Productivity Changes in the Chinese Provincial Governments

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Abstract: This paper applies a Data Envelope Analysis (DEA) method to the measurements and evaluations of Chinese provincial governmental productivity. It defines operationally the inputs and outputs of the government and governmental productivity in terms of eight indicators, and calculates the changes in governmental productivity with the DEA method for the period of 1985 to 2003. It decomposes the total factor productivity (TFP) into efficient changes and technical changes, and illustrates the characteristics of the changes in governmental productivity from periods to periods, and analyzes theoretically the characteristic patterns. It compares the differences in changes of governmental productivity among the different regions. In the processes of analysis, we emphasize the effects of administrative and economic reforms on governmental productivity, and the relationship between governmental productivity and administrative and economic reforms.

Government performs multiple roles and provides a host of goods and services to its populations, to achieve various economic and social objectives, by combining labor with other inputs, in a modern mixed economy. The efficiency with which these goods and services are provided has been termed governmental productivity or public productivity, which refers to "a ratio between inputs and outputs. Productivity is improved when increases of output are achieved per unit of input" (Birnbaum, 1990). Governmental productivity is total factor productivity (TFP) because of government being an organization with multiple inputs and multiple outputs.

It is common in China to regard the government, both at central and local levels, as too large, too clumsy, and too costly to perform public functions appropriately. With its inception of reform and opening the door to the world since 1978, China has staged government reforms five times to adapt the government to a market economy and to enhance governmental productivity.

Concerns about governmental productivity among policymakers and researchers alike have been receiving a new boost in China since the middle 1990s. With the introduction of wide-ranging institutional reforms arising from the Western world since the late 1980s, government administration innovations and productivity-enhancing measures have been staged and imitated in succession by the various provincial governments.

This paper, for the first time, takes stock of the effects of those innovations and reforms on provincial governmental productivity. It applies a Data Envelope Analysis (DEA) method to the measurements and evaluations of provincial governmental productivity in China. It defines operationally the inputs and outputs of the government and governmental productivity in terms of eight indicators, and calculates the changes in governmental productivity with a DEA method for the period of 1985 to 2003. It decomposes the total factor productivity into efficient changes and technical changes, and illustrates the characteristics of the changes in governmental productivity from periods to periods, and analyzes theoretically the characteristic spatial patterns. It compares the differences in changes of governmental productivity among different regions. In the process of analysis, we emphasize the effects of administrative and economic reforms on governmental productivity, and the relationship between governmental productivity and government administration.

This paper proceeds as follows: Section 2 provides a selective overview of the literature on the definitions of government inputs and outputs, and defines the indicators used in this paper. Section 3 lays out the paper's methodology. Section 4 calculates the Malmquist productivity indices and provides an analysis of changes in Chinese provincial governmental productivity and different productivity patterns among different regions. Section 5 summarizes the results and recommendations for further studies.

The Definitions of Government Input and Output

Theoretical Definition of Government Outputs

The multiplicity of government activities and objectives makes it more difficult to define the outputs of government relative to the inputs. It's reasonable to argue that government has the same number of outputs as activities and goals that government is engaged in. It is highly difficult to deal with the degree of aggregation on which government outputs are measured. Fortunately, the relative theories of the government's roles and scopes in public management provide the basic guidelines for defining government outputs.

In its 1997 report on development, the World Bank argued that five fundamental tasks lie at the core

of every government's mission: (1) establishing a foundation of law; (2) maintaining a non-distortionary policy environment; (3) investing in basic social services and infrastructure; (4) protecting the vulnerable; and (5) protecting the environment.

Anderson (1989) proposed seven basic functions of government, which he claims are general roles of every government. Hughes (2002) viewed this set of government roles as more pragmatic and broader. Anderson's general roles of government include: (1) providing the basic institutions, rules and arrangements necessary for the satisfactory operation of a modern market system; (2) providing various collective goods and services which market fails to provide; (3) providing fair mechanisms and procedures for the resolution and adjustment of group conflicts; (4) providing suitable regulation and effective monitoring for the maintenance of competition; (5) making and carrying out effective policies for protection of natural resources; (6) taking measures for individuals' minimum access to the public or collective goods and services of the economy; and (7) making policies for stabilization of the economy.

Hughes (2002) observed that this set of government roles is more pragmatic and broader. In our opinion, the common essential features between Anderson's *general roles of government* and the World Bank report's *fundamental tasks of government* are that both define government functions in the terms of government outputs. We follow these definitions of government functions as our guidelines of defining government outputs.

