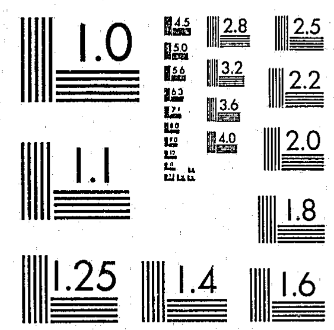

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COST FUNCTIONS FOR CORRECTIONAL INSTITUTIONS

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ABSTRACT

The research reported here has been the estimation of cost functions for several types of California correctional institutions over the period 1948 to 1964 and for selected California jails in 1971-72. Prisons and jails are considered as multiple-product firms producing confinement, hotel-like amenities, and rehabilitation. Lacking a convincing measure of rehabilitative output, we netted out items clearly associated with that aspect of output and took average daily inmate population as the product measure. For the maximum security prisons incremental costs were less than average costs, tempered somewhat by the component of costs associated with a more violent inmate population. For medium security prisons we found long-run constant returns to scale in confinement. And lastly, for city and county jails it appears to be the case that there are constant returns to scale.

INTRODUCTION

According to a recent report of the Law Enforcement Assistance Administration, expenditures by all governmental units on correctional institutions and programs amounted to almost $4.4 billion, of which $2.5 billion was expended at the state level.[1]

Despite these large sums, there has been little analytic cost analysis of correctional institutions. In this paper we begin to remedy this state of affairs. Our approach to analyzing the costs of corrections involves an empirical case study. Chosen for this purpose were five California State Correctional Institutions and 128 city and county jails within the State of California. The cost data on State Correctional Institutions was taken from the budgets of the California Department of Corrections reported in the California State Budget, 1948-1964, cost data for city and county jails from the California Bureau of Criminal Statistics, Jail Space Utilization Study.

Viewed from the governmental level, correctional activities or outputs are intermediate products or inputs in a government's production of crime control. Correctional authorities are a supplier of intermediate products, but unlike most such suppliers in the private sector, they supply their output to only a single buyer, the state government, in this examples. It may well be that by ignoring the structure of the market in which the California Department of Corrections operates we shall have biased our cost estimates. However, we have chosen to examine correctional institutions as if they were cost-minimizing enterprises and have thus eschewed all questions of market structure.

DEFINING CORRECTIONAL OUTPUT

Cost functions relate output levels to costs, and thus before we can actually estimate such functions for correctional institutions we must deal with the problem of specifying the output of such institutions. Here the name is the message, and correctional institutions are supposed to correct or rehabilitate a subset of the population convicted of criminal behavior.[2] Although there is currently a great deal of debate concerning the exact degree of rehabilitation that takes place in correctional institutions, we can safely posit that one output of most correctional institutions is rehabilitation.[3] In addition to rehabilitation, correctional institutions produce the obvious output of confinement. Current confinement technology requires that correctional institutions produce in addition to confinement per se a certain level of hotel service and in most cases a specified level of personal goods and services, including medical care.[4] Thus, correctional institutions, as they are presently operated, produce multiple outputs of which confinement, hotel services, personal services, and rehabilitation are the most significant.

For all outputs except rehabilitation the measurement problem is tractable. It is true that there are significant quality differences in this confinement output, but in most cases this can be controlled by simply stratifying the analysis according to the security level of the

of the institution.[5] Likewise there are quality differences in hotel and personal services, and while these present a more difficult measurement problem than confinement, solutions, albeit imperfect ones, can be found in this area. As for the output of rehabilitation, while there are simple theoretical measures (e.g., recidivism rates), the measurement problem is extremely complex. Because of the empirical problems in measuring rehabilitation, the cost functions estimated in this study exclude rehabilitation. Rather, we have made the extreme assumption that costs directed at rehabilitation do not show up in any of the output measures we shall use. There is no doubt that cost functions including rehabilitation output would be a desirable and useful tool for correctional decision-makers, and this is certainly an area for future research.

SHORT-RUN COSTS MAXIMUM SECURITY PRISONS

The California Department of Corrections currently administers 12 major correctional institutions of which two--San Quentin State Prison and Folsom State Prison--are classified as maximum security prisons; three--Soledad or the Correctional Training Facility, the California Men's Colony, and Deuel Vocational Institution--are medium security prisons; and six--the California Institution for Men, the California Conservation Center, the Sierra Conservation Center, the California Institution for Women, the California Rehabilitation Center and the California Medical Facility--are either minimum security prisons or special purpose institutions.[6] Of these institutions, we have chosen the two maximum security prisons and the three medium security prisons for our cost function estimation.

