasing the efficiency of Korean city governments. In this sense, the empirical results of this study support the argument that local governments that have lower expenditures and more independent revenue sources tend to be more efficient local governments.

Fourth, in light of political factors and government efficiency, two political factors: mayors' political preferences, and citizens' voting percentages in mayors' elections do not relate to the efficiency of Korean city governments. These political factors are unrelated to the efficiency of local government in the Korean context. As a result, contrary to expectations based upon theoretical arguments, the empirical evidence of this study does not support the argument that political factors such as mayors' political preferences and citizens' participation in mayors' elections are related to the efficiency of local government.

Finally, with respect to environmental factors and government efficiency, the population size of Korean cities has a positive relationship on the efficiency of local governments, while the number of public employees in Korean city governments has a negative impact on the efficiency of local governments. In other words, as the population size of a Korean city increases, the efficiency of the Korean city government increases until the range of population reaches 800,000 to 900,000. In contrast, the increase in the number of public employees of Korean city governments relates to a decrease in the efficiency of Korean city governments. Consolidated Korean city governments are less efficient than non-consolidated city governments. That is, non-consolidated Korean city governments are the more efficient governments. As a result, this study supports the argument that the population of city, the number of public employees, and the degree of consolidation is associated with the increased efficiency of local government.

8.3 Limitations of the study

First, even though Korean local governments are required to have uniform data collections, this research has its limitations. There are limitations in generalizing and applying the findings of this study to local governments of other nations. In other words, in order to best support the finings of this study, more related research studies about other nations' local governments are needed. Only through replicating the analytic framework of this study elsewhere can the findings from this study be strongly supported or verified.

Second, this study only examines efficiency as one component of performance. In other words, this study did not measure effectiveness in local government. As a matter of fact, effectiveness measurement is just as important as efficiency measurement in terms of measuring overall performance in the public sector. Therefore, if the results of this study are interpreted beyond economic efficiency measurement, there may be overestimations or distortions.

Third, in addition to limited efficiency measurement, the input and output variables available and selected to measure efficiency in local government also do not cover all local government public services. This means that the measurement of local government performance in this study deals with limited public service areas, not all areas. In other words, these very limited variables of performance measurement explain limited local government performance in bounded public service areas.

Finally, although this study uses two sets of cross-sectional data in order to complement the deficiency of cross-sectional data often used in previous studies, this research provides just two snapshots. That is, two cross-sectional data sets of only two years require more accurate validation of this study. As an alternative to this study data, the use of more panel data[32] is highly recommended to improve the validation of study.

8.4. Suggestions for Further Research

First, as mentioned above, so far no published study used panel data to trace the change or evolution of overall local government performance over time. The study using panel data could provide a firmer test ground for verifying theoretical causal relations or arguments.

Second, a fundamental question of the study of local government performance is that so far there is no proper production model for local governments (Moriarty and Kennedy 2002). It has been argued that the input-output economic model is well suited to the public sector area. In other words, it assumes that local governments maximize outputs like a business. In this sense, further study is needed to the development of a production model to fit in local government.

Third, further study is needed to investigate the relationship between objective results of performance in local government and the extent of subjective perception by

[32] In statistics, the term 'panel data' refers to two dimensional data. More specifically, data are generally divided into the number of dimensions. A time series data set contains observations on a single phenomenon observed over time periods, while a cross-sectional data set has observations on multiple phenomena observed at a single point in time. A panel data set contains observations on multiple phenomena observed over multiple time periods. In other words, panel data has a two dimensional data set mixed by time series and cross-sectional data sets (Arellano 2003).

public employees of performance results. In other words, there may be a gap between objective and subjective evaluations regarding local government performance. This kind of study would contribute to explaining the difference between subjective and objective evaluations of performance in local government.

Finally, most studies have focused rather narrowly on performance measurement by assessing even more limited variables. Therefore, future research will be needed to integrate limited performance measurement into more general performance measurement by assessing more diverse variables. Moreover, new techniques or methodologies are needed to overcome the deficiency of present methodologies and to better measure the performance of local government more accurately and reliably.

APPENDIX A

DATA SETS FOR INPUT-OUTPUT VARIABLES AND INDEPENDENT AND DEPENDENT VARIABLES 2005, 2001

Table A.1 Input-Output Variables Data Base for Analysis, 2005

NO.	CITIES	EXPEN	PU EMPY	REVEN	WATER	SE WAG	ROAD	SO WEL	PARK	CUL FA
1	Suwon	0.88	2.21	660,486	99.3	97.0	77.4	0.02	2.59	0.06
2	Seongnam	0.78	2.29	887,956	99.8	98.5	91.1	0.01	5.46	0.08
3	Uijeongbu	1.05	2.16	502,668	97.4	97.9	96.1	0.01	0.60	0.02
4	Anyang	0.62	2.58	663,412	99.9	100.0	84.3	0.01	1.48	0.08
5	Bucheon	0.67	2.29	563,017	99.9	90.0	93.2	0.01	1.73	0.09
6	Gwangmyeong	0.78	2.71	456,142	99.7	98.3	100.0	0.01	0.56	0.04
7	Pyeongtaek-	1.19	4.12	709,421	82.6	72.0	77.1	0.03	1.42	0.07
8	Dongducheon	2.44	5.73	608,024	91.5	95.6	59.7	0.10	1.21	0.09
9	Ansan	0.72	2.29	703,281	99.2	98.9	95.5	0.00	6.89	0.02
10	Gwacheon	2.23	6.70	8,590,631	98.4	95.0	100.0	0.04	98.31	0.15
11	Guri	1.29	3.05	542,882	99.7	99.8	100.0	0.00	0.87	0.03
12	Namyangju	0.70	2.90	587,736	84.2	86.0	90.5	0.01	0.17	0.02
13	Osan	0.90	3.56	738,470	98.7	89.0	95.4	0.03	0.37	0.07
14	Siheung	0.73	2.06	759,281	99.1	84.3	83.5	0.01	1.91	0.02
15	Gunpo	0.86	2.38	555,696	99.7	97.6	70.2	0.01	1.41	0.03
16	Uiwang	1.54	2.99	540,584	97.3	97.4	96.5	0.01	0.70	0.03
17	Hanam	1.20	4.17	1,090,063	91.9	69.8	97.1	0.02	7.26	0.02
18	Goyang	0.72	2.13	714,702	96.0	86.8	98.8	0.01	4.54	0.05
19	Yongin	1.26	2.01	1,419,004	88.2	73.4	74.8	0.02	3.25	0.03
20	Paju	1.34	3.68	948,838	77.3	35.9	76.1	0.02	0.41	0.04
21	Icheon	1.34	4.39	825,659	60.4	50.0	64.9	0.04	0.00	0.03
22	Yangju	1.33	3.92	681,535	78.3	55.7	62.7	0.05	0.17	0.04
23	Pocheon	1.49	4.65	700,694	53.3	44.1	66.9	0.06	0.00	0.08
24	Hwaseong	1.32	3.54	101,075	62.8	29.0	77.2	0.02	0.81	0.00
25	Gwangju	1.02	3.39	1,068,164	84.8	86.5	93.8	0.07	0.19	0.01
26	Anseong	1.71	5.29	844,029	67.1	45.0	84.6	0.05	0.61	0.13
27	Gimpo	1.65	3.36	776,723	69.1	62.0	58.2	0.01	2.06	0.02
28	Chuncheon	1.21	5.26	660,954	89.7	85.0	75.7	0.05	6.64	0.07
29	Wonju	1.51	4.23	609,491	85.2	82.7	70.5	0.04	14.96	0.04
30	Gangreung	3.76	5.18	501,969	87.8	82.5	67.6	0.05	6.72	0.11
31	Donghae	2.84	5.47	441,711	96.9	93.9	58.4	0.02	13.77	0.12
32	Taebaek-	5.39	9.63	404,394	97.8	72.5	58.4	0.04	45.76	0.11
33	Sokcho	2.85	6.12	561,973	99.0	86.8	65.5	0.02	7.22	0.08
34	Samcheok	6.28	10.27	443,411	83.4	74.6	68.0	0.00	1.33	0.11
35	Cheongju	0.75	2.62	499,471	96.0	97.3	99.2	0.03	10.41	0.09
36	Chungju	1.65	7.46	548,914	79.0	76.7	73.8	0.02	23.81	0.06
37	Jecheon	1.86	7.56	448,937	83.7	83.7	68.4	0.04	4.99	0.10
38	Cheonan	0.91	2.93	947,343	83.0	74.3	56.0	0.05	5.35	0.04
39	Gongju	1.94	7.27	449,026	60.6	50.5	67.3	0.06	2.01	0.05
40	Boryeong	2.37	7.98	556,902	61.0	52.0	81.1	0.05	6.45	0.05
41	Asan	2.20	4.70	936,809	63.9	43.6	49.8	0.05	6.27	0.03
42	Seosan	1.56	6.06	774,000	55.6	42.1	77.4	0.04	11.33	0.06
43	Nonsan	1.69	6.01	364,875	54.0	50.8	84.8	0.08	5.02	0.04
44	Gyeryong	1.43	7.76	544,393	92.4	95.6	77.0	0.03	31.28	0.00
45	Jeonju	0.75	2.35	461,607	96.2	94.2	100.0	0.04	9.44	0.07
46	Gunsan	1.28	3.88	480,554	88.6	81.5	80.5	0.06	16.24	0.06
47	Iksan	1.03	4.44	414,969	86.5	79.2	76.9	0.04	14.19	0.06
48	Jeongeup	2.38	8.15	342,482	84.6	51.0	73.9	0.04	19.71	0.14
49	Namwon	2.52	10.39	319,090	58.0	59.3	70.5	0.09	1.90	0.07
50	Gimje	1.50	6.23	347,316	69.1	39.1	65.1	0.03	0.77	0.03
51	Mokpo	1.05	4.44	401,898	99.5	95.0	45.5	0.09	13.26	0.07
52	Yeosu	2.40	5.25	562,780	84.1	84.8	60.6	0.03	14.96	0.05
53	Suncheon	1.25	4.69	424,792	85.4	89.1	83.3	0.03	6.97	0.04
54	Naju	2.73	9.51	382,084	48.0	42.0	52.0	0.06	12.15	0.15
55	Gwangyang	1.65	5.79	750,500	85.9	82.6	51.9	0.00	29.20	0.05

Table A.1 – *Continued*

56	Pohang	0.95	3.78	649,751	90.0	56.9	85.7	0.01	7.72	0.03
57	Gyeongju	1.38	5.12	566,604	73.2	75.3	70.9	0.04	9.63	0.06
58	Gimcheon	2.11	7.26	417,517	63.2	61.7	65.2	0.08	14.25	0.11
59	Andong	2.17	7.26	423,083	77.6	69.8	63.6	0.09	13.44	0.09
60	Gumi	0.90	3.79	750,313	94.7	80.6	75.5	0.01	21.45	0.02
61	Yeongju	1.93	7.81	333,665	79.2	78.7	77.0	0.07	17.45	0.07
62	Yeongcheon	2.43	8.12	501,149	72.5	51.3	85.8	0.05	13.15	0.04
63	Sangju	2.30	10.08	309,811	62.3	52.3	82.0	0.03	15.89	0.06
64	Mungyeong	2.91	10.99	338,910	79.6	67.6	68.0	0.01	12.82	0.10
65	Gyeongsan	1.47	4.30	558,008	90.7	84.9	54.0	0.02	11.10	0.05
66	Changwon	1.10	2.13	762,005	92.9	90.8	96.2	0.01	9.57	0.07
67	Masan	0.88	3.75	290,118	94.8	90.1	73.3	0.03	7.94	0.07
68	Jinju	1.17	4.41	477,194	91.5	85.4	88.2	0.01	18.13	0.07
69	Jinhae	1.17	3.46	559,743	95.0	77.0	98.7	0.03	12.19	0.07
70	Tongyeong	2.16	6.81	479,268	99.4	71.1	69.0	0.03	3.81	0.07
71	Sacheon	2.33	7.26	373,537	84.9	57.6	63.1	0.04	18.27	0.05
72	Gimhae	1.27	2.68	713,237	89.7	80.9	56.5	0.02	24.39	0.04
73	Miryang	3.38	13.25	435,960	55.0	58.9	68.5	0.03	0.01	0.01
74	Geoje	2.69	4.75	679,443	85.5	49.4	83.1	0.04	39.23	0.08
75	Yangsan	1.18	3.50	758,601	75.8	70.3	57.4	0.06	17.64	0.01
76	Jeju	1.12	3.53	640,106	100.0	96.8	92.0	0.05	7.83	0.18
77	Seogwipo	2.41	7.39	627,659	100.0	92.0	98.1	0.06	21.14	0.25