Empirical Definitions of Government Inputs and Outputs

There has been a wide range of literature on measuring and evaluating the performance of government as a whole both in national and sub-national levels since the late 1980s (Tanzi and Schuknecht, 1997; Harbison and Hanushek, 1992). This literature falls into two broad categories in designing the indicators measuring and evaluating government performance: One category scores the scale indicators, the other measures inputs and outputs quantitatively.

A typical example of the second category is the program for measuring productivity change staged in Sweden in 1982 (Murray, 1987). The program covered 70% of the governmental sector in Sweden, 75% of the municipal sector and 55% of the national government sector. In this program, as far as possible, definitions and evaluations of output and quality were made from the consumer perspective. Wherever possible, outputs were measured in conformity with how government consumption was recorded according to the purpose of the national accounts. This means that large sections of the government sector were measured across several agencies. The program included sectors such as general administration, police and justice, education, health, social security, child, old-age care, libraries, roads, etc. Costs were measured in the same way as in the national accounts.

The Government Performance Project—a collaboration between *Governing* and the Maxwell School of Syracuse University, funded by the Pew Charitable Trusts, started in 1999—is a good example of scoring the scale indicators. The project measures government performance in 32 sub-indicators which are categorized into 5 broader indicators: financial management, capital management, human resources, managing for results and information technology. *Governing* has reported the score cards for the 50 states of the U.S. for several years.

Each of the two methods mentioned above has its own advantages and disadvantages. Scoring scale indicators, which are more suitable to countries which have hard budgeting institutions, emphasize the results, while the input-output method considers both inputs and outputs at the same time. China is a developing country and is known for its soft budgeting arrangements. Therefore, we choose to use the input-output method.

Measurements of Government Inputs and Outputs

Government inputs and outputs used in this paper follow the scope of government outlined in the *System of the National Accounts* developed by United Nations, based on the input and output indicators used in the above empirical studies and specific situations of Chinese government operation.

In the classification of the *System of National Accounts*, government inputs are defined in terms of the following two aspects: government expenditure and administration staff.

Government expenditure is one government input. The efficiency and effectiveness of government performing its functions in a market economy has to do with every branch of the public domain—for instance, education, health, welfare, and so on. So the government expenditure as a government input includes government investment and consumption, which includes transfer payments.

Administration staff is another kind of government input. We chose this factor as government input for several reasons. Classic economic theory has considered administrative staffs as non-productive. If the number of total labors is fixed, then the more administrative staffs there are, the less productive labor there is in an economy, and therefore the less the economy's potential exists to create wealth. Modern economic theory holds, on the other hand, that government activities are similarly productive. According to this theory, administrative staffs cannot be distinguished by whether they are productive or not, but by how productive factors are best disposed. In addition, administrative staffs as an independent input take a critical or irreplaceable role in government production, although the number of administrative staffs positively influences the government's expenditures. The administrative staffs here include, taking into account

the Chinese political system, staffs of government agencies, political party institutions, and social organizations, without taking institutional staffs (e.g., teachers, doctors, nurses, and so on) into consideration.

As far as the output is concerned, considering the fact that China is a developing and economic transition country, as well as economic growth ability and speed, we use the following five indicators for measuring government output on the basis of Anderson's definition about government functions.

The first indicator of the output reflects economic growth potential, which is measured by GDP growth rate. This is a composite indicator, not only showing the efficiency and effectiveness of government performing its functions, but also revealing the effects of combinations of different inputs. The second indicatr is about the effects of government regulation. Because of the difficulties in comparing regulations, many studies measure the effects of regulation with instrumental variables, especially with subjectively perceptive investigating data. Limited by the inaccessibility of subjective investigating data, the effects of regulation are measured by the ratio of the average laborers' incomes from all non-agricultural sectors, to that in the natural monopolistic sectors in a province. The third indicator is a reflection about quality and quantity of public goods provided by a provincial government, and we chose two kinds of public goods, education and public health. The former is measured by the ratio of teachers to students in primary and secondary education. The latter is assessed by the number of medical staff per million people and the number of medical beds per million people. The fourth output indicator reflects local citizens' social economic welfare and fairness, measured by the reciprocal of the citizen's Engel coefficient and Gini's coefficient. The last output indicator reflects quality of infrastructures and conditions of law and order for economic activities, captured by non-governmental investment growth rate.

All in all, the set of government inputs and outputs in this paper mainly goes with the conceptual framework in the following Table 1.