Folsom State Prison and San Quentin State Prison were selected for the estimation of short-run functions because, over the time period covered in our data, the size of these prisons as measured by design capacity has been relatively constant. During the period under consideration, 1948 to 1964, the design capacity of Folsom State Prison ranged from 1894 to 1994 while the design capacity at San Quentin during the same period ranged from 2568 to 2667.[7]

Since actual inmate populations at Folsom during the period ranged from 2141 to 2919 and from 3426 to 4793 at San Quentin, rated capacity is certainly not a measure of absolute prisoner capacity but rather an indication of the physical size of the plant. While a relatively fixed design capacity is not an exact counterpart of a fixed plant size in a private firm, it is a close enough approximation to make the concept of a short run cost function meaningful in this context.

Clearly, one of the outputs of a prison is confinement, and the number of individuals confined per unit of time is a reasonable measure of this output level. It is reasonable to assume that the quality of confinement per se can be held constant over a large range of inmate populations within a prison of fixed design capacity. The quality of the hotel services output produced jointly with confinement may, however, vary as confinement output varies. If, however, we make the strong assumption that hotel services quality does not vary significantly with

confinement, our output measure is sufficient for describing both activities. That is, if hotel services are constant we can write the cost function for a prison as

$$C = C(P|H = \overline{H},\ R = \overline{R}), \qquad (1)$$

Where C is the annual cost of providing all non-rehabilitative outputs (confinement and related hotel as well as personal goods and services), P is the number of inmates confined in the institution during that year, H is hotel services held constant at quality level $\overline{H}$ (subject to the point made below) and R is rehabilitation held constant at $\overline{R}$.[8]

For policy purposes we simply assume that changes in hotel services output are relevant to decision-makers only when the deterioration in hotel service quality approaches the correctional authorities' lower bound. In the case of Folsom and San Quentin we have taken the actual inmate figures to imply that this lower bound was not reached during the period 1948-64. However, for populations greater than those historically experienced some care must be exercised in interpreting the estimated relationship. These short run cost functions, and in fact all such functions based on a prison of fixed capacity, are only useful management tools up to the population level P at which the lower bound in terms of the quality of hotel services is reached.

Table 1 shows total non-rehabilitative expenditures (FTC) and inmate populations (ADIPF) at Folsom State Prison from 1948 to 1964. Missing from the expenditure data are most of the capital charges associated with the operation of this fixed capacity facility, specifically a measure of the actual annual cost or annual opportunity cost to the State of California of owning much of the in-place capital, such as the buildings and major equipment items at Folsom. For the purposes of short-run cost analysis this underestimation is not crucial. While the omission of capital charges understates the actual cost per inmate, it has very little effect on the magnitude of a change in total costs due to a change in the inmate population.

While cost figures derived from actual budget data are not total cost figures, neither are they a pure measure of variable costs. Unless all fixed costs are entirely omitted from the budget data the expenditure data does not represent pure variable costs. Judging from the budget details and actual estimation results, it is unlikely that all fixed costs have been deleted. To the extent that cost functions estimated from this data include an element of fixed costs, it once again does not impinge on their relevance in answering the important short run question of how total costs vary with changes in the inmate population.

The cost data in Table 1 span a period of 17 years, and thus the effect of price level changes must be accounted for. Our procedure for accomplishing this involved segregating the cost data into three major categories: (1) Salaries and Wages (FTS), (2) Purchases of Goods and Services (FTOE), (3) and Minor Equipment Purchases (FTK). After segregating the cost data, each category was deflated by the appropriate deflator obtained from U.S. Department of Commerce publications.

Table 2 gives the constant dollar or deflated costs by category, and Table 3 is the constant dollar version of Table 1. In both Tables 2 and 3 the letter R preceding the symbols defined above simply denotes a deflated series, e.g., RFTC is total non-rehabilitative expenditures at Folsom State Prison in 1967 dollars. Thus, Table 3 contains the basic data actually used in estimating a short run total cost function for Folson State Prison.

For the Folsom cost function the following two functional forms were employed:

$$RFTC = \beta_0 + \beta_1 ADIPF \qquad (2)$$

$$RFTC = \alpha_0 + \alpha_1 ADIPF + \alpha_3 (ADIPF)^2 \qquad (3)$$

If Eq. 2 is the relevant cost function, then the marginal cost of an additional prisoner is β_1. On the other hand, if Eq. 3 turns out to be the best approximate to the actual cost function, then the incremental or marginal cost will be ($\alpha_1 + 2\alpha_3 ADIPF$).

The results of our estimation are given in Table 4. According to these results the estimated version of Eq. 2 is

$$RFTC = 2{,}499{,}932 + 296\ ADIPF, \qquad (2A)$$

with an R^2 of .20. From 2A we can infer that adding an additional inmate to Folsom costs approximately $296 in 1967 dollars. The explanatory power of the regression is not very large, and one must, therefore, draw conclusions gingerly. It appears to be the case that for confinement and hotel services there were significant economies of scale at Folsom in the sense that marginal cost was only about 25% of average cost.

