The Impact of Management Control Systems on Efficiency and Quality Performance – An Empirical Study of Taiwanese Correctional Institutions

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Abstract

Management control systems (MCS) have been widely suggested as a key framework with which organizations can increase the probability that people make decisions and take actions congruent with the entire goals of the organizations. Most of the previous studies have mainly focused on efficiency performance, and we have little knowledge of the impact of MCS on both quality and productivity performance. In this study, we use both non-parametric data envelopment analysis (DEA) and parametric stochastic frontier analysis (SFA) to examine how MCS affects efficiency and quality performance in correctional institutions. Our results show that correctional institutions in Taiwan have considerable technical inefficiency, which is attributable to their unfavorable resource usage. We also find that correctional institutions with tight MCS have higher efficiency and quality performance. Our overall results support the argument that tight control systems can be used to achieve efficiency and quality performance.

JEL classification: M41

Keywords: Data envelopment analysis, management control system, non-profit organizations, productivity, quality management

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The authors would like to thank anonymous reviewers for constructive comments and suggestions. We also thank reviewers and participants at the 2003 American Accounting Association Annual Meeting, and 2004 American Accounting Association Management Accounting Section Midyear Meeting for helpful comments. Financial support from the Taiwan National Science Council is gratefully acknowledged (NSC89-2416-H-004-077-EB).

1. Introduction

Management control systems (MCS) have been widely used as a framework to align the congruence between employees' decision-making and action-taking with the organizations' goals (e.g., Chenhall and Euske, 2007; Davila and Foster, 2007; Sandino, 2007). Prior research on MCS has examined the relationship between MCS and quality strategy (Daniel and Reitsperger, 1991; Daniel and Reitsperger, 1992), the role of MCS in planned organizational change (Chenhall and Euske, 2007), the impact of personnel control on organization effectiveness (Abernethy and Brownell, 1997), and the cultural effects of MCS (Daniel and Reitsperger, 1992; Chow et al., 1999; Sunder, 2002). Recent studies investigate issues on MCS for early-stage startup companies (Davila and Foster, 2007) and the retail sector (Sandino, 2007). A good MCS generally ensures that an organization operates effectively and efficiently. Anthony and Young (2002) define "an effective program as one that moves the organization toward its goals, while an efficient program is one that accomplishes its purposes at the lowest possible cost."

Although efficiency is only one of many organizational goals, it has received a lot of attention from prior research for both profit-making organizations (e.g., Resti, 1997) and non-profit organizations (e.g., Chakraborty et al., 2001). However, Athanassopoulos (1997) argues that operating efficiency is not constrained within a typical cost minimization framework, but that it is given a broader dimension which covers issues related to the quality of services. In a non-management control system context, Kingdon (1996) shows that school quality is statistically significant in explaining variations in the productivity of individuals. Thatcher and Oliver (2001) also point out that when evaluating the impact of IT investment on company performance, both production efficiency and quality should be considered. Nevertheless, we have little knowledge of how MCS affects both the efficiency and quality performances of non-profit organizations. As such, in this study we examine how the MCS tightness (in terms of depth) affects both efficiency and quality performances in a correctional institution setting.

Correctional institutions are non-profit organizations and they are also an integral part of the law enforcement system. These institutions not only prevent crime by separating those incarcerated from those who are free, but also rehabilitate prisoners and help them change their behavior (Schmidt and Witte, 1984). Consequently, in addition to providing the offenders' basic needs (e.g., food, clothing, and medical care), the institutions have to design both educational and recreational programs. Therefore, given the constraints of limited allocated resources and the requirement of providing acceptable conditions to offenders, it is important that these institutions efficiently utilize their resources and also achieve a quality goal. Based on the severity level of the offense, correctional institutions are classified into prisons and detention institutions. Within the prisons, convicted criminals are further classified into segregated criminals, recidivists, felons, and ordinary criminals. Accordingly, in response to varying severity levels of the offense, these correctional institutions adopt different management control systems, which may have different impacts on efficiency and quality performance.

Prior accounting studies (Hayes and Millar, 1990; Mensah and Li, 1993) examined the efficiency performance in prisons. Hayes and Millar (1990) examined the efficiency performance (relationship between inputs and outputs) in 33 jails. Using a translog budget model, they report that additional useful performance evaluation and control monitoring information is not available from budget models which assume fixed cost-minimizing input cost (budget) shares. Mensah and Li (1993) consider Data Envelopment Analysis (DEA), a better model than the translog model, and extend the Hayes and Millar study by using both translog and DEA to study the efficiency performance. They found that the DEA model is more suitable than the translog model from the standpoint of a routine budgetary control system. In this study, we extend the prior studies by examining both the efficiency and quality performance of correctional institutions. Also, to explore the impact of MCS tightness on efficiency and quality performance, we include not only prisons but also detention houses, and classify them based on the type of institutions, i.e., adult versus juvenile.