Sources: (MOGAHA 2005,2001; MOPE 2005, 2001)

Table A.2 Input-Output Variables Data Base for Analysis, 2001

NO.	CITIES	EXPEN	PU EMPY	REVEN	WATER	SE WAG	ROAD	SO WEL	PARK	CUL FA
1	Suwon	0.49	2.21	465,099	98.5	65.8	69.3	0.01	1.46	0.04
2	Seongnam	0.49	2.40	452,472	99.7	98.3	100.0	0.00	3.53	0.02
3	Uijeongbu	0.51	2.10	344,946	94.2	98.1	87.7	0.01	2.09	0.04
4	Anyang	0.46	2.64	408,554	99.5	99.2	82.6	0.01	1.59	0.05
5	Bucheon	0.50	2.52	367,284	99.7	88.8	91.2	0.01	1.46	0.02
6	Gwangmyeong	0.40	2.29	315,050	99.0	97.9	100.0	0.00	0.60	0.03
7	Pyeongtaek-	0.63	3.87	395,427	79.6	67.4	91.3	0.03	2.77	0.03
8	Dongducheon	1.60	5.88	312,502	91.0	70.0	100.0	0.07	1.00	0.09
9	Ansan	0.45	2.19	436,203	98.6	95.2	90.0	0.00	3.57	0.02
10	Gwacheon	1.58	5.99	4,369,764	97.0	94.0	100.0	0.04	94.06	0.07
11	Guri	0.65	3.19	400,685	98.7	97.4	100.0	0.00	1.38	0.03
12	Namyangju	0.64	2.64	415,205	79.5	74.8	88.0	0.01	0.17	0.01
13	Osan	0.93	3.58	552,198	93.8	93.9	95.4	0.03	4.79	0.03
14	Siheung	0.54	1.94	485,914	93.4	60.6	79.9	0.01	2.54	0.01
15	Gunpo	0.42	2.26	362,419	99.5	97.9	80.1	0.00	1.44	0.01
16	Uiwang	0.54	3.60	434,216	93.0	96.8	96.7	0.01	1.10	0.02
17	Hanam	0.79	3.96	405,679	83.5	68.1	100.0	0.05	0.19	0.01
18	Goyang	0.44	2.12	465,108	95.2	86.5	97.6	0.01	4.75	0.01
19	Yongin	0.65	2.51	934,269	80.0	46.5	74.0	0.02	0.94	0.02
20	Paju	1.18	4.11	609,677	60.7	40.0	76.1	0.03	0.00	0.03
21	Icheon	0.92	3.92	500,133	54.4	43.7	61.8	0.02	0.00	0.06
22	Anseong	1.09	5.23	542,843	55.4	40.0	86.4	0.02	0.38	0.06
23	Gimpo	0.90	3.56	693,429	63.5	58.5	63.5	0.02	0.13	0.02
24	Chuncheon	0.85	5.32	345,465	85.9	82.6	81.7	0.04	6.52	0.05
25	Wonju	0.73	4.41	347,403	82.1	72.0	86.2	0.03	1.54	0.03
26	Gangreung	0.89	5.10	325,693	86.7	72.3	68.6	0.03	0.00	0.04
27	Donghae	1.12	5.28	337,131	95.4	90.2	36.3	0.00	0.00	0.06

Table A.2 - Continued

28	Taebaek-	1.93	9.55	262,613	98.0	63.8	68.3	0.04	1.10	0.04
29	Sokcho	1.01	5.75	355,762	98.0	64.1	50.9	0.01	0.94	0.06
30	Samcheok	1.83	9.86	249,765	77.7	49.2	63.6	0.00	0.00	0.06
31	Cheongju	0.51	2.69	343,076	94.7	92.6	61.2	0.03	0.78	0.05
32	Chungju	1.01	5.31	384,528	74.2	71.0	66.8	0.02	4.31	0.04
33	Jecheon	1.09	6.25	251,294	74.1	80.3	65.3	0.03	0.18	0.06
34	Cheonan	0.63	3.11	240,013	75.8	67.7	54.4	0.01	0.51	0.04
35	Gongju	1.19	6.63	165,868	58.2	45.7	69.1	0.04	1.54	0.07
36	Boryeong	1.35	7.73	173,234	54.8	59.4	91.1	0.07	0.00	0.01
37	Asan	0.85	6.34	246,722	49.4	42.7	61.7	0.03	0.58	0.03
38	Seosan	0.98	5.67	198,063	48.9	40.5	73.9	0.01	1.22	0.03
39	Nonsan	0.89	8.29	175,137	59.6	14.7	78.6	0.06	0.59	0.01
40	Jeonju	0.52	2.90	320,459	93.1	93.7	99.1	0.03	1.02	0.03
41	Gunsan	0.79	5.85	305,242	83.2	100.0	81.6	0.04	0.59	0.03
42	Iksan	0.86	7.36	265,535	70.0	62.2	74.2	0.04	2.01	0.04
43	Jeongeup	1.08	6.78	202,457	69.9	42.9	71.8	0.03	1.38	0.03
44	Namwon	1.51	8.91	215,649	53.7	51.2	76.7	0.02	1.78	0.04
45	Gimje	1.38	17.72	210,460	58.4	32.3	74.0	0.03	1.02	0.03
46	Mokpo	0.82	5.15	301,639	99.3	69.5	94.3	0.07	1.70	0.03
47	Yeosu	0.93	12.01	34,632	79.9	79.9	77.8	0.03	1.10	0.02
48	Suncheon	0.90	4.63	280,752	81.0	65.7	69.8	0.05	0.43	0.05
49	Naju	1.48	9.17	226,306	43.5	49.5	49.4	0.05	0.79	0.04
50	Gwangyang	0.93	5.79	536,399	81.7	81.7	55.5	0.00	0.00	0.01
51	Pohang	0.72	3.65	452,991	86.3	50.6	66.7	0.01	1.12	0.03
52	Gyeongju	0.87	4.81	373,128	67.2	48.7	62.8	0.03	1.81	0.04
53	Gimcheon	1.15	6.85	276,710	62.3	59.6	72.8	0.04	0.29	0.03
54	Andong	1.24	6.69	259,223	70.8	64.4	66.1	0.13	0.26	0.06
55	Gumi	0.75	3.87	537,386	90.0	75.0	78.5	0.01	1.31	0.04
56	Yeongju	1.25	7.13	228,259	74.7	72.2	73.4	0.04	0.00	0.05
57	Yeongcheon	1.03	7.30	271,608	64.3	44.1	81.4	0.02	12.12	0.02
58	Sangju	1.43	8.51	204,782	53.7	38.3	79.2	0.02	0.15	0.03
59	Mungyeong	1.77	9.30	202,280	79.3	34.5	69.3	0.01	0.34	0.03
60	Gyeongsan	0.72	4.02	352,023	85.3	69.9	68.2	0.01	0.62	0.02
61	Changwon	0.55	2.32	418,495	85.4	81.8	94.7	0.01	4.40	0.02
62	Masan	0.51	3.81	358,996	91.8	26.7	70.9	0.02	0.00	0.05
63	Jinju	0.76	4.09	305,553	87.6	84.0	72.2	0.02	0.61	0.05
64	Jinhae	0.89	4.56	327,159	93.5	74.3	55.3	0.01	3.99	0.03
65	Tongyeong	1.02	6.14	258,760	79.7	63.1	49.0	0.02	1.57	0.04
66	Sacheon	1.08	6.83	262,373	79.9	38.9	64.8	0.03	1.25	0.02
67	Gimhae	0.90	2.80	442,836	80.5	72.8	67.1	0.02	2.24	0.03
68	Miryang	1.18	6.36	226,427	49.4	45.4	60.0	0.02	0.55	0.02
69	Geoje	0.93	4.59	353,821	77.9	40.4	79.8	0.03	0.92	0.06
70	Yangsan	0.68	3.29	515,727	70.4	63.2	55.2	0.03	5.74	0.01
71	Jeju	0.74	3.68	416,418	100.0	95.9	99.5	0.04	5.76	0.06
72	Seogwipo	2.04	6.75	474,155	100.0	83.8	92.2	0.08	4.61	0.07

Sources: (MOGAHA 2005,2001; MOPE 2005, 2001)

Table A.3 Independent and Dependent Variables for Regression Analysis, 2005

NO.	CITIES	ECOPOP	MANUEMPY	LOWINCOM	INDSOUR	EXPEN	GRANT	POLIPARTY	VOTE	POP
1	Suwon	62.6	18.6	1.34	64.8	0.88	16.0	4	40.80	1,042,132
2	Seongnam	62.6	16.7	1.79	70.2	0.78	19.2	4	41.70	986,170
3	Uijeongbu	62.6	6.8	1.97	53.3	1.05	23.0	4	42.50	400,018
4	Anyang	62.6	20.8	1.19	66.9	0.62	19.4	4	43.80	625,197
5	Bucheon	62.6	33.1	1.78	64.4	0.67	19.7	2	38.60	864,501
6	Gwangmyeong	62.6	21.6	1.92	50.3	0.78	27.9	2	45.60	333,053
7	Pyeongtaek-	62.6	44.8	2.48	44.9	1.19	30.3	4	48.10	378,073
8	Dongducheon	62.6	24.2	4.06	21.6	2.44	43.0	4	54.70	81,117
9	Ansan	62.6	46.7	2.14	62.9	0.72	17.0	4	36.50	686,873
10	Gwacheon	62.6	5.5	1.30	43.9	2.23	49.8	4	56.90	68,641
11	Guri	62.6	7.8	2.08	46.2	1.29	29.9	4	43.40	193,532
12	Namyangju	62.6	27.1	1.68	44.5	0.70	27.0	4	43.40	423,073
13	Osan	62.6	30.5	1.50	51.9	0.90	32.0	5	47.60	122,784
14	Siheung	62.6	55.1	1.29	60.1	0.73	17.9	4	37.90	390,933
15	Gunpo	62.6	40.6	1.49	56.4	0.86	22.9	2	47.20	278,680
16	Uiwang	62.6	30.3	0.84	51.5	1.54	32.9	4	48.90	146,595
17	Hanam	62.6	22.1	1.78	47.4	1.20	32.5	4	49.40	131,565
18	Goyang	62.6	14.1	1.27	61.2	0.72	25.9	4	41.90	893,965
19	Yongin	62.6	37.5	0.74	63.7	1.26	24.2	4	46.20	649,577
20	Paju	62.6	44.2	2.06	40.7	1.34	26.2	4	49.50	252,700
21	Icheon	62.6	43.3	2.36	48.4	1.34	23.8	2	49.40	192,725
22	Yangju	62.6	52.9	1.87	35.3	1.33	35.7	4	49.90	159,891
23	Pocheon	62.6	48.3	3.14	34.1	1.49	38.0	4	57.20	158,487
24	Hwaseong	62.6	66.2	1.58	64.0	1.32	16.7	4	49.50	286,736
25	Gwangju	62.6	42.0	1.60	52.7	1.02	17.0	4	53.20	212,621
26	Anseong	62.6	44.7	2.97	34.3	1.71	35.1	4	54.80	156,839
27	Gimpo	62.6	54.4	1.28	38.0	1.65	19.8	4	47.50	216,689
28	Chuncheon	58.5	5.9	3.86	34.4	1.21	47.3	4	52.40	254,323
29	Wonju	58.5	16.1	3.00	29.6	1.51	42.0	4	47.80	286,136
30	Gangreung	58.5	8.9	3.14	33.4	3.76	47.4	4	54.00	228,325
31	Donghae	58.5	10.2	3.38	21.9	2.84	43.9	4	56.80	101,048
32	Taebaek-	58.5	5.4	3.80	16.3	5.39	35.6	4	62.00	53,384
33	Sokcho	58.5	5.1	3.98	30.1	2.85	51.0	4	56.80	88,386
34	Samcheok	58.5	7.7	5.32	13.9	6.28	46.6	4	70.00	74,577
35	Cheongju	59.4	18.4	2.49	55.1	0.75	22.3	4	45.50	626,614
36	Chungju	59.4	16.2	3.09	21.2	1.65	43.1	4	54.30	208,557
37	Jecheon	59.4	11.0	4.24	22.2	1.86	51.3	4	59.70	139,403
38	Cheonan	64.4	37.0	1.88	48.9	0.91	27.3	4	42.30	509,744
39	Gongju	64.4	17.6	4.96	19.2	1.94	50.4	3	63.90	131,140
40	Boryeong	64.4	13.4	6.41	20.5	2.37	40.9	5	64.80	109,401
41	Asan	64.4	55.2	3.64	39.9	2.20	32.8	4	50.00	205,057
42	Seosan	64.4	27.5	3.63	23.0	1.56	54.6	2	55.10	150,890
43	Nonsan	64.4	21.6	5.29	14.7	1.69	53.5	5	49.90	136,503
44	Gyeryong	64.4	6.3	1.68	17.5	1.43	66.6	5	49.90	31,174
45	Jeonju	58.8	8.1	3.35	43.0	0.75	27.8	2	41.90	624,260
46	Gunsan	58.8	22.0	5.67	23.2	1.28	42.1	3	49.20	266,541
47	Iksan	58.8	25.2	5.19	34.7	1.03	37.9	2	47.90	324,533
48	Jeongeup	58.8	20.2	8.93	14.1	2.38	55.1	2	60.20	133,018
49	Namwon	58.8	14.6	8.20	12.8	2.52	52.7	3	69.60	96,603
50	Gimje	58.8	27.3	10.07	16.1	1.50	49.0	2	67.20	105,900
51	Mokpo	65.1	6.7	5.69	29.7	1.05	37.2	2	48.40	242,380
52	Yeosu	65.1	21.1	4.57	33.0	2.40	36.8	2	57.20	306,115
53	Suncheon	65.1	8.0	4.38	26.4	1.25	46.7	2	55.00	270,833
54	Naju	65.1	22.0	10.33	13.8	2.73	43.5	3	70.20	100,054
55	Gwangyang	65.1	30.3	2.86	49.4	1.65	31.6	2	59.90	137,601