We also investigated several causes of cost variation not measured by our single variable, ADIPF. Included in this investigation were additional factors such as the median age of Folsom inmates, minor capacity changes at Folsom, the percentage of total inmates committed for commission of violent crimes (FVC), and finally a time trend variable (T). These regressions are also reported in Table 4.

First, by including a variable measuring the violence history of inmates (FVC)[9] the estimated cost function becomes:

$$RFTC = 1{,}849{,}466 + 268\ ADIPF + 2{,}154{,}884\ FVC \qquad (2B)$$

and the R^2 jumps to 0.53, a substantial increase in explanatory power over Eq. (2A). From 2B it appears as if the composition of the inmate population is quite important in determining the absolute cost of operating a prison. Consistent with our intuition the more violent the prison population the higher are its total costs. One would expect that the costs of more guards, of isolating prisoners, and the like would vary directly with the violence record of the inmates.

However, the most interesting aspect of 2B is that the marginal cost is extremely close to the estimate provided by the simple model in Eq. 2A. Thus, while we can explain more of the variation in total costs by including a violence index in the equation, the estimated

magnitude of the key parameter in the system (the coefficient of ADIPF) is not significantly changed by this procedure.

Our next respecification of the model involved the use of a simple time trend. In this case the estimated equation is

$$RFTC = 2{,}547{,}580 + 207\ ADIPF + 20177\ T \qquad (2C)$$

where T is the time trend. This equation had an R^2 of 0.69. The interpretation of a positive coefficient on T is that there is a secular increase in the cost of operating a fixed capacity prison.[10] Since the simple correlation between T and FVC is 0.88, part of what we are measuring in the time variable is probably the secular increase in the percentage of inmates with a violent history. Nonetheless given that the explanatory power of this specification exceeds that of 2B, there are obviously factors other than the increase in FVC over time that cause the secular increase in the operating costs of Folsom.

Unfortunately, data limitations prevented us from exploring this area in more detail, but it is clear from these two simple extensions that very simple modifications of the elementary linear model in 2A greatly increase the explanatory power of the estimated relationship. Nonetheless, in all of the cases presented here the estimates of the marginal cost of confinement are very close in magnitude, and our comments regarding the interpretation of the incremental cost estimate in Eq. 2A remain valid in these more complex specifications.

Another, and complementary method of analyzing prison cost data, is to estimate short-run average cost functions. The sample used in this estimation is drawn from San Quentin's post-war expenditure and output data. In Table 5 we have presented the same data for San Quentin as was presented for Folsom in Table 1. Transforming the total cost data into cost per inmate (AVDSQTC) format, we get the cost series shown in Table 6.

A simple linear form of the total cost function implies, in the case of San Quentin, the following form for the average cost function:

$$\text{AVDSQTC} = \gamma_0 + \gamma_1 \text{RADSQ} \qquad (3)$$

where γ_0 is a constant term and RADSQ = 1/ADIPSQ. In this case the cost per inmate (AVDSQTC) will change by $-\gamma_1[1/(\text{ADIPSQ})^2]$. As long as γ_1 is positive, the cost per inmate will decrease as the inmate population increases and the magnitude of this decrease will be related to the inmate population and in fact will be smaller, the larger the inmate population.[11]

Estimating Eq. 3 using the San Quentin data, we obtained the following average cost function:

$$\text{AVDSQTC} = 59 + 4{,}844{,}719 \text{ RADSQ} \qquad (3A)$$

Details on this estimation are given in Table 7. This relationship has an R^2 of .90 and the estimate of the coefficient γ_1 is statistically significant. We can reject the hypothesis that $\gamma_1 \leq 0$, and thus, based on Eq. 3A, we can conclude that at San Quentin, as at Folsom, cost per inmate decreases as the inmate population increases.

As our results indicate Eq. 3A is adequate for analyzing San Quentin's cost function over the range actually experienced during the post-war period; however, considering another functional form does provide additional insight. For example, instead of using Eq. 3A as an approximation to the short run average cost function, let us approximate it using the estimated cost function (3B).

$$\text{AVDSQTC} = -902 + 7432285 \text{ RADSQ} + .00002 \text{ ADSQ2} \qquad (3B)$$

where $\text{ADSQ2} = (\text{ADIPSQ})^2$. It is straightforward to establish that Eq. 3B implies that cost per inmate (AVDSQTC) declines until the inmate population reaches approximately 5700 and increases thereafter.[12] What a cost function like Eq. 3B indicates, is that while our experience in institutions like San Quentin suggests that cost per inmate substantially overestimates incremental costs, there is a strong possibility that at very high inmate populations (relative to design capacity) cost per inmate would actually underestimate incremental costs.