Our sample includes 57 Taiwanese correctional institutions (20 prisons, 18 detention houses, 3 juvenile reformatory schools, and 16 juvenile detention and classification houses) from 1998 to 2000. We find that the level of MCS tightness affects both efficiency and quality performance of the correctional institutions. Specifically, correctional institutions with tighter MCS have a better efficiency and quality performance than do institutions with looser MCS. These findings are consistent with Merchant's (1998, p.155) argument that "tight control is good because it provides a high degree of certainty that people will act as the organization wishes". In addition, we observe substantial inefficiency in the Taiwanese correctional institutions, and this inefficiency is attributable to their unfavorable resource usages and not to the scale of these institutions.

The remainder of this paper is organized as follows. Section 2 contains the hypothesis development. Section 3 describes the data collection, and variable measurement. Section 4 presents our empirical results, followed by a summary and conclusion in the final section.

2. Hypothesis Development

Quite a number of prior accounting studies have adopted the conventional view that MCS is a passive tool designed to assist managers' decision-making (see a review by Chenhall, 2003). Flamholtz (1996), on the other hand, used a broader definition of management control as measures to (1) motivate people to take actions congruent with organizational objectives, (2) coordinate efforts of different functions of an organization, and (3) provide information concerning performance and operational results. All organizations can be viewed as sets of contracts whereby individuals enter into contracts with organizations to satisfy their needs (Sunder, 2002). Previous studies (e.g., Feltham and Xie, 1994; Darrough and Melumad, 1995; Ho and Vera-Muñoz, 2001) have shown that conflicts between individual and organizational interests cause goal incongruence and organizational inefficiency (e.g., moral hazard, slackness, and embezzlement). This goal-incongruence behavior may then interfere with the organization's long-term value maximization (Baiman, 1990; Holmstrom and Milgrom, 1991; Jaworski and Young, 1992; Lambert, 2000). Consequently, organizations normally employ control systems with an aim to mitigate goal incongruence and also to motivate individuals to act for the organization's best interest (Sunder, 1997; Merchant, 1998).

Management control systems include *action* and *results control* (Merchant, 1998). A tight control system can monitor individual behavior more closely, resulting in a higher chance of motivating employees to act for the organization's best interest. On the other hand, a loose control system may not be able to monitor individual behavior closely and may lead to a lower chance of having people act in the organization's best interest. However, the implementation and maintenance costs associated with the tight control system are generally high. Therefore, when choosing control systems, top management normally analyzes their associated costs and benefits. For *action control*, systems are considered tight if there are frequent and detailed reviews, constant direct supervision, and significant rewards or punishments given to the individuals affected (Merchant, 1998). Therefore, it is very likely that employees will engage consistently in all of the actions critical to the operation's success and will not undertake harmful actions. Regarding *results controls*, systems are likely to be tight if rewards and punishments significant to the individuals involved are directly and definitely linked to the accomplishment of the desired results.

As discussed earlier, correctional institutions include both prisons and detention institutions. Compared with detention institutions, prisons implement tighter MCS. In Taiwan convicted criminals are classified into four categories: segregated criminals, recidivists, felons, and ordinary criminals. Those who are identified as segregated criminals must be incarcerated alone in the first six-month term. The buildings and security systems are designed to restrict the inmates' movements and to keep a tighter control over those considered to be dangerous criminals. The most capable management staff is assigned to closely supervise and monitor the criminals' behavior. On the other hand, detention institutions only roughly separate the suspects or defendants into ordinary and segregated criminals, and the (action) controls of these institutions are looser than for those of prison institutions.

Moreover, to motivate offenders to demonstrate better behavior, prisons implement a four-level progressive treatment. If convicted inmates have shown clear signs of rehabilitation and good behavior, they are upgraded to higher levels and receive better treatment. For instance, when convicted inmates are upgraded to the highest level, they are allowed to meet their friends without any restriction or supervision. Also, their prison term may be shortened (i.e., by six days for every one-month sentence term), and they are eligible for parole release, which is not applicable to the lowest level criminals (tight results controls). Such a program is not available for the loose-result control detention institutions.

In addition, compared with prisons, detention institutions face higher uncertainties and have different goals to achieve. This is because detention institutions only detain suspects for a short period of time, and they cannot treat their detainees as criminals, nor do they have to rehabilitate the detainees. Prior studies suggest that uncertainty and analyzability of organizations' tasks may affect their adoption of MCS (e.g., Abernethy and Brownell, 1997). Uncertainty may affect the efficiency of an organization because the higher uncertainties an organization faces, the less restriction the budget will have. Therefore, prisons and detention institutions may adopt MCS with different levels of tightness.

Merchant (1998) argued that tight control is better for an organization since it provides a high level of certainty that people will behave based on the organization's expectations. However, there is little empirical evidence supporting this argument. Daniel and Reitsperger (1991) examined the tightness of MCS on workers' quality and efficiency performance by comparing British workers in Japanese-managed electronics factories with those working in U.S. or British-managed companies. He reported that in a closely monitored system (i.e., Japanese-managed factories), British workers significantly outperformed their counterparts in both U.S.- and U.K.-managed companies in terms of quality and efficiency.

