Chapter 7

ECONOMIC COSTS OF THE EVACUATION

7.1 INTRODUCTION

At the most general level the economic costs of the Mississauga evacuation consist of the value of the lost opportunities for production and consumption resulting from the evacuation. Production losses consist of the reductions in output of business and the public sector that are not made up later. Increased expenditures on food, accommodation, and travel are examples of consumption losses; resources used in these ways are not available for other purposes. A less obvious though equally important form of lost consumption opportunities is the foregone use of houses, apartments, and other buildings, such as schools and libraries that were evacuated. Mortgage payments and rents were not affected by the evacuation but the value of a building lies in the value of the services it provides. An interruption to the provision of these services because of the evacuation represents an irretrievable loss of opportunities for consumption that is just as real as the losses incurred from spoiled food.

These few examples illustrate how the costs of the evacuation may be defined. Closely related to the problems of definition are those of estimation. The main difficulty in estimating the costs lies in the fact that not all costs show up as monetary payments, as in the case of lost housing services, and some monetary payments do not correspond to foregone opportunities, as when an expense would have been incurred anyway.

A further problem that bears on the definition and estimation of the evacuation costs stems from the question of geographical coverage. For the household sector, additional expenses were incurred not only by those households that were evacuated, but also by those outside the evacuation zone which provided accommodation to evacuated friends and relatives.

A more problematic issue relating to business sector costs is to the extent to which losses from companies inside the evacuation zone were matched by gains to other companies located

outside the zone. In these cases, costs to Mississauga cannot be counted as costs to the province as a whole, since they do not correspond to an overall reduction in production or consumption. Such transfers could have important distributional implications and could provide just cause for compensation, but they are qualitatively distinct from business losses due to perished stock and other wasted resources.

Table 7.1 provides an overview of the range of economic impacts of the Mississauga evacuation. Two zones are distinguished: the evacuation zone and the area outside of the evacuation zone. Each of these zones contains a set of resources consisting of: buildings, infrastructure (roads, water and electricity supply, etc.), durable goods, non-durable goods and labour. Labour is defined here as the typical daily work force available in either zone rather than the portion of the total work force that happens to reside in each zone. The entries in Table 7.1 give examples of the types of impacts that should be considered in an overall assessment of the costs involved.

Owing to the limited resources available to the study team, the assessment of the economic costs of the evacuation described in this chapter is not fully comprehensive. The study does not consider costs born by C.P. Rail or Dow Chemical but only those imposed on others by the accident. For the household sector, only costs borne by households inside the evacuation zone are estimated. These estimates are based on responses to the public surveys conducted by the project (Appendix 1). Costs to Mississauga's business community, that is, the private sector, were looked at in total but the emphasis is still placed on that portion of the private sector which was closed down due to the evacuation. With respect to the public sector, the costs incurred by the various government departments and emergency services provide the main focus of attention. The costs to voluntary associations were not estimated.

Table 7.1

AN OVERVIEW OF THE ECONOMIC IMPACTS OF THE EVACUATION

RESOURCES	HOUSEHOLDS	BUSINESS SECTOR	PUBLIC SECTOR
In Evacuation Zone			
- Buildings	Housing, schools, libraries, hospitals etc. unavailable	Factories and shops closed	Offices closed
- Infrastructure	Transportation impeded	Transportation impeded	Transportation impeded
- Durable Goods	Cars, household equipment unavailable	Cars, trucks & equipment unavailable	Cars, trucks & equipment unavailable
- Non-Durable Goods	Food perished, pets died	Food perished	Food perished
- Labour	Employment reduced	Employment reduced	Some employment reduced, other increased (police, fire, ambulance)
Outside Evacuation Zone			
- Buildings	Housing provided by friends, realations, hotels, & evacuation centres	Some closures, more intensive use in other cases	Increased use of some buildings
- Infrastructure	Transportation impeded	Transportation impeded	Transportation impeded
- Durable Goods	Cars borrowed & rented	Idle capacity, equipment rented	Idle capacity, equipment rented
- Non-Durable Goods	Additional food & travel expenses	Some increases & some decreases in materials used	Increased supplies for emergency services
- Labour	Some increases and some decreases in employment	Some increases & some decreases in employment	Increased employment for those providing emergency services