The impact of our findings on San Quentin's cost structure is that they support our previous work on Folsom. The data are consistent with the hypothesis that prisons such as Folsom and San Quentin are underutilized in terms of confinement output; total confinement costs might be minimized by using one large facility more intensely rather than maintaining the two separate institutions. However, with this prescription one needs to recall that prisons produce a joint output and that maximizing efficiency with regard to only one of those outputs might be detrimental to the others. It may well be that minimizing confinement costs pushes hotel services and rehatilitation below the acceptable lower bound.

LONG-RUN COSTS MEDIUM SECURITY PRISONS

Unlike the design capacity of both Folsom and San Quentin, the design capacity of DVI, CMC and CTF have varied considerably over the post-war period.[13] DVI had a design capacity of 540 in 1948 and 1523 in 1964. CMC started operation in 1954 with a design capacity of 600 and in 1964 had a design capacity of 3762; finally CTF or Soledad had a design capacity of 600 in 1948 and 3239 in 1964. Thus, these medium security prisons have not had a fixed plant size over the post-war period and represent an excellent example for estimating long run cost functions.

Data restrictions prevent us from exploring the area in sufficient detail in this study. First, the lack of capital cost data seriously restricts our ability to estimate pure long run cost functions. While the lack of such data was not a serious drawback in short-run cost function estimation, it is a major obstacle in long-run cost function estimation. At present, for state institutions, we have only the most informal evidence. Based on our review of some capital appropriations information, it appears that capital costs are proportional to output, but this point must be taken as a maintained hypothesis, not an estimated relationship.

Additionally, extracting a consistent series for non-rehabilitation

total costs posed a more difficult problem in these cases. Those and similar data problems, lead us to view these estimated long run cost functions more as an illustration than as rigorous estimations of an actual long run cost functions.

Our estimates of the appropriate long run total operating cost functions for DVI, CMC and CTF were,

$$RDVITC = 304{,}344 + 1{,}773\ DVIAPIP, \tag{4}$$

$$RCMCTC = -53{,}437 + 1517\ CMCADIP, \text{ and} \tag{5}$$

$$RCTFTC = 909{,}307 + 885\ CTFADIP - .009\ (CTFAIP)^2 \tag{6}$$

where RDVITC, RCMCTC and RCTFTC are deflated total operating costs at DVI, CMC and CTF respectively, and DVIADIP, CMCADIP and CTFADIP are average daily inmate populations at DVI, CMC and CTF respectively. The R^2's for Eqs. (4), (5) and (6) are .74, .97 and .80 respectively. Table 8 reports these results.

It is interesting to note that in two cases (DVI and CMC) a simple linear cost function is a good approximation and in those cases the incremental or marginal costs ($1773 and $1517) are very close to costs per inmate figures or average costs.[14] This suggests that in the long run, at least, operating costs are nearly proportional to output. In this aspect, the results for CTF are somewhat of an anomaly. For CTF the best approximation appears to be nonlinear and is characterized by marginal cost substantially below average cost, that is increasing returns to scale.

At this point, our results on estimating long run cost functions for state prisons are far too imprecise for us to conclude that, in fact, long run operating costs are proportional to inmate populations. Because of the nature of our results in this area, we decided to investigate long run cost functions using another sample, city and county jails in the State of California.

LONG-RUN COSTS -- JAILS

Up to this point we have reported on our investigation of empirical cost functions based on time-series data. However there was a second part of our investigation that involved the estimation of cost functions using cross-section data. We used the cost and output data generated by the California Bureau of Criminal Statistics' Jail Space Utilization Study for 1971-72 to estimate a cost function for city and county jails in California.[15] Using this cross section approach enabled us to shed some additional light on estimating long run cost functions and to investigate a number of interesting areas precluded by data restrictions in the time-series analysis.

The first question we investigated using this data source was the relationship of capital costs to inmate population. As in the case of state institutions, city and county institutions do not include capital costs in their operating budgets, and the results in the survey did not

provide a direct measure of such costs. However some respondents to the survey (35) did give the original construction costs of their physical plant, and the year in which the construction was actually completed. We transformed the construction cost data into a constant dollar series by using the appropriate Department of Commerce deflator for government construction. Then, assuming that confinement technology was constant over the period covered, we estimated the following investment functions:[16]

$$X_{40} = 1,066,514 + 2180(X_{18}) \qquad (7)$$

$$X_{40} = 1,321,703 - 1746(X_{18}) + 1942(X_{18}^2) \qquad (8)$$

where X_{40} is deflated costs of physical plant and X_{18} is the rated capacity of the institution. As reported in Table 9, in neither case was the explanatory power of the relationship overwhelming ($R^2 = 0.12$ in Eq. 7 and 0.14 in Eq. 8). Adjusted for the difference in the number of variables, the explanatory power ($\bar{R}^2$) of Eq. 7 is trivially better than Eq. 8. The coefficient estimate in Eq. 7 is significant and in this sense the simple linear form is superior to the form involving X_{18}^2.