Prior studies suggest there is a positive relation between efficiency and quality (e.g., Kingdon, 1996; Sengupta, 2000; Mobley and Magnussen, 2002). Kingdon (1996) examined the relative cost efficiency and quality of private and public schools in India. He reports that fee-charging private schools are well received in India and attributes the popularity of private schools to both their better quality and cost efficiency. Furthermore, Mobley and Magnussen (2002), using DEA to measure the excess staffing in hospitals, report that poor quality is associated with less efficient hospital staffing.

Based on the above discussion, we predict a positive correlation between the tightness of MCS and its efficiency and quality performance:

H1: ***The efficiency performance of the correctional institutions with tight MCS is better than that with loose MCS.***

H2: ***The quality performance of the correctional institutions with tight MCS is better than that with loose MCS.***

The correctional institution setting is unique because of its principal–agent relationship. In the traditional organization managers are agents; however, in correctional institutions agents include both management staff and prisoners. Specifically, for efficiency performance, the object is management staff (input vs output), but for quality performance the object is prisoners.

3. Research Method

3.1 Data Collection

We collected monthly data from 61 correctional institutions in Taiwan from 1998 to 2000. Because three prisons and one juvenile reformatory school were established after 1998 and had no complete data available during this study period, they were removed from our sample. That is, our final sample includes 57 institutions: 20 prisons, 18 detention houses, 3 juvenile reformatory schools, and 16 juvenile detention and classification houses. Some efficiency and quality data (e.g., operating expenses, management staff, incidents, and number of inmates) are confidential and sensitive, and thus they were collected by transcriptions from the Department of Correction, Department of Accounting, and Department of Statistics in the Ministry of Justice. All the data concerning the control variables (e.g., age of institution, institution location, type of institution) were taken from the *Monthly Bulletin of Statistics of Justice* published by the Ministry of Justice. Because of the data complexity, it took us more than a year to complete the interviews and data collection.

3.2 Model Specifications

To develop a conceptual framework, we visited the Taipei Detention House (the fourth largest correctional institution in Taiwan) to better understand the operation and management control systems of correctional institutions. Furthermore, we interviewed several officers of correctional institutions to identify variables that may affect the efficiency and quality performance as well as to discuss these variable measurements.

We use a two-step method to examine the influence of MCS' tightness on efficiency performance. First, we calculate the efficiency score (*EFFICIENCY*) for each institution by using two widely accepted efficiency analysis methods – Data Envelopment Analysis (DEA), and Stochastic Frontier Analysis (SFA).[1] A higher *EFFICIENCY* score implies that the unit makes better use of the resources at a given level of output and it has better efficiency performance. The input variables include operating expenses, management staff, and available space. Regarding the output variable, theoretically we should use the number of jail-days (e.g., Hayes and Millar, 1990) to better capture the resources being consumed by different inmates. Unfortunately, we could not obtain the number of jail-days so we use the number of inmates as a surrogate for the output variable.

Then, we use the calculated efficiency scores as the dependent variable in the following regression model to examine the effect of MCS' tightness on efficiency:

$$
\begin{aligned}
EFFICIENCY_{it} = \alpha_0^E &+ \beta_1^E MCSTIGHT_{it} + \beta_2^E AGE_{it} + \beta_3^E LOCATION_{it} \\
&+ \beta_4^E FELONY_{it} + \beta_5^E ADULT_{it} + \beta_6^E YEAR1_{it} + \beta_1^E YEAR2_{it} + \varepsilon_{it}^E \qquad (1)
\end{aligned}
$$

Here, i refers to the i-th institution in the sample; t is the time period from 1 to 36. The βs are parameters to be estimated and ε is the error term. We describe the independent variable (*MCSTIGHT*) and control variables below.

Tight MCS refers to a high degree of certainty that people will act according to what the organization requires. In Taiwan, prisons housing convicteεd prisoners have much tighter MCS, both in action and results controls, than detention houses holding criminal suspects or defendants under investigation or during trial. Different from detention houses, prisons use progressive treatments to motivate the inmates to behave better so that they can be upgraded to higher levels and receive better treatment (e.g.,

[1] DEA is a non-parametric mathematical programming approach to frontier estimation and it was first introduced by Charnes et al. (1978). Since then, a great number of studies have used the application and extension of DEA. There are different models of DEA: a constant return to scale (CRS) model introduced by Charnes et al. (1978) and a variable return to scale (VRS) model by Banker et al. (1984). The SFA model was first introduced by Aigner et al. (1977) and Meeusen and van den Broeck (1977). The original specification of the SFA model involved a production function specified for cross-sectional data with two components: one to account for technical inefficiency, and the other to account for random effects such as weather, strikes, and luck. Following prior studies (Coelli, 1996), we apply the estimation of the commonly used production frontiers, Cobb-Douglas (CD) and translog (TS) functional forms in SFA. For more detailed information concerning DEA and SFA refer to Coelli et al. (2005).

becoming eligible for parole release). Here, *MCSTIGHT* is defined to be 1 if it is a prison institution; otherwise it is 0. We expect the coefficient of *MCSTIGHT* (β_1^E) to be positive.