In addition to these restrictions on the scope of the cost estimates, it is emphasized that the accuracy of the estimates of the components of costs that were included varies according to the availability of reliable data. Whereas a detailed questionnaire was used to obtain information on household costs, the estimates of business sector costs were based on rather rough calculations using national and provincial statistics. Public sector cost estimates were derived directly from government agencies. It was simply not possible to utilize a perfectly consistent set of accounting procedures across agencies within the public sector. By the same token, the comparability of the cost estimates among the sectors is limited.

7-2 HOUSEHOLD SECTOR COSTS

The household sector costs for which estimates are presented include:

a) additional food expenses;

b) additional accommodation expenses;

c) additional travel expenses.

Two periods are distinguished:

a) the evacuation period

b) the 5 days after the return home.

Estimates are also provided of the income lost by households in the evacuation zone.

In addition to these costs, estimates are presented of the sums of money that households say would have fully compensated them for the evacuation. These amounts are compared with the reported out-of-pocket expenses and income losses, and also with the compensation claimed and received from Canadian Pacific Rail.

The information on household costs was obtained from responses to a detailed questionnaire (see Appendex 1). One may be concerned that such responses may be biased. For instance, if people feel that they were harmed unjustly by the evacuation then they may overstate their dollar costs. On the other hand, since the questionnaire was administered many months after the evacuation people may have overlooked some of the costs they did, in fact, incur. These considerations necessarily imply some degree of uncertainty in regard to the accuracy of the information supplied by the households, although we have no reason to believe that the resulting estimates are biased in one direction or the other.

7.2.1 Estimated Additional Costs Borne by Households Going to Private Homes and Hotels

Table 7.2 shows that the vast majority of households evacuating to private homes and hotels reported some increase in costs and for 75% of the households the increase in total costs was $40 or more. The average increase in costs per household was reported at almost $200.

Respondents to the questionnaire[1] were also asked to estimate the additional costs that they incurred according to specific categories: accommodation, food, travel, and other. Table 7.2 shows that 70% of the households in the evacuation zone incurred no additional costs for accommodation, whereas this was true for only 30% of the households in the case of food. Additional food costs accounted for more than one-third of all the additional costs on average per household. By adding the estimated average additional cost per household for each of the categories, a total additional cost can be estimated. This is shown in Table 7.2 to be somewhat less than the total costs reported by the respondents. The discrepancy is due to the fact that some households only reported a total additional cost and did not provide any information on the breakdown.

According to the Mississauga Planning Office there were 75,500 households in the evacuation zone in November 1979. Of these about 5% or 3,775 went to evacuation centres and are dealt with as a separate sample. It is possible to estimate the total costs to the households in the evacuation zone, excluding those that went to evacuation centres, by multiplying the average cost per household, given in column 3 of Table 7.2, by 71,725. The results are given in column 4 where it is shown that the total

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[1] *Respondents who did not answer questions about costs were dropped from the sample for the purposes of this analysis.*

Table 7.2

ESTIMATED ADDITIONAL COSTS BORNE BY HOUSEHOLDS
IN THE EVACUATION ZONE DURING THE EVACUATION PERIOD[1]

Cost Category	% of Households Reporting $0	% of Households Reporting Less Than $40	Average per Household ($)	Estimated Total Cost for Evacuation Zone ($ million)
- Accommodation	70	73	34.8	2.5
- Food	30	45	65.9	4.7
- Travel	37	83	20.3	1.5
- Other	40	61	55.1	4.0
Total (calculated)	-	-	176.1	12.6
Total (reported)	12	25	199.2	14.3

[1] For the 71,725 households that did not go to an evacuation centre.

calculated cost of the evacuation, during the evacuation period, was $12.6 million. This compares with an estimated total reported cost of $14.3 million.

