Assessing the Relative Performance of U.S. University Technology Transfer: Non-Parametric Evidence

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Abstract: - This study presents non-parametric evidence on the relative efficiency of U.S. university technology transfer performance (TTP) through data envelopment analysis (DEA) model. We also compare three alternative DEA models —Charnes-Cooper-Rhodes (CCR), slack-based measure (SBM), and supper-efficiency slack-based measure (super SBM) to determine relative efficiencies and to measure the slack values among universities on the basis of the Association of University Technology Managers (AUTM) licensing survey data. We hope the result of this study is able to offer a performance ranking and provide managerial suggestions for each university to improve their technology transfer performance (TTP).

Key-Words: - U.S. university, Technology transfer performance, Relative performance, Data Envelopment Analysis (DEA), Super-efficiency, Slack-based measure (SBM).

1 Introduction

University licensing has increased dramatically since passage of the Bayh-Dole Act in 1980, giving universities the right to retain title to inventions resulting from federally sponsored research. From 1979 to 1984, the number of patents issued annually doubled (from 177 to 408) and between 1984 and 1989 it doubled again (to 1,008) [1].U.S. government typically assigns patents and other forms of property rights to innovators to give private agents incentives to engage in costly research activities. At the same time, technology from universities and research institutions improves technology innovation for industry. Technology innovation always plays an important role in economic growth [2]. Accordingly, university technology transfer plays a vital element for industrial innovation.

The literatures reveal diverse viewpoints about university technology transfer research. Some researches [3-6] explored technology transfer mechanisms by observing the knowledge spillover effect through patent activities. Hauksson [7] and Rogers [8] focused on the performance of the university technology transfer office. O'Shea et al. [9] adopt a resource-based perspective to demonstrate that some universities are more successful than others at generating technology-based spinoff companies. Based on resource-based perspective, university spinoff outcomes are correlated with eight key attributes of resources, capabilities, and institutional, financial, commercial, and personnel cost [9]. O'Shea et al. [10] indicated that the characteristics and behaviour of university spinoff activity are important subjects in economics and management studies [10]. However, Siegl and Phan [11] point out institutions that choose to stress the entrepreneurial dimension of technology transfer need to address skill deficiencies in technology transfer offices (TTOs). Another problem is, reward systems are inconsistent with enhanced entrepreneurial activity, education/training for faculty members, post-docs, and graduate students related to interactions with entrepreneurs [11].

In the age of fundamental change, technology management, especially technology transfer performance (TTP), has become an important issue among the entire American research universities. Nowadays, due to the complexity of patenting and licensing process, a direct and precise TTP evaluation and comparison is usually important but difficult.

Here we will focus on the measurement of TTP in U.S. universities. This study used Association of University Technology Managers (AUTM) license survey data to be our sources and then sort and compared TTP between U.S. universities. Efficiency ratings should be considered as a key element for achieving greater performance and better position. The technology of data envelopment analysis (DEA) is employed to determine a multi-factor TTP model. DEA has been widely adopted as an evaluation tool for benchmarking and identifying the best-practice frontier. It produces a single measure of "relative" efficiency for each decision-making unit (DMU) by solving a linear programming model associated with multiple inputs and multiple outputs. The term "relative" in DEA implies those efficient DMUs achieving maximum benefits with less effort than their peers or minimizing the inputs needed to achieve the given outputs. Since the DMUs with relative efficiency are those on the efficient frontier, these may serve as a benchmark for seeking improvements [12]. In traditional DEA model, efficiency score is from 0 to 1 (1 denotes 'with efficiency'). We may get the same score (i.e. score=1), therefore we can't get the accurate efficient rank of DMUs. In order to overcome this problem, this study presents an extension to the DEA, by incorporating the Charnes-Cooper-Rhodes (CCR), slack-based measure (SBM), and supper-efficiency slack-based measure (super SBM) to determine relative efficiencies and to measure the slack values among universities on the basis of the AUTM licensing survey data whereby TTP is transformed into monetary value. By means of super SBM model, we can get the priority of each DMU (i.e. to solve the problem of many DMUs efficiency being 1) and therefore the accurate ranking is possible.

The structure of this paper is as follows. In Section 2 we review technology transfer literatures and introduce our methodologies. In section 3, we describe the methodology. In Section 4, we discuss research results, and in the final section we make conclusions and give managerial implications.

2 Literature Review

In Section 1, we have discussed the factors that might affect U.S. university TTP. In Section 2, we discuss methods that have been used in evaluating TTP. In the final Section, we describe the data envelopment analysis for evaluating TTP.

2.1 Critical Factors of Technology Transfer Performance

The literatures referring factors of TTP, Pakes and Griliches [13] analyzed 121 large firms in the U.S.A between 1968 and 1975, they found R&D expenditures were significant correlated with the amount of patent. Foltz et al. [14] use the number of patent applications and total university patents and Rogers et al. [15] use invention disclosures, patent applications, and start-ups to measure TTP. Thursby and Thursby [16] investigated 62 supervisors of university technology transfer office by questionnaire survey. They find that the most important factors for technology transfer are royalties and fee. On the contrary, the number of licenses signed, the amount of sponsored research, and patents awarded are not important. Thursby and Kemp [17] used DEA to analyze 112 American universities between 1991-1996, and they selected licenses executed, amount of royalties, amount of patents, citation analysis, patent applications, and invention disclosures as the indicators to measure TTP. Publication is a popular way for university professors to share new knowledge or ideas with other people and for knowledge itself to evolve. Research outcomes, in terms of publications, will increase the opportunity of technology transfer. Publications with potential commercial applications, publicized by research professors, would be identified much easier than others for technology transfer [16]. It is obvious that any increase for publications, always encouraged by university, would facilitate technology transfer. Compared to research expenditure, the size of a firm is a common variable to measure organizational performance. Schumpeter [18] has approved that firm size has positive correlation with research expenditures. Acs and Audretsch [19] found that firms with different sizes have different innovative level and firm size is an important factor for organizational performance. Therefore, this study analyzed the impact of school size for university TTP as well. On the other hand, Trune and Goslin [20], Jensen and Thursby [21], Thursby and Thursby [22] argued license income is the most important outcome for technology transfer in both technology office (TTO) and administration perspectives. Based on Rogers, Ying et al. [15] outlined the process of technology transfer (see figure 1), which depicted the whole technology license income generating mechanism from research expenditure to license income. Therefore, this study selected the argument of Rogers, Ying et al. [15], Trune and Goslin [20], Jensen and Thursby [21], Thursby and Thursby [22] and adopted "license income" as our major indicator for evaluating TTP.

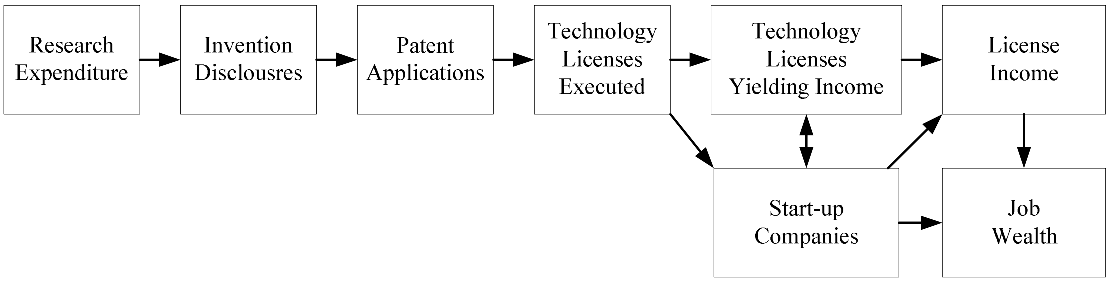

Fig. 1 The process of technology transfer from a research university

Debackere and Veugelers [23] pointed out that a university within a decentralized model that creates a specialized and decentralized technology transfer office is instrumental in securing a sufficient level of autonomy for developing relations with industry. Besides, Industry Science Links (ISLs) are an important concept of policy orientation. The effective ISLs can be fostered through the design and the development of university-based technology transfer organizations (TTOs) [23]. Scientists are more likely to switch to the entrepreneurial role when they are affiliated with institutions that employ other scientists who have participated in commercial science or high status scientists who have previously made the transition [24]. Although the spinoff activities and TTO have been reported as important factors that affect the TTP, this study will not include these factors because of the limitation of the data in this study.

Based on above literatures and current available data, this research decided to select research expenditures, school size, published articles, patent issued and invention disclosures to be our inputs, and use license income as output of DEA model.

2.2 Methods for Evaluating Technology Transfer Performance

Lipinski et al. [25] used SEM to construct an integrated framework to measure TTP, they used four theoretical views- Resource based view, Transaction cost economics, Alliance, and Agency theory and the affect that they have on university TTP. Waroonkun and Stewart [26] also apply SEM to build a model of the international technology transfer process in construction projects.

Thursby and Kemp [17] used DEA to analyze 112 American universities between 1991 and 1996, and they selected licenses executed, amount of royalties, amount of patents, citation analysis, patent applications, and invention disclosures as the indicators to measure TTP. Geraint and Johnes [27] used DEA to analyze the research efficiency of 36 British university economy departments from 1984 to 1988. They found that research expenditure, as research variable, enhances decision efficiency, indicating R&D expenditure has influence on research output.

Accordingly, SEM and DEA are popular techniques for the measure of TTP. SEM can help us construct the model and DEA can measure relative efficiency (or performance) and even give further managerial suggestions. According to the purpose of our study, DEA will be a better method for the purposes of this research.

2.3 Data Envelopment Analysis (DEA)

DEA is a linear programming method that can take into account multiple inputs and outputs simultaneously to measure relative efficiency of multiple homogenous DMUs in various contexts. In particular, the DEA model is a nonparametric one that does not require the assignment of predetermined weights to input and output factors. Indeed, DEA has been applied to efficiency measurement in various applications including the power industry [28-30], education [31], R&D performance [32], health care [33], banking [34-35], military [36], organization performance [37], project evaluation [38], and courts [39]. Extensive reviews and additional applications can be found in Seiford [40] and Charnes et al.[41].