Furthermore, based on our interviews and observations, we include several control variables that may confound the empirical results in our regression models. Following Trumbull and Witte (1981–82), we include the age of an institution (*AGE*), since it may affect the institution's physical condition, operating expenses and subsequently efficiency. Government expenditure (e.g., repair costs for appliances, facilities, and equipment) for older correctional institutions is normally higher than that for newer ones. However, for newer institutions the government invests a high amount of resources in facilities and equipment, which also increases the average cost of confining inmates by providing more comfortable living areas. We use the median of the years the institutions were built, i.e., 1985, to classify correctional institutions into two age groups. Specifically, *AGE* is 1 if the institutions were established or rebuilt after 1985; otherwise it is 0. Since the age of an institution may have positive and negative impacts on efficiency or quality performance, we do not make any prior prediction here.

We also include the location of the correctional institution (*LOCATION*) in the model. As pointed out by the officers we interviewed, the cost structure of correctional institutions in remote areas (such as eastern Taiwan) is different from that of other regions. For example, to compensate for the location inconvenience, the management staff working in eastern Taiwan receives a higher salary and premiums for travel and transportation expenditures. The higher staff salary and compensation for travel and transportation result in higher expenditures for remote institutions than for other areas. *LOCATION* is equal to 1 if the institution is located in eastern Taiwan; otherwise it is 0.

The prison terms for felony normally exceed ten years, which are much longer than those for misdemeanors. Therefore, felons have more incentive to behave well in order to apply for parole. Nonetheless, due to long prison terms, felons are more likely to violate the prison rules because of various family or psychological factors. Our interview with management staff of correctional institutions suggests that due to the long prison terms, felons normally have better relationships with management staff, which makes management easier for felony institutions than for misdemeanor institutions. *FELONY* is equal to 1 if it is a felony institution; otherwise it is 0.[2]

Institutions have different objectives for holding young offenders versus holding adults.[3] Compared to adult institutions, juvenile institutions provide more rehabilitation programs, which require more resources and extensive plans to meet the total needs of juveniles over prolonged periods (Carter et al., 1985). As such, *ADULT* is equal to 1 for an adult institution and is equal to 0 if it is a juvenile institution. In light of

[2] There are two differences between felony and misdemeanor institutions. First, since felons must stay in prisons over a long period, there are limited variations in felony institutions. On the other hand, the shorter prison terms require the misdemeanor prison to have more staff to deal with the movement of prisoners. Second, the criminal law requires that prisoners be imprisoned for one-half of their sentences before they are eligible for parole.

[3] For juvenile institutions, it is important to provide educational and vocational training; therefore, the offenders will possess skills when they are released from prison. Conversely, adult institutions aim at controlling and punishing the criminals and they are designed for supervision, control, and surveillance of inmates.

the deteriorating financial condition in Taiwan, in 1999 the government adopted an economic policy that required all government agencies to use resources more effectively and efficiently. Therefore, to control for the impact of the governmental policy on quality and productivity performance of correctional institutions, we include two time-trend dummy variables. Specifically, *YEAR1* is equal to 1 if the year is 1999; otherwise it is 0. Similarly, *YEAR2* is equal to 1 if the year is 2000, and it is 0 otherwise.

Furthermore, we use the following model to examine the effect of MCS on quality performance:

$$\begin{aligned} QUALITY_{it} = {} & \alpha_0^Q + \beta_1^Q MCSTIGHT_{it} + \beta_2^Q AGE_{it} + \beta_3^Q LOCATION_{it} \\ & + \beta_4^Q FELONY_{it} + \beta_5^Q ADULT_{it} + \beta_6^Q YEAR1_{it} + \beta_1^Q YEAR2_{it} + \varepsilon_{it}^Q \end{aligned} \quad (2)$$

QUALITY is defined as the frequency of custody accidents (e.g., fighting, escaping) in correctional institutions. The frequency of custody accidents reflects the level of tension in correctional institutions and the threat of physical harm (Schmidt and Witte, 1984). We measure *QUALITY* by the ratio of the number of prisoners' custody accidents to the total prisoner population in each correctional institution per month. Therefore, lower scores of *QUALITY* imply better quality performance.

4. Results

4.1 Efficiency Performance Analysis

Panel A of Table 1 summarizes the descriptive statistics for both the input and output variables that are used to measure efficiency scores of correctional institutions. As shown in Panel A, there are significant differences in the number of inmates, operating expenses, available space, and number of management staff among the 57 institutions. For example, the mean of the number of inmates is 905 and its standard deviation is 1,196, with a wide range from 0 to 6,163. Note the minimum number is zero, since some correctional institutions have no inmates during certain months. Similarly, there is a wide range of operating expenses (from US$1,728 to US$2,146,490), management staff (from 3 to 409), and available space (from 4 to 3,081 square meters).[4]

4.2 MCS, Efficiency and Quality Performance

Panel B of Table 1 presents the descriptive statistics for independent and dependent variables of efficiency and quality models. To test the robustness of our results for efficiency performance, we ran four alternative DEA and SFA models: DEA – CRS (constant return to scale), DEA – VRS (variable return to scale), SFA – CD (Cobb-Douglas), and SFA – TS (translog). The mean efficiency scores of the Taiwanese