The data for the paper all comes from the Chinese statistics yearbook. Due to insufficient data from Tibet, however, the samples here do not include this province. Therefore, the number of samples from 1985 to 1996 is 29, and from 1997 to 2003 is 30, including Chongqing.

Table 1. Government Inputs and Outputs

Government input	Government output
1. Monetary input Governmental fiscal expenditures /GDP	1. Economic growth potentials
	2. Regulation effects
	3. Education
2. Labor input Administrative staffs / Total employment or Administrative staffs /total population	4. Public health
	5. The level and fairness of residential welfare
	6. Infrastructures and law environment for economic activities

The Specification of the Model and Decompositions of TFP

DEA Models and Advantages

DEA is a new way to analyze the relative efficiency and managerial performance of the productive organizations with the same multi-inputs and multi-outputs. Charnes, Cooper and Rhodes firstly published their preliminary research, "Data Envelopment Analysis," in order to develop a more effective evaluating method while the effectiveness of some governmental projects that supported a vulnerable children's study in public schools was assessed. This method immediately attracted the attention of scholars in management and operation fields, and thus developed quickly within a short period of time. So far, the initial CCR ratio model has branched out into a variety of famous models, like the "multiplicative model" (Charnes, et al., 1982); the "BBC model" (Banker, Charnes, and Cooper, 1984); the "additive model" (Charnes, et al., 1985); the "FG model" (Fare and Grosskopf, 1985); the "CCWY model" (Charnes, Cooper, Wei, and Yue, 1988); "the CCWH model" (Charnes, Cooper, Wei, and Huang, 1989); the "ST model" (Seiford and Thrall, 1990); etc.

Recently, the DEA method has been widely used in performance evaluation situations, such as the maintenance moves of a United States Air Force base, English and Welsh police station public security work, the operational works of banking and university organizations, and the activities of different cities and countries (Seiford and Thrall, 1990). It can be said that there is no area in which DEA does not play its powerful performance assessing role, for it has outgrown the frailty of the traditional methods and opened new areas for performance evaluation. The reason for this is due not only to its special effectiveness for multiple-input and multiple-output activities,but also to its formidable ability to process different data types, unit types, and the same type of units of different scales. Besides, it works not only in quantitative evaluation but also in qualitative evaluation, either in efficiency evaluation or in effectiveness evaluation.

The Specification of the Models

In this paper, one province is taken as one decision-making unit. The DEA method improved by Fare, et al. (1994, 1996) is adopted to construct the production frontiers composed of total factor productivities of all provincial governments in China for every period. The changes in efficiency and in the technical achievements of every provincial government can be measured by comparing a provincial government's productivity to the production frontier. According to Fare, et al., the production frontier or the referential technology can be expressed in the following three equivalent ways: the input requirement set $L(y)$ (i.e., all the input combinations that can form output vector y); the output possibility set $P(x)$ (i.e., all the output combinations that are formed by input vector x); and the graph (i.e., the combination of all technical feasible input vector x and output vector y). In this paper we choose the input requirement set as the basic model.

Suppose that a decision-making unit has an input vector $x_k^t = (x_{k1}^t, x_{k2}^t, \cdots, x_{kN}^t)$, and an output vector $y_k^t = (y_{k1}^t, y_{k2}^t, \cdots, y_{kM}^t)$, where x_{kn}^t means the n^{th} input of the k^{th} decision-making unit and y_{kj}^t is its j^{th} output. As a result, the input requirement set will be

$$L^t(y^t \mid \square) = \{(x_1^t, x_2^t, \cdots, x_N^t) : subject\ to\ some\ conditions\}$$

that is, to solve the following programming under some constraints:

$$F_i(y^t, x^t \mid \square) = \min\{\lambda : \lambda x^t \in L^t(y^t \mid \square)\}.$$

According to Fare, et al. (1994, 1996), $F_i(y^t, x^t \mid \square)$ is referred as technical efficiency. The technical efficiency model has different forms; the model in this paper was chosen to use the strong disposability of constant returns to scale:

$$L^t(y^t \mid C, S) = \{(x_1^t, x_2^t, \cdots, x_N^t) : \sum_{k=1}^{K} z_k^t y_{km}^t \geq y_m^t, \sum_{k=1}^{K} z_k^t x_{kn}^t \leq x_n^t, z_k^t \geq 0\}$$

$$F_i(y^t, x^t \mid C, S) = \min\{\lambda : \lambda x^t \in L^t(y^t \mid C, S)\}$$

where C refers to Constant returns to scale, S to strong disposability of constant returns to scale. $0 < F_i(y^t, x^t \mid \cdot) \leq 1$ by the definition of $F_i(y^t, x^t \mid \cdot)$. A decision-making unit *k* is technically input efficient (simply as "relative efficiency"), if and only if $F_i(y^t, x^t \mid \cdot) = 1$. A decision-making unit *k* is technically input inefficient (simply as "relative inefficiency"), if $F_i(y^t, x^t \mid \cdot) = 1$ (Fare, et al., 1994, 1996).