The DEA approach was introduced by Charnes, Cooper, and Rhodes [42]; the first model is thus called the Charnes-Cooper-Rhodes (CCR) model. DEA model is developed to produce an efficiency frontier based on the concept of Pareto optimum. The DMUs that lie on the efficiency frontier are non-dominated and are thus called Pareto-optimal units or efficient DMUs. DMUs that do not lie on the efficiency frontier are deemed to be relatively inefficient.

Suppose there are N DMUs, with m input factors and n output factors. Let x_{ij} and y_{rj} denote the inputs and outputs of j th DMU $(i = 1...m, j = 1...N, r = 1...n)$. The efficiency of k th DMU is calculated by the following CCR model:

$$
\begin{aligned}
&(E_k)^{-1} = \max \lambda \\
&s.t. \\
&\sum_{j=1}^{N} x_{ij} z_j \le x_{ik}, i = 1,...,m; \\
&\sum_{j=1}^{N} y_{rj} z_j \ge \lambda y_{rk}, r = 1,...,n; \\
&z_j \ge 0
\end{aligned}
\tag{1}
$$

Since formula (1) evaluates the overall efficiency of DMU k only, it should be applied to each $k(k = 1,..., N)$ to evaluate all DMUs. The result $\lambda(\ge 1)$ expresses the factor by which the output of DMU k must be increased to achieve efficiency. The reciprocal of λ, E_k, denotes means the overall efficiency (E) of the DMU k. Since λ denotes how much the outputs should be increased proportionally to become efficient, the result from formula (1) is termed output-oriented [42].

Similarly, the input-oriented DEA model is as follows:

$$
\begin{aligned}
&(E_k) = \min \lambda \\
&s.t. \\
&\sum_{j=1}^{N} x_{ij} z_j \le \lambda x_{ik}, i = 1,...,m; \\
&\sum_{j=1}^{N} y_{rj} z_j \ge y_{rk}, r = 1,...,n; \\
&z_j \ge 0
\end{aligned}
\tag{2}
$$

The CCR model assumes constant returns to scale (CRS), implying that the producers are able to linearly scale the inputs and outputs without increasing or decreasing efficiency. Under this condition, the overall efficiency scores calculated by input-oriented and output-oriented CCR models are equal. Subsequently, Banker et al.[43] proposed the BCC model that assumes variable returns to scale (VRS) as follows.

$$
\begin{aligned}
&(TE_k)^{-1} = \max \lambda \\
&s.t. \\
&\sum_{j=1}^{N} x_{ij} z_j \le x_{ik}, i = 1,...,m; \\
&\sum_{j=1}^{N} y_{rj} z_j \ge \lambda y_{rk}, r = 1,...,n; \\
&\sum_{j=1}^{N} z_j = 1; \\
&z_j \ge 0
\end{aligned}
\tag{3}
$$

This approach forms a more restricted feasible region than the CCR model and thus, provides technical efficiency (TE) scores greater than or equal to those obtained assuming CRS. The result (TE_k) from the BCC model scores the technical efficiency of DMU k.

Furthermore, scale efficiency (SE_k) can be derived by comparing overall efficiency and TE as follows:

$$SE_k = \frac{E_k}{TE_k} \tag{4}$$

SE equal to unity indicates that this DMU is operating at the most productive scale, in which the overall efficiency equals its TE. Otherwise, the DMU could be at decreasing returns to scale if a proportional increase of all input levels produces a less than proportional increase in output levels, and *vice versa* for increasing returns to scale.

3 Methodology

3.1 Data

The data used in this research are collected from three sources: research expenditures, number of patents issued, number of invention disclosures, and license income are collected from AUTM licensing survey. School size which indicates the number of students for each university are collected from National Centre for Education Statistics (NCES). The details of published articles are collected from ARWU survey 2006.

This research will discuss the effect of research expenditures upon the license income. All the data of variables are for 2006; the data samples are based on AUTM licensing survey summary and compared with top 500 universities ranked by ARWU and NCES. This study selected the universities in the USA which are ranked in top 500 and participated in the AUTM survey and NCES. Since the license incomes vary largely among different universities, after taking logarithm, we will use the regression technology to analysis the license income and then finally derive the data set, i.e. technology transfer achievement in 94 outstanding universities in the USA.

3.2 Research model

Our research model is shown as Fig. 2. Inputs include research expenditures, school size, published articles, patents issued, and invention disclosures. All these five inputs are key components of technology transfer activities. Although there are many possible indicators which are able to measure the TTP, this study use license income as our major indicator for evaluating TTP according to the suggestion of Trune and Goslin [20], Jensen and Thursby [21], and Thursby and Thursby [22].

According to the concept of our research model (see Fig. 2), we also provide data summary which is shown in Table 1.

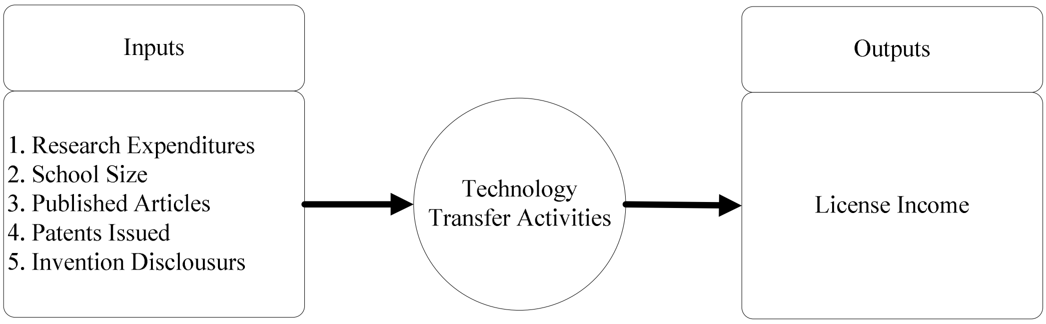

Fig. 2 Research Model

Table 1 Descriptive Statistics

	Inputs					Outputs
	Research Expenditures*	School Size	Published Articles	Patents Issued	Invention Disclosures	License Income*
Max	1,757,268,191	51,818	100	152	533	157,412,824
Min	12,599,334	696	17	1	2	1,792
Average	314,262,175	22,917	42	22	127	9,822,919
SD.	271,506,844	13,264	15	24	106	19,861,047

*U.S. dollars in 2006; SD. denotes standard deviation

3.3 Variables definition

3.3.1 Inputs variables

i. Research Expenditures

The Association of University Technology Managers (AUTM) license survey defined research expenditures as expenditures for research projects used by universities during a certain fiscal year funded by grants from the federal government, industry, foundations, voluntary health organizations (such as AHA, ACS, etc.), or other non-profit organizations. Indirect costs are to be included.

In the research, the data of research expenditures 2006 is based on AUTM survey 2006 and listed in U.S. dollars.

ii. School Size
This variable is based on NCES, using the number of registration in the universities in 2006 as the value of this variable. The total registration is the sum of undergraduates, postgraduates, and PhD students, and represents the school size.

iii. Published Articles
According to Wong and Singh [44], we use "papers" to represent the research publications based on the SCI sub-index from the ARWU. This SCI sub-index gives the university's score based on the number of its publications listed in the SCI and SSCI database, with the scores being normalized to a maximum of 100 for the university with the largest number of journal articles. The SCI sub-index is calculated on the basis of annual publication counts, with the data lagged by 1 year. We used the SCI sub-indices of 2007 (based on information gathered in 2006) by the ARWU.

iv. Patents Issued
According to the definition of AUTM, the number of patents issued equals the number of the American patents acquired by the institute in a certain fiscal year, including patents issued and patents reissued. The American patent number for each universities in 2006 used in this research is based on the AUTM survey 2006.

v. Invention Disclosures
The Bayh–Dole Act stipulates academics working on federal research grants must disclose their inventions to the TTO. Once the invention is formally disclosed, the TTO simultaneously evaluates the commercial potential of the technology and decides whether to patent the innovation [45]. Accordingly, applying invention disclosures is one of the pre-operations for protecting patent or intellectual property. The patent can be more effectively protected at a lower cost by submitting invention disclosures to the TTO and obtain a legal recognition for a certain period of time. According to the definition of AUTM, regardless of the level of invention disclosures, the invention disclosures will be count if only it is brought up within the fiscal year and recorded by the institute. The recorded invention disclosure number used in this research is drawn from the AUTM 2006 survey.

3.3.2 Output variable

License Income
According to the definition of AUTM, the license income equals the received license income from others subtracting payment for license to other institutes in a fiscal year, the formula is as follow:

$$LI = LIr - LIptoi$$

LI = Total License income
LIr = License income received
$LIptoi$ = License income paid to other institutions.

The received license income including license issue fee, payment under options, annual minimums, running royalty, termination fee, the amount of equity received when cashed-in, and the software and biological material end-user license fee which is not less than 1,000 U.S. dollars. The following items are not included in the license income: research funding, patent expense reimbursement, a valuation of equity not cashed-in, software and biological material end-user license fee which is less than 1,000 U.S. dollars, trade mark license royalties from university insignia, and the income from material sponsors which is transferred under Material Transfer Agreement, MTA.

Payment for license income to other institutes is the total amount paid to other institutes under inter-institutional agreement. This mount should be deducted from license income to avoid repeated calculation of license income. Besides, since the license incomes among different universities vary largely, this study applied logarithm of the original amount as the value of this variable to reduce sample differences without changing the characteristic of this sample, so as to reduce the possibility of error caused by the deviation value.

3.4 Slack-based measure (SBM)
Both DEA and super-efficiency model of modified data envelope analysis (MDEA) consider the weight of output to input, making use of a linear programming problem to measure efficiency value, which is called ratio efficiency. DEA and MDEA use radial to measure efficiency value, called radial efficiency. Although MDEA model could solve the problem of the original DEA efficiency value that is equal to 1, but it cannot estimate when the return-to-scale is variable.