[4] Available space is a measure of prison capacity. Prior studies have used the reported number of beds as a measure of prison capacity (e.g., Hayes and Millar, 1990; Butler and Johnson, 1997). However, through our interview with correctional officers, we find that in Taiwan inmates do not sleep on beds, but lie on shared wooden floors, which is acceptable in that culture. Therefore, we use available space instead of number of beds as a surrogate for prison capacity.

correctional institutions are 0.5055 (DEA – CRS), 0.5567 (DEA – VRS), 0.4597 (SFA – CD), and 0.5407 (SFA – TS). These results are very similar, indicating that correctional institutions are substantially inefficient. Also, there is a wide range of efficiency performance among the 57 institutions with a range from 0 to 1.00 (for DEA – CRS) and from 0.01 to 0.97 (for both SFA – CD and SFA – TS). Note that the above efficiency scores are based on their pure usages of resources. We then further test the institutions' efficiency attributable to different scales (scale efficiency or SE) by calculating the ratio of the efficiency score under DEA – CRS to that under DEA – VRS. As shown in Panel B, the mean score of scale efficiency[5] is 0.9080 (0.5055/0.5567) for correctional institutions, which is much higher than 0.5567 (under DEA – VRS) due to pure usage or technical efficiency. Taken together, our results imply that correctional institutions' inefficiencies are mainly attributable to their resource usages and not to their scales.

Recall that *QUALITY* is the ratio of number of prisoners' custody accidents to number of prisoners. As seen in Panel B of Table 1, the mean of *QUALITY* is 0.0099 (ranging from 0 to 0.2222). Also, the mean of *MCSTIGHT* (0.4035) suggests that slightly more detention houses than prisons were included in this sample. The high mean of *ADULT* (0.6584) indicates that this sample contains a higher proportion of adult prisons.

Table 1 Descriptive Statistics for Efficiency and Quality Performance

Variables	Mean	Standard Deviation	Maximum	Minimum
Panel A				
Output Variable				
Number of inmates	905	1,196	6,163	0
Input Variables				
Operating expense (USD)	244,166	242,964	2,146,490	1,728
Management staff (no. of staff)	100	94	409	3
Available space (square meters)	535	604	3,081	4
Panel B				
Dependent Variables				
EFFICIENCY DEA–CRS	0.5055	0.2968	0.0040	1.0000
DEA–VRS	0.5567	0.3062	0.0060	1.0000
SFA–CD	0.4597	0.2889	0.0034	0.9681
SFA–TS	0.5407	0.2927	0.0031	0.9781
QUALITY	0.0099	0.0143	0.0000	0.2222
Independent Variables				

[5] We obtain a measure of scale efficiency (SE) of the DMU as follows: SE = (DEA – CRS / DEA – VRS). For more detailed information concerning DEA and SFA, see Coelli et al. (2005).

MCSTIGHT	0.4035	0.4907	0.0000	1.0000
AGE	0.2632	0.4405	0.0000	1.0000
LOCATION	0.2105	0.4078	0.0000	1.0000
FELONY	0.1930	0.3947	0.0000	1.0000
ADULT	0.6584	0.4744	0.0000	1.0000
YEAR1	0.3333	0.4715	0.0000	1.0000
YEAR2	0.3333	0.4715	0.0000	1.0000

Variable definitions: DEA–CRS: Constant return to scale under DEA; DEA–VRS: Variance return to scale under DEA; SFA–CD: Cobb-Douglas under SFA; SFA–TS: translog under SFA; QUALITY is the ratio of the number of prisoners' custody accidents (e.g., fighting, brawling, gambling, disobeying the officers, tattoos, escaping, committing suicide, uprisings, serious violence, and others) to the total prisoner population in each correctional institution per month; MCSTIGHT is equal to 1 if it is a prison institution; otherwise it is 0; AGE is equal to 1 if the institutions were established or rebuilt after 1985 (median value); otherwise it is 0; LOCATION is equal to 1 if the institutions are located in eastern Taiwan; otherwise it is 0; FELONY is equal to 1 for felony institutions, and 0 otherwise; ADULT is equal to 1 for adult institutions and 0 for juvenile institutions; YEAR1 is equal to 1 if the year is 1999; otherwise it is 0; YEAR2 equals 1 if it is 2000; otherwise, it is 0.