The Changes of TFP

Technical efficiency measures the relative efficiency of different provincial governments in the same period. In order to get government productivity change index with time (Malmquist productivity index, or simply productivity), it is necessary to define input distance function. Fare, et al. (1994, 1997) defined input distance function as the reciprocal of the Farell technical efficiency, that is, the input distance function under the referential technology is:

$$D_i^t(y^t, x^t \mid C, S) = 1 / F_i^t(y^t, x^t \mid C, S).$$

Geometrically speaking, input distance function can be considered as the projection of the combination of inputs and outputs on the production frontier. According to Fare, et al. (1994, 1997), (x^t, y^t) is on the production frontier if and only if $D_i^t(y^t, x^t) = 1$. If $D_i^t(y^t, x^t) > 1$, (x^t, y^t) is out of the production frontier, and accordingly the activity of the unit is technically inefficient. If *t* is replaced with *t+1* in all the previous formulas, the input distance function in period *t+1* is $D_i^{t+1}(y^{t+1}, x^{t+1})$.

The total factor productivity index on the basis of input-orientation, following Caves (1982), can be defined as Malmquist index:

$$M_i^t = D_i^t(y^t, x^t) / D_i^t(y^{t+1}, x^{t+1})$$

which is used to measure the technical efficiency in *t+1* period, taking the technical efficiency in t period as a benchmark, namely projecting the combination of inputs and outputs in *t+1* period onto the production frontier in *t* period. Similarly, the technical efficiency in *t+1* period can be defined as benchmark as well to measure the technical efficiency of *t* period:

$$M_i^t = D_i^{t+1}(y^t, x^t) / D_i^{t+1}(y^{t+1}, x^{t+1}).$$

The Decomposition of TFP

Total factor productivity of t+1 period can be obtained through t period in accordance with method proposed by Fare, et al. (1994, 1996), who applied Fisher's (1922) method and constructed the "ideal index". Fisher's ideal index is the geometrical mean value of the Paache index and Laspeyres index, which are, respectively, the upper and lower bound of the true index. Therefore, as the geometrical mean value of the two indexes, the Fisher

ideal index is the better evaluation of the true index. For the above reasons, Fare and others took the geometrical mean value of Malmquist index in *t* period and *t+1* period as the Malmquist productivity index on the basis of input-orientation. See the following function:

$$M_i(x^{t+1}, y^{t+1}; x^t, y^t) = \left\{ \left[\frac{D_i^t(y^t, x^t)}{D_i^t(y^{t+1}, x^{t+1})} \right] \left[\frac{D_i^{t+1}(y^t, x^t)}{D_i^{t+1}(y^{t+1}, x^{t+1})} \right] \right\}^{1/2}$$

Through some simple algebra manipulations, the above formula can be decomposed as the following:

$$M_i(x^{t+1}, y^{t+1}; x^t, y^t) = \frac{D_i^t(y^t, x^t)}{D_i^t(y^{t+1}, x^{t+1})} \left[\frac{D_i^{t+1}(y^{t+1}, x^{t+1})}{D_i^t(y^{t+1}, x^{t+1})} \times \frac{D_i^{t+1}(y^t, x^t)}{D_i^t(y^t, x^t)} \right]^{1/2}$$
$$= EC(x^{t+1}, y^{t+1}; x^t, y^t) TC(x^{t+1}, y^{t+1}; x^t, y^t)$$

where $EC(\square)$ expresses the relative efficiency change index under the condition of constant returns to scale as well as free disposability of factors. It is the efficiency change of a decision-making unit in *t+1* period taking the production frontier of t period as the benchmark and it also means the horizontal effect of productivity change of different decision-making units.

$TC(\square)$ is the technical change index, which measures the change of the best production frontier from t period and t+1 period. It reflects the expansion of the best production frontier (i.e. the growth effect of productivity).

Empirical Analysis of the Calculated Results

In order to compare the government productivities of different provinces in different periods, we divide the different provinces in a same period into three subgroups: provinces with government productivities ranking ahead in the current period, provinces with government productivities above the average, and provinces with government productivities below the average.