We next attempted to use the cross section data for estimating a long run operating cost function. The cost function that was estimated using the Jail Space Utilization data was a long run function because across the sample of 128 institutions, all factors were variable. It should be noted that using cross section data is not without difficulties.

There is the obvious problem of assuming that all of the jails in the sample actually produced the same output. To some extent we have adjusted for this by considering attributes of the output and of the institutions themselves in several of the estimates that appear in Table 10. Considering the attributes of the output was of particular importance here because of the impossibility, in many instances, of obtaining total costs exclusive of rehabilitation expenses, as had been done in the other case study. Since jails provide only a minimal amount of this service, this data limitation was probably not terribly important.

Still another problem of estimation using this particular cross section data is the transient and stochastic nature of the inmate population in many city and county facilities. With a fluctuating population, facilities may tend to be built with a design capacity that exceeds their expected output or population. Excess capacity will be built into the system as insurance, and the plants may be minimum cost in terms of the maximum inmate population that the decision-maker feels he must be able to accommodate on extremely short notice. Such risk aversion will certainly bias the estimated function upward relative to a minimum total cost function on expected values. Given the desired degree of excess capacity, the estimated function will give the operational relationship between operating cost variation and average inmate population in systems with large transient populations.

With these caveats before us, we are now in a position to present

some of the major results of our estimation:

$$X_{26} = 199,750 + 2881\ X_{20} \qquad (8)$$

$$X_{26} = 339,427 + 1862X_{20} + .37\ X_{20}^2 \qquad (9)$$

$$X_{26} = 195,349 + 3501\ X_{20} - 1.14\ X_{20}^2 + .00048\ X_{20}^3 \qquad (10)$$

where X_{26} = total annual operating costs of the jail, and X_{20} is the average daily population of the jail. The adjusted R^2's for the equations are 0.78, 0.79, and 0.80 respectively. The appropriate functional form is not immediately obvious.

From inspecting the details of the estimation in Table 10, we notice that the least significant coefficients in the estimations are the coefficients on X_{20}^2 and X_{20}^3 in Eq. 10, and of these, the coefficient X_{20}^2 has the highest standard error relative to the coefficient estimate. If we cannot reject the hypothesis that the coefficient on X_{20}^2 in Eq. 10 is in fact zero, then all equations evidence non-decreasing marginal costs. Moreover the increase in marginal cost in both Eqs. 9 and 10 would be quite small. For example, in Eq. 9 the increase in marginal cost per inmate is .75 or $75 per 100 inmates. Given that the mean of X_{20} is 240, this variation in marginal cost is not very significant, and it appears that we can accept the simple linear form in Eq. 8 as an operational approximation to the long run cost function.

If we take this analysis one step further and introduce a quality of hotel service variable, our results become even more interesting.

Using square footage per inmate at rated capacity, we obtain the following estimated cost function:

$$X_{26} = -130 + 1627\, X_{20} + 25{,}809\, X_{42} \qquad (11)$$

where X_{42} is the square footage per inmate measure. This relationship suggests that is you hold service level constant, then we have a nearly proportional relationship between output and operating costs when the jail size is allowed to vary. Only 12 jails provided sufficient information for this estimation and thus while the results are suggestive, they are by no means definitive.[17]

CONCLUSIONS

We may now summarize our findings. It is worth re-interating that our measure of output is simply prisoners confined for each of the three types of correctional institutions which we have studies. We have not found it possible explicitly to keep the quality of the hotel and personal services constant, save in an imperfect way for jails. To the extent that those services are inversely related to the number of prisoners confined in a fixed-capacity institution, our results underestimate the total cost of the correctional industry. Additionally, we have tried to avoid the knotty problem of rehabilitated output by deducting all those items in the Department of Corrections' budgets which were clearly identifiable as rehabilitation-related. In whichever direction that rehabilita-

tion and confinement are related, our estimated functions may be biased, according as to how accurately we have netted out rehabilitation costs and our output measure does not confound confined and reformed prisoners.

For the two maximum security prisons--San Quentin and Folsom-- we found significant economies of scale in confinement regardless of whether we estimated total or average cost functions. For both prisons we also found a significant and slightly increasing incremental cost associated with confining a more violent inmate population.

For the three medium security prisons--the Correctional Training Facility (Soleded), the Deuel Vocational Institute, and the California Men's Colony (San Luis Obispo)--we were able to estimate long-run cost functions since capacity changed significantly in all three institutions over the sample period, 1948-1964. For Deuel and CMC we discovered constant returns to scale in confinement with long-run marginal and average costs approximately equal at levels of $1500-$1700. There was evidence for long-run economies of scale in confinement only at the CTF.