Table A.3 – *Continued*

56	Pohang	65.2	22.7	3.44	50.1	0.95	27.1	4	53.00	508,937
57	Gyeongju	65.2	31.8	3.23	30.0	1.38	43.9	4	59.60	280,092
58	Gimcheon	65.2	31.2	5.07	20.6	2.11	50.6	3	64.40	144,587
59	Andong	65.2	7.6	6.00	16.7	2.17	48.3	4	66.90	174,596
60	Gumi	65.2	53.6	1.88	57.9	0.90	19.2	4	43.60	370,088
61	Yeongju	65.2	13.8	5.69	17.7	1.93	53.1	4	68.60	121,908
62	Yeongcheon	65.2	36.2	6.38	22.0	2.43	54.7	4	58.70	110,891
63	Sangju	65.2	14.0	4.74	13.6	2.30	54.7	4	70.20	112,943
64	Mungyeong	65.2	12.4	7.07	15.2	2.91	50.7	3	69.70	79,820
65	Gyeongsan	65.2	36.4	4.22	35.1	1.47	42.6	4	46.50	223,357
66	Changwon	62.1	45.8	1.18	67.7	1.10	11.1	4	48.70	511,280
67	Masan	62.1	20.2	2.47	41.8	0.88	34.8	4	46.10	428,980
68	Jinju	62.1	13.7	3.29	33.7	1.17	36.9	4	59.30	338,556
69	Jinhae	62.1	28.4	2.38	30.9	1.17	44.9	3	61.10	152,773
70	Tongyeong	62.1	19.3	3.88	21.3	2.16	50.8	3	56.90	133,613
71	Sacheon	62.1	27.4	5.00	21.1	2.33	49.2	4	59.40	113,217
72	Gimhae	62.1	46.6	2.50	47.7	1.27	23.0	4	42.60	433,076
73	Miryang	62.1	18.3	5.38	21.0	3.38	53.9	4	60.60	116,196
74	Geoje	62.1	46.7	2.20	33.0	2.69	35.9	4	52.90	193,434
75	Yangsan	62.1	49.6	1.88	46.9	1.18	32.8	4	51.20	216,365
76	Jeju	70.0	3.7	3.31	37.4	1.12	28.5	3	63.40	296,990
77	Seogwipo	70.0	3.0	4.46	18.8	2.41	37.6	3	73.20	84,070

Sources: (MOGAHA 2005,2001; MOPE 2005, 2001; NEC 2002, 1998)

Table A.3 – *Continued*

NO.	CITIES	DENSITY	CONSOL	COMPETI	PUEMPY	TECHEF	COSTEF	SCALEF	STOCHEF
1	Suwon	8,609.10	0	1	2,300	1	0.72057496	1	0.760262
2	Seongnam	6,953.67	0	1	2,259	1	0.91024798	1	0.781477
3	Uijeongbu	4,902.18	0	1	863	1	0.66664904	1	0.733549
4	Anyang	10,683.48	0	1	1,610	1	1	1	0.782094
5	Bucheon	16,158.90	0	1	1,984	1	1	1	0.770894
6	Gwangmyeong	8,648.48	0	1	902	1	0.9143365	0.91785291	0.748077
7	Pyeongtaek-	836.11	1	1	1,556	0.60682714	0.56541885	0.56551031	0.736634
8	Dongducheon	847.97	0	1	465	1	0.51282664	0.8972745	0.658853
9	Ansan	4,668.16	0	1	1,572	1	1	1	0.776293
10	Gwacheon	1,914.67	0	1	460	1	1	1	0.805997
11	Guri	5,811.77	0	1	590	1	0.55878337	0.74183443	0.71797
12	Namyangju	919.68	1	1	1,226	0.87156989	0.92758673	0.92758673	0.767718
13	Osan	2,872.81	0	1	437	0.89056762	0.84324389	0.84324389	0.760323
14	Siheung	2,908.73	0	1	806	1	0.86495927	1	0.779133
15	Gunpo	7,658.15	0	1	662	0.91732926	0.72019352	0.94615472	0.752993
16	Uiwang	2,714.72	0	1	439	0.62030595	0.45206808	0.72659954	0.702003
17	Hanam	1,413.61	0	1	548	0.63406095	0.66554747	0.66784276	0.75876
18	Goyang	3,343.68	0	1	1,901	1	1	1	0.777016
19	Yongin	1,098.19	1	1	1,306	1	0.61074483	1	0.773124
20	Paju	375.73	1	1	929	0.62028596	0.49318488	0.54757131	0.744759
21	Icheon	417.88	1	1	847	0.60148631	0.52764502	0.55076243	0.735713
22	Yangju	515.38	1	1	627	0.66981102	0.58838281	0.68381081	0.726312
23	Pocheon	191.77	1	1	737	0.7102484	0.64551375	0.75328268	0.716841
24	Hwaseong	416.69	1	1	1,016	0.58483153	0.43067186	0.49806135	0.591011
25	Gwangju	492.42	1	1	721	1	1	1	0.770031
26	Anseong	283.08	1	1	829	0.62524464	0.60107672	0.63783176	0.714952
27	Gimpo	783.49	1	1	728	0.5424043	0.31408951	0.48658809	0.717689

Table A.3 – *Continued*

28	Chuncheon	227.83	1	0	1,337	0.60306449	0.66462903	0.66462903	0.729129
29	Wonju	329.95	1	0	1,210	0.60061606	0.53408558	0.62812685	0.708201
30	Gangreung	160.77	1	0	1,183	0.44047592	0.2475634	0.62369248	0.597205
31	Donghae	561.22	0	0	553	0.449067	0.32750329	0.5430697	0.618217
32	Taebaek-	175.85	0	0	514	0.3489103	0.2544925	0.43849387	0.525199
33	Sokcho	839.61	0	0	541	0.34546125	0.25083075	0.38127052	0.635599
34	Samcheok	62.89	1	0	766	0.18434892	0.11306087	0.23060205	0.513332
35	Cheongju	4,084.84	0	0	1,643	1	1	1	0.756241
36	Chungju	211.94	1	0	1,555	0.50539024	0.5285649	0.5285649	0.68733
37	Jecheon	157.96	1	0	1,054	0.40773155	0.44047775	0.44047775	0.661052
38	Cheonan	801.12	1	0	1,493	1	0.96145784	1	0.772879
39	Gongju	139.40	1	0	953	0.45502235	0.44372338	0.4443413	0.657208
40	Boryeong	192.50	1	0	873	0.33120326	0.32068246	0.32068246	0.651404
41	Asan	378.12	1	0	963	0.51457969	0.36888284	0.61502705	0.700901
42	Seosan	204.07	1	0	915	0.46662299	0.47373786	0.47373786	0.716528
43	Nonsan	246.03	1	0	820	1	0.66316476	0.68913688	0.658432
44	Gyeryong	513.57	1	0	242	0.61293363	0.77133695	0.77133695	0.699661
45	Jeonju	3,026.72	0	0	1,467	1	1	1	0.752974
46	Gunsan	701.31	1	0	1,034	0.79897441	0.73668618	0.85926918	0.708397
47	Iksan	639.97	1	0	1,440	0.6929818	0.7631359	0.7631359	0.716645
48	Jeongeup	191.99	1	0	1,084	0.44577035	0.44647747	0.44647747	0.612597
49	Namwon	128.32	1	0	1,004	1	0.47750463	0.47860644	0.596618
50	Gimje	194.24	1	0	660	0.42670368	0.35925513	0.3889302	0.666693
51	Mokpo	5,058.01	0	0	1,075	1	1	1	0.713071
52	Yeosu	613.85	1	0	1,606	0.42522184	0.31624607	0.44887784	0.655661
53	Suncheon	298.48	1	0	1,271	0.54221399	0.54718462	0.54718462	0.701037
54	Naju	165.67	1	0	952	0.43872111	0.4231324	0.4231324	0.603563
55	Gwangyang	307.03	1	0	797	0.6141811	0.60387657	0.60389249	0.710172
56	Pohang	451.29	1	0	1,922	0.68928954	0.70054426	0.70054426	0.749602
57	Gyeongju	211.55	1	0	1,434	0.52908564	0.52731568	0.52731568	0.709675
58	Gimcheon	143.24	1	0	1,049	0.82673581	0.56812892	0.63531147	0.643273
59	Andong	114.82	1	0	1,268	1	0.54149977	0.65777114	0.640857
60	Gumi	600.56	1	0	1,402	1	1	1	0.760607
61	Yeongju	182.26	1	0	952	0.53526394	0.53546427	0.53546427	0.634617
62	Yeongcheon	120.50	1	0	900	0.38052733	0.36668456	0.38241685	0.640524
63	Sangju	90.01	1	0	1,139	0.31880701	0.3241449	0.3241449	0.605326
64	Mungyeong	87.51	1	0	877	0.27591879	0.27426426	0.27441775	0.584173
65	Gyeongsan	542.70	1	0	960	0.54868051	0.49646152	0.53280945	0.704926
66	Changwon	1,747.07	1	0	1,087	1	0.68484576	1	0.75241
67	Masan	1,301.16	1	0	1,610	0.72821509	0.79940049	0.79940049	0.710076
68	Jinju	475.09	1	0	1,492	0.69883444	0.72538773	0.72538773	0.714811
69	Jinhae	1,354.85	0	0	528	0.69913682	0.66237882	0.70681745	0.726109
70	Tongyeong	563.46	1	0	910	0.3789474	0.33001967	0.34510219	0.651837
71	Sacheon	285.20	1	0	822	0.3987553	0.37197752	0.3996642	0.623232
72	Gimhae	934.70	1	0	1,161	1	0.73764847	1	0.735853
73	Miryang	145.42	1	0	1,540	0.19723123	0.17514241	0.18527009	0.585087
74	Geoje	482.74	1	0	919	0.63221507	0.43627868	0.75314068	0.658913
75	Yangsan	446.99	1	0	757	0.88939063	0.75976387	0.9495895	0.742354
76	Jeju	1,162.43	0	0	1,047	1	1	1	0.737576
77	Seogwipo	329.82	0	0	621	1	0.7069908	0.86922419	0.659193

Sources: (MOGAHA 2005,2001; MOPE 2005, 2001; NEC 2002, 1998)