Table 2 summarizes Pearson correlations for efficiency performance and quality performance. As seen in Table 2, the Pearson correlation coefficients of the efficiency scores among the four different alternative models are very high, ranging from 0.721 to 0.946. The high correlations suggest a high consistency for the four efficiency models used. Also, we found positive and significant correlations between these efficiency scores and *MCSTIGHT* (range from 0.262 to 0.451), suggesting that tighter MCS results in higher efficiency performance. There is a significantly negative correlation between *QUALITY* and *MCSTIGHT* (-0.251, $p < 0.01$). This indicates that tightness of MCS has a positive impact on quality performance. Furthermore, significantly negative correlations between *AGE* and *EFFICIENCY* scores (except for SFA – TS) imply that the newer an institution, the lower the efficiency performance. This may be explained by a negative correlation between *MCSTIGHT* and *AGE* (-0.085), i.e., the newer an institution, the looser is its MCS. Similarly, we observe significant negative correlations between *LOCATION* and *EFFICIENCY* scores (from -0.172 to -0.250), suggesting that those institutions located in eastern Taiwan display lower efficiency performance. As explained earlier, the inefficiency may be attributed to higher compensation to motive staff to work in eastern Taiwan and also to compensate them for the inconvenience. Also, *LOCATION* positively correlates with *QUALITY* (0.087). This suggests that eastern Taiwanese institutions have lower quality performance compared with those institutions in western Taiwan. The correlation coefficients between *ADULT* and *EFFICIENCY* scores (ranging from 0.258 to 0.515) affirm that juvenile institutions require more resources to educate the children. Also, the correlation coefficients between *ADULT* and *QUALITY* (0.082) indicate that if an institution is an adult institution, its quality performance is poor. However, we do not find any significant coefficients between *YEAR1*, *YEAR2* and other variables.

Table 2 Pearson Correlation Matrix for Efficiency Performance and Quality Performance

	DEA–CRS	DEA–VRS	SFA–CD	SFA–TS	QUALITY	MCSTIGHT	AGE	LOCATION	FELONY	ADULT	YEAR1	YEAR2
DEA–CRS	1.000	0.910	0.885	0.840	-0.036	0.350	-0.079	-0.207	0.372	0.382	0.037^{NS}	0.007^{NS}
DEA–VRS		1.000	0.798	0.721	-0.099	0.262	-0.060	-0.172	0.339	0.258	0.023^{NS}	0.007^{NS}
SFA–CD			1.000	0.946	0.001^{NS}	0.445	-0.111	-0.230	0.468	0.495	0.000^{NS}	-0.076
SFA–TS				1.000	0.023^{NS}	0.451	-0.027^{NS}	-0.250	0.277	0.515	0.000^{NS}	-0.088
QUALITY					1.000	-0.251	-0.002^{NS}	0.087	0.084	0.082	0.043^{NS}	0.025^{NS}
MCSTIGHT						1.000	-0.085	0.102	0.141	0.331	0.000^{NS}	0.000^{NS}
AGE							1.000	-0.015^{NS}	-0.292	-0.085	0.000^{NS}	0.000^{NS}
LOCATION								1.000	0.075	0.085	0.000^{NS}	0.000^{NS}
FELONY									1.000	0.337	0.000^{NS}	0.000^{NS}
ADULT										1.000	0.019^{NS}	-0.031^{NS}
YEAR1											1.000	-0.500
YEAR2												1.000

^{NS} indicates that the correlation coefficient is not significantly different from zero at the 10% level (two-tailed test). All the other correlation coefficients are significantly different from zero at the 1% level (two-tailed test).

Variable definitions: DEA–CRS: Constant return to scale under DEA; DEA–VRS: Variance return to scale under DEA; SFA–CD: Cobb-Douglas under SFA; SFA–TS: translog under SFA; *QUALITY* is the ratio of the number of prisoners' custody accidents (e.g., fighting, brawling, gambling, disobeying the officers, tattoos, escaping, committing suicide, uprisings, serious violence, and others) to the total prisoner population in each correctional institution per month; *MCSTIGHT* is equal to 1 if it is a prison institution; otherwise it is 0; *AGE* is equal to 1 if the institutions were established or rebuilt after 1985 (median value); otherwise it is 0; *LOCATION* is equal to 1 if the institutions are located in eastern Taiwan; otherwise it is 0; *FELONY* is equal to 1 for felony institutions, and 0 otherwise; *ADULT* is equal to 1 for adult institutions and 0 for juvenile institutions; *YEAR1* is equal to 1 if the year is 1999; otherwise it is 0; *YEAR2* equals 1 if it is 2000; otherwise, it is 0.

Efficiency Performance. Recall that H1 predicts that the tightness of MCS in correctional institutions has a positive impact on efficiency performance. In addition to the above discussed strong positive correlation coefficients between *MCSTIGHT* and the four types of efficiency scores, we run the following two tests: (a) t-tests to check if the efficiency score of tight MCS is higher than that of loose MCS, and (b) a regression analysis. Table 3 presents the results of both t-tests and regression analysis of the impact of the tightness of MCS on efficiency performance of the correctional institutions. As shown in Panel A of Table 3, efficiency scores of tight MCS are higher than those of loose MCS under the four different DEA and SFA models (all of the t values are statistically significant at the 0.01 level).

Panel B of Table 3 shows a positive effect of the tightness of MCS on efficiency performance of correctional institutions across the four different models ($\beta_1^E = 0.161$, $p < 0.01$ for DEA – CRS; $\beta_1^E = 0.131$ for DEA – VRS, $p < 0.01$; $\beta_1^E = 0.196$, $p < 0.01$ for SFA – CD; $\beta_1^E = 0.204$ for SFA – TS, $p < 0.01$). Furthermore, the regression results reveal that efficiency performance is significantly influenced by *AGE*, *LOCATION*, and *ADULT*, and whether it is Year 1999 or 2000, using all four efficiency measures. Taken as a whole, our results suggest that tighter MCS of the correctional institutions results in higher efficiency performance and, thus, H1 is supported.