Lastly, we used the extensive survey of the California Bureau of Criminal Statistics' Jail Space Utilization Study of 1971-72 to estimate cost functions for city and county jails. It was necessary to produce separate estimates for capital and operating costs. Our regressions suggest a simple linear relationship between the capacity of a jail and the real costs of physical plant, but the relationship is not statistically powerful. For the estimates of long-run operating costs, we could not reject the hypothesis of non-decreasing long-run marginal costs.

The best fit was for constant returns to scale. By introducing a service quality variable, we found still stronger evidence of long-run constant returns to scale for city and county jails. We stress that these estimates are a beginning and that much further research is needed in the economics of correctional institutions.

NOTES

[1] Expenditure and Employment Data for the Criminal Justice System, 1977.

[2] It is a subset since not all convicted criminals are actually sent to such institutions.

[3] Certainly for some local jails and holding facilities the term correctional institution is misleading, and they neither intend nor accomplish a measurable amount of rehabilitation.

[4] It is interesting to note in this connection that even in centralized confinement centers all hotel services have not always been produced in the institution. A graphic example of this is the practice during the French Revolution of allowing prisoners to have their meals catered by private restaurants, at their own expense.

[5] In cases where escape ratios differ significancly between institutions of similar security levels or over time in the same institution the problem of measuring confinement may be made more difficult but certainly not impossible.

[6] A description of the institutions is available in a data appendix available on request from the authors.

[7] According to the Chief of Facilities planning for the department of Corrections (Mr. Thomas L. Smithson), design capacity is an actual count of cells, wards and dormitories, allowing for single-celling.

[8] If, on the contraty, hotel services are changing as P changes, then our cost function is relating annual costs to the quantity of confinement services and a mixture of a change in the quantity and quality of hotel services. For simplicity we have deleted personal goods and services from this discussion but without doing much violence to practice we can assume, like confinement, they can be held constant as P increased.

[9] This index was constructed by taking the annual percent of total inmates who had been sentenced for the violent crimes of robbery, homocide, assault, ans sex crimes.

[10] Recall that we are working with constant dollar costs and this secular increase is not merely a simple inflation factor.

11
$$\frac{d\ AVDSQTC}{d\ ADIPSQ} = -\delta_1 \left[1/(ADIPSQ)^2\right]$$

$$\frac{d\left(\frac{d\ AVDSQTC}{d\ ADIPSQ}\right)}{d\ ADIPSQ} = 2\,\delta_1 \left[1/(ADIPSQ)^3\right]$$

12
$$\frac{dAVDSQTC}{dADIPSQ} = 0 \text{ and } \frac{d\left(\frac{dAVDSQTC}{dADIPSQ}\right)}{dADIPSQ} > 0,$$

at ADIPSQ = 5700 in Eq. 3B.

[13] The data appendix, available upon request, gives details of capacity variation.

[14] The negative term on Eq. 6 does suggest a nonlinearity at output ranges outside the sample.

[15] A list of the jails covered in this survey is available in the data appendix on request.

[16] A full list of variables is given in the data appendix.

[17] We have only reviewed selected results from our investigation of California jails. The interested reader is referred to the additional results in the data appendix.

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TABLE 1

Cost and Inmate Data

Folsom State Prison

YEAR	FTC	ADIPF
1948	$1,995,532	2,535
1949	2,037,461	2,750
1950	2,218,270	2,738
1959	2,407,471	2,415
1952	2,434,532	2,212
1953	2,693,584	2,500
1954	2,712,909	2,622
1955	2,732,171	2,436
1956	2,812,894	2,141
1957	3,100,055	2,460
1958	3,255,748	2,868
1959	3,410,436	2,450
1960	3,784,565	2,783
1961	3,815,040	2,919
1962	3,858,202	2,634
1963	3,923,725	2,526
1964	4,266,637	2,557

Source: State of California, The Governor's Budget, 1950-1967.

Notes: FTC = nominal total costs at Folsom,
ADIPF = average daily inmate population at Folsom.

TABLE 2

Deflated[a] Cost Data

Folsom State Prison

YEAR	RFTS	RFTOE	RFTK
1948	1,690,270	862,463	96,173
1949	1,743,818	1,212,907	59,882
1950	1,715,260	1,361,316	96,346
1951	1,849,176	1,318,699	60,410
1952	1,849,230	1,199,431	57,343
1953	1,99[illegible],341	1,281,11[illegible]	57,802
1954	2,018,750	1,198,763	53,162
1955	2,016,762	1,095,293	44,282
1956	2,048,787	998,747	49,888
1957	2,070,887	1,124,384	51,836
1958	2,044,410	1,179,828	31,510
1959	2,152,715	1,103,100	49,750
1960	2,293,602	1,183,231	64,420
1961	2,206,049	1,206,842	40,81[illegible]
1962	2,232,572	1,133,434	38,150
1963	2,257,986	1,025,726	67,294
1964	2,253,661	1,068,099	55,653

Source: State of California, The Governor's Budget, 1950-1967.