Table A.4 Independent and Dependent Variables for Regression Analysis, 2001

NO.	CITIES	ECOP OP	MAN UEMP Y	LOWI NCO M	INDS OUR	EXPE N	GRAN T	POLIP ARTY	VOTE	POP
1	Suwon	62.1	21.8	1.51	72.9	0.49	13.1	3	45.8	951,253
2	Seongnam	62.1	19.7	2.34	72.9	0.49	16.8	2	50.5	928,196
3	Uijeongbu	62.1	8.9	2.24	61.9	0.51	18.2	2	47.6	362,529
4	Anyang	62.1	25.1	1.38	72.5	0.46	13.9	4	49.1	583,240
5	Bucheon	62.1	39.3	2.35	69.0	0.50	12.4	2	44.8	780,003
6	Gwangmyeong	62.1	24.0	2.33	62.9	0.40	22.2	2	48.8	338,855
7	Pyeongtaek-	62.1	37.3	3.06	53.1	0.63	18.9	5	50.8	359,073
8	Dongducheon	62.1	25.7	4.83	44.4	1.60	33.4	4	60.2	76,758
9	Ansan	62.1	50.5	2.92	68.1	0.45	13.5	2	44.2	575,574
10	Gwacheon	62.1	3.2	1.22	47.5	1.58	48.8	2	56.2	71,749
11	Guri	62.1	11.4	2.86	47.4	0.65	16.5	2	48.8	170,008
12	Namyangju	62.1	30.8	1.94	54.3	0.64	26.4	2	45.6	359,388
13	Osan	62.1	34.4	1.79	40.0	0.93	20.4	5	58.6	106,457
14	Siheung	62.1	58.9	1.44	62.6	0.54	12.6	2	46.2	322,457
15	Gunpo	62.1	42.4	1.95	67.3	0.42	17.3	2	49.8	271,306
16	Uiwang	62.1	33.4	0.98	53.7	0.54	24.1	2	52.0	121,777
17	Hanam	62.1	21.5	2.32	42.5	0.79	29.4	2	51.7	123,664
18	Goyang	62.1	16.1	1.35	67.6	0.44	20.2	2	45.1	800,297
19	Yongin	62.1	41.2	1.09	75.3	0.65	13.4	4	55.0	395,028
20	Paju	62.1	42.5	2.87	43.9	1.18	25.5	2	56.8	193,719
21	Icheon	62.1	49.2	2.34	49.8	0.92	14.6	2	53.4	184,491
22	Anseong	62.1	38.5	4.23	31.7	1.09	23.7	3	64.6	137,643
23	Gimpo	62.1	55.4	1.74	56.4	0.90	14.2	2	55.0	165,466
24	Chuncheon	58.0	6.9	3.45	35.4	0.85	31.0	4	57.8	251,991
25	Wonju	58.0	14.9	3.15	40.7	0.73	30.9	5	54.3	270,891
26	Gangreung	58.0	11.9	2.65	31.9	0.89	34.0	4	61.9	233,812
27	Donghae	58.0	9.2	3.43	27.5	1.12	29.2	4	64.9	104,409
28	Taebaek-	58.0	6.7	4.00	22.1	1.93	30.7	4	67.7	57,067
29	Sokcho	58.0	5.7	4.32	30.8	1.01	28.1	4	58.3	90,201
30	Samcheok	58.0	9.4	5.35	18.2	1.83	39.4	3	76.1	82,255
31	Cheongju	59.8	21.9	2.42	69.9	0.51	10.1	2	51.0	582,758
32	Chungju	59.8	19.0	3.13	25.6	1.01	35.4	3	60.1	218,098
33	Jecheon	59.8	11.7	3.72	25.9	1.09	39.3	5	62.8	148,308
34	Cheonan	63.2	36.8	2.38	46.4	0.63	19.9	5	45.5	425,135
35	Gongju	63.2	18.1	5.17	17.0	1.19	38.6	5	66.1	135,931
36	Boryeong	63.2	12.3	6.28	17.8	1.35	39.6	3	63.7	118,721
37	Asan	63.2	48.6	4.56	32.4	0.85	23.2	3	56.0	185,847
38	Seosan	63.2	21.6	3.51	28.2	0.98	37.7	3	60.9	150,329
39	Nonsan	63.2	20.3	5.83	21.2	0.89	38.2	2	60.9	170,406
40	Jeonju	59.2	10.4	3.23	51.0	0.52	11.6	2	42.3	622,238
41	Gunsan	59.2	20.8	5.21	31.7	0.79	26.6	3	56.2	278,577
42	Iksan	59.2	27.4	4.89	31.6	0.86	28.6	2	52.8	336,651
43	Jeongeup	59.2	18.6	8.65	15.2	1.08	44.0	3	67.9	152,574
44	Namwon	59.2	15.5	7.98	16.2	1.51	45.4	2	73.3	103,783
45	Gimje	59.2	24.7	9.35	16.5	1.38	41.2	3	68.3	116,211
46	Mokpo	64.6	8.2	5.74	30.7	0.82	20.9	2	53.3	245,831
47	Yeosu	64.6	20.5	3.89	33.5	0.93	26.2	3	63.4	324,217
48	Suncheon	64.6	5.1	4.40	28.4	0.90	33.3	2	57.1	270,698
49	Naju	64.6	20.7	10.75	16.9	1.48	38.4	2	72.7	108,962
50	Gwangyang	64.6	29.1	2.80	38.1	0.93	26.8	2	67.5	138,097
51	Pohang	65.2	33.7	3.23	51.5	0.72	18.6	4	62.7	517,250
52	Gyeongju	65.2	29.3	2.99	29.1	0.87	39.0	4	63.4	291,409
53	Gimcheon	65.2	29.0	5.25	24.5	1.15	41.8	4	67.5	150,684
54	Andong	65.2	7.2	6.34	18.9	1.24	39.3	3	68.0	184,108
55	Gumi	65.2	52.7	1.61	64.1	0.75	18.4	4	48.7	341,034

Table A.4 - *Continued*

56	Yeongju	65.2	13.6	5.97	21.8	1.25	37.8	3	69.8	131,351
57	Yeongcheon	65.2	36.0	6.14	19.2	1.03	42.2	4	67.9	120,758
58	Sangju	65.2	12.4	5.51	14.7	1.43	46.4	4	68.9	124,884
59	Mungyeong	65.2	10.5	6.89	16.7	1.77	37.6	5	67.8	90,000
60	Gyeongsan	65.2	41.1	4.24	37.4	0.72	25.5	4	53.9	216,399
61	Changwon	61.4	48.0	1.00	69.1	0.55	11.2	4	50.1	523,142
62	Masan	61.4	21.7	2.26	50.0	0.51	17.3	4	53.9	434,085
63	Jinju	61.4	14.2	3.13	38.7	0.76	29.3	4	62.5	342,536
64	Jinhae	61.4	30.7	2.82	37.3	0.89	27.6	3	67.3	134,549
65	Tongyeong	61.4	14.0	3.50	19.6	1.02	42.6	4	64.1	137,115
66	Sacheon	61.4	27.1	5.02	23.0	1.08	36.7	3	69.8	119,543
67	Gimhae	61.4	47.0	2.86	39.1	0.90	14.6	4	50.8	347,070
68	Miryang	61.4	18.7	5.27	19.4	1.18	39.1	4	66.8	124,936
69	Geoje	61.4	44.9	2.33	32.9	0.93	31.9	4	63.6	176,028
70	Yangsan	61.4	52.6	2.00	61.5	0.68	13.3	3	55.0	194,442
71	Jeju	68.3	3.6	3.22	40.3	0.74	19.3	2	69.0	279,087
72	Seogwipo	68.3	2.8	4.19	23.6	2.04	21.2	3	78.0	85,737

Sources: (MOGAHA 2005,2001; MOPE 2005, 2001; NEC 2002, 1998)

Table A.4 – *Continued*

NO.	CITIES	DENSITY	CONSOL	COMPETI	PUEMPY	TECHEF	COSTEF	SCALEF	STOCHEF
1	Suwon	7,853.16	0	1	2,107	1	0.94940727	1	0.768919
2	Seongnam	6,543.97	0	1	2,229	1	0.89995145	0.94872239	0.80013
3	Uijeongbu	4,443.30	0	1	763	1	0.92390593	1	0.493694
4	Anyang	9,966.51	0	1	1,542	1	1	1	0.952941
5	Bucheon	14,595.86	0	1	1,964	1	0.88380788	0.8629027	0.672805
6	Gwangmyeong	8,801.43	0	1	776	1	1	1	0.893411
7	Pyeongtaek-	793.86	1	1	1,388	0.78037036	0.79894431	0.70712627	0.596564
8	Dongducheon	802.24	0	1	451	1	0.64686045	0.97639565	0.067808
9	Ansan	3,971.67	0	1	1,262	1	0.97723831	1	0.908815
10	Gwacheon	2,000.81	0	1	430	1	1	1	0.995833
11	Guri	5,106.88	0	1	542	0.69806752	0.65311811	0.72033313	0.459267
12	Namyangju	781.30	1	1	949	0.74279787	0.6136594	0.72491952	0.421115
13	Osan	2,489.64	0	1	381	0.7221005	0.61036998	0.81538914	0.2957
14	Siheung	2,452.89	0	1	626	1	0.80758677	1	0.562861
15	Gunpo	7,463.71	0	1	612	1	1	0.9753892	0.92391
16	Uiwang	2,256.80	0	1	438	0.75798623	0.84089999	0.61775782	0.912782
17	Hanam	1,328.58	0	1	490	1	0.86177257	0.94408308	0.352791
18	Goyang	2,993.67	0	1	1,697	1	1	1	0.999074
19	Yongin	667.81	1	1	990	1	0.83306984	0.94435721	0.873498
20	Paju	283.79	1	1	797	0.58971842	0.43212481	0.62582871	0.203546
21	Icheon	400.07	1	1	723	0.78928166	0.63142331	0.79056704	0.297806
22	Anseong	248.30	1	1	720	0.6024226	0.54179248	0.58878468	0.275515
23	Gimpo	598.32	1	1	589	0.72290084	0.54914935	0.69550146	0.400227
24	Chuncheon	225.72	1	0	1,340	0.71093365	0.76981828	0.6128354	0.333539
25	Wonju	312.17	1	0	1,194	0.71404125	0.71196755	0.64810894	0.410618
26	Gangreung	224.80	1	0	1,192	0.60864205	0.61152189	0.56305176	0.267527
27	Donghae	579.82	0	0	551	0.54870499	0.44452674	0.54165447	0.163011
28	Taebaek-	188.01	0	0	545	0.33720198	0.29388284	0.32156684	0.056485
29	Sokcho	857.02	0	0	519	0.50798045	0.48295618	0.48187907	0.241369
30	Samcheok	69.37	1	0	811	0.3549092	0.28688079	0.30667038	0.063404
31	Cheongju	3,801.42	0	0	1,565	1	1	1	0.614224
32	Chungju	221.66	1	0	1,158	0.48632023	0.43173416	0.39783633	0.244574

Table A.4 – *Continued*

33	Jecheon	168.08	1	0	927	0.6106363	0.57700134	0.52566158	0.153047
34	Cheonan	667.98	1	0	1,322	0.74209981	0.59276521	0.60319268	0.293908
35	Gongju	144.51	1	0	901	0.66053194	0.58034969	0.54658523	0.08546
36	Boryeong	209.09	1	0	918	0.61636989	0.58910246	0.56471942	0.075007
37	Asan	342.71	1	0	1,178	0.54417765	0.51989373	0.3975656	0.280233
38	Seosan	203.38	1	0	852	0.43644979	0.36649745	0.32265005	0.144
39	Nonsan	276.85	1	0	1,413	0.64234284	0.7718485	0.45709797	0.228703
40	Jeonju	3,017.06	0	0	1,805	1	1	1	0.608779
41	Gunsan	737.52	1	0	1,631	1	0.80313365	0.58336994	0.387203
42	Iksan	663.91	1	0	2,479	0.60332849	0.68534728	0.42901407	0.34618
43	Jeongeup	220.27	1	0	1,035	0.46969327	0.45030272	0.38434664	0.135872
44	Namwon	137.87	1	0	925	0.30033158	0.29277627	0.24556712	0.081394
45	Gimje	213.11	1	0	2,059	0.25881036	0.32717836	0.13345566	0.19129
46	Mokpo	5,223.78	0	0	1,265	1	0.99812407	0.85308245	0.312672
47	Yeosu	650.92	1	0	3,895	0.38764718	0.4913944	0.20781855	0.058115
48	Suncheon	298.37	1	0	1,252	0.76229079	0.7517008	0.75767948	0.209464
49	Naju	180.44	1	0	999	0.40188093	0.37492558	0.33324323	0.091231
50	Gwangyang	309.58	1	0	800	0.43986624	0.44570791	0.34844107	0.446056
51	Pohang	458.85	1	0	1,888	0.62097452	0.58059958	0.5328233	0.46421
52	Gyeongju	220.15	1	0	1,403	0.64503685	0.62339276	0.57383151	0.313417
53	Gimcheon	149.26	1	0	1,032	0.49112865	0.45972849	0.4249019	0.159301
54	Andong	121.14	1	0	1,232	1	1	1	0.12101
55	Gumi	552.51	1	0	1,320	0.64466475	0.60193814	0.56939253	0.536445
56	Yeongju	196.42	1	0	937	0.47667824	0.49657693	0.44948057	0.110804
57	Yeongcheon	131.30	1	0	881	0.44900489	0.48535243	0.32098818	0.2224
58	Sangju	99.53	1	0	1,063	0.30463714	0.27975534	0.23783578	0.084853
59	Mungyeong	98.68	1	0	837	0.25120243	0.21074813	0.1935367	0.053328
60	Gyeongsan	525.90	1	0	871	0.6014062	0.57306626	0.4945097	0.398976
61	Changwon	1,787.54	1	0	1,212	0.9032729	0.8121264	0.9540348	0.553439
62	Masan	1,317.53	1	0	1,653	0.8261038	0.94537114	0.64247838	0.92077
63	Jinju	480.52	1	0	1,401	0.63100584	0.61022709	0.59476017	0.309933
64	Jinhae	1,204.99	0	0	614	0.52765403	0.52801009	0.48093087	0.246474
65	Tongyeong	579.74	1	0	842	0.45002099	0.42933159	0.36227193	0.184098
66	Sacheon	301.41	1	0	817	0.42709102	0.40890858	0.34456738	0.178175
67	Gimhae	749.19	1	0	971	0.72520975	0.50136222	0.80550416	0.19895
68	Miryang	156.36	1	0	795	0.41654136	0.31401615	0.34486411	0.114108
69	Geoje	440.11	1	0	808	0.69479615	0.6702358	0.6948102	0.237937
70	Yangsan	401.60	1	0	640	0.88397999	0.76524852	0.7999777	0.562935
71	Jeju	1,092.92	0	0	1,026	1	1	1	0.396997
72	Seogwipo	336.79	0	0	579	1	0.50958156	0.79491075	0.064267
Sources: (MOGAHA 2005,2001; MOPE 2005, 2001; NEC 2002, 1998)									