According to the sequence and process of administrative and economic system reforms, the variation of local governmental productivities with times is divided into three periods: 1985 to 1991; 1992 to 1996; and 1997 to 2003. From 1985 to 1991 is the exploring period for the administrative and market economic system reform of China, and this period is characterized in aggregate by the reform of government agencies and the activating of a market economy. From 1992 to 1996 is the period of keeping orientation of the market economic system firmly and redefining governmental functions thereof. The central characteristics of this period lie in the redefinition of governmental interventions, the transformation of governmental functions, the reform of administrative systems, and the restructuring and simplification of government agencies and their procedures. From 1997 to 2003 is the period of China carrying out reforms of the administrative and regulative system for accession to the WTO. This period is characterized by that of loosening or recovering governmental regulation, carrying out WTO requirements gradually, and reforming the relationships between government and the state-owned enterprises. Theoretically speaking, these three periods are reflected in three different stages of the transformation of governmental functions and the improvement of government efficiency. Hence, corresponding variations in government productivity are expected theoretically.

Meanwhile, to find out the regional characteristics of variation of local Chinese governmental productivities, the patterns of governmental productivities in different regions are divided into three areas: the eastern, the middle and the western.[1]

The Overall Patterns of Local Chinese Governments' TFP

Table 2 illustrates the average time sequence data of the whole country, the mean annual growth of local Chinese governments' TFP is 1% since 1985.[2] From the average point of view, this growth comes completely from the efficiency variation, for the mean annual growth of efficiency variation is 2% while the growth of technical variation is 0 since 1985. It suggests that, since 1985, local Chinese governments' TFP has actually witnessed a considerable variation and this variation is a horizontal effect in the main; that is to say, there is a catch-up effect or convergence effect in the government total factor productivities of different provinces. This catch-up or convergence effect indicates that, there are leaders and followers in the reform of local Chinese governments: One province takes the lead in carrying out reform in respect of efficiency, and after a certain period of time, this reform is imitated by other provinces; therefore, the variation of efficiency sees an effect of diffusion.

Meanwhile, this horizontal effect in the government total factor productivities of different provinces shows that the administrative system reform of local governments is in a stable period and there is no individual province that has significant efficiency or technical advantage. The calculated results show that, from 1999 until 2002, the number of provinces with best productivities continued at about 10, just 1/3 of the total samples studied in this paper. In 2003, this figure amounted to 13, accounting for 40.3% of the total samples. There are only two provinces, namely, Guangdong and Gansu, showing an efficiency decline in 2003, and the efficiency variation of all the other provinces is greater than or equal to 0. At the same time, only 9 provinces saw a positive technical variation and all the others negative. Hence, in the aggregate tendency, the horizontal effect of efficiency variation must be greater than the growth effect of the productivity frontiers.

Table 2. Mean Malmquist Productivity Index of Chinese Local Governments and its Decomposition During 1985 to 2003

Year	Malmquist productivity Index	Efficiency variation index	Technical variation index	Year	Malmquist productivity Index	Efficiency variation index	Technical variation index
1985-1986	0.88	1.03	0.86	1994-1995	0.95	0.96	0.99
1986-1987	1.06	0.95	1.11	1995-1996	0.95	1.05	0.91
1987-1988	0.98	1.05	0.94	1997-1998	0.95	1.05	0.91
1988-1989	0.91	0.91	1.05	1998-1999	0.96	1.03	0.94
1989-1990	1.01	1.22	0.86	1999-2000	1.09	0.95	1.15
1990-1991	1.07	1.04	1.04	2000-2001	0.92	1.02	0.91
1991-1992	1.22	0.94	1.31	2001-2002	1.03	1.01	1.02
1992-1993	1.22	1.05	1.18	2002-2003	1.01	1.02	0.96
1993-1994	0.95	1.03	0.92	Mean	1.01	1.02	1.00

The Variation of Local Chinese Governments' TFP During 1985 to 1991

The TFP of Chinese local governments showed a general tendency of continuous growth during the period of 1985 to 1991. It can be concluded from Table 2 that the mean annual growth of local governments' TFP reached 2% during this period. This growth comes from both the efficiency variation (2%) and the technical variation (2%). Therefore, in this period, local governments' TFP saw both the horizontal effect and the growth effect. That is to say, there are leaders and followers in the reforms of local government administrative systems and economic systems.