Table 3 Statistical Results of the Impact of MCS on Efficiency Performance

Panel A. t-tests

		Tight MCS	Loose MCS	t value
Efficiency Performance	DEA–CRS	0.6316	0.4202	16.892***
	DEA–VRS	0.6542	0.4908	12.289***
	SFA–CD	0.6159	0.3539	22.499***
	SFA–TS	0.7011	0.4323	22.855***

Panel B. Regression Results

$$EFFICIENCY_{it} = \alpha_0^E + \beta_1^E MCSTIGHT_{it} + \beta_2^E AGE_{it} + \beta_3^E LOCATION_{it} + \beta_4^E FELONY_{it} + \beta_5^E ADULT_{it} + \beta_6^E YEAR1_{it} + \beta_1^E YEAR2_{it} + \varepsilon_{it}^E$$

Variables	DEA–CRS	DEA–VRS	SFA–CD	SFA–TS	VIF value
Constant	0.321[a] (24.909)***	0.424 (29.345)***	0.282 (26.771)***	0.204 (31.257)***	
MCSTIGHT	0.161 (13.933)***	0.131 (10.112)***	0.196 (20.746)***	0.204 (20.178)***	1.134
AGE	0.003 (2.348)**	0.004 (2.605)***	0.003 (2.668)***	0.005 (4.306)***	1.097
LOCATION	-0.200 (-15.174)***	-0.168 (-11.398)***	-0.223 (-20.679)***	-0.235 (-20.367)***	1.016
FELONY	0.220 (14.745)***	0.236 (14.109)***	0.262 (21.434)***	0.107 (8.174)***	1.228

ADULT	0.139 (11.123)***	0.007 (5.015)***	0.178 (17.374)***	0.238 (21.669)***	1.247
YEAR1	0.003 (2.580)***	0.002 (1.561)	-0.003 (-3.031)***	-0.004 (-3.277)***	1.333
YEAR2	0.003 (1.964)**	0.002 (1.243)	-0.006 (-5.376)***	-0.007 (-5.769)***	1.334
F value	152.283***	83.685***	336.299***	851.331	
Adjusted R^2	0.341	0.220	0.534	0.693	

N = 2,052: Tight MCS = 828, Loose MCS = 1,224.

*** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.

"a" denotes the coefficient of the variable, and the figures in parentheses are the t values.

Variable definitions: DEA–CRS: Constant return to scale under DEA; DEA–VRS: Variance return to scale under DEA; SFA–CD: Cobb-Douglas under SFA; SFA–TS: translog under SFA; *MCSTIGHT* is equal to 1 if it is a prison institution; otherwise it is 0; *AGE* is equal to 1 if the institutions were established or rebuilt after 1985 (median value); otherwise it is 0; *LOCATION* is equal to 1 if the institutions are located in eastern Taiwan; otherwise it is 0; *FELONY* is equal to 1 for felony institutions, and 0 otherwise; *ADULT* is equal to 1 for adult institutions and 0 for juvenile institutions; *YEAR1* and *YEAR2*: To control the time effect, *YEAR1* is equal to 1 if the year is 1999; otherwise it is 0; and *YEAR2* equals 1 if it is 2000; otherwise, it is 0.

Quality Performance. Similarly, we conducted a t-test to explore whether tight MCS has better quality performance than loose MCS does. Also, we ran a regression analysis to test the impact of MCS on quality performance by controlling possible confounding factors. The statistical results of both t-tests and regression analyses are summarized in Table 4. Recall that the quality performance is measured by custody accidents. That is, the lower the score, the better the quality performance. Panel A of Table 4 shows that the quality performance scores are 0.00096 for tight-MCS and 0.00172 for loose-MCS correctional institutions; the difference being statistically significant (t = -10.192, $p <$ 0.01). Consistent with our t-test results, Panel B of Table 4 indicates that MCS tightness has a significant and negative impact on custody accidents (β_1^Q = - 0.0009, $p < 0.01$). Also, we found that quality performance is significantly affected by the location of the institution (t = 4.888, $p < 0.01$), whether it is an adult institution (t = 3.098, $p <$ 0.01), and whether it is in Year 1999 or 2000. All in all, these findings support H2, that the tightness of MCS in correctional institutions has a positive impact on quality performance.

Table 4 Statistical Tests of the Impact of MCS on Quality Performance

Panel A. t-test Result			
	Tight MCS	Loose MCS	t value
Quality Performance	0.00096	0.00172	-10.192***

Panel B. Regression Results

$$QUALITY_{it} = \alpha_0^Q + \beta_1^Q MCSTIGHT_{it} + \beta_2^Q AGE_{it} + \beta_3^Q LOCATION_{it} + \beta_4^Q FELONY_{it} + \beta_5^Q ADULT_{it} + \beta_6^Q YEAR1_{it} + \beta_1^Q YEAR2_{it} + \varepsilon_{it}^Q$$

Variables	Coefficient	t-value	VIF value
CONSTANT	0.002	11.274***	
MCSTIGHT	-0.0009	-11.456***	1.134
AGE	0.00006	0.734	1.097
LOCATION	0.0005	4.888***	1.016
FELONY	0.0002	2.136**	1.228
ADULT	0.0003	3.098***	1.247
YEAR1	0.0002	2.607***	1.333
YEAR2	0.0002	2.322***	1.334
F value	23.998***		
Adjusted R^2	0.0940		

N = 2,052: Tight MCS = 828, Loose MCS = 1,224.

*** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.

Variable definitions: *QUALITY*: We use "custody accidents" to proxy the quality performance of correctional institutions. The higher the number of "custody accidents", the lower the quality performance will be. Because of data limitation for custody accidents, the remaining samples are 1,548: tight MCS = 828, loose MCS = 720; *MCSTIGHT* is equal to 1 if it is a prison institution; otherwise it is 0; *AGE* is equal to 1 if the institutions were established or rebuilt after 1985 (median value); otherwise it is 0; *LOCATION* is equal to 1 if the institutions are located in eastern Taiwan; otherwise it is 0; *FELONY* is equal to 1 for felony institutions, and 0 otherwise; *ADULT* is equal to 1 for adult institutions and 0 for juvenile institutions; *YEAR1* and *YEAR2*: To control the time effect, *YEAR1* is equal to 1 if the year is 1999; otherwise it is 0; and *YEAR2* equals 1 if it is 2000; otherwise, it is 0.

We also use the variance inflationary factor (VIF) to test whether there is a multicollinearity problem among the independent variables in our regression analyses. As seen in Panel B of Tables 3 and 4, the VIF values of all independent variables are less than 1.334. Therefore, we rule out the possibility that there is a multicollinearity problem in our above analyses for both efficiency and quality performance (Snee, 1973).[6] In sum, our overall results show that the tightness of MCS has a positive impact on both corrective institutions' efficiency and quality performance.

[6] The operating expenses, management staff, and available space of the correctional institutions are based on a pre-approved number of inmates and depend on the remoteness of their location.

5. Conclusion

The impact of management control systems on quality and productivity performance has received increasing attention. However, most of the prior studies have focused on efficiency performance, and we have little knowledge of the impact of management control systems on either quality or productivity performance. Also, these studies use profit-making organizations, and so the results may not be applicable to non-profit organizations (Chenhall, 2003). This is because the input of managers of non-profit organizations cannot be evaluated on the basis of the shareholders' claims, and also their performance is normally evaluated on the basis of non-financial measures (e.g., quality of output). In comparison with financial budgeting systems, relatively little research has been done on non-financial control systems (McKinnon and Bruns, 1992; Fisher, 1995). Whether conventional or accounting-based control is suitable in the correctional institutional setting, and whether these institutions need to design their control systems around a variety of non-accounting controls (Rockness and Shields, 1988; Foster and Gupta, 1994; Abernethy and Stoelwinder, 1995) remain unknown.

In this study, we examine the effect of management control systems on both productivity and quality performance in Taiwanese correctional institutions. Our results show that correctional institutions with tight MCS have both efficient and high quality performance. These findings have both practical and theoretical implications. As discussed earlier, there is substantial inefficiency in Taiwanese correctional institutions, and this is mainly due to the unfavorable usage of resources. It is likely that the staff of these correctional institutions do not efficiently manage their budgets that come from the government. In this regard, the government can enhance efficiency performance by reducing cost and controlling budget more effectively.

The second implication is that, based on our tests, correctional institutions with tight MCS have a better efficiency performance than those with loose MCS. From the quality perspective, the frequency of criminal violations in the institutions with tight MCS is also lower than that of institutions with loose MCS. Therefore, the positive association between tight MCS and both efficiency and quality performance suggests that managers should set up tight MCS for all the correctional institutions.

There are several limitations to this study, and readers need to be cautious when interpreting our results. First, although we conduct robustness tests by applying two alternative efficiency models, our empirical results may still be affected by the choice of input and output variables. Second, the results of DEA and SFA may be subject to the heterogeneity problem with correctional institutions. For example, juvenile institutions aim to educate and discipline young offenders, while adult institutions focus on intensive control and surveillance of inmates. Thus, when comparing efficiency of the correctional institutions, one needs to keep in mind their different types of operations. Third, b*ecause SFA* requires specification of a *production function, misspecification may exist due to structural differences among the production functions of correctional institutions under SFA. Fourth, t*he results are based on the sample of correctional institutions. The MCS environment of those institutions may be different from those of other organizations, for example, profit-making organizations. Therefore, caution should be taken when generalizing the research results.

There is definitely a need for more research to use alternative techniques and data sources to explore the impact of MCS' tightness on different organizational performance. Furthermore, our results show that correctional institutions with tight MCS have good efficiency and quality performance. Nonetheless, we did not address the issue of how to apply controls tightly, which is a major management decision but has not yet received adequate attention in research (Merchant, 1998). Therefore, future studies can examine the costs and benefits associated with implementing MCS and may also identify the optimal levels of MCS tightness in different organizations.

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