Tone [46] proposes a slacks-based measure of efficiency (SBM), which is non-radial and deals with input/output slacks directly. The SBM returns an efficiency measurement between 0 and 1, and gives unity if and only if the DMU concerned is on the frontiers of the production possibility set with no input/output slacks. Because SBM used non-radial to measure efficiency value, it has no problem of measurement.

We formulate the following fractional program [SBM]:

n denotes the number of DMUs
m denotes the number of inputs
s denotes the number of

3.4.1 Constant returns-to-scale SBM model

$$\min \rho = \frac{1-\frac{1}{m}\sum_{i=1}^{m}\frac{s_i^-}{x_{io}}}{1+\frac{1}{s}(\sum_{i=1}^{s}\frac{s_i^+}{y_{i0}})}$$

$$\begin{aligned} & s.t. \\ & x_0 = X\lambda + s^- \\ & y_0 = Y\lambda - s^+ \\ & s^- \geq 0, s^+ \geq 0, \lambda \geq 0 \end{aligned} \quad (5)$$

x_0 : input quantity of DMUs
y_0 : output quantity of DMUs
s^- : input excess
s^+ : output shortfall

Model (6) can be transformed into an equivalent linear program using the Charnes-Cooper transformation as follows [47];

$$\begin{aligned} & \min \tau = t - \frac{1}{m}\sum_{r=1}^{m}\frac{s_i^-}{x_{i0}} \\ & 1 = t + \frac{1}{s}\sum_{r=1}^{s}\frac{s_i^+}{y_{i0}} \\ & s.t. \\ & tx_0 = X\Lambda + s^- \\ & ty_0 = Y\Lambda + s^+ \\ & \Lambda \geq 0, s^- \geq 0, s^+ \geq 0, t \geq 0 \end{aligned} \quad (6)$$

$$S^- = ts^-, S^+ = ts^+, \Lambda = t\lambda$$

denotes (6)'s optimal solution $(\tau^*, t^*, \Lambda^*, S^{-^*}, S^{+^*})$ then (5)'s SBM model optimal solution:

$$\rho^* = \pi^*, \lambda^* = \frac{\Lambda^*}{t^*}, s^{-^*} = \frac{S^{-^*}}{t^*}, s^{+^*} = \frac{S^{+^*}}{t^*} \quad (7)$$

When $\rho^* = 1$ of $DMU(x_0, y_0)$, it denotes SBM efficiency. It means DMU has no excess input or output shortfall.

In order to solve the problem of many DMUs efficiency being 1, Tone [48] proposes a slacks-based measure of super-efficiency to estimate DMUs efficiency. Super SBM is based on SBM to estimate $DMU(x_0, y_0)$'s super efficiency ρ^*, the model is as follow：

3.4.2 Constant returns-to-scale super SBM model

$$\delta^+ = \min \delta = \frac{\frac{1}{m}\sum_{i=1}^{m}\frac{\bar{x}_i}{x_{i0}}}{\frac{1}{s}\sum_{r=1}^{s}\frac{\bar{y}_r}{y_{r0}}}$$

$$\begin{aligned} & s.t. \\ & \bar{x} \geq \sum_{j=1,\leq\neq 0}^{s} \lambda_j x_j \\ & \bar{y} \geq \sum_{j=1,\neq 0}^{n} \lambda_j y_j \\ & \bar{x} \geq x_0, \bar{y} \leq y_0 \\ & \bar{y} \geq 0, \lambda \geq 0 \end{aligned} \quad (8)$$

Model (8) can be transformed into an equivalent linear program:

$$\begin{aligned} & \tau^* = \min \tau = \frac{1}{m}\sum_{i=1}^{m}\frac{\tilde{x}}{x_{i0}} \\ & 1 = \frac{1}{s}\sum_{r=1}^{s}\frac{\tilde{y}_r}{y_{r0}} \\ & s.t. \\ & \tilde{x} \geq \sum_{j=1,\leq 0}^{n} \Lambda_j x_j \\ & \tilde{y} \geq \sum_{j=1,\leq 0}^{n} \Lambda_j y_j \\ & \tilde{x} \geq tx_0, \tilde{y} \leq ty_0 \\ & \Lambda \geq 0, \tilde{y} \geq 0, t \geq 0 \end{aligned} \quad (9)$$

3.4.3 Variable returns-to-scale super SBM model

$$\delta^* = \min \delta = \frac{\frac{1}{m}\sum_{i=1}^{m}\frac{\bar{x}_i}{x_{i0}}}{\frac{1}{s}\sum_{r=1}^{s}\frac{\bar{y}_r}{y_{r0}}}$$

$$\begin{aligned} &s.t. \\ &\bar{x} \geq \sum_{j=1,\leq\neq 0}^{s} \lambda_j x_j \\ &\bar{y} \leq \sum_{j=1,\neq 0}^{n} \lambda_j y_j \\ &\sum_{j=1,\neq 0}^{n} \lambda_j = 1 \\ &\bar{x} \geq x_0, \bar{y} \leq y_0 \\ &\bar{y} \geq 0, \lambda \geq 0 \end{aligned} \tag{10}$$

4 Results

4.1 Correlation analysis

Using DEA to evaluate the efficiency of college technology transfer, the selection of input and output variables will influence on the correction of final efficiency value or not. As a result, this research uses Pearson correlation coefficient to test the correlation and significance level between input and output. All factors are proved to be positively and significantly correlated ($p < 0.05$) except for school size. In the following process, we will exclude school size in order to meet Isotonicity hypothesis. The correlation matrix is shown in Table 2.

Table 2 Correlation Matrix

	Research Expenditures	School Size (Number of Students)	Published Articles	Patents Issued	Invention Disclosures	License Income
Research Expenditures	1.00					
School Size	0.24 *	1.00				
Published Articles	0.78 **	0.42 **	1.00			
Patents Issued	0.68 **	0.15	0.60 **	1.00		
Invention Disclosures	0.76 **	0.20	0.69 **	0.85 **	1.00	
License Income	0.27 *	0.19	0.38 **	0.25 *	0.31 **	1.00

* denotes significant at 0.05 level; ** denotes significant at 0.01 level

4.2 Model efficiency score and rank

We use DEA-Solver-Pro 6.0 to calculate efficiency scores. In the CCR and SBM model, the efficiency score 1 means relatively efficient and the efficiency score smaller than 1 means relatively inefficient. In the Super SBM model, the efficiency score can be larger than 1, so it is more sensitive and with higher accuracy. The results are shown in Table 3. In the CCR model, the measurement of TTP for 94 colleges, efficiency score of two (DMU31, DMU91) of them is equal to 1, that means they are relatively efficient. And there are 92 colleges with no efficiency because their efficiency scores are smaller than 1. In the SBM model, efficiency scores of 9 colleges (DMU27, DMU29, DMU31, DMU41, DMU43, DMU62, DMU70, DMU84, DMU91) are 1, that means they are relatively efficient. And there are 85 colleges with no efficiency because their efficiency scores are smaller than 1. In the Super SBM model, there are 9 colleges' (DMU27, DMU29, DMU31, DMU41, DMU43, DMU62, DMU70, DMU84, DMU91) efficiency scores equal to 1, indicating they are relatively efficient. And there are 85 colleges with no efficiency because their efficiency scores are smaller than 1. The results of Super SBM and SBM model are highly similar.

Table 3 Efficiency rank and score

No.	DMU	CCR		SBM		Super SBM	
		Score	Rank	Score	Rank	Score	Rank
1	Arizona State Univ.	0.034	42	0.188	67	0.188	67
2	Auburn Univ.	0.008	71	0.267	38	0.267	38
3	Brigham Young Univ.	0.157	14	0.441	14	0.441	14
4	California Inst. of Technology	0.09	24	0.137	82	0.137	82
5	Carnegie Mellon Univ.	0.056	32	0.212	58	0.212	58
6	Case Western Reserve Univ.	0.104	22	0.248	42	0.248	42
7	Clemson Univ.	0.03	46	0.28	33	0.28	33
8	Colorado State Univ.	0.016	54	0.247	43	0.247	43
9	Cornell Research Fdn., Inc.	0.032	43	0.106	93	0.106	93
10	Dartmouth College	0.055	34	0.268	37	0.268	37
11	Drexel Univ.	0.004	90	0.348	24	0.348	24
12	Duke Univ.	0.023	51	0.115	89	0.115	89
13	Emory Univ.	0.125	17	0.228	49	0.228	49
14	Florida State Univ.	0.014	57	0.217	55	0.217	55
15	George Mason Univ.	0.003	91	0.389	21	0.389	21
16	Georgetown Univ.	0.155	15	0.404	18	0.404	18
17	Georgia Inst. of Technology	0.014	59	0.136	84	0.136	84
18	Harvard Univ.	0.072	27	0.124	87	0.124	87
19	Indiana Univ. (ARTI)	0.071	28	0.236	46	0.236	46
20	Iowa State Univ.	0.056	33	0.199	61	0.199	61
21	Johns Hopkins Univ.	0.07	29	0.105	94	0.105	94
22	Kansas State Univ. Research Fdn.	0.027	48	0.404	19	0.404	19
23	Massachusetts Inst. of Technology (MIT)	0.241	8	0.158	75	0.158	75
24	Medical College of Wisconsin Research Fdn.	0.012	62	0.75	10	0.75	10
25	Medical Univ. of South Carolina	0.014	60	0.441	13	0.441	13
26	Michigan State Univ.	0.028	47	0.156	76	0.156	76
27	Michigan Technological Univ.	0.014	58	1	1	1.022	6
28	Mississippi State Univ.	0.007	81	0.283	32	0.283	32
29	Montana State Univ.	0.007	79	1	1	1.069	5
30	Mount Sinai School of Medicine of NYU	0.368	3	0.497	12	0.497	12
31	New York Univ.	1	1	1	1	1	9
32	Northeastern Univ.	0.012	65	0.322	26	0.322	26
33	Northwestern Univ.	0.207	11	0.269	35	0.269	35
34	Ohio State Univ.	0.005	83	0.115	90	0.115	90