During this period, the increase of TFP mainly came from four periods: 1986 to 1987 (6%); 1989 to 1990 (1%); 1990 to 1991 (7%); and 1991 to 1992 (20%). Horizontal effect was seen in four periods, 1985 to 1986 (3%); 1987 to 1988 (5%); 1989 to 1990 (22%); and 1990 to1991 (4%), and growth effect was seen in the following four periods: 1986-1987 (11%); 1988-1989 (5%); 1990 to 1991 (3%); and 1991 to 1992 (29%). Obviously, the four periods of growth in total factor productivity correspond to the four periods of technical variation in the aggregate; therefore, in this time the increase of local governments' TFP mainly came from technical variation (i.e., the growth effect).

During this time, the local government TFP of the following provinces saw a relatively rapid growth: Guangdong (10%); Hainan (5%); Shandong (4%); Beijing, Tianjing, Shanxi, Guangxi, Sichuan, and Guizhou (3% respectively). Besides, the government total factor productivity of Hebei province saw an annual mean growth of 2%, and Jiangsu, Heilongjiang, and Fujian 1% each. It is evident that this result perfectly conforms to the process of experimenting and expanding of the reforms of local governments and economic systems.

The local governments' TFP shows obvious regional structural patterns during this period. Table 3 illustrates that the annual average growth of government TFP in the eastern regions amounts to 6%, while the figure is -1% in the middle and the west regions. The efficiency variation is 1% in the east and the middle areas, while it is 4% in the west area: The horizontal effect of the west area is much greater than that of the east and the middle areas. The technical variation of the east is 6%, while there is no change in the middle and the west areas. The growth effect of the east is much greater than that of the middle and the west areas. Meanwhile, in this period the horizontal effect and the growth effect go one after another; that is to say, the former appears after the latter comes out. This suggests that, averagely speaking, the east area was expanding the productivity frontiers effectively, while the middle and the west areas were keeping pace with the frontiers. Therefore, the east area always played the role of leader in the reforms of the administrative system and economic systems, while the middle and the west areas always played the role of follower in this period.

The Variation of Local Chinese Governments' TFP in 1992 to1996

As mentioned above, the period from 1992 to 1996 was important for China to keep the market-orientated system reform firm and carry out administrative system reform centered on the transformation of governmental functions. Reform in this period made active contributions to the enhancement of the TFP of local governments. Table 4 illustrates this clearly.

As shown in Table 4, the total factor productivity of local Chinese governments saw a mean annual growth of 1.8%; the efficiency variation (i.e., horizontal effect), saw a mean annual growth of 1%; and the technical variation (i.e., growth effect), 1.8%. Therefore, similar to the 1985 to 1991 period, horizontal effect and growth effect coexist in this period, and they are both lower than the previous period.

Table 3. The Variation of Local Chinese Governments' TFP and its Decomposition in 1985 to 1991

		1985-1986	1986-1987	1987-1988	1988-1989	1989-1990	1990-1991	1991-1992	Mean
TFP	Mean of the west	0.84	1.16	0.95	0.92	0.97	1.13	1.44	1.06
	Mean of the middle	0.87	1.06	0.97	0.93	1.02	1.01	1.1	0.99
	Mean of the west	0.94	0.95	1.03	0.89	1.03	1.06	1.06	0.99
	Mean	0.88	1.06	0.98	0.91	1.01	1.07	1.2	1.02
Efficiency variation	Mean of the west	1.04	0.98	1	1.04	1.04	1.04	0.95	1.01
	Mean of the middle	0.98	0.95	1.05	0.94	1.13	1.06	0.93	1.01
	Mean of the west	1.06	0.93	1.1	0.74	1.5	1.01	0.94	1.04
	Mean	1.03	0.95	1.05	0.91	1.22	1.04	0.94	1.02
Technical variation	Mean of the west	0.81	1.18	0.95	0.89	0.94	1.09	1.54	1.06
	Mean of the middle	0.88	1.12	0.92	1	0.92	0.95	1.19	1.00
	Mean of the west	0.89	1.04	0.94	1.25	0.72	1.05	1.14	1.00
		0.86	1.11	0.94	1.05	0.86	1.03	1.29	1.02

Table 4. The Variation of Local Chinese Governments' TFP and its Decomposition in 1992 to1996