APPENDIX B

RESULTS OF TECHNICAL, COST, AND SCALE EFFICIENCY USING DATA ENVELOPMENT ANALYSIS 2005, 2001

Table B.1 DEA Technical Efficiency in Korean City Govn'ts, 2005

Input Items: (1) EXPEN; (2) EMPLY
Output Items: (1) REVEN; (2) WATER; (3) SEWAG; (4) ROAD; (5) SOWEL; (6) PARK; (7) CULFA: (SBM-I-V Model)

No.	DMUs (Korean Cities)	Technical Efficiency Score	Rank	Reference Set	Lambda
1	Suwon	1	1	Suwon	1
2	Seongnam	1	1	Seongnam	1
3	Uijeongbu	1	1	Uijeongbu	1
4	Anyang	1	1	Anyang	1
5	Bucheon	1	1	Bucheon	1
6	Gwangmyeong	1	1	Gwangmyeong	1
7	Pyeongtaek-	0.60682714	47	Anyang	0.15548774
8	Dongducheon	1	1	Dongducheon	1
9	Ansan	1	1	Ansan	1
10	Gwacheon	1	1	Gwacheon	1
11	Guri	1	1	Guri	1
12	Namyangju	0.87156989	30	Bucheon	0.87401361
13	Osan	0.89056762	28	Bucheon	0.28109151
14	Siheung	1	1	Siheung	1
15	Gunpo	0.91732926	27	Seongnam	0.52248251
16	Uiwang	0.62030595	43	Ansan	0.7019136
17	Hanam	0.63406095	40	Gwacheon	5.60E-02
18	Goyang	1	1	Goyang	1
19	Yongin	1	1	Yongin	1
20	Paju	0.62028596	44	Gwacheon	3.99E-02
21	Icheon	0.60148631	49	Gwacheon	3.95E-02
22	Yangju	0.66981102	39	Cheonan	0.4610293
23	Pocheon	0.7102484	34	Gwacheon	3.13E-02
24	Hwaseong	0.58483153	51	Goyang	0.74971572
25	Gwangju	1	1	Gwangju	1
26	Anseong	0.62524464	42	Gwacheon	3.74E-02
27	Gimpo	0.5424043	53	Gwacheon	6.56E-03
28	Chuncheon	0.60306449	48	Gwacheon	1.83E-02
29	Wonju	0.60061606	50	Gwacheon	0.06059633
30	Gangreung	0.44047592	63	Jeonju	0.40031905
31	Donghae	0.449067	61	Gwacheon	4.77E-02
32	Taebaek-	0.3489103	71	Bucheon	0.1266666
33	Sokcho	0.34546125	72	Bucheon	0.67579241
34	Samcheok	0.18434892	77	Bucheon	0.79634128
35	Cheongju	1	1	Cheongju	1
36	Chungju	0.50539024	58	Gwacheon	0.16162342
37	Jecheon	0.40773155	67	Jeonju	0.71862262
38	Cheonan	1	1	Cheonan	1
39	Gongju	0.45502235	60	Cheonan	2.83E-02
40	Boryeong	0.33120326	73	Cheonan	0.20314335
41	Asan	0.51457969	57	Gwacheon	5.16E-03
42	Seosan	0.46662299	59	Gwacheon	3.79E-02
43	Nonsan	1	1	Nonsan	1
44	Gyeryong	0.61293363	46	Ansan	0.21644988
45	Jeonju	1	1	Jeonju	1
46	Gunsan	0.79897441	32	Gwacheon	6.17E-02
47	Iksan	0.6929818	37	Gwacheon	5.34E-02
48	Jeongeup	0.44577035	62	Gwacheon	0.11924845
49	Namwon	1	1	Namwon	1
50	Gimje	0.42670368	65	Goyang	0.45944687

Table B.1 - *Continued*

51	Mokpo	1	1	Mokpo	1
52	Yeosu	0.42522184	66	Gwacheon	6.21E-02
53	Suncheon	0.54221399	54	Goyang	0.26724496
54	Naju	0.43872111	64	Gwacheon	0.01908352
55	Gwangyang	0.6141811	45	Gwacheon	0.22232816
56	Pohang	0.68928954	38	Ansan	0.72883923
57	Gyeongju	0.52908564	56	Gwacheon	6.33E-03
58	Gimcheon	0.82673581	31	Dongducheon	0.37022867
59	Andong	1	1	Andong	1
60	Gumi	1	1	Gumi	1
61	Yeongju	0.53526394	55	Gwacheon	0.1018723
62	Yeongcheon	0.38052733	69	Gwacheon	3.99E-02
63	Sangju	0.31880701	74	Gwacheon	7.25E-02
64	Mungyeong	0.27591879	75	Gwacheon	3.13E-02
65	Gyeongsan	0.54868051	52	Gwacheon	1.86E-02
66	Changwon	1	1	Changwon	1
67	Masan	0.72821509	33	Bucheon	0.15025835
68	Jinju	0.69883444	36	Gwacheon	9.78E-02
69	Jinhae	0.69913682	35	Gwacheon	3.10E-02
70	Tongyeong	0.3789474	70	Anyang	0.69555824
71	Sacheon	0.3987553	68	Gwacheon	9.58E-02
72	Gimhae	1	1	Gimhae	1
73	Miryang	0.19723123	76	Goyang	0.22043997
74	Geoje	0.63221507	41	Gwacheon	0.3352253
75	Yangsan	0.88939063	29	Gwacheon	7.83E-02
76	Jeju	1	1	Jeju	1
77	Seogwipo	1	1	Seogwipo	1
Statistics Summary: Average Technical Efficiency Score = 0.70483381; No. of DMUs = 77; SD = 0.25347525; Maximum = 1; Minimum = 0.18434892; No. of efficient DMUs = 26; No. of inefficient DMUs = 51. Source: Calculations Based Upon Appendix A.1					

Table B.2 DEA Cost Efficiency in Korean City Govn'ts, 2005

Input Items: (1) EXPEN; (2) EMPLY Output Items: (1) REVEN; (2) WATER; (3) SEWAG; (4) ROAD; (5) SOWEL; (6) PARK; (7) CULFA: (New Cost-I Model)					
No.	DMUs (Korean Cities)	Cost Efficiency Score	Rank	Reference Set	Lambda
1	Suwon	0.72057496	25	Anyang	0.88878609
2	Seongnam	0.91024798	15	Anyang	0.66031404
3	Uijeongbu	0.66664904	30	Anyang	0.29185611
4	Anyang	1	1	Anyang	1
5	Bucheon	1	1	Bucheon	1
6	Gwangmyeong	0.9143365	14	Anyang	0.09322562
7	Pyeongtaek-	0.56541885	41	Anyang	0.27273995
8	Dongducheon	0.51282664	50	Gwacheon	1.49E-02
9	Ansan	1	1	Ansan	1
10	Gwacheon	1	1	Gwacheon	1
11	Guri	0.55878337	42	Anyang	0.17389498
12	Namyangju	0.92758673	13	Anyang	0.26615018
13	Osan	0.84324389	17	Anyang	0.32132829
14	Siheung	0.86495927	16	Anyang	0.9794356
15	Gunpo	0.72019352	26	Anyang	0.997998
16	Uiwang	0.45206808	55	Anyang	0.23927732
17	Hanam	0.66554747	31	Anyang	0.77640864
18	Goyang	1	1	Goyang	1
19	Yongin	0.61074483	36	Anyang	0.61089449
20	Paju	0.49318488	52	Anyang	0.3320189
21	Icheon	0.52764502	48	Gwacheon	3.28E-02
22	Yangju	0.58838281	39	Gwacheon	3.42E-02
23	Pocheon	0.64551375	35	Gwacheon	3.33E-02

Table B.2 - *Continued*

24	Hwaseong	0.43067186	60	Bucheon	0.35594326
25	Gwangju	1	1	Gwangju	1
26	Anseong	0.60107672	38	Gwacheon	3.83E-02
27	Gimpo	0.31408951	71	Anyang	0.58117678
28	Chuncheon	0.66462903	32	Anyang	8.72E-02
29	Wonju	0.53408558	46	Gwacheon	6.90E-02
30	Gangreung	0.2475634	75	Anyang	1.52E-02
31	Donghae	0.32750329	67	Anyang	0.54529756
32	Taebaek-	0.2544925	73	Gwacheon	0.40545747
33	Sokcho	0.25083075	74	Anyang	0.36606233
34	Samcheok	0.11306087	77	Anyang	0.44448334
35	Cheongju	1	1	Cheongju	1
36	Chungju	0.5285649	47	Gwacheon	0.15877218
37	Jecheon	0.44047775	58	Anyang	0.17962139
38	Cheonan	0.96145784	12	Anyang	7.55E-02
39	Gongju	0.44372338	57	Gwangju	7.70E-02
40	Boryeong	0.32068246	69	Gwacheon	5.81E-03
41	Asan	0.36888284	63	Gwacheon	5.54E-02
42	Seosan	0.47373786	54	Gwacheon	4.33E-02
43	Nonsan	0.66316476	33	Jeonju	0.5383214
44	Gyeryong	0.77133695	19	Gwacheon	0.23998925
45	Jeonju	1	1	Jeonju	1
46	Gunsan	0.73668618	23	Gwacheon	6.21E-02
47	Iksan	0.7631359	20	Gwacheon	6.09E-02
48	Jeongeup	0.44647747	56	Gwacheon	0.14081058
49	Namwon	0.47750463	53	Jeonju	0.27319487
50	Gimje	0.35925513	65	Anyang	0.11044689
51	Mokpo	1	1	Mokpo	1
52	Yeosu	0.31624607	70	Gwacheon	6.81E-02
53	Suncheon	0.54718462	43	Anyang	0.15642226
54	Naju	0.4231324	61	Gwacheon	2.77E-02
55	Gwangyang	0.60387657	37	Anyang	0.44589176
56	Pohang	0.70054426	28	Anyang	0.37414821
57	Gyeongju	0.52731568	49	Gwacheon	0.0239127
58	Gimcheon	0.56812892	40	Gwacheon	1.46E-02
59	Andong	0.54149977	44	Jeonju	0.1664741
60	Gumi	1	1	Gumi	1
61	Yeongju	0.53546427	45	Gwacheon	6.36E-02
62	Yeongcheon	0.36668456	64	Gwacheon	2.78E-02
63	Sangju	0.3241449	68	Gwacheon	8.62E-02
64	Mungyeong	0.27426426	72	Anyang	0.41478348
65	Gyeongsan	0.49646152	51	Anyang	3.31E-02
66	Changwon	0.68484576	29	Anyang	2.49E-03
67	Masan	0.79940049	18	Anyang	0.22429473
68	Jinju	0.72538773	24	Anyang	0.11388588
69	Jinhae	0.66237882	34	Gwacheon	2.13E-02
70	Tongyeong	0.33001967	66	Anyang	0.39741781
71	Sacheon	0.37197752	62	Gwacheon	0.10459114
72	Gimhae	0.73764847	22	Gwacheon	0.10191282
73	Miryang	0.17514241	76	Gwangju	0.1801703
74	Geoje	0.43627868	59	Gwacheon	0.34633554
75	Yangsan	0.75976387	21	Gwacheon	9.01E-02
76	Jeju	1	1	Jeju	1
77	Seogwipo	0.7069908	27	Gwacheon	0.11069568