35	Oregon Health & Science Univ.	0.008	74	0.226	51	0.226	51
36	Oregon State Univ.	0.025	50	0.25	41	0.25	41
37	Penn State Univ.	0.008	72	0.112	91	0.112	91
38	Purdue Research Fdn.	0.026	49	0.136	83	0.136	83
39	Rensselaer Polytechnic Inst.	0.005	82	0.292	31	0.292	31
40	Rice Univ.	0.007	78	0.225	53	0.225	53
41	Southern Methodist Univ.	0.001	93	1	1	4.102	1
42	Tufts Univ.	0.02	52	0.216	57	0.216	57
43	Tulane Univ.	0.356	4	1	1	1.094	4
44	Univ. of Akron	0.047	39	0.406	17	0.406	17
45	Univ. of Arizona	0.013	61	0.155	77	0.155	77
46	Univ. of Central Florida	0.009	70	0.218	54	0.218	54
47	Univ. of Chicago/UCTech	0.061	31	0.183	69	0.183	69
48	Univ. of Cincinnati	0.005	85	0.202	60	0.202	60
49	Univ. of Colorado	0.17	12	0.237	45	0.237	45
50	Univ. of Connecticut	0.008	73	0.184	68	0.184	68
51	Univ. of Delaware	0.004	89	0.298	30	0.298	30
52	Univ. of Florida	0.224	9	0.195	63	0.195	63
53	Univ. of Georgia	0.141	16	0.268	36	0.268	36
54	Univ. of Illinois, Chicago, Urbana	0.074	26	0.149	79	0.149	79
55	Univ. of Iowa Research Fdn.	0.122	18	0.226	50	0.226	50
56	Univ. of Kansas	0.005	86	0.429	15	0.429	15
57	Univ. of Kentucky Research Fdn.	0.007	75	0.175	72	0.175	72
58	Univ. of Louisville	0.001	92	0.367	22	0.367	22
59	Univ. of Maryland, Baltimore County	0.005	84	0.389	20	0.389	20
60	Univ. of Maryland, College Park	0.012	64	0.144	81	0.144	81
61	Univ. of Massachusetts	0.246	7	0.306	29	0.306	29
62	Univ. of Miami	0.046	40	1	1	1.25	3
63	Univ. of Michigan	0.091	23	0.116	88	0.116	88
64	Univ. of Minnesota	0.287	6	0.27	34	0.27	34
65	Univ. of Nebraska	0.012	63	0.195	62	0.195	62
66	Univ. of New Hampshire	0.005	87	0.427	16	0.427	16
67	Univ. of New Mexico/Sci. & Tech. Corp.	0.007	76	0.211	59	0.211	59
68	Univ. of North Carolina, Chapel Hill	0.016	56	0.125	86	0.125	86
69	Univ. of Oklahoma, All Campuses	0.007	80	0.246	44	0.246	44
70	Univ. of Oregon	0.108	21	1	1	1.017	7
71	Univ. of Pennsylvania	0.04	41	0.106	92	0.106	92
72	Univ. of Pittsburgh	0.055	36	0.148	80	0.148	80

73	Univ. of Rhode Island	0.03	45	0.522	11	0.522	11
74	Univ. of Rochester	0.302	5	0.317	27	0.317	27
75	Univ. of South Carolina	0.004	88	0.229	48	0.229	48
76	Univ. of South Florida	0.016	55	0.178	71	0.178	71
77	Univ. of Southern California	0.011	68	0.127	85	0.127	85
78	Univ. of Tennessee	0.011	67	0.191	65	0.191	65
79	Univ. of Texas at Austin	0.055	35	0.151	78	0.151	78
80	Univ. of Texas Health Science Ctr., Houston	0.052	38	0.365	23	0.365	23
81	Univ. of Texas Medical Branch	0.011	66	0.254	40	0.254	40
82	Univ. of Texas Southwestern Med. Ctr.	0.111	20	0.217	56	0.217	56
83	Univ. of Utah	0.117	19	0.225	52	0.225	52
84	Univ. of Vermont	0	94	1	1	1.003	8
85	Univ. of Virginia Patent Fdn.	0.032	44	0.188	66	0.188	66
86	Univ. of Washington/Wash. Res. Fdn.	0.167	13	0.169	73	0.169	73
87	Univ. of Wisconsin at Madison	0.216	10	0.166	74	0.166	74
88	Utah State Univ.	0.007	77	0.325	25	0.325	25
89	Vanderbilt Univ.	0.063	30	0.192	64	0.192	64
90	Virginia Commonwealth Univ.	0.018	53	0.262	39	0.262	39
91	Wake Forest Univ.	1	1	1	1	1.46	2
92	Washington State Univ. Research Fdn.	0.01	69	0.307	28	0.307	28
93	Washington Univ. St. Louis	0.074	25	0.181	70	0.181	70
94	Wayne State Univ.	0.052	37	0.236	47	0.236	47

4.3 Strategy analysis for improving license income

Judging by Table 3, SBM and Super SBM are highly similar in the measurement of efficiency, but they are significantly different in the result of ranking. In the Super SBM, owing to the efficiency score may be larger than 1, the efficiency rank is clearer. The ranking is more definite, so no same ranking problem in the SBM, which is helpful for appraisal of technology transfer performance and budget allocation. As a result, this study applied slack analysis of Super SBM model between input and output variables in order to obtain the reasonable score for DMUs; moreover, we can also evaluate the difference between practical and ideal (or efficiency) value. Hence, we can offer suggestions and adjust technology transfer strategy based on the results of Super SBM. For example, DMU1 in the research expenditures is 131,814,265 U.S. dollars, its projection level with efficiency is 16,814,627.6 U.S. dollars, and its efficiency difference is -114,999,637.4, or -87.24 % (see appendix 1).

4.4 Comparisons

Table 4 shows top 10 efficiency rankings and scores. Compared to CCR model, SBM and Super SBM models have great difference in score and ranking. The efficiency ranking is not clear in the SBM model because there are nine DMUs with the same efficiency score (equal to 1). In order to avoid such disadvantage of SBM model, we make use of Super SBM model to analyze our data. Based on Super SBM, we observed that DMU41 has greatest TTP efficiency (score=4.102; rank=1). Table 5 shows the last 10 efficiency rankings and scores. Similar to Table 4, CCR model has great difference as SBM and Super SBM models. In this part, SBM and Super SBM have same results in score and ranking.

Table 4 Top 10 efficiency rank and score

	CCR			SBM			Super SBM	
DMU	Score	Rank	DMU	Score	Rank	DMU	Score	Rank
DMU31	1.000	1	DMU27	1.000	1	DMU41	4.102	1
DMU91	1.000	1	DMU29	1.000	1	DMU91	1.460	2
DMU30	0.368	3	DMU31	1.000	1	DMU62	1.250	3
DMU43	0.356	4	DMU41	1.000	1	DMU43	1.094	4
DMU74	0.302	5	DMU43	1.000	1	DMU29	1.069	5
DMU64	0.287	6	DMU62	1.000	1	DMU27	1.022	6
DMU61	0.246	7	DMU70	1.000	1	DMU70	1.017	7
DMU23	0.241	8	DMU84	1.000	1	DMU84	1.003	8
DMU52	0.224	9	DMU91	1.000	1	DMU31	1.000	9
DMU87	0.216	10	DMU24	0.750	10	DMU24	0.750	10

Table 5 Last 10 Efficiency rank and score

	CCR			SBM			Super SBM	
DMU	Score	Rank	DMU	Score	Rank	DMU	Score	Rank
DMU84	0.005	85	DMU21	0.127	85	DMU21	0.127	85
DMU41	0.005	86	DMU9	0.125	86	DMU9	0.125	86
DMU58	0.005	87	DMU71	0.124	87	DMU71	0.124	87
DMU15	0.004	88	DMU37	0.116	88	DMU37	0.116	88
DMU11	0.004	89	DMU34	0.115	89	DMU34	0.115	89
DMU51	0.004	90	DMU12	0.115	90	DMU12	0.115	90
DMU75	0.003	91	DMU63	0.112	91	DMU63	0.112	91
DMU66	0.001	92	DMU18	0.106	92	DMU18	0.106	92
DMU56	0.001	93	DMU68	0.106	93	DMU68	0.106	93
DMU48	0.000	94	DMU77	0.105	94	DMU77	0.105	94

4.5 Strategy for improving university's license income

Based on Table 5, we list 10 universities (DMU21, DMU9, DMU71, DMU37, DMU34, DMU12, DMU63, DMU18, DMU68, DMU77) with poorest technology transfer efficiency according to Super SBM models. Then we propose improving strategy, which is show in Table 6. Let us make an example, for DMU21, in order to reach the efficiency of current output (which means obtaining 13,938,457 U.S. dollars of license income), it has to decrease 1,727,120,581 U.S. dollars in research expenditures, 46 published articles, 78 patents issued and 352 invention disclosures. In other words, DMU21 over invested in research expenditures, publications, patents and invention disclosures. And if it wants to reach the efficient level, it should lower its inputs.