In these calculations, respondents not answering a question were dropped from the sample. This would tend to overstate the estimated average and total costs if no answer really meant that zero costs were incurred. However, the maximum error that could be introduced by this means is 20%.

Figure 7.1 shows the distribution of extra costs broken down by category, and the total additional expenses reported. These are presented as cumulative distributions, which show the percentage of households reporting costs at or below any given level. Thus, Figure 7.1 shows that 30% of the households reported total additional expenses of $50 or below, and 75% reported total additional expenses of approximately $225 or below. The median total additional costs corresponds to the 50% cumulative frequency; thus, 50% of households reported total added costs of $140 (the median) or less. A similar analysis can be done for any individual category of costs, using the cumulative frequency curves.

For a comparatively small number of households the additional costs were many times greater than the average costs for all households. This pattern is indicated by the sharp upward turn in all the cumulative frequency curves in the 90%-plus region in Figure 7.1.

7.2.2 Estimated Additional Costs Borne by Households Evacuating to private homes and hotels during the Five days after returning home

Table 7.3 shows that the majority of households in the evacuation zone incurred no additional costs after returning home. This is true for each of the categories of costs and for the costs in total. The average additional cost per household

FIGURE 7.1

CUMULATIVE DISTRIBUTION OF COSTS TO HOUSEHOLDS
(that did not go to evacuation centres)
DURING THE EVACUATION PERIOD