Notes: RFTS = real salarie and wages,
RFTOE = real purchases of goods and services,
RFTK = real minor equipment purchases.

[a]The deflators are explained in the text and more formally in the appendix available on request.

TABLE 3

Deflated[a] Total Cost and Inmate Data

Folsom State Prison

YEAR	RFTC	ADIPF
1948	3,085,333	2,535
1949	3,016,607	2,750
1950	3,172,922	2,738
1951	3,228,285	2,415
1952	3,196,004	2,212
1953	3,338,261	2,500
1954	3,270,675	2,622
1955	3,166,337	2,436
1956	3,097,422	2,141
1957	3,247,107	2,460
1958	3,255,748	2,868
1959	3,305,565	2,450
1960	3,541,253	2,783
1961	3,453,703	2,919
1962	3,404,156	2,634
1963	3,351,006	2,526
1964	3,377,413	2,557

Source: State of California, The Governor's Budget, 1950-1967.

Notes: RFTC = real total cost,
ADIPF = average daily inmate population.

[a]The deflators are explained in the text and more formally in the appendix available on request.

TABLE 4

Estimated of Total Cost Functions
for Folsom State Prison, 1948-1964.

EQ. NO.	DEPENDENT VARIABLE	CONSTANT	ADIPF	ADF2	FMA	FVC	DVM2	T	R^2 ($\bar{R}^2$)
(2C)	RFTC	2547580	207 (102)**					20177 (4305)	.69 (.65)
	RFTC	644213	1765 (3218)	-.29 (.63)					.20 (.09)
(2A)	RFTC	2499932	296 (157)						.20 (.15)
(2B)	RFTC	1849466	268 (124)			2154884 (679248)			.53 (.46)
	RFTC	-373117	1156 (2581)**	-.18 (.50)	47687. (57998)	-805730 (1586774)	81239 (98058)	25985. (14956)	(.73) (.57)

All estimates are OLS and additional regression results are available upon request.

**Standard error

Source: State of California, The Governor's Budget, 1950-1967.

Variables: RFTC = Deflated Folsom total costs,

ADIPF = average daily inmate population at Folsom,

ADF2 = $(ADIPF)^2$,

FMA = median age of inmate population at Folsom,

FVC = percent of total inmate population at Folsom committed for violent crimes (homicide, assault, robbery, and sex offenses),

DVM2 = dummy variable for capacity change at Folsom,

T = time trend indicator with 1948 = 1, 1949 = 2, ...

TABLE 5

Deflated Cost[a] and Inmate Data

San Quentin State Prison

YEAR	RSQTC	ADIPSQ
1948	$5,083,855	3988
1949	4,631,915	4023
1950	4,960,589	3750
1951	5,074,511	3636
1952	5,133,211	3781
1953	5,253,772	3737
1954	5,161,086	3935
1955	5,114,222	3480
1956	4,994,232	3426
1957	4,974,927	4130
1958	5,069,511	4742
1959	4,885,032	4326
1960	5,361,720	4793
1961	5,179,408	4565
1962	5,070,898	3794
1963	5,251,443	4265
1964	5,211,327	3850

Source: State of California, The Governor's Budget, 1950-1967.

Notes: RSQTC = Reat total costs at San Quentin
ADIPSQ = average daily inmate population.

[a]The method of deflation is exactly that used on the Folsom cost data.

TABLE 6

Deflated Average Cost[a] and Inmate Data

San Quentin State Prison

YEAR	AVDSQTC	ADIPSQ
1948	1275	3988
1949	1151	4023
1950	1323	2750
1951	1396	3636
1952	1358	3781
1953	1405	3737
1954	1312	3935
1955	1470	3480
1956	1458	3426
1957	1205	4130
1958	1069	4742
1959	1129	4326
1960	1119	4793
1961	1135	4565
1962	1337	3794
1963	1231	4265
1964	1354	3850

Source: State of California, The Governor's Budget, 1950-1967.

Notes: AVDSQTC = Average total costs at San Quentin
ADIPSQ = average daily inmate population at San Quentin.

[a]See the text.