Table 6 Improving strategy for last 10 DMUs

DMU No.	DMU I/O	Rank	Score Data	Projection	Difference	%
DMU21		85	0.105			
	Research Expenditures		1,757,268,191	30,147,610	-1,727,120,581	(0.983)
	Published Articles		68	22	-46	(0.681)
	Patents Issued		82	4	-78	(0.946)
	Invention Disclosures		363	11	-352	(0.970)
	License Income		13,938,457	13,938,457	0	0.000
DMU9		86	0.106			
	Research Expenditures		605,341,000	20,309,267	-585,031,733	(0.966)
	Published Articles		65	20	-45	(0.695)
	Patents Issued		59	4	-55	(0.939)
	Invention Disclosures		237	6	-231	(0.975)
	License Income		6,125,000	6,125,000	0	0.000
DMU71		87	0.106			
	Research Expenditures		640,224,563	22,991,385	-617,233,178	(0.964)
	Published Articles		71	20	-50	(0.713)
	Patents Issued		49	4	-45	(0.922)
	Invention Disclosures		306	7	-299	(0.977)
	License Income		8,255,096	8,255,096	0	0.000
DMU37		88	0.112			
	Research Expenditures		656,634,000	14,294,794	-642,339,206	(0.978)
	Published Articles		58	19	-39	(0.676)
	Patents Issued		37	3	-34	(0.915)
	Invention Disclosures		152	3	-149	(0.981)
	License Income		1,348,400	1,348,400	0	0.000
DMU34		89	0.115			
	Research Expenditures		652,328,819	13,789,370	-638,539,449	(0.979)
	Published Articles		61	19	-42	(0.694)
	Patents Issued		27	3	-24	(0.885)
	Invention Disclosures		145	3	-142	(0.982)
	License Income		947,000	947,000	0	0.000
DMU12		90	0.115			
	Research Expenditures		589,637,000	17,790,390	-571,846,610	(0.970)
	Published Articles		62	19	-43	(0.687)
	Patents Issued		39	3	-36	(0.912)
	Invention Disclosures		160	5	-155	(0.971)
	License Income		4,124,547	4,124,547	0	0.000

DMU63		91	0.116			
	Research Expenditures		796,963,386	38,332,448	-758,630,938	(0.952)
	Published Articles		77	23	-54	(0.700)
	Patents Issued		79	5	-74	(0.936)
	Invention Disclosures		288	15	-273	(0.948)
	License Income		20,438,727	20,438,727	0	0.000
DMU18		92	0.124			
	Research Expenditures		623,958,100	38,850,295	-585,107,805	(0.938)
	Published Articles		100	23	-77	(0.768)
	Patents Issued		35	5	-30	(0.854)
	Invention Disclosures		277	15	-262	(0.945)
	License Income		20,849,993	20,849,993	0	0.000
DMU68		93	0.125			
	Research Expenditures		583,996,531	15,619,152	-568,377,379	(0.973)
	Published Articles		60	19	-41	(0.683)
	Patents Issued		27	3	-24	(0.880)
	Invention Disclosures		97	4	-93	(0.964)
	License Income		2,400,184	2,400,184	0	0.000
DMU77		94	0.127			
	Research Expenditures		431,000,000	14,691,676	-416,308,324	(0.966)
	Published Articles		53	19	-34	(0.642)
	Patents Issued		34	3	-31	(0.907)
	Invention Disclosures		131	3	-128	(0.977)
	License Income		1,663,597	1,663,597	0	0.000

5. Conclusions and Implications

Our research offers a direct and precise method for efficiency evaluation in TTP. The efficiency evaluation technique employed in this paper can provide another insight to analyze the performance of TTP in U.S. universities. The implication of the DEA efficiency results is to derive the efficiency level of a university's R&D activity from the observed performance of peer U.S. universities. It also helps identifying the benchmarking of U.S. universities, which would be valuable information for improving their TTP performance and R&D strategies. In detail, benchmarks are provided to improve their weakness of R&D strategy, budget arrangement, and R&D resource allocation of poorly performing U.S. universities.

Considering that TTP is also a critical part of management activity for increasing financial resources in universities, more researches can be devoted to evaluating TTP efficiency and to addressing relevant strategies to improve it. We use CCR, SBM and Super SBM models to analyze our technology transfer data and also observed the difference between each model. CCR and SBM models have great difference in the value of efficiency score and ranking. Compared to SBM model, Super SBM model can increase the discriminating power of DEA and provide more precise score in ranking these universities. According to the result of Super SBM, this study hopes that we can provide a direction of improving their strategies in these universities with poor technology transfer efficiency. With the information provided by our analysis, a university manager can recheck their policy constraints and evaluate the effectiveness of TTP activities. This facilitates the allocation of resources to generate the potential for higher performance. The Super SBM approach may act as a tool for dealing with similar managerial issues, and the results should provide valuable information for management.

However, some non-quantifiable factors may also affect the performance of TTP in universities besides the quantitative factors that were included in this study. A critical success factor of TTP in the university is to create the appropriate combination of incentive mechanism to help the research groups as well as to the individual scholars and the proceeds from their transfer activities [23]. In addition, university outcomes performance is highly correlated with resources, capabilities, and institutional, financial, commercial, and personnel cost based on resource-based perspective [9].

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Appendix

Results of Super SBM model

MDU No.	DMU I/O	Score Data	Projection	Difference	%
DMU1		0.188			
	Research Expenditures	131814265.000	16814627.600	(114999637.400)	(0.872)
	Published Articles	42.700	19.253	(23.447)	(0.549)
	Patents Issued	23.000	3.340	(19.660)	(0.855)
	Invention Disclosures	154.000	4.106	(149.894)	(0.973)
	License Income	3349612.000	3349612.000	0.000	0.000
DMU 2		0.267			
	Research Expenditures	126522000.000	13478119.900	(113043880.100)	(0.894)
	Published Articles	29.700	18.657	(11.043)	(0.372)
	Patents Issued	10.000	3.071	(6.929)	(0.693)
	Invention Disclosures	93.000	2.439	(90.561)	(0.974)
	License Income	699810.000	699810.000	0.000	0.000
DMU 3		0.441			
	Research Expenditures	26108921.000	16463147.467	(9645773.533)	(0.369)
	Published Articles	25.300	19.190	(6.110)	(0.242)
	Patents Issued	10.000	3.312	(6.688)	(0.669)
	Invention Disclosures	94.000	3.930	(90.070)	(0.958)
	License Income	3070472.000	3070472.000	0.000	0.000
DMU 4		0.137			
	Research Expenditures	411126907.000	29260887.392	(381866019.608)	(0.929)
	Published Articles	50.300	21.476	(28.824)	(0.573)
	Patents Issued	152.000	4.345	(147.655)	(0.971)
	Invention Disclosures	533.000	10.322	(522.678)	(0.981)
	License Income	13234236.000	13234236.000	0.000	0.000
DMU 5		0.212			
	Research Expenditures	243259000.000	20209313.233	(223049686.767)	(0.917)
	Published Articles	36.700	19.859	(16.841)	(0.459)
	Patents Issued	21.000	3.614	(17.386)	(0.828)
	Invention Disclosures	111.000	5.801	(105.199)	(0.948)
	License Income	6045618.000	6045618.000	0.000	0.000
DMU 6		0.248			
	Research Expenditures	290530274.000	36430611.680	(254099662.320)	(0.875)
	Published Articles	43.000	21.118	(21.882)	(0.509)
	Patents Issued	10.000	3.000	(7.000)	(0.700)
	Invention Disclosures	174.000	13.401	(160.599)	(0.923)
	License Income	10794377.000	10794377.000	0.000	0.000

DMU 7		0.280			
	Research Expenditures	116258121.000	15682459.650	(100575661.350)	(0.865)
	Published Articles	28.300	19.050	(9.250)	(0.327)
	Patents Issued	13.000	3.249	(9.751)	(0.750)
	Invention Disclosures	56.000	3.540	(52.460)	(0.937)
	License Income	2450462.000	2450462.000	0.000	0.000
DMU 8		0.247			
	Research Expenditures	267400000.000	13943819.114	(253456180.886)	(0.948)
	Published Articles	38.900	18.740	(20.160)	(0.518)
	Patents Issued	8.000	3.109	(4.891)	(0.611)
	Invention Disclosures	42.000	2.672	(39.328)	(0.936)
	License Income	1069661.000	1069661.000	0.000	0.000
DMU 9		0.106			
	Research Expenditures	605341000.000	20309267.363	(585031732.637)	(0.966)
	Published Articles	65.100	19.877	(45.223)	(0.695)
	Patents Issued	59.000	3.622	(55.378)	(0.939)
	Invention Disclosures	237.000	5.851	(231.149)	(0.975)
	License Income	6125000.000	6125000.000	0.000	0.000
DMU 10		0.268			
	Research Expenditures	190632094.000	16730699.977	(173901394.023)	(0.912)
	Published Articles	32.100	19.238	(12.862)	(0.401)
	Patents Issued	12.000	3.333	(8.667)	(0.722)
	Invention Disclosures	38.000	4.064	(33.936)	(0.893)
	License Income	3282958.000	3282958.000	0.000	0.000
DMU 11		0.348			
	Research Expenditures	102156000.000	13057200.185	(89098799.815)	(0.872)
	Published Articles	29.000	18.550	(10.450)	(0.360)
	Patents Issued	5.000	3.000	(2.000)	(0.400)
	Invention Disclosures	95.000	2.219	(92.781)	(0.977)
	License Income	209204.000	209204.000	0.000	0.000
DMU 12		0.115			
	Research Expenditures	589637000.000	17790389.787	(571846610.213)	(0.970)
	Published Articles	62.000	19.427	(42.573)	(0.687)
	Patents Issued	39.000	3.419	(35.581)	(0.912)
	Invention Disclosures	160.000	4.593	(155.407)	(0.971)
	License Income	4124547.000	4124547.000	0.000	0.000
DMU 13		0.228			
	Research Expenditures	366020127.000	34997837.941	(331022289.059)	(0.904)
	Published Articles	48.600	22.500	(26.100)	(0.537)
	Patents Issued	19.000	4.808	(14.192)	(0.747)
	Invention Disclosures	130.000	13.188	(116.812)	(0.899)
	License Income	17790432.000	17790432.000	0.000	0.000