		1992-1993	1993-1994	1994-1995	1995-1996	Mean
Total factor productivity	Mean of the west	1.24	0.92	0.89	0.92	0.993
	Mean of the middle	1.16	1.01	1.00	0.97	1.035
	Mean of the west	1.25	0.93	0.97	0.95	1.025
	Mean	1.22	0.95	0.95	0.95	1.018
Efficiency variation	Mean of the west	1.07	1.07	0.91	1.04	1.023
	Mean of the middle	1.03	1.03	0.99	1.09	1.035
	Mean of the west	1.04	0.99	0.99	1.02	1.01
	Mean	1.05	1.03	0.96	1.05	1.023
Technical variation	Mean of the west	1.19	0.86	0.98	0.89	0.98
	Mean of the middle	1.13	0.98	1.01	0.9	1.005
	Mean of the west	1.2	0.95	0.98	0.94	1.018
	Mean	1.17	0.93	0.99	0.91	1.001

The variation of local governments' TFP in this period mainly comes from the years 1992 to 1993, with a 22% growth rate, where the growth rate of efficiency variation is 5% and technical growth rate 17%, while the TFP growths of other years are all negative (see Table 4). A comparison of Table 2 to Table 4 illustrates that the local governments' TFP sees a relatively high annual growth from 1990 to 1993. This can be explained in several ways: One is that the anti-corruption movement in 1989 brought deterrence restraint to the authorities' behavior during the following years, and therefore exerted a certain influence on the government's efficiency; another is that the governance improvement conducted after 1989 might have promoted the enhancement of government efficiency and the improvement of economic environment; and the last one lies in the fact that the

economic system reform of China has encountered some problems and the scope of government interventions has been narrowed since 1989: The government's financial expenditure is, therefore, reduced and the decreasing of return to scale is relieved; the government's TFP is relatively improved.

Individually, the government's TFP for Guangdong and Hainan saw 48% and 46% growth, respectively, from 1991 to 1992. From 1992 to 1993, the government's TFP for Zhejiang, Fujian, Guangxi, Guizhou, Yunnan, and Shaanxi witnessed a growth of 45%, 47%, 54%, 49%, 44%, and 33% respectively, while that of Beijing, Shanxi, Jilin, Jiangxi, and Hubei saw a growth of 22%, 18%, 31%, 29%, and 22% respectively. Notably, the government's TFP for Hainan Province saw 135% growth. This high growth rate might be related to Hainan's specific government reforms (i.e., building "small government and great society") in the early 1990's. If this is true, the reform of Hainan's government should be an important orientation for the structuring reform of local Chinese governments in the next period; that is, to eradicate the traditional practice of setting functional agencies corresponding to those of upper-level government, so as to adapt the agency structures and sizes of government to economic development levels.

Seen from different regions, during the period from 1992 to 1996, the TFP of governments in the east region saw a mean annual growth of -0.7%, while the figure reached 3.5% and 2.5% in the middle and the west respectively. This pattern is a significant contrast to the previous period. As to the efficiency variation (i.e., horizontal effect), a mean annual growth of 2.3%, 3.5% and 1% was respectively seen in the east, middle and west. As to the technical variation (i.e., growth effect), the east, middle and west areas separately witnessed a mean annual growth of -2%, 0.5% and 1.8%. Meanwhile, the staggered patterns of growth effect and horizontal effect, which was seen in the previous period, disappeared. This suggests that there is a significant convergence effect in the government's total factor productivities among different regions. The growth rates of the east and middle become negative or slow down, while that of the west are accelerated. In other words, the reforms of administrative and economic systems become sluggish in this period, while the provinces in the middle and west accelerate their reforms to catch up to the east.

The Variation of Local Chinese Governments' TFP in 1997 to 2003

The variation of local governments' TFP in 1997 to 2003 differs from that of the previous two periods. Average local Chinese governments' TFP growth staggered from 1997 to 2003. Table 5 illustrates that the local governments' TFP saw a positive growth in the following years: 1999 to 2000 (10%); 2001 to 2002 (4%); and 2002 to 2003 (1%), and a negative growth in 1997 to 1998 (-5%); 1998 to 1999 (-4%); and 2000 to 2001 (-8%). In this period, the horizontal effect was significant, with a mean annual growth of 1% in efficiency variation, and negative efficiency variation was seen in only one year. This is consistent with the evident convergence effect in the local governments' TFP of the previous period. On the other hand, the growth effect became negative, with a mean annual decline of 1%, and the growth effect only existed in two years (i.e., 1999 to 2000 and 2001 to 2002, with a technical variation of 15% and 2% respectively). These two years happen to be the years of positive TFP growths.