Statistics Summary: Average Cost Efficiency Score = 0.61423092; No. of DMUs = 77; SD = 0.23931291; Maximum = 1; Minimum =0.11306; No. of efficient DMUs = 11; No. of inefficient DMUs = 66.
Source: Calculations Based Upon Appendix A.1

Table B.3 DEA Scale Efficiency in Korean City Govn'ts, 2005

Input Items: (1) EXPEN; (2) EMPLY
Output Items: (1) REVEN; (2) WATER; (3) SEWAG; (4) ROAD; (5) SOWEL; (6) PARK; (7) CULFA: (Generalized RTS Model)

No.	DMUs (Korean Cities)	Scale Efficiency Score	Rank	Reference Set	Lambda
1	Suwon	1	1	Suwon	1
2	Seongnam	1	1	Seongnam	1
3	Uijeongbu	1	1	Uijeongbu	1
4	Anyang	1	1	Anyang	1
5	Bucheon	1	1	Bucheon	1
6	Gwangmyeong	0.91785291	23	Anyang	5.89E-02
7	Pyeongtaek-	0.56551031	49	Anyang	0.2673526
8	Dongducheon	0.8972745	24	Gwacheon	6.27E-03
9	Ansan	1	1	Ansan	1
10	Gwacheon	1	1	Gwacheon	1
11	Guri	0.74183443	33	Uijeongbu	0.63509827
12	Namyangju	0.92758673	22	Anyang	0.26615018
13	Osan	0.84324389	27	Anyang	0.32132829
14	Siheung	1	1	Siheung	1
15	Gunpo	0.94615472	21	Suwon	0.53432128
16	Uiwang	0.72659954	34	Suwon	3.55E-02
17	Hanam	0.66784276	40	Anyang	0.51377804
18	Goyang	1	1	Goyang	1
19	Yongin	1	1	Yongin	1
20	Paju	0.54757131	51	Gwacheon	4.92E-02
21	Icheon	0.55076243	50	Gwacheon	2.37E-02
22	Yangju	0.68381081	39	Gwangju	0.11773651
23	Pocheon	0.75328268	31	Cheonan	0.31283837
24	Hwaseong	0.49806135	58	Goyang	0.37366586
25	Gwangju	1	1	Gwangju	1
26	Anseong	0.63783176	43	Gwacheon	2.66E-02
27	Gimpo	0.48658809	59	Siheung	0.31038551
28	Chuncheon	0.66462903	41	Anyang	8.72E-02
29	Wonju	0.62812685	45	Gwacheon	6.90E-02
30	Gangreung	0.62369248	46	Jeonju	0.89579921
31	Donghae	0.5430697	53	Gwacheon	5.45E-02
32	Taebaek-	0.43849387	66	Gwacheon	0.40913361
33	Sokcho	0.38127052	71	Bucheon	0.32403271
34	Samcheok	0.23060205	76	Bucheon	0.46588512
35	Cheongju	1	1	Cheongju	1
36	Chungju	0.5285649	56	Gwacheon	0.15877218
37	Jecheon	0.44047775	65	Anyang	0.17962139
38	Cheonan	1	1	Cheonan	1
39	Gongju	0.4443413	64	Gwangju	0.13573162
40	Boryeong	0.32068246	74	Gwacheon	5.81E-03
41	Asan	0.61502705	47	Gwacheon	8.53E-03
42	Seosan	0.47373786	61	Gwacheon	4.33E-02
43	Nonsan	0.68913688	38	Gwangju	0.71782843
44	Gyeryong	0.77133695	29	Gwacheon	0.23998925
45	Jeonju	1	1	Jeonju	1
46	Gunsan	0.85926918	26	Gwacheon	6.21E-02
47	Iksan	0.7631359	30	Gwacheon	6.09E-02
48	Jeongeup	0.44647747	63	Gwacheon	0.14081058
49	Namwon	0.47860644	60	Gwangju	0.13607596
50	Gimje	0.3889302	69	Anyang	0.13611463
51	Mokpo	1	1	Mokpo	1
52	Yeosu	0.44887784	62	Jeonju	0.41980048
53	Suncheon	0.54718462	52	Anyang	0.15642226
54	Naju	0.4231324	67	Gwacheon	2.77E-02
55	Gwangyang	0.60389249	48	Anyang	0.43963069
56	Pohang	0.70054426	37	Anyang	0.37414821

Table B.3 - *Continued*

57	Gyeongju	0.52731568	57	Gwacheon	0.0239127
58	Gimcheon	0.63531147	44	Gwacheon	6.35E-03
59	Andong	0.65777114	42	Jeonju	0.25809982
60	Gumi	1	1	Gumi	1
61	Yeongju	0.53546427	54	Gwacheon	6.36E-02
62	Yeongcheon	0.38241685	70	Gwacheon	2.78E-02
63	Sangju	0.3241449	73	Gwacheon	8.62E-02
64	Mungyeong	0.27441775	75	Anyang	0.41848238
65	Gyeongsan	0.53280945	55	Ansan	0.24325688
66	Changwon	1	1	Changwon	1
67	Masan	0.79940049	28	Anyang	0.22429473
68	Jinju	0.72538773	35	Anyang	0.11388588
69	Jinhae	0.70681745	36	Gwacheon	3.17E-02
70	Tongyeong	0.34510219	72	Bucheon	0.2389446
71	Sacheon	0.3996642	68	Gwacheon	0.10459114
72	Gimhae	1	1	Gimhae	1
73	Miryang	0.18527009	77	Cheonan	0.13813763
74	Geoje	0.75314068	32	Gwacheon	0.34419032
75	Yangsan	0.9495895	20	Gwacheon	9.01E-02
76	Jeju	1	1	Jeju	1
77	Seogwipo	0.86922419	25	Gwacheon	5.27E-02

Statistics Summary: Average Scale Efficiency Score = 0.69413372; No. of DMUs = 77; SD = 0.23890964; Maximum = 1; Minimum = 0.18527009; No. of efficient DMUs = 19; No. of inefficient DMUs = 58.
Source: Calculations Based Upon Appendix A.1

Table B.4 DEA Summary in Scores and Rank of Technical, Cost, and Scale Efficiency in Korean City Government, 2001

Input Items: (1) EXPEN; (2) EMPLY
Output Items: (1) REVEN; (2) WATER; (3) SEWAG; (4) ROAD; (5) SOWEL; (6) PARK; (7) CULFA

No.	DMUs (2001) (Korean City Govn't)	Technical Efficiency Score	Cost Efficiency Score	Scale Efficiency Score
1	Suwon	1	0.94940727	1
2	Seongnam	1	0.89995145	0.94872239
3	Uijeongbu	1	0.92390593	1
4	Anyang	1	1	1
5	Bucheon	1	0.88380788	0.8629027
6	Gwangmyeong	1	1	1
7	Pyeongtaek-	0.78037036	0.79894431	0.70712627
8	Dongducheon	1	0.64686045	0.97639565
9	Ansan	1	0.97723831	1
10	Gwacheon	1	1	1
11	Guri	0.69806752	0.65311811	0.72033313
12	Namyangju	0.74279787	0.6136594	0.72491952
13	Osan	0.7221005	0.61036998	0.81538914
14	Siheung	1	0.80758677	1
15	Gunpo	1	1	0.9753892
16	Uiwang	0.75798623	0.84089999	0.61775782
17	Hanam	1	0.86177257	0.94408308
18	Goyang	1	1	1
19	Yongin	1	0.83306984	0.94435721
20	Paju	0.58971842	0.43212481	0.62582871
21	Icheon	0.78928166	0.63142331	0.79056704
22	Anseong	0.6024226	0.54179248	0.58878468
23	Gimpo	0.72290084	0.54914935	0.69550146
24	Chuncheon	0.71093365	0.76981828	0.6128354
25	Wonju	0.71404125	0.71196755	0.64810894

Table B.4 - *Continued*

26	Gangreung	0.60864205	0.61152189	0.56305176
27	Donghae	0.54870499	0.44452674	0.54165447
28	Taebaek-	0.33720198	0.29388284	0.32156684
29	Sokcho	0.50798045	0.48295618	0.48187907
30	Samcheok	0.3549092	0.28688079	0.30667038
31	Cheongju	1	1	1
32	Chungju	0.48632023	0.43173416	0.39783633
33	Jecheon	0.6106363	0.57700134	0.52566158
34	Cheonan	0.74209981	0.59276521	0.60319268
35	Gongju	0.66053194	0.58034969	0.54658523
36	Boryeong	0.61636989	0.58910246	0.56471942
37	Asan	0.54417765	0.51989373	0.3975656
38	Seosan	0.43644979	0.36649745	0.32265005
39	Nonsan	0.64234284	0.7718485	0.45709797
40	Jeonju	1	1	1
41	Gunsan	1	0.80313365	0.58336994
42	Iksan	0.60332849	0.68534728	0.42901407
43	Jeongeup	0.46969327	0.45030272	0.38434664
44	Namwon	0.30033158	0.29277627	0.24556712
45	Gimje	0.25881036	0.32717836	0.13345566
46	Mokpo	1	0.99812407	0.85308245
47	Yeosu	0.38764718	0.4913944	0.20781855
48	Suncheon	0.76229079	0.7517008	0.75767948
49	Naju	0.40188093	0.37492558	0.33324323
50	Gwangyang	0.43986624	0.44570791	0.34844107
51	Pohang	0.62097452	0.58059958	0.5328233
52	Gyeongju	0.64503685	0.62339276	0.57383151
53	Gimcheon	0.49112865	0.45972849	0.4249019
54	Andong	1	1	1
55	Gumi	0.64466475	0.60193814	0.56939253
56	Yeongju	0.47667824	0.49657693	0.44948057
57	Yeongcheon	0.44900489	0.48535243	0.32098818
58	Sangju	0.30463714	0.27975534	0.23783578
59	Mungyeong	0.25120243	0.21074813	0.1935367
60	Gyeongsan	0.6014062	0.57306626	0.4945097
61	Changwon	0.9032729	0.8121264	0.9540348
62	Masan	0.8261038	0.94537114	0.64247838
63	Jinju	0.63100584	0.61022709	0.59476017
64	Jinhae	0.52765403	0.52801009	0.48093087
65	Tongyeong	0.45002099	0.42933159	0.36227193
66	Sacheon	0.42709102	0.40890858	0.34456738
67	Gimhae	0.72520975	0.50136222	0.80550416
68	Miryang	0.41654136	0.31401615	0.34486411
69	Geoje	0.69479615	0.6702358	0.6948102
70	Yangsan	0.88397999	0.76524852	0.7999777
71	Jeju	1	1	1
72	Seogwipo	1	0.50958156	0.79491075

(1) Technical Efficiency Statistics Summary: Average Efficiency Scores = 0.70168398; No. of DMUs = 72; SD = 0.23472321; Maximum = 1; Minimum =0.25120243; No. of efficient DMUs =20; No. of inefficient DMUs = 52.
(2) Cost Efficiency Statistics Summary: Average Cost Efficiency Score = 0.65155552; No. of DMUs = 72; SD = 0.22538225; Maximum = 1; Minimum = 0.21074813; No. of efficient DMUs =9; No. of inefficient DMUs = 63.
(3) Scale Efficiency Statistics Summary: Average Scale Score = 0.64057726; No. of DMUs = 72; SD = 0.25599779; Maximum = 1; Minimum = 0.13345566; No. of efficient DMUs =12; No. of inefficient DMUs = 60.
Source: Calculations Based Upon Appendix A.2

Table B.5 DEA Technical Inefficiency Decomposition Analysis, 2001

Input Items: (1) EXPEN; (2) EMPLY
Output Items: (1) REVEN; (2) WATER; (3) SEWAG; (4) ROAD; (5) SOWEL; (6) PARK; (7) CULFA: (SBM-I-V Model)