DMU 14		0.217			
	Research Expenditures	189229916.000	14031888.093	(175198027.907)	(0.926)
	Published Articles	39.000	18.756	(20.244)	(0.519)
	Patents Issued	12.000	3.116	(8.884)	(0.740)
	Invention Disclosures	51.000	2.716	(48.284)	(0.947)
	License Income	1139604.000	1139604.000	0.000	0.000
DMU 15		0.389			
	Research Expenditures	69524779.000	12777349.302	(56747429.698)	(0.816)
	Published Articles	25.600	18.532	(7.068)	(0.276)
	Patents Issued	5.000	3.014	(1.986)	(0.397)
	Invention Disclosures	48.000	2.089	(45.911)	(0.957)
	License Income	143269.000	143269.000	0.000	0.000
DMU 16		0.404			
	Research Expenditures	197683529.000	31316438.259	(166367090.741)	(0.842)
	Published Articles	33.400	20.556	(12.844)	(0.385)
	Patents Issued	5.000	3.000	(2.000)	(0.400)
	Invention Disclosures	45.000	10.954	(34.046)	(0.757)
	License Income	8478309.000	8478309.000	0.000	0.000
DMU 17		0.136			
	Research Expenditures	467724048.000	14885235.368	(452838812.632)	(0.968)
	Published Articles	44.800	18.908	(25.892)	(0.578)
	Patents Issued	39.000	3.185	(35.815)	(0.918)
	Invention Disclosures	366.000	3.142	(362.858)	(0.991)
	License Income	1817319.000	1817319.000	0.000	0.000
DMU 18		0.124			
	Research Expenditures	623958100.000	38850295.157	(585107804.843)	(0.938)
	Published Articles	100.000	23.188	(76.812)	(0.768)
	Patents Issued	35.000	5.119	(29.881)	(0.854)
	Invention Disclosures	277.000	15.112	(261.888)	(0.945)
	License Income	20849993.000	20849993.000	0.000	0.000
DMU 19		0.236			
	Research Expenditures	380815996.000	27448735.141	(353367260.859)	(0.928)
	Published Articles	39.900	20.131	(19.769)	(0.496)
	Patents Issued	9.000	3.000	(6.000)	(0.667)
	Invention Disclosures	257.000	9.104	(247.896)	(0.965)
	License Income	6726733.000	6726733.000	0.000	0.000
DMU 20		0.199			
	Research Expenditures	248458000.000	21681061.055	(226776938.945)	(0.913)
	Published Articles	44.000	20.122	(23.878)	(0.543)
	Patents Issued	19.000	3.733	(15.267)	(0.804)
	Invention Disclosures	120.000	6.536	(113.464)	(0.946)
	License Income	7214457.000	7214457.000	0.000	0.000

DMU 21		0.105			
	Research Expenditures	1757268191.000	30147609.792	(1727120581.208)	(0.983)
	Published Articles	67.900	21.634	(46.266)	(0.681)
	Patents Issued	82.000	4.417	(77.583)	(0.946)
	Invention Disclosures	363.000	10.765	(352.235)	(0.970)
	License Income	13938457.000	13938457.000	0.000	0.000
DMU 22		0.404			
	Research Expenditures	98283021.000	15515018.316	(82768002.684)	(0.842)
	Published Articles	29.900	18.820	(11.080)	(0.371)
	Patents Issued	4.000	3.000	(1.000)	(0.250)
	Invention Disclosures	43.000	3.395	(39.605)	(0.921)
	License Income	1322282.000	1322282.000	0.000	0.000
DMU 23		0.158			
	Research Expenditures	1212800000.000	67370132.778	(1145429867.222)	(0.945)
	Published Articles	61.700	28.282	(33.418)	(0.542)
	Patents Issued	121.000	7.421	(113.579)	(0.939)
	Invention Disclosures	523.000	29.357	(493.643)	(0.944)
	License Income	43500000.000	43500000.000	0.000	0.000
DMU 24		0.750			
	Research Expenditures	104282102.000	102551657.282	(1730444.718)	(0.017)
	Published Articles	28.700	21.853	(6.847)	(0.239)
	Patents Issued	2.000	2.000	0.000	0.000
	Invention Disclosures	130.000	33.087	(96.913)	(0.746)
	License Income	499602.000	499602.000	0.000	0.000
DMU 25		0.441			
	Research Expenditures	150088251.000	13912105.449	(136176145.551)	(0.907)
	Published Articles	30.500	18.644	(11.856)	(0.389)
	Patents Issued	3.000	3.000	(0.000)	0.000
	Invention Disclosures	43.000	2.628	(40.372)	(0.939)
	License Income	596367.000	596367.000	0.000	0.000
DMU 26		0.156			
	Research Expenditures	358097000.000	17863443.360	(340233556.640)	(0.950)
	Published Articles	51.000	19.440	(31.560)	(0.619)
	Patents Issued	21.000	3.425	(17.575)	(0.837)
	Invention Disclosures	156.000	4.629	(151.371)	(0.970)
	License Income	4182565.000	4182565.000	0.000	0.000
DMU 27		1.022			
	Research Expenditures	44199616.000	44199616.000	0.000	0.000
	Published Articles	17.100	18.603	1.503	0.088
	Patents Issued	8.000	8.000	0.000	0.000
	Invention Disclosures	41.000	41.000	0.000	0.000
	License Income	462675.000	462675.000	0.000	0.000

DMU 28		0.283			
	Research Expenditures	189917000.000	13196794.768	(176720205.232)	(0.931)
	Published Articles	24.800	18.607	(6.193)	(0.250)
	Patents Issued	11.000	3.048	(7.952)	(0.723)
	Invention Disclosures	67.000	2.298	(64.702)	(0.966)
	License Income	476386.000	476386.000	0.000	0.000
DMU 29		1.069			
	Research Expenditures	103048865.000	103048865.000	0.000	0.000
	Published Articles	21.500	26.505	5.005	0.233
	Patents Issued	2.000	2.085	0.085	0.042
	Invention Disclosures	32.000	32.000	0.000	0.000
	License Income	219931.000	219931.000	0.000	0.000
DMU 30		0.497			
	Research Expenditures	269562764.000	57131621.422	(212431142.578)	(0.788)
	Published Articles	34.500	23.393	(11.107)	(0.322)
	Patents Issued	6.000	3.000	(3.000)	(0.500)
	Invention Disclosures	39.000	23.304	(15.696)	(0.403)
	License Income	20169293.000	20169293.000	0.000	0.000
DMU 31		1.000			
	Research Expenditures	210804000.000	210804000.000	0.000	0.000
	Published Articles	53.900	53.900	0.000	0.000
	Patents Issued	19.000	19.000	0.000	0.000
	Invention Disclosures	101.000	101.000	0.000	0.000
	License Income	157412824.000	157412824.000	0.000	0.000
DMU 32		0.322			
	Research Expenditures	52991546.000	13191614.610	(39799931.390)	(0.751)
	Published Articles	24.500	18.606	(5.894)	(0.241)
	Patents Issued	13.000	3.048	(9.952)	(0.766)
	Invention Disclosures	52.000	2.296	(49.704)	(0.956)
	License Income	472272.000	472272.000	0.000	0.000
DMU 33		0.269			
	Research Expenditures	348439588.000	78818208.996	(269621379.004)	(0.774)
	Published Articles	57.000	25.776	(31.224)	(0.548)
	Patents Issued	15.000	3.000	(12.000)	(0.800)
	Invention Disclosures	170.000	33.678	(136.322)	(0.802)
	License Income	29990550.000	29990550.000	0.000	0.000
DMU 34		0.115			
	Research Expenditures	652328819.000	13789370.075	(638539448.925)	(0.979)
	Published Articles	61.200	18.712	(42.488)	(0.694)
	Patents Issued	27.000	3.096	(23.904)	(0.885)
	Invention Disclosures	145.000	2.594	(142.406)	(0.982)
	License Income	947000.000	947000.000	0.000	0.000

DMU 35		0.226			
	Research Expenditures	257302253.000	14184630.336	(243117622.664)	(0.945)
	Published Articles	35.700	18.674	(17.026)	(0.477)
	Patents Issued	10.000	3.000	(7.000)	(0.700)
	Invention Disclosures	115.000	2.758	(112.242)	(0.976)
	License Income	719786.000	719786.000	0.000	0.000
DMU 36		0.250			
	Research Expenditures	189606000.000	14963583.682	(174642416.318)	(0.921)
	Published Articles	37.700	18.922	(18.778)	(0.498)
	Patents Issued	9.000	3.191	(5.809)	(0.646)
	Invention Disclosures	49.000	3.181	(45.819)	(0.935)
	License Income	1879542.000	1879542.000	0.000	0.000
DMU 37		0.112			
	Research Expenditures	656634000.000	14294794.326	(642339205.674)	(0.978)
	Published Articles	58.000	18.803	(39.197)	(0.676)
	Patents Issued	37.000	3.137	(33.863)	(0.915)
	Invention Disclosures	152.000	2.847	(149.153)	(0.981)
	License Income	1348400.000	1348400.000	0.000	0.000
DMU 38		0.136			
	Research Expenditures	388500000.000	17411427.368	(371088572.632)	(0.955)
	Published Articles	51.300	19.359	(31.941)	(0.623)
	Patents Issued	32.000	3.388	(28.612)	(0.894)
	Invention Disclosures	256.000	4.404	(251.596)	(0.983)
	License Income	3823581.000	3823581.000	0.000	0.000
DMU 39		0.292			
	Research Expenditures	64277619.000	12920682.532	(51356936.468)	(0.799)
	Published Articles	27.100	18.557	(8.543)	(0.315)
	Patents Issued	12.000	3.026	(8.974)	(0.748)
	Invention Disclosures	75.000	2.161	(72.839)	(0.971)
	License Income	257102.000	257102.000	0.000	0.000
DMU 40		0.225			
	Research Expenditures	81693556.000	13139650.601	(68553905.399)	(0.839)
	Published Articles	30.000	18.596	(11.404)	(0.380)
	Patents Issued	34.000	3.044	(30.956)	(0.911)
	Invention Disclosures	77.000	2.270	(74.730)	(0.971)
	License Income	431003.000	431003.000	0.000	0.000
DMU 41		4.102			
	Research Expenditures	12599334.000	56705432.940	44106098.940	3.501
	Published Articles	18.500	19.900	1.400	0.076
	Patents Issued	3.000	4.000	1.000	0.333
	Invention Disclosures	2.000	19.000	17.000	8.500
	License Income	1792.000	1792.000	0.000	0.000

