CHAPTER 11

# PER CAPITA LOSSES AND THEIR RELATION TO SHORTAGE

In order to make comparisons among our sample communities and later to construct a function relating expected losses to the chosen level of system adjustment, we must standardize our loss estimates at least for the obvious variation due to city size. The familiar deflator for this purpose is population, although one could certainly conceive of other meaningful size indicators relevant to variations in water use, such as the size of the city's industrial sector as measured by floor space, employment, or value added. No single deflator can be expected to remove all the variation not in fact due to size of shortage suffered. But since we do not have a large enough sample to permit regression analysis, we cannot explore the possibility of removing several extraneous influences.

In Table 34, the loss estimates from Chapters 9 and 10 are presented in per capita terms.[1] Only the results for the local/20 percent and national/8 percent combinations are shown because they are most relevant for decision-makers at the respective levels. They also represent the extremes in the variation of losses under our different assumptions.

## SECTORAL PATTERNS

The sectoral patterns of loss found in Table 34 appear quite irregular when compared with the variations in shortage, from Braintree (9.7 percent) through Pittsfield (14 percent) to Fitchburg (22 percent). Of the "raw" (uncorrected) sectoral per capita losses, only the industrial sector increases in step with shortages. The losses of the other sectors either vary

[1] Population data are from the U.S. Census of 1960 and the Massachusetts Census of 1965. For 1966, the trend between 1960 and 1965 was simply extrapolated. The 1965 Pittsfield population is used to maintain consistency with the decision to identify the losses there with the peak year of the drought in the western part of the state.

irregularly with shortage (as for the municipal, domestic, and miscellaneous sectors) or are essentially constant (the commercial sector). The differences in the municipal and domestic figures seem to be attributable to the nature of the city government's choice in each case concerning the way in which the burden of potential shortage would be borne. In Pittsfield, for example, domestic restrictions do not deprive the government of revenue, since domestic water is sold at a flat annual rate. The constancy of the commercial sector losses may, on the other hand, be due to the varying completeness of our coverage of this sector in each of the cities.

Under the local/20 percent/zero deferral or transferral combination, the pattern of sectoral losses is substantially like that just discussed. The industrial sector still exhibits an increase from Braintree to Fitchburg, though its size has been considerably reduced.

TABLE 34. PER CAPITA LOSSES

Raw data (Table 22)

(*dollars*)

| Sector | Braintree | Fitchburg | Pittsfield |
|---|---|---|---|
| Industrial | 0.07 | 5.60 | 1.55 |
| Municipal | 3.99 | 7.48 | 1.45 |
| Commercial | 0.25 | 0.21 | 0.26 |
| Domestic | 1.10 | 1.41 | 0.89 |
| Miscellaneous | 0.03 | 0.72 | 2.63 |
| Total | 5.44 | 15.42 | 6.79 |

Local/20 percent data (Table 29)

(*dollars*)

| | | | |
|---|---|---|---|
| Industrial | 0.07 | 1.42 | 0.80 |
| Municipal | 3.99 | 7.48 | 1.45 |
| Commercial | 0.25 | 0.06 | 0.26 |
| Domestic | 1.08 | 1.38 | 0.87 |
| Miscellaneous | 0.03 | 0.72 | 1.15 |
| Total | 5.42 | 11.07 | 4.53 |

National/8 percent data (Table 32)

(*dollars*)

| | | | |
|---|---|---|---|
| Industrial | 0.07 | (7.89) | (0.20) |
| Municipal | 3.99 | 7.48 | 1.45 |
| Commercial | 0.01 | (0.20) | 0.19 |
| Domestic | 1.05 | 1.37 | 0.85 |
| Miscellaneous | 0.03 | 0.72 | 1.15 |
| Total | 5.15 | 1.49 | 3.45 |

*Sources:* See footnote 1 of this chapter.
*Note:* Figures in parentheses represent gains.

When we alter our assumptions to those of a national accounting stance, an 8 percent discount rate, and complete deferral or transferral of lost production (to areas or periods of less than full employment), the original sector patterns in the industrial and commercial sectors disappear completely. Now, reflecting the lower discount rate and the importance of investments in Fitchburg's (and, to some extent in Pittsfield's) industrial sector, the sectoral "losses" become larger gains as we move from Braintree to Fitchburg. We obtain a similar result in the commercial sector, and again it reflects the impact of the changing discount rate on investment evaluation. The other sectoral patterns do not change, though again we subtract a few cents from the domestic losses in reevaluating well investments.