No.	DMUs (2005) (Korean City Govn't)	Technical Efficiency Score	Input Excess EXPEN Inefficiency	Input Excess EMPLY Inefficiency
1	Suwon	1	0	0
2	Seongnam	1	0	0
3	Uijeongbu	1	0	0
4	Anyang	1	0	0
5	Bucheon	1	0	0
6	Gwangmyeong	1	0	0
7	Pyeongtaek-	0.78037036	0.10903065	1.03149143
8	Dongducheon	1	0	0
9	Ansan	1	0	0
10	Gwacheon	1	0	0
11	Guri	0.69806752	0.22704557	0.81981229
12	Namyangju	0.74279787	0.20312245	0.52015856
13	Osan	0.7221005	0.34957107	0.6378159
14	Siheung	1	0	0
15	Gunpo	1	0	0
16	Uiwang	0.75798623	7.29E-02	1.25412528
17	Hanam	1	0	0
18	Goyang	1	0	0
19	Yongin	1	0	0
20	Paju	0.58971842	0.61436011	1.22952084
21	Icheon	0.78928166	0.24156514	0.62156624
22	Anseong	0.6024226	0.44987352	2.00661725
23	Gimpo	0.72290084	0.32353169	0.68878021
24	Chuncheon	0.71093365	0.18751706	1.90336898
25	Wonju	0.71404125	0.18850841	1.38598483
26	Gangreung	0.60864205	0.33632689	2.0716427
27	Donghae	0.54870499	0.52884596	2.26692876
28	Taebaek-	0.33720198	1.28497322	6.30967204
29	Sokcho	0.50798045	0.48203673	2.91625177
30	Samcheok	0.3549092	1.14365769	6.56714173
31	Cheongju	1	0	0
32	Chungju	0.48632023	0.48865293	2.87411665
33	Jecheon	0.6106363	0.37025745	2.73945767
34	Cheonan	0.74209981	0.13074842	0.9607486
35	Gongju	0.66053194	0.31709883	2.73183619
36	Boryeong	0.61636989	0.47708845	3.2013859
37	Asan	0.54417765	0.32447186	3.37129926
38	Seosan	0.43644979	0.4982419	3.49741694
39	Nonsan	0.64234284	0.17367972	4.32219045
40	Jeonju	1	0	0
41	Gunsan	1	0	0
42	Iksan	0.60332849	0.22594197	3.89911703
43	Jeongeup	0.46969327	0.54252381	3.78701976
44	Namwon	0.30033158	1.00953262	6.49878814
45	Gimje	0.25881036	0.87682423	15.0053149
46	Mokpo	1	0	0
47	Yeosu	0.38764718	0.42682804	9.21822041
48	Suncheon	0.76229079	0.22130536	1.05577897
49	Naju	0.40188093	0.85462632	5.68449882
50	Gwangyang	0.43986624	0.4749294	3.54537996
51	Pohang	0.62097452	0.25718808	1.4652779
52	Gyeongju	0.64503685	0.30064098	1.74873168
53	Gimcheon	0.49112865	0.56786416	3.59541664
54	Andong	1	0	0
55	Gumi	0.64466475	0.24498253	1.47818193
56	Yeongju	0.47667824	0.62717836	3.8929851
57	Yeongcheon	0.44900489	0.47178669	4.68566402

Table B.5 - *Continued*

58	Sangju	0.30463714	0.93945159	6.229413
59	Mungyeong	0.25120243	1.28537091	7.15618029
60	Gyeongsan	0.6014062	0.25256578	1.79574579
61	Changwon	0.9032729	9.12E-02	6.23E-02
62	Masan	0.8261038	1.66E-02	1.20027564
63	Jinju	0.63100584	0.27804142	1.513758
64	Jinhae	0.52765403	0.39134265	2.29814738
65	Tongyeong	0.45002099	0.52408284	3.58751499
66	Sacheon	0.42709102	0.58222843	4.14022522
67	Gimhae	0.72520975	0.41147542	0.26387872
68	Miryang	0.41654136	0.68979165	3.71028099
69	Geoje	0.69479615	0.29199826	1.35999315
70	Yangsan	0.88397999	0.10671338	0.24453337
71	Jeju	1	0	0
72	Seogwipo	1	0	0
Returns to Scale = Variable (Sum of Lambda = 1) Source: Calculations Based Upon Appendix A.2				

Table B.6 DEA Technical Efficiency in Korean City Govn'ts, 2001

Input Items: (1) EXPEN; (2) EMPLY
Output Items: (1) REVEN; (2) WATER; (3) SEWAG; (4) ROAD; (5) SOWEL; (6) PARK; (7) CULFA: (SBM-I-V Model)

No.	DMUs (Korean Cities)	Technical Efficiency Score	Rank	Reference Set	Lambda
1	Suwon	1	1	Suwon	1
2	Seongnam	1	1	Seongnam	1
3	Uijeongbu	1	1	Uijeongbu	1
4	Anyang	1	1	Anyang	1
5	Bucheon	1	1	Bucheon	1
6	Gwangmyeong	1	1	Gwangmyeong	1
7	Pyeongtaek-	0.78037036	26	Gwacheon	1.46E-02
8	Dongducheon	1	1	Dongducheon	1
9	Ansan	1	1	Ansan	1
10	Gwacheon	1	1	Gwacheon	1
11	Guri	0.69806752	36	Gwangmyeong	0.97888014
12	Namyangju	0.74279787	29	Goyang	1
13	Osan	0.7221005	33	Uijeongbu	0.12464254
14	Siheung	1	1	Siheung	1
15	Gunpo	1	1	Gunpo	1
16	Uiwang	0.75798623	28	Uijeongbu	0.24809205
17	Hanam	1	1	Hanam	1
18	Goyang	1	1	Goyang	1
19	Yongin	1	1	Yongin	0.99989369
20	Paju	0.58971842	50	Gwacheon	6.22E-02
21	Icheon	0.78928166	25	Anyang	0.70178145
22	Anseong	0.6024226	48	Anyang	0.6572133
23	Gimpo	0.72290084	32	Gwacheon	7.95E-02
24	Chuncheon	0.71093365	35	Gwacheon	5.57E-02
25	Wonju	0.71404125	34	Gwacheon	7.05E-03
26	Gangreung	0.60864205	46	Cheongju	0.42477948
27	Donghae	0.54870499	51	Anyang	0.88658107
28	Taebaek-	0.33720198	68	Suwon	5.13E-02
29	Sokcho	0.50798045	54	Anyang	0.94005951
30	Samcheok	0.3549092	67	Anyang	0.79930744
31	Cheongju	1	1	Cheongju	1
32	Chungju	0.48632023	56	Uijeongbu	0.29910279
33	Jecheon	0.6106363	45	Anyang	0.31711038

Table B.6 - *Continued*

34	Cheonan	0.74209981	30	Uijeongbu	0.78502653
35	Gongju	0.66053194	38	Anyang	0.35086653
36	Boryeong	0.61636989	44	Hanam	0.60962018
37	Asan	0.54417765	52	Jeonju	0.98245916
38	Seosan	0.43644979	62	Uijeongbu	0.45394182
39	Nonsan	0.64234284	41	Jeonju	0.71800436
40	Jeonju	1	1	Jeonju	1
41	Gunsan	1	1	Gunsan	1
42	Iksan	0.60332849	47	Gwacheon	1.18E-02
43	Jeongeup	0.46969327	58	Gwacheon	4.07E-03
44	Namwon	0.30033158	70	Uijeongbu	0.26328672
45	Gimje	0.25881036	71	Goyang	0.16622088
46	Mokpo	1	1	Mokpo	1
47	Yeosu	0.38764718	66	Goyang	0.13513296
48	Suncheon	0.76229079	27	Cheongju	0.60494691
49	Naju	0.40188093	65	Jeonju	0.84618905
50	Gwangyang	0.43986624	61	Gwangmyeong	0.1774225
51	Pohang	0.62097452	43	Suwon	0.53611551
52	Gyeongju	0.64503685	39	Gwacheon	1.20E-02
53	Gimcheon	0.49112865	55	Jeonju	0.90698776
54	Andong	1	1	Andong	1
55	Gumi	0.64466475	40	Suwon	0.62906865
56	Yeongju	0.47667824	57	Cheongju	0.61672169
57	Yeongcheon	0.44900489	60	Gwacheon	9.01E-02
58	Sangju	0.30463714	69	Uijeongbu	0.35498901
59	Mungyeong	0.25120243	72	Uijeongbu	0.66450314
60	Gyeongsan	0.6014062	49	Uijeongbu	0.19737642
61	Changwon	0.9032729	22	Uijeongbu	1.75E-02
62	Masan	0.8261038	24	Anyang	0.12124347
63	Jinju	0.63100584	42	Anyang	0.13087429
64	Jinhae	0.52765403	53	Uijeongbu	0.41258837
65	Tongyeong	0.45002099	59	Goyang	0.29011578
66	Sacheon	0.42709102	63	Goyang	0.26482082
67	Gimhae	0.72520975	31	Gwacheon	1.25E-02
68	Miryang	0.41654136	64	Goyang	0.3175642
69	Geoje	0.69479615	37	Anyang	6.94E-02
70	Yangsan	0.88397999	23	Gwacheon	5.03E-02
71	Jeju	1	1	Jeju	1
72	Seogwipo	1	1	Seogwipo	1
Statistics Summary: Average Efficiency Scores = 0.70168398; No. of DMUs = 72; SD = 0.23472321; Maximum = 1; Minimum =0.25120243; No. of efficient DMUs =20; No. of inefficient DMUs = 52. Source: Calculations Based Upon Appendix A.2					

Table B.7 DEA Cost Efficiency in Korean City Govn'ts, 2001

Input Items: (1) EXPEN; (2) EMPLY Output Items: (1) REVEN; (2) WATER; (3) SEWAG; (4) ROAD; (5) SOWEL; (6) PARK; (7) CULFA: (New Cost-I Model)					
No.	DMUs (Korean Cities)	Cost Efficiency Score	Rank	Reference Set	Lambda
1	Suwon	0.94940727	12	Anyang	0.53864635
2	Seongnam	0.89995145	15	Gwangmyeong	0.96757834
3	Uijeongbu	0.92390593	14	Anyang	0.2349897
4	Anyang	1	1	Anyang	1
5	Bucheon	0.88380788	16	Gwangmyeong	0.59728284
6	Gwangmyeong	1	1	Gwangmyeong	1
7	Pyeongtaek-	0.79894431	23	Anyang	3.89E-02
8	Dongducheon	0.64686045	32	Cheongju	1.54578844
9	Ansan	0.97723831	11	Gwangmyeong	0.69749451
10	Gwacheon	1	1	Gwacheon	1
11	Guri	0.65311811	31	Gwangmyeong	0.9344365
12	Namyangju	0.6136594	35	Gwangmyeong	2.58E-02

Table B.7 - *Continued*

13	Osan	0.61036998	37	Gwangmyeong	9.72E-02
14	Siheung	0.80758677	21	Gwangmyeong	0.63335639
15	Gunpo	1	1	Gunpo	1
16	Uiwang	0.84089999	18	Gwangmyeong	0.81639962
17	Hanam	0.86177257	17	Gwacheon	1.86E-02
18	Goyang	1	1	Goyang	1
19	Yongin	0.83306984	19	Gwacheon	0.14329089
20	Paju	0.43212481	60	Gwacheon	8.79E-02
21	Icheon	0.63142331	33	Anyang	0.45933467
22	Anseong	0.54179248	47	Anyang	0.50475881
23	Gimpo	0.54914935	46	Gwacheon	0.11758811
24	Chuncheon	0.76981828	25	Gwacheon	4.05E-02
25	Wonju	0.71196755	28	Gwacheon	1.58E-02
26	Gangreung	0.61152189	36	Gwacheon	4.35E-03
27	Donghae	0.44452674	59	Anyang	1.08118229
28	Taebaek-	0.29388284	68	Gwacheon	4.67E-04
29	Sokcho	0.48295618	55	Anyang	0.92371481
30	Samcheok	0.28688079	70	Anyang	1.14365045
31	Cheongju	1	1	Cheongju	1
32	Chungju	0.43173416	61	Anyang	0.26320268
33	Jecheon	0.57700134	44	Cheongju	1.13987324
34	Cheonan	0.59276521	40	Gwangmyeong	0.27155255
35	Gongju	0.58034969	43	Gwacheon	6.09E-03
36	Boryeong	0.58910246	41	Jeonju	0.68065265
37	Asan	0.51989373	49	Gwacheon	8.97E-03
38	Seosan	0.36649745	65	Anyang	0.06830583
39	Nonsan	0.7718485	24	Jeonju	0.58335775
40	Jeonju	1	1	Jeonju	1
41	Gunsan	0.80313365	22	Jeonju	1.00127914
42	Iksan	0.68534728	29	Gwacheon	8.02E-03
43	Jeongeup	0.45030272	57	Cheongju	5.28E-02
44	Namwon	0.29277627	69	Anyang	0.35431813
45	Gimje	0.32717836	66	Cheongju	0.25258392
46	Mokpo	0.99812407	10	Gwacheon	8.21E-03
47	Yeosu	0.4913944	53	Gwacheon	2.53E-03
48	Suncheon	0.7517008	27	Cheongju	0.67018767
49	Naju	0.37492558	64	Gwacheon	1.81E-03
50	Gwangyang	0.44570791	58	Gwangmyeong	0.7696334
51	Pohang	0.58059958	42	Anyang	0.32526633
52	Gyeongju	0.62339276	34	Gwacheon	2.31E-02
53	Gimcheon	0.45972849	56	Gwacheon	8.43E-03
54	Andong	1	1	Andong	1
55	Gumi	0.60193814	39	Anyang	0.31849893
56	Yeongju	0.49657693	52	Cheongju	0.81508408
57	Yeongcheon	0.48535243	54	Gwacheon	0.10198742
58	Sangju	0.27975534	71	Anyang	0.21353242
59	Mungyeong	0.21074813	72	Anyang	5.50E-02
60	Gyeongsan	0.57306626	45	Anyang	0.13357506
61	Changwon	0.8121264	20	Gwangmyeong	6.53E-02
62	Masan	0.94537114	13	Anyang	0.25173396
63	Jinju	0.61022709	38	Anyang	0.43155047
64	Jinhae	0.52801009	48	Anyang	0.15848122
65	Tongyeong	0.42933159	62	Gwacheon	6.19E-03
66	Sacheon	0.40890858	63	Gwacheon	1.93E-03
67	Gimhae	0.50136222	51	Gwacheon	3.12E-02
68	Miryang	0.31401615	67	Gwacheon	5.56E-03
69	Geoje	0.6702358	30	Cheongju	0.93376118
70	Yangsan	0.76524852	26	Gwacheon	6.75E-02
71	Jeju	1	1	Jeju	1
72	Seogwipo	0.50958156	50	Gwacheon	2.04E-02