TABLE 7

Estimate Cost Functions for San
Quentin State Prison (1948-1964)

EQ. NO.	DEPENDENT VARIABLE	CONSTANT	RADSQ2	ADIPSQ	ADSQ2	SQVC	SQMA	LADSQ	R^2 ($\bar{R}^2$)
(3A)	AVDSQTC	59	4844719						.90
			(421324)**						(.89)
	AVDSQTC	-1776	8557277	.22					.90
			(4186712)	(.25)					(.88)
(3B)	AVDSQTC	-902	7432285		.00002				.90
			(2823925)		(.00002)				(.88)
	AVDSQTC	-956	7462883		.00002	98			.90
			(2930122)		(.00002)	(491)			(.87)
	AVDSQTC	-1701	8658719		.00003	-589	21		.92
			(2956452)		(.00002)	(684)	(15)		(.89)
	LAVSQ	15						-.95	.89
								(.09)	(.88)

All estimates are OLS.

**Standard Error

Source: State of California, The Governor's Budget, 1950-1967.

Variables: AVDSQTC = RSQTC/ADIPSQ, Deflated cost per inmate at San Quentin,

LAVSQ = natural logarithm of deflated cost per inmate at San Quentin,

RADSQ2 = 1/ADIPSQ,

ADIPSQ = average daily inmate population at San Quentin,

ADSQ2 = $(ADIPSQ)^2$,

SQVC = percent of total inmate population at San Quentin committed for violent crimes (homicide, robbery, assault, and sex offenses),

SQMA = median age of inmate population at San Quentin each year

LADSQ = natural logarithm of average daily inmate population at San Quentin.

TABLE 8

Estimated Long-Run Cost Function for Medium
Security Correctional Institutions, 1948-1964.

EQ. NO.	DEPENDENT VARIABLE	CONSTANT	CTFADIP	$(CTFADIP)^2$	DVIADIP	$(DVIADIP)^2$	CMCADIP	$(CMCADIP)^2$	R^2
(6)	RCTFTC	2865834	-17						.12
			(12)**						
	RCTFTC	909308	885	-.009					.80
			(130)	(.001)					
(4)	RDVITC	304334			1773				.74
					(274)				
	RDVITC	108405			-149	1			.75
					(2116)	(1)			
(5)	RCMCTC***	-63626					1548		.97
							(70)		
	RCMCTC***	-53437					1517	.009	.97
							(241)	(.066)	

All estimates are OLS.

**Standard Error

***1954-1964

Source: State of California, The Governor's Budget, 1950-1967.

Variables: RCTFTC = Deflated total cost at the Correctional Training Facility (Soledad),

CTFADIP = average daily inmate population at CTF,

RDVITC = deflated total cost at Deuel Vocational Institute,

DVIADIP = average daily inmate population at DVI,

RCMCTC = deflated total cost at California Man's Colony (San Luis Obispo),

CMCADIP = average daily inmate population at CMC.

TABLE 9

Investment Functions for California Jails

DEPENDENT VARIABLE	CONSTANT	X18	$(X18)^2$	R^2	$\bar{R}^2$	N
X40	1066514 (701654)*	2180 (1022)		.12	.094	35
X40	1321703 (763991)	-1746 (4639)	1942 (2238)	.14	.086	35

All estimates are OLS.

*Standard Error

Source: California Department of Justice (1974).

Variables: X40 = Deflated costs of physical plant for jails,

X18 = rated capacity of the jail.

TABLE 10

Estimated Total Operating Cost Functions for California City and County Jails, 1972-72.

EQ. NO.	DEPENDENT VARIABLE	CONSTANT	X20	$(X20)^2$	$(X20)^3$	(X18)	X42	R^2	$\bar{R}^2$	N
(8)	X26	199750 (106804)*	2881 (196)					.78	.78	63
(9)	X26	339427 (121003)	1862 (495)	.37 (.16)				.80	.79	63
(10)	X26	195349 (139932)	3501 (9778)	-1.74 (1.10)	.00048 (.00026)			.81	.80	63
	X26	142489 (216711)	1972 (835)			910 (.815)		.78	.77	60
	X43	186185 (103402)	2861 (190)					.79	.79	63
	X43	322976 (117036)	1863 (479)	.36 (.16)				.80	.79	63
(11)	X26	-130 (271730)	1627 (508)				25809 (11603)	.68	.61	12
	X26	85105 (286747)	3516 (2024)			-1687 (1750)	24740 (11201)	.72	.62	12
	X43	.4488 (1.020)	.0033 (.0016)				.0428 (.0392)	.53		9
	X1	1.0561 (.0745)	-.0001 (.0001)	4.90 (.93)	(1/X20)			.32		72

All estimates are OLS.

*Standard error.

Source: California Department of Justice (1974).

Variables: See the data appendix for a complete list.

X26 = Total operating costs.

X43 = toptal operating costs minus capital outlays,
X1 = average cost of food per inmate day,
X20 = average estimated daily inmate population,
X18 = total rated capacity,
X42 = total detention floor space divided by total rated capacity.