DMU 42		0.216			
	Research Expenditures	136171347.000	14168122.216	(122003224.784)	(0.896)
	Published Articles	37.900	18.780	(19.120)	(0.505)
	Patents Issued	16.000	3.127	(12.873)	(0.805)
	Invention Disclosures	41.000	2.784	(38.216)	(0.932)
	License Income	1247799.000	1247799.000	0.000	0.000
DMU 43		1.094			
	Research Expenditures	136030929.000	136030929.000	0.000	0.000
	Published Articles	28.100	28.100	0.000	0.000
	Patents Issued	2.000	2.751	0.751	0.376
	Invention Disclosures	14.000	14.000	0.000	0.000
	License Income	6763692.000	6763692.000	0.000	0.000
DMU 44		0.406			
	Research Expenditures	53988492.000	14963762.482	(39024729.518)	(0.723)
	Published Articles	21.200	18.922	(2.278)	(0.107)
	Patents Issued	8.000	3.191	(4.809)	(0.601)
	Invention Disclosures	57.000	3.181	(53.819)	(0.944)
	License Income	1879684.000	1879684.000	0.000	0.000
DMU 45		0.155			
	Research Expenditures	535846792.000	14723481.980	(521123310.020)	(0.973)
	Published Articles	54.600	18.879	(35.721)	(0.654)
	Patents Issued	15.000	3.171	(11.829)	(0.789)
	Invention Disclosures	90.000	3.061	(86.939)	(0.966)
	License Income	1688857.000	1688857.000	0.000	0.000
DMU 46		0.218			
	Research Expenditures	107996000.000	13516634.890	(94479365.110)	(0.875)
	Published Articles	30.000	18.664	(11.336)	(0.378)
	Patents Issued	30.000	3.074	(26.926)	(0.898)
	Invention Disclosures	114.000	2.458	(111.542)	(0.978)
	License Income	730398.000	730398.000	0.000	0.000
DMU 47		0.183			
	Research Expenditures	391000000.000	32140299.458	(358859700.542)	(0.918)
	Published Articles	54.100	20.647	(33.453)	(0.618)
	Patents Issued	16.000	3.000	(13.000)	(0.813)
	Invention Disclosures	141.000	11.348	(129.652)	(0.920)
	License Income	8851413.000	8851413.000	0.000	0.000
DMU 48		0.202			
	Research Expenditures	148512700.000	13203565.237	(135309134.763)	(0.911)
	Published Articles	44.200	18.608	(25.592)	(0.579)
	Patents Issued	11.000	3.049	(7.951)	(0.723)
	Invention Disclosures	116.000	2.302	(113.698)	(0.980)
	License Income	481763.000	481763.000	0.000	0.000

DMU 49		0.237			
	Research Expenditures	632973484.000	59480894.630	(573492589.370)	(0.906)
	Published Articles	45.700	23.651	(22.049)	(0.483)
	Patents Issued	14.000	3.000	(11.000)	(0.786)
	Invention Disclosures	198.000	24.428	(173.572)	(0.877)
	License Income	21233214.000	21233214.000	0.000	0.000
DMU 50		0.184			
	Research Expenditures	152500000.000	13622495.709	(138877504.291)	(0.911)
	Published Articles	38.100	18.683	(19.417)	(0.510)
	Patents Issued	26.000	3.083	(22.917)	(0.881)
	Invention Disclosures	67.000	2.511	(64.489)	(0.963)
	License Income	814471.000	814471.000	0.000	0.000
DMU 51		0.298			
	Research Expenditures	148800000.000	12867989.473	(135932010.527)	(0.914)
	Published Articles	34.200	18.548	(15.652)	(0.458)
	Patents Issued	6.000	3.022	(2.978)	(0.496)
	Invention Disclosures	35.000	2.134	(32.866)	(0.939)
	License Income	215254.000	215254.000	0.000	0.000
DMU 52		0.195			
	Research Expenditures	459114540.000	66614640.624	(392499899.376)	(0.855)
	Published Articles	65.500	28.147	(37.353)	(0.570)
	Patents Issued	78.000	7.360	(70.640)	(0.906)
	Invention Disclosures	260.000	28.980	(231.020)	(0.889)
	License Income	42900000.000	42900000.000	0.000	0.000
DMU 53		0.268			
	Research Expenditures	323843000.000	49703902.296	(274139097.704)	(0.847)
	Published Articles	45.000	22.577	(22.423)	(0.498)
	Patents Issued	13.000	3.000	(10.000)	(0.769)
	Invention Disclosures	106.000	19.750	(86.250)	(0.814)
	License Income	16805484.000	16805484.000	0.000	0.000
DMU 54		0.149			
	Research Expenditures	808374000.000	25468945.098	(782905054.902)	(0.969)
	Published Articles	47.400	20.798	(26.602)	(0.561)
	Patents Issued	41.000	4.039	(36.961)	(0.902)
	Invention Disclosures	319.000	8.428	(310.572)	(0.974)
	License Income	10222735.000	10222735.000	0.000	0.000
DMU 55		0.226			
	Research Expenditures	346357000.000	33892938.221	(312464061.779)	(0.902)
	Published Articles	49.600	22.303	(27.297)	(0.550)
	Patents Issued	22.000	4.719	(17.281)	(0.786)
	Invention Disclosures	89.000	12.636	(76.364)	(0.858)
	License Income	16912938.000	16912938.000	0.000	0.000

DMU 56		0.429			
	Research Expenditures	132106000.000	13105573.634	(119000426.366)	(0.901)
	Published Articles	32.300	18.555	(13.745)	(0.426)
	Patents Issued	3.000	3.000	0.000	0.000
	Invention Disclosures	52.000	2.242	(49.758)	(0.957)
	License Income	231111.000	231111.000	0.000	0.000
DMU 57		0.175			
	Research Expenditures	184113481.000	13737612.567	(170375868.433)	(0.925)
	Published Articles	42.600	18.703	(23.897)	(0.561)
	Patents Issued	20.000	3.092	(16.908)	(0.845)
	Invention Disclosures	85.000	2.569	(82.431)	(0.970)
	License Income	905895.000	905895.000	0.000	0.000
DMU 58		0.367			
	Research Expenditures	148246000.000	12707097.155	(135538902.845)	(0.914)
	Published Articles	30.700	18.512	(12.188)	(0.397)
	Patents Issued	4.000	3.000	(1.000)	(0.250)
	Invention Disclosures	72.000	2.052	(69.948)	(0.972)
	License Income	50652.000	50652.000	0.000	0.000
DMU 59		0.389			
	Research Expenditures	65718000.000	12802898.787	(52915101.213)	(0.805)
	Published Articles	20.100	18.536	(1.564)	(0.078)
	Patents Issued	9.000	3.016	(5.984)	(0.665)
	Invention Disclosures	20.000	2.102	(17.898)	(0.895)
	License Income	163560.000	163560.000	0.000	0.000
DMU 60		0.144			
	Research Expenditures	313826827.000	14955962.026	(298870864.974)	(0.952)
	Published Articles	53.300	18.921	(34.379)	(0.645)
	Patents Issued	22.000	3.190	(18.810)	(0.855)
	Invention Disclosures	114.000	3.177	(110.823)	(0.972)
	License Income	1873489.000	1873489.000	0.000	0.000
DMU 61		0.306			
	Research Expenditures	404962000.000	46825257.741	(358136742.259)	(0.884)
	Published Articles	37.800	24.613	(13.187)	(0.349)
	Patents Issued	18.000	5.763	(12.237)	(0.680)
	Invention Disclosures	141.000	19.095	(121.905)	(0.865)
	License Income	27183583.000	27183583.000	0.000	0.000
DMU 62		1.250			
	Research Expenditures	303500000.000	303500000.000	0.000	0.000
	Published Articles	40.600	40.600	0.000	0.000
	Patents Issued	1.000	2.000	1.000	1.000
	Invention Disclosures	42.000	42.000	0.000	0.000
	License Income	931430.000	931430.000	0.000	0.000

DMU 63		0.116			
	Research Expenditures	796963386.000	38332448.097	(758630937.903)	(0.952)
	Published Articles	77.100	23.096	(54.004)	(0.700)
	Patents Issued	79.000	5.077	(73.923)	(0.936)
	Invention Disclosures	288.000	14.853	(273.147)	(0.948)
	License Income	20438727.000	20438727.000	0.000	0.000
DMU 64		0.270			
	Research Expenditures	594877000.000	83352632.249	(511524367.751)	(0.860)
	Published Articles	67.000	31.137	(35.863)	(0.535)
	Patents Issued	28.000	8.712	(19.288)	(0.689)
	Invention Disclosures	230.000	37.340	(192.660)	(0.838)
	License Income	56193050.000	56193050.000	0.000	0.000
DMU 65		0.195			
	Research Expenditures	323861560.000	14205419.605	(309656140.395)	(0.956)
	Published Articles	36.000	18.787	(17.213)	(0.478)
	Patents Issued	17.000	3.130	(13.870)	(0.816)
	Invention Disclosures	88.000	2.802	(85.198)	(0.968)
	License Income	1277420.000	1277420.000	0.000	0.000
DMU 66		0.427			
	Research Expenditures	128270352.000	13006238.811	(115264113.189)	(0.899)
	Published Articles	23.500	18.545	(4.955)	(0.211)
	Patents Issued	4.000	3.000	(1.000)	(0.250)
	Invention Disclosures	32.000	2.195	(29.805)	(0.931)
	License Income	186125.000	186125.000	0.000	0.000
DMU 67		0.211			
	Research Expenditures	181122808.000	13581438.488	(167541369.512)	(0.925)
	Published Articles	36.800	18.675	(18.125)	(0.493)
	Patents Issued	13.000	3.079	(9.921)	(0.763)
	Invention Disclosures	96.000	2.491	(93.509)	(0.974)
	License Income	781864.000	781864.000	0.000	0.000
DMU 68		0.125			
	Research Expenditures	583996531.000	15619151.926	(568377379.074)	(0.973)
	Published Articles	60.100	19.039	(41.061)	(0.683)
	Patents Issued	27.000	3.244	(23.756)	(0.880)
	Invention Disclosures	97.000	3.508	(93.492)	(0.964)
	License Income	2400184.000	2400184.000	0.000	0.000
DMU 69		0.246			
	Research Expenditures	135238856.000	13288028.000	(121950828.000)	(0.902)
	Published Articles	28.500	18.623	(9.877)	(0.347)
	Patents Issued	16.000	3.056	(12.944)	(0.809)
	Invention Disclosures	56.000	2.344	(53.656)	(0.958)
	License Income	548842.000	548842.000	0.000	0.000