## COMMUNITY PER CAPITA LOSSES

The net results of these changing sectoral patterns are the community per capita annual losses, which are graphed against shortages in Figure 19. To illustrate the great sensitivity of our estimate of the loss-shortage relation to the discount rate, we have fitted by eye a curve to each set of points. In addition, because it seems unlikely that present investment opportunities will continue unexploited in the face of rising costs and pressures on sources, we have provided an alternative version of the national/8 percent curve which does not fall off with increasing shortage.

The general shape of the local/20 percent curve is similar to that for the uncorrected data, though for the former the total increase in loss with level of shortage is less than for the latter. In addition, under the local/20 percent assumptions, the per capita loss for Pittsfield was estimated to be less than that for Braintree, though, of course, Pittsfield's shortage was larger. This may reflect an overly conservative view of the tree-loss estimate provided to us for Pittsfield. Our credibility correction to this estimate had the effect of reducing the city's total per capita loss under each accounting stance by $1.47. If this were added back in to the accounts, the Pittsfield loss in the local/20 percent account would be $6.00 per capita, more than that recorded for Braintree ($5.42). In addition, applying this same adjustment to the national/8 percent accounts would give us a total town loss of $4.92 for Pittsfield, essentially equal to the $5.15 figure calculated for Braintree under this combination. These adjusted points are plotted in Figure 19 and were taken into account in fitting the suggested relations.

We now concentrate on the results obtained using the local/20 percent combination, but we also include results reflecting the national/8 percent relation we suggest in Figure 19. Our major reason for choosing to con-

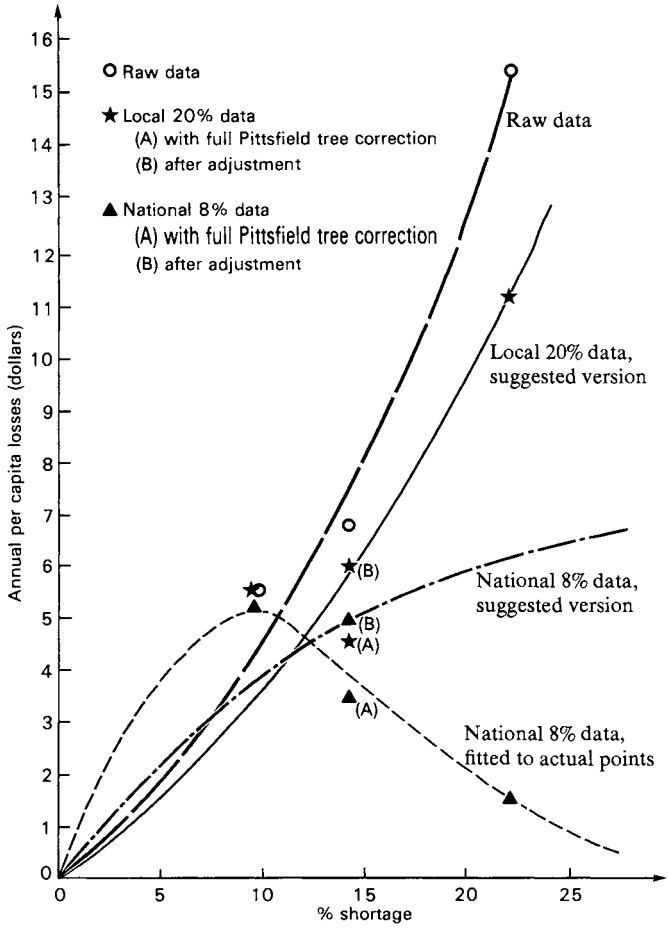


Figure 19. Per capita annual losses as a function of shortage.

centrate on this account is our belief that water supply is likely to continue to be an area of local investment neither receiving much outside financial help nor subject to much outside control. The local/20 percent account results seem to us the appropriate ones to use in evaluating water supply capacity expansion from the purely local point of view.

Before moving on to further calculations, we suggest as a conclusion based on our estimates of the cost of the recent drought, that as we consider larger accounting frameworks and as we allow the discount rate to move toward a level probably more closely reflecting the rate of time preference, the drought tends to lose its image as a crisis, a creator of huge

losses. At least in humid areas under present conditions of technological "slack," we may rather view the drought as a fortuitous spur to large-scale industrial rationalization of water use. We may still feel that distributional considerations prohibit us from viewing droughts as social "goods," but certainly realism demands at least a tacit moderation of official preoccupation with drought protection and explicit tempering of official public statements about the fantastic costs being generated by this natural "calamity."