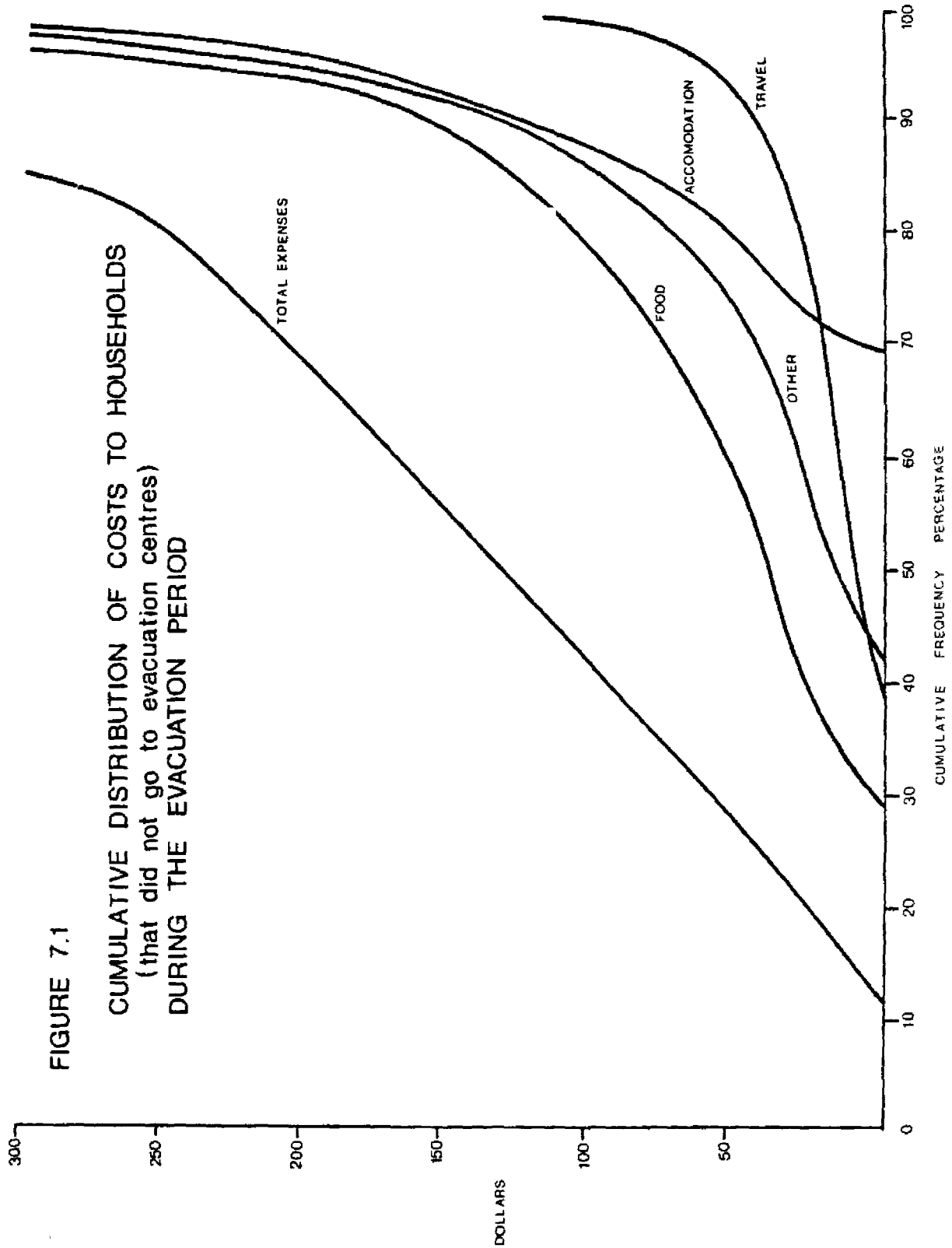

Table 7.3

ESTIMATED ADDITIONAL COSTS BORNE BY HOUSEHOLDS IN THE EVACUATION ZONE DURING THE 5 DAYS AFTER RETURNING HOME[1]

Cost Category	% of Households Reporting $0	% of Households Reporting Less Than $40	Average per Household ($)	Estimated Total Cost for Evacuation Zone ($ million)
- Accommodation	99	99	1.4	0.1
- Food	72	86	13.7	1.0
- Travel	93	98	2.1	0.2
- Other	89	95	8.3	0.6
- Total (calculated)	-	-	25.5	1.8
- Total (reported)	66	80	27.2	2.0

[1] For the 71,725 households that did not go to an evacuation centre

calculated from the estimates for each category of expenditures is $25.5. This compares with the total reported costs of $27.2. Again, the discrepancy is due to the fact that not all respondents included a breakdown of additional costs by category. It is clear from Table 7.3 that additional food costs was the major category of expenses, accounting for just over half of the total calculated costs per household. The estimates of the average additional costs per household combined with the estimated number of households in the evacuated zone give total estimated costs for the evacuation zone during the 5 days after returning home of about $2 million.

Figure 7.2 shows the distribution of these additional costs across all households. About 95% of the households incurred additional costs of $100 or less. However, in the remaining 5% of households in Group 1, additional costs of several hundred dollars were reported.

7.2.3. Estimated income lost by households going to private homes or hotels.

Table 7.4 reports the estimated income losses for up to three wage earners in each household[1]. Of the first income earners in each household, 73% reported no income loss and the average income loss to person One per household was $78.4. This corresponds to an estimated total income loss for person One of over $5.5 million. The estimated income losses for persons Two and Three are, as expected, considerably less than for person One, since a much smaller proportion of all households have two and three income earners than have one income earner. The total income loss on average per household in this group is estimated at $111.6. This corresponds to

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1 *Unlike the interpretation of "no answer" in response to questions of additional costs, "no answer" in response to questions of income losses was interpreted as meaning that no income loss was involved.*

FIGURE 7.2

CUMULATIVE DISTRIBUTION OF TOTAL COSTS
TO HOUSEHOLDS (that did not go to evacuation centres)
IN THE FIVE DAYS AFTER RETURNING HOME

