PROBLEMS IN ESTIMATING THE OPTIMAL-COST PRISON SIZE: A REPLY

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In his comment on our article (p. 139) Professor Kritzer offers several criticisms of our estimation of the least-cost size prison. We will discuss each of these criticisms in turn. Professor Kritzer points out that the major thrust of our "findings is that the least expensive prison to operate is larger than small but smaller than gargantuan" (p. 139). He feels that this point is obvious, being "simply a reminder of the economies of scale and the diseconomies of excessive scale" (p. 139). We disagree. Although basic and intermediate economics texts usually depict average cost curves as U-shaped (first decreasing and then increasing with facility size), most empirical work which seeks to estimate such curves does not find U-shaped curves to exist in practice.[1] In the case of prisons, we cite references indicating that work on correctional standards assumes that prison costs do *not* vary with prison size. In addition, we cite literature which indicates that the size prison to construct in two of our largest and most sophisticated prison systems (the California and federal systems) are currently made without taking costs into consideration. Thus, we feel that the point is less than obvious.

Even if the point were obvious, it is still, we believe, useful to explore the range of prison sizes for which costs increase and the range of sizes for which they decrease. One work indicates that a prison with a capacity of 500 inmates, as recommended by the Commission on Accreditation for Corrections (1977), is a size for which prison costs are quite high. We believe that this is a useful finding to consider when recommending such standards.

Professor Kritzer points out that we report a specific figure for the optimal size prison (1371) and that the "apparent precision of this figure may be a powerful signal to prison planners and lawmakers that new prisons should be designed

[1] See Witte *et al.* (1979) for a survey of this literature.

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to house about 1300 to 1500 inmates" (p. 139). The number 1371 is the prison capacity which minimizes the estimated average cost for prisons in our sample. We are quite aware that this figure is a point estimate and, thus, that the least-cost size prison, even for the prisons in our sample, may actually be somewhat larger or smaller than this number. Indeed, based on three years experience working with cost data for the California and Federal prison systems and a careful reading of other work on prison costs, we, in our summary and conclusions, state that "minimum costs per confined day will probably be achieved only with prisons of rather substantial size, say 1000 to 1600 inmates" (p. 134). Further, we do not recommend that prisons actually be built this large; we recommend only that cost be one consideration in the determination of prison size. Finally, we are careful to point out that our study is not definitive but, rather, "serves to point up the potential usefulness of studies of the sort we have undertaken" (p. 135).

Professor Kritzer points out that we estimate our model using data from only six Federal Correctional Institutions (FCIs) and that these six were not a random sample of all FCIs. This is true, and we made no attempt to hide this fact in our article. However, it does appear that we were not, in our article, clear as to why we did this. In our original work with data for federal prisons, we used data for all 21 FCIs to estimate a long-run cost curve (Witte *et al.*, 1979). Later we estimated short-run cost curves for each of these FCIs. These short-run cost curves indicated that the factors affecting short-run costs and the way in which they affect these costs were quite diverse. We interpreted these findings as an indication that some of the 21 FCIs in our sample were using quite different methods of operation than others. As determining the unique effect of prison size on costs requires that the prisons considered use at least broadly similar methods of operation, we searched among the 21 FCIs for a subgroup which appeared to be using similar methods of operation. More specifically, we calculated an F-statistic to determine if we could accept the hypothesis that the way in which various factors affected costs were broadly the same for any subgroup of FCIs. The six prisons we analyzed were the subgroup which we identified as having the most similar methods of operation. If one were to estimate a cost curve using prisons with widely differing methods of operation (such as the 21 FCIs in our sample), the shape of the curve would reflect both the effects of changed

prison size and changed methods of operation on costs. In this article we were seeking to isolate the effect of prison size on costs.

To explore the way in which average prison operating costs vary when both prison size and methods of operation are allowed to vary, we estimated an average cost curve for the 18 FCIs which operated continuously during the ten quarters for which we pool data.[2] Professor Kritzer suggests this as an alternative to the estimation presented in our article. This analysis indicates that prison costs decline continuously with increased size within the range of prison sizes observed in our data.[3] Thus, it appears that when one allows both prison size and the method of prison operation to vary, costs decline continuously with prison size—bigger prisons are cheaper to operate. This finding is consistent with our findings for the California prison system, which we discuss briefly in our article.

Our results indicate that the rate of decline in average costs with increased prison size is less when both prison size and methods of operation are allowed to vary than when only prison size varies. However, even if we allow changes in methods of operation, our results indicate that prisons as small as 500 inmates will be markedly more costly to run than prisons with larger populations.

Finally, Professor Kritzer objects to our pooling of cross-sectional and time-series data. He suggests that the relationships among the observations in each time series are not autoregressive in nature and that variation in population and cost are random and unrelated. Therefore, he suggests that we essentially have only six observations, not 60. We do not believe that this is the case. Before pooling the data, we estimated short-run cost functions for each of the prisons using monthly data. The results indicated strong systematic relationships between output and cost as well as the existence of an autoregressive process.

In moving from our short-run to our long-run work, we decided to use quarterly rather than monthly data. We did this to avoid short-run accounting adjustments which occur on an inter-quarterly basis. We next searched for a subset of

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[2] Three FCIs opened during the time period used for analysis.

[3] Specifically the coefficient on CD is insignificantly different from zero at ordinary levels of statistical significance (e.g., a =.05). The coefficient on LNCD is negative and significantly different from zero at ordinary levels of statistical significance. This indicates that costs decline continuously with increased prison size.

quarterly data within which methods of operation appeared similar using statistical tests. The ten quarters we use is such a subset of the data. The tests we conducted to determine if pooling was appropriate indicate that estimating an average cost curve for any quarter within the ten used should lead to broadly similar conclusions.[4]

We feel that our paper has illustrated the need to conduct empirical studies of the costs of prisons. Furthermore, we feel that we have presented strong evidence that prisons which house only 500 inmates are likely to be quite a bit more costly than prisons which are two or three times larger. The methods used may not be ideal, but given the constraints imposed by the data, we believe that they were carefully carried out and provide useful insights.

REFERENCES

WITTE, Ann D., Richard HOFLER, William MCGUIRE, Pamela REID, Jeffrey BASS, William TRUMBULL, and Colette CHABBOTT (1979) *Empirical Investigations of Correctional Cost Functions*. Final report to the National Institute of Justice on LEAA Grant No. 78-NI-AX-0059.

[4] Specifically, we estimated a long-run average cost curve for each of the quarterly data sets (10 different data sets) which contained the variables which had, in our previous work, been most strongly related to average costs. It was impossible to estimate our full mode for each quarter, as there would have been negative degrees of freedom. Thus, these quarterly models were estimated for a reduced specification.