Statistics Summary: Average Cost Efficiency Score = 0.65155552; No. of DMUs = 72; SD = 0.22538225; Maximum = 1; Minimum = 0.21074813; No. of efficient DMUs =9; No. of inefficient DMUs = 63.
Source: Calculations Based Upon Appendix A.2

Table B.8 DEA Scale Efficiency in Korean City Govn'ts, 2001

Input Items: (1) EXPEN; (2) EMPLY
Output Items: (1) REVEN; (2) WATER; (3) SEWAG; (4) ROAD; (5) SOWEL; (6) PARK; (7) CULFA: (Generalized RTS Model)

No.	DMUs (Korean Cities)	Scale Efficiency Score	Rank	Reference Set	Lambda
1	Suwon	1	1	Suwon	1
2	Seongnam	0.94872239	16	Uijeongbu	0.47620415
3	Uijeongbu	1	1	Uijeongbu	1
4	Anyang	1	1	Anyang	1
5	Bucheon	0.8629027	19	Uijeongbu	0.57349446
6	Gwangmyeong	1	1	Gwangmyeong	1
7	Pyeongtaek-	0.70712627	29	Uijeongbu	0.12803554
8	Dongducheon	0.97639565	13	Dongducheon	0.59784076
9	Ansan	1	1	Ansan	1
10	Gwacheon	1	1	Gwacheon	1
11	Guri	0.72033313	28	Uijeongbu	0.46648787
12	Namyangju	0.72491952	27	Gwangmyeong	1.96E-02
13	Osan	0.81538914	21	Uijeongbu	0.32470633
14	Siheung	1	1	Siheung	1
15	Gunpo	0.9753892	14	Uijeongbu	0.90288647
16	Uiwang	0.61775782	35	Uijeongbu	0.54164236
17	Hanam	0.94408308	18	Gwacheon	0.01856362
18	Goyang	1	1	Goyang	1
19	Yongin	0.94435721	17	Uijeongbu	0.57939106
20	Paju	0.62582871	34	Uijeongbu	0.16373627
21	Icheon	0.79056704	25	Anyang	0.45933467
22	Anseong	0.58878468	39	Uijeongbu	0.2432723
23	Gimpo	0.69550146	30	Uijeongbu	0.32596256
24	Chuncheon	0.6128354	36	Uijeongbu	0.38050551
25	Wonju	0.64810894	32	Uijeongbu	4.67E-02
26	Gangreung	0.56305176	44	Uijeongbu	0.62235795
27	Donghae	0.54165447	46	Anyang	1.08118229
28	Taebaek-	0.32156684	65	Uijeongbu	0.91071313
29	Sokcho	0.48187907	50	Anyang	0.92371481
30	Samcheok	0.30667038	67	Anyang	1.14365045
31	Cheongju	1	1	Cheongju	1
32	Chungju	0.39783633	56	Uijeongbu	0.47461118
33	Jecheon	0.52566158	48	Cheongju	1.13987324
34	Cheonan	0.60319268	37	Uijeongbu	0.46569471
35	Gongju	0.54658523	45	Dongducheon	0.06667275
36	Boryeong	0.56471942	43	Jeonju	0.68065265
37	Asan	0.3975656	57	Uijeongbu	0.6176915
38	Seosan	0.32265005	64	Uijeongbu	0.52190371
39	Nonsan	0.45709797	52	Jeonju	0.58335775
40	Jeonju	1	1	Jeonju	1
41	Gunsan	0.58336994	40	Uijeongbu	0.86222955
42	Iksan	0.42901407	54	Gwacheon	8.02E-03
43	Jeongeup	0.38434664	58	Uijeongbu	0.28920397
44	Namwon	0.24556712	68	Uijeongbu	0.57548128
45	Gimje	0.13345566	72	Uijeongbu	0.61958647
46	Mokpo	0.85308245	20	Uijeongbu	0.59151931
47	Yeosu	0.20781855	70	Uijeongbu	0.50171562
48	Suncheon	0.75767948	26	Cheongju	0.39622602
49	Naju	0.33324323	63	Uijeongbu	0.50099448
50	Gwangyang	0.34844107	60	Uijeongbu	0.38564442

Table B.8 - *Continued*

51	Pohang	0.5328233	47	Suwon	0.23827147
52	Gyeongju	0.57383151	41	Uijeongbu	0.23355751
53	Gimcheon	0.4249019	55	Gwacheon	1.87E-03
54	Andong	1	1	Andong	1
55	Gumi	0.56939253	42	Suwon	6.08E-02
56	Yeongju	0.44948057	53	Cheongju	0.50692958
57	Yeongcheon	0.32098818	66	Gwacheon	0.10198742
58	Sangju	0.23783578	69	Uijeongbu	0.61430261
59	Mungyeong	0.1935367	71	Uijeongbu	0.77186739
60	Gyeongsan	0.4945097	49	Uijeongbu	0.88832388
61	Changwon	0.9540348	15	Uijeongbu	8.74E-02
62	Masan	0.64247838	33	Uijeongbu	0.37639476
63	Jinju	0.59476017	38	Uijeongbu	0.29080684
64	Jinhae	0.48093087	51	Uijeongbu	0.96756261
65	Tongyeong	0.36227193	59	Uijeongbu	0.66829924
66	Sacheon	0.34456738	62	Uijeongbu	0.76371553
67	Gimhae	0.80550416	22	Uijeongbu	0.77071363
68	Miryang	0.34486411	61	Uijeongbu	0.68865823
69	Geoje	0.6948102	31	Cheongju	0.56999589
70	Yangsan	0.7999777	23	Uijeongbu	0.49622108
71	Jeju	1	1	Jeju	1
72	Seogwipo	0.79491075	24	Gwacheon	1.49E-02

Statistics Summary: Average Scale Score = 0.64057726; No. of DMUs = 72; SD = 0.25599779; Maximum = 1; Minimum = 0.13345566; No. of efficient DMUs =12; No. of inefficient DMUs = 60.
Source: Calculations Based Upon Appendix A.2

APPENDIX C

SUMMARIES OF ANOVA ANALYSES WITH REGARD TO EFFICIENCY FACTORS AND GOVERNMENT EFFICIENCY 2001

Table C.1 ANOVA Analysis of Population Size and Government Efficiency, 2001

Size of City (Population)	N	Technical Efficiency	Cost Efficiency	Scale Efficiency
Under 100,000	7	0.6358	0.4901	0.5821
100,001-200,000	31	0.5785	0.5386	0.5180
200,001-300,000	11	0.7753	0.7522	0.6781
300,001-400,000	11	0.7740	0.7152	0.7257
400,001-500,000	2	0.7841	0.7690	0.6228
500,001-600,000	5	0.9048	0.8739	0.8973
600,001-700,000	1	1.0000	1.0000	1.0000
700,001-800,000	1	1.0000	0.8838	0.8629
800,001-900,000	1	1.0000	1.0000	1.0000
Over 900,001	2	1.0000	0.9246	0.9743
Total (mean)	72	0.7016	0.6515	0.6405

ANOVA		Sum of Squares	Degree of Freedom	Mean Square	F	Sig.
Technical Efficiency	Between Groups	1.283	9	0.143	3.293	0.002
	Within Groups	2.684	62	0.043		
	Total	3.967	71			
Cost Efficiency	Between Groups	1.455	9	0.162	4.549	0.000
	Within Groups	2.203	62	0.036		
	Total	3.657	71			
Scale Efficiency	Between Groups	1.445	9	0.161	3.042	0.004
	Within Groups	3.273	62	0.053		
	Total	4.719	71			

Source: Calculations Based Upon Appendix A.2

Table C.2 ANOVA Analysis of Employee Size of Government and Government Efficiency, 2001

1,000 Citizens Per Capita Public Employees	N	Technical Efficiency	Cost Efficiency	Scale Efficiency
2.0000-3.9999	29	0.8813	0.8149	0.8501
4.0000-5.9999	20	0.6753	0.6221	0.6070
6.0000-7.9999	14	0.5868	0.5361	0.4921
8.0000-9.9999	7	0.3703	0.3586	0.2993
Over 10.0000	2	0.3232	0.4092	0.1706
Total (mean)	72	0.7016	0.6515	0.6405

ANOVA		Sum of Squares	Degree of Freedom	Mean Square	F	Sig.
Technical Efficiency	Between Groups	2.190	7	0.547	20.642	0.000
	Within Groups	1.777	67	0.027		
	Total	3.967	71			
Cost Efficiency	Between Groups	1.696	7	0.424	14.483	0.000
	Within Groups	1.961	67	0.029		
	Total	3.657	71			
Scale Efficiency	Between Groups	2.861	7	0.715	25.809	0.000
	Within Groups	1.857	67	0.028		
	Total	4.719	71			

Source: Calculations Based Upon Appendix A.2

Table C.3 ANOVA Analysis of Expenditure and Government Efficiency, 2001

Per Capita Expenditure (million)	N	Technical Efficiency	Cost Efficiency	Scale Efficiency
Under 0.9999	46	0.7936	0.7514	0.7320
1.0000-1.9999	25	0.5204	0.4734	0.4661
2.0000-2.9999	1	1.0000	0.5095	0.7949
Over 3.0000	0	-	-	-
Total (mean)	72	0.7016	0.6115	0.6405

ANOVA		Sum of Squares	Degree of Freedom	Mean Square	F	Sig.
Technical Efficiency	Between Groups	1.299	2	0.650	16.804	0.000
	Within Groups	2.668	69	0.039		
	Total	3.967	71			
Cost Efficiency	Between Groups	1.272	2	0.636	18.393	0.000
	Within Groups	2.386	69	0.035		
	Total	3.657	71			
Scale Efficiency	Between Groups	1.170	2	0.585	11.371	0.000
	Within Groups	3.549	69	0.051		
	Total	4.719	71			

Source: Calculations Based Upon Appendix A.2

Table C.4 ANOVA Analysis of Independent Revenue Source and Government Efficiency, 2001

Percent of Independent Revenue Sources	N	Technical Efficiency	Cost Efficiency	Scale Efficiency
Under 20.000%	13	0.4564	0.4323	0.3826
20.001-30.000	12	0.5719	0.5112	0.4936
30.001-40.000	16	0.6441	0.6151	0.5594
40.001-50.000	10	0.8359	0.7475	0.7950
50.001-60.000	6	0.7708	0.7305	0.7130
Over 60.001%	15	0.9621	0.8969	0.9369
Total (mean)	72	0.7016	0.6515	0.6605

ANOVA		Sum of Squares	Degree of Freedom	Mean Square	F	Sig.
Technical Efficiency	Between Groups	2.263	5	0.453	17.530	0.000
	Within Groups	1.704	66	0.026		
	Total	3.967	71			
Cost Efficiency	Between Groups	1.915	5	0.383	14.503	0.000
	Within Groups	1.743	66	0.026		
	Total	3.657	71			
Scale Efficiency	Between Groups	2.821	5	0.564	19.623	0.000
	Within Groups	1.898	66	0.029		
	Total	4.719	71			

Source: Calculations Based Upon Appendix A.2

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