DMU 70		1.017			
	Research Expenditures	95732891.000	95732891.000	0.000	0.000
	Published Articles	26.700	26.700	0.000	0.000
	Patents Issued	2.000	2.136	0.136	0.068
	Invention Disclosures	48.000	48.000	0.000	0.000
	License Income	4318661.000	4318661.000	0.000	0.000
DMU 71		0.106			
	Research Expenditures	640224563.000	22991385.388	(617233177.612)	(0.964)
	Published Articles	70.800	20.356	(50.444)	(0.713)
	Patents Issued	49.000	3.839	(45.161)	(0.922)
	Invention Disclosures	306.000	7.191	(298.809)	(0.977)
	License Income	8255096.000	8255096.000	0.000	0.000
DMU 72		0.148			
	Research Expenditures	601568000.000	35150039.055	(566417960.945)	(0.942)
	Published Articles	65.600	20.978	(44.622)	(0.680)
	Patents Issued	22.000	3.000	(19.000)	(0.864)
	Invention Disclosures	165.000	12.788	(152.212)	(0.923)
	License Income	10214441.000	10214441.000	0.000	0.000
DMU 73		0.522			
	Research Expenditures	56706000.000	13730398.876	(42975601.124)	(0.758)
	Published Articles	19.900	18.702	(1.198)	(0.060)
	Patents Issued	4.000	3.091	(0.909)	(0.227)
	Invention Disclosures	19.000	2.565	(16.435)	(0.865)
	License Income	900166.000	900166.000	0.000	0.000
DMU 74		0.317			
	Research Expenditures	355293162.000	60465635.840	(294827526.160)	(0.830)
	Published Articles	43.100	27.049	(16.051)	(0.372)
	Patents Issued	24.000	6.864	(17.136)	(0.714)
	Invention Disclosures	141.000	25.908	(115.092)	(0.816)
	License Income	38016557.000	38016557.000	0.000	0.000
DMU 75		0.229			
	Research Expenditures	173323287.000	13116391.516	(160206895.484)	(0.924)
	Published Articles	34.500	18.592	(15.908)	(0.461)
	Patents Issued	11.000	3.042	(7.958)	(0.724)
	Invention Disclosures	84.000	2.258	(81.742)	(0.973)
	License Income	412531.000	412531.000	0.000	0.000
DMU 76		0.178			
	Research Expenditures	265804555.000	14742580.822	(251061974.178)	(0.945)
	Published Articles	36.400	18.883	(17.517)	(0.481)
	Patents Issued	29.000	3.173	(25.827)	(0.891)
	Invention Disclosures	109.000	3.071	(105.929)	(0.972)
	License Income	1704025.000	1704025.000	0.000	0.000

DMU 77		0.127			
	Research Expenditures	431000000.000	14691675.760	(416308324.240)	(0.966)
	Published Articles	52.700	18.874	(33.826)	(0.642)
	Patents Issued	34.000	3.169	(30.831)	(0.907)
	Invention Disclosures	131.000	3.045	(127.955)	(0.977)
	License Income	1663597.000	1663597.000	0.000	0.000
DMU 78		0.191			
	Research Expenditures	240280186.000	14212336.135	(226067849.865)	(0.941)
	Published Articles	40.400	18.788	(21.612)	(0.535)
	Patents Issued	15.000	3.130	(11.870)	(0.791)
	Invention Disclosures	92.000	2.806	(89.194)	(0.970)
	License Income	1282913.000	1282913.000	0.000	0.000
DMU 79		0.151			
	Research Expenditures	446686000.000	23213756.948	(423472243.052)	(0.948)
	Published Articles	54.800	20.396	(34.404)	(0.628)
	Patents Issued	36.000	3.857	(32.143)	(0.893)
	Invention Disclosures	98.000	7.302	(90.698)	(0.926)
	License Income	8431700.000	8431700.000	0.000	0.000
DMU 80		0.365			
	Research Expenditures	174831472.000	19815880.971	(155015591.029)	(0.887)
	Published Articles	29.200	19.293	(9.907)	(0.339)
	Patents Issued	5.000	3.000	(2.000)	(0.400)
	Invention Disclosures	62.000	5.452	(56.548)	(0.912)
	License Income	3270024.000	3270024.000	0.000	0.000
DMU 81		0.254			
	Research Expenditures	155036202.000	13794001.242	(141242200.758)	(0.911)
	Published Articles	29.600	18.713	(10.887)	(0.368)
	Patents Issued	12.000	3.096	(8.904)	(0.742)
	Invention Disclosures	71.000	2.597	(68.403)	(0.963)
	License Income	950678.000	950678.000	0.000	0.000
DMU 82		0.217			
	Research Expenditures	336840793.000	28056129.238	(308784663.762)	(0.917)
	Published Articles	38.000	21.260	(16.740)	(0.441)
	Patents Issued	28.000	4.248	(23.752)	(0.848)
	Invention Disclosures	133.000	9.720	(123.280)	(0.927)
	License Income	12277436.000	12277436.000	0.000	0.000
DMU 83		0.225			
	Research Expenditures	246566451.000	33114939.956	(213451511.044)	(0.866)
	Published Articles	47.500	22.164	(25.336)	(0.533)
	Patents Issued	20.000	4.656	(15.344)	(0.767)
	Invention Disclosures	180.000	12.247	(167.753)	(0.932)
	License Income	16295064.000	16295064.000	0.000	0.000

DMU 84		1.003			
	Research Expenditures	95540632.000	95540632.000	0.000	0.000
	Published Articles	29.300	29.300	0.000	0.000
	Patents Issued	2.000	2.024	0.024	0.012
	Invention Disclosures	43.000	43.000	0.000	0.000
	License Income	15751.000	15751.000	0.000	0.000
DMU 85		0.188			
	Research Expenditures	238754000.000	17717585.526	(221036414.474)	(0.926)
	Published Articles	45.800	19.414	(26.386)	(0.576)
	Patents Issued	15.000	3.413	(11.587)	(0.773)
	Invention Disclosures	177.000	4.557	(172.443)	(0.974)
	License Income	4066727.000	4066727.000	0.000	0.000
DMU 86		0.169			
	Research Expenditures	936360325.000	92528329.057	(843831995.943)	(0.901)
	Published Articles	74.100	27.282	(46.818)	(0.632)
	Patents Issued	37.000	3.000	(34.000)	(0.919)
	Invention Disclosures	310.000	40.237	(269.763)	(0.870)
	License Income	36199485.000	36199485.000	0.000	0.000
DMU 87		0.166			
	Research Expenditures	831895000.000	65939244.489	(765955755.511)	(0.921)
	Published Articles	67.200	28.027	(39.173)	(0.583)
	Patents Issued	69.000	7.306	(61.694)	(0.894)
	Invention Disclosures	464.000	28.642	(435.358)	(0.938)
	License Income	42363611.000	42363611.000	0.000	0.000
DMU 88		0.325			
	Research Expenditures	138670000.000	13219632.037	(125450367.963)	(0.905)
	Published Articles	23.900	18.611	(5.289)	(0.221)
	Patents Issued	8.000	3.050	(4.950)	(0.619)
	Invention Disclosures	54.000	2.310	(51.690)	(0.957)
	License Income	494523.000	494523.000	0.000	0.000
DMU 89		0.192			
	Research Expenditures	387857107.000	31482398.913	(356374708.087)	(0.919)
	Published Articles	51.000	20.575	(30.425)	(0.597)
	Patents Issued	15.000	3.000	(12.000)	(0.800)
	Invention Disclosures	132.000	11.033	(120.967)	(0.916)
	License Income	8553468.000	8553468.000	0.000	0.000
DMU 90		0.262			
	Research Expenditures	149256000.000	14552336.565	(134703663.435)	(0.903)
	Published Articles	33.700	18.849	(14.851)	(0.441)
	Patents Issued	9.000	3.158	(5.842)	(0.649)
	Invention Disclosures	74.000	2.976	(71.024)	(0.960)
	License Income	1552936.000	1552936.000	0.000	0.000

DMU 91		1.460			
	Research Expenditures	146382536.000	146382536.000	0.000	0.000
	Published Articles	33.200	36.907	3.707	0.112
	Patents Issued	3.000	8.189	5.189	1.730
	Invention Disclosures	66.000	66.000	0.000	0.000
	License Income	60588512.000	60588512.000	0.000	0.000
DMU 92		0.307			
	Research Expenditures	130198611.000	14194887.088	(116003723.912)	(0.891)
	Published Articles	32.200	18.675	(13.525)	(0.420)
	Patents Issued	6.000	3.000	(3.000)	(0.500)
	Invention Disclosures	70.000	2.763	(67.237)	(0.961)
	License Income	724431.000	724431.000	0.000	0.000
DMU 93		0.181			
	Research Expenditures	519871000.000	27181616.850	(492689383.150)	(0.948)
	Published Articles	53.400	21.104	(32.296)	(0.605)
	Patents Issued	21.000	4.177	(16.823)	(0.801)
	Invention Disclosures	119.000	9.284	(109.716)	(0.922)
	License Income	11582912.000	11582912.000	0.000	0.000
DMU 94		0.236			
	Research Expenditures	220731000.000	17681408.785	(203049591.215)	(0.920)
	Published Articles	39.800	19.408	(20.392)	(0.512)
	Patents Issued	12.000	3.410	(8.590)	(0.716)
	Invention Disclosures	50.000	4.538	(45.462)	(0.909)
	License Income	4037996.000	4037996.000	0.000	0.000