Table 5. The Variation of Local Chinese Governments' TFP and its Decomposition in 1997 to 2003

		1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	Mean
Total factor productivity	Mean of the eastern	0.92	0.95	0.99	0.95	1.03	1.01	0.98
	Mean of the middle	0.89	0.93	1.11	0.92	1.07	0.99	0.99
	Mean of the western	1.03	1	1.19	0.9	1.01	1.02	1.03
	Mean	0.95	0.96	1.1	0.92	1.04	1.01	1.00
Efficiency variation	Mean of the east	1.01	1.03	0.91	1.09	1.02	1.01	1.01
	Mean of the middle	0.99	0.99	0.95	1.07	1.04	1.01	1.01
	Mean of the west	1.12	1.05	0.98	0.9	0.98	1.05	1.01
	Mean	1.04	1.02	0.95	1.02	1.01	1.02	1.01
Technical variation	Mean of the east	0.91	0.92	1.09	0.88	1.01	1	0.97
	Mean of the middle	0.9	0.94	1.16	0.86	1.03	0.98	0.98
	Mean of the west	0.93	0.95	1.19	0.98	1.03	0.98	1.01
	Mean	0.91	0.94	1.15	0.91	1.02	0.99	0.99

The variation of local Chinese governments' TFP in this period embodied the following characteristics. First, a great decline of local governments TFP was seen in 1997 to 1999 and 2000 to 2001, and it was the provinces in the east or middle regions that experienced a relatively great decline. This might be related to the Southeast Asian Finance Crisis, or to the slowdown of government reform in the east area. Second, most of the provinces that saw great growth in these years are located in the middle or west area. For instance, in 1997 to 1998 when the whole country on average saw a decline, Ningxia witnessed 69% growth; Hunan 8%; Inner Mongolia 7%; Qinghai 7%; and Guangdong and Guangxi 5%. In 1998 to 1999, relatively high growth was seen in the following provinces: Shaanxi (20%), Gansu and Qinghai (15%), Hainan (14%), Ningxia (7%), Jiangxi and Shandong (5%), and Xinjiang (4%). This pattern also appeared in the other years of this period. Third, the west area, as a whole, saw powerful TFP growth. In 1997 to 2003, the mean annual growth of the government's TFP in the west area reached 3%, in which the growth rate amounted to 19% in 1999 to 2000 and 2% in 2002 to 2003. Fourth, the increase in the TFP of local governments in the west provides a great contrast to the decline in the east; therefore, an obvious convergence effect is shown in the government TFP between different regions.

The above characteristics originate from several factors. First, during the Southeast Asian Finance Crisis, the east area suffered a much greater influence than the west area did; therefore, the government TFP of the west area improved continuously at the same time when that of the east area declined. Second, the implementation of the strategy of developing the west brings a lot of resources into the west area, not only improving the productive capability greatly, but also affecting the government's behaviors and enhancing the government's efficiency. Third, while carrying out the strategy of developing the west, the local governments in the west area accelerated reforms of the administrative and economic systems, and the institutional level of government management and the economic development environment improved much. Fourth, through the 20 years of reform and openings, the economic and social agents in the west area have not only changed their cultural attitudes and behaviors, but also stepped on the developing roads more appropriate to them than before.

Conclusions and Discussions

The paper applies a Data Envelope Analysis to the measurements and evaluations of the Chinese provincial governmental total factor productivity. DEA has a strong advantage in evaluating the performance of non-market decision-making organizations; it has explored some fields which in the past is unsolvable using tradition methods.

This paper takes advantage of this method to survey provincial government productivity changes for the period of 1985 to 2003 in China, and has carried on decomposition on the provincial government productivity to the efficiency change and the technical change; it has analyzed the productivity changes at different times and in different provinces, and has carried on theoretical analysis of this kind of condition; it has explained the influence upon the governmental relative efficiency brought by reforms of administrative systems and the interdependence between governmental relative efficiency and governmental administrative systems.

Due to non-access to data resources, this paper has not established subject perceptions indicators, which are similar to public satisfaction indicators, to evaluate government performance. In fact, the subject perceptions indicators which are used to evaluate government performance and government quality could definitely be melded into the model in this article. The lack of subject perceptions indicators is an obvious insufficiency of this paper.

Notes

[1] Due to the limited space herein, no more detailed data about the yearly productivities of provincial governments is reported in this paper. Interested readers may refer to the author for such information (ygq@bnu.edu.cn).

[2] According to the definition of the Malmquist index, the indexes in the table minus 1 are productivity change; similarly hereinafter.

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