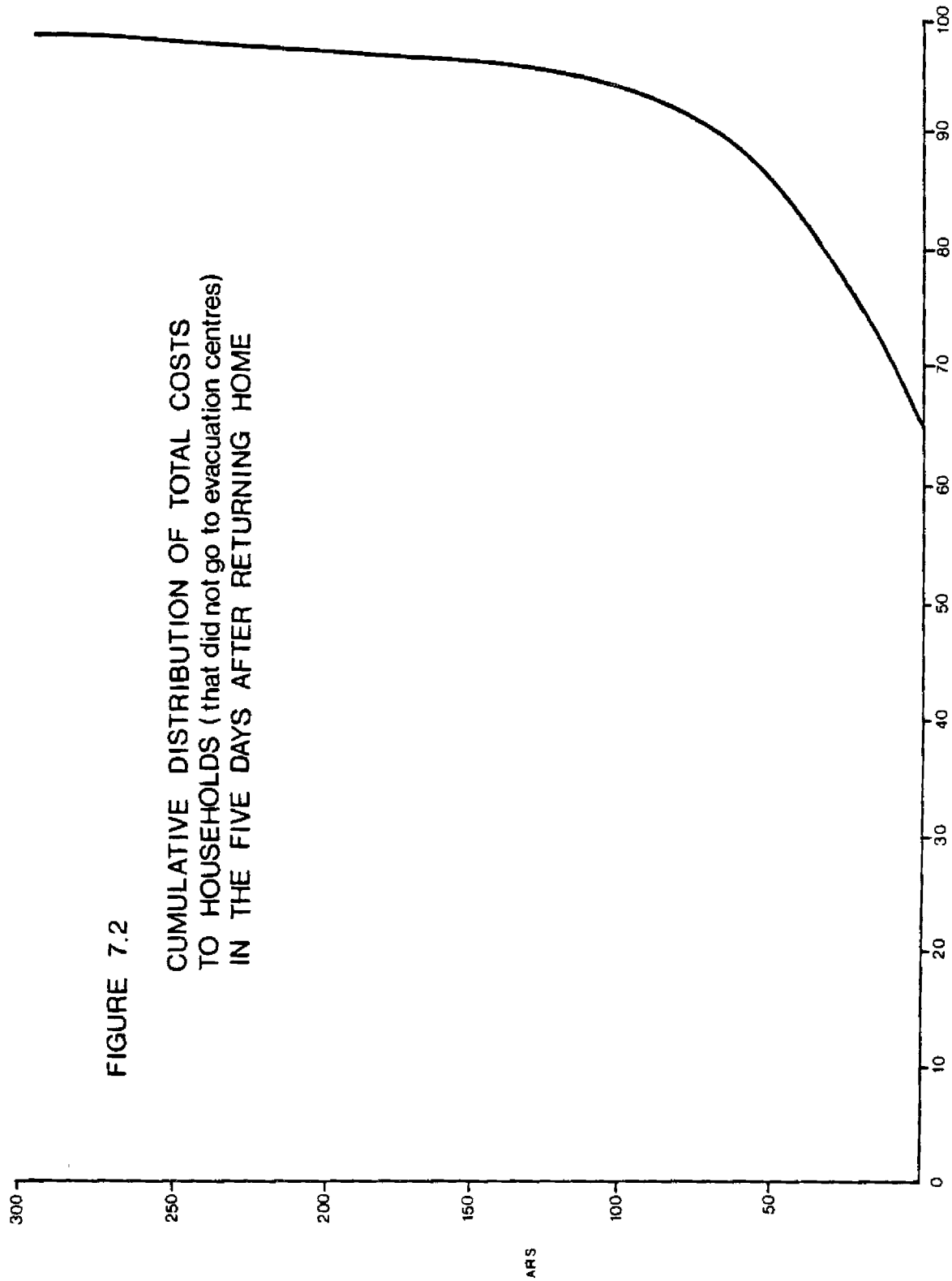

Table 7.4

ESTIMATED INCOME LOST BY HOUSEHOLDS IN THE EVACUATION ZONE[1]

Income Earners in Household[2]	% of Households Reporting no Income Loss for Person Indicated	Average per Household ($)	Estimated Total Income Lost ($ million)
Person 1	73	78.4	5.6
Person 2	88	31.2	2.2
Person 3	98	2.0	0.1
Total	-	111.6	8.00

[1] For the 71,725 households that did not go to an evacuation centre

[2] Households can have up to 3 income earners

a total income loss for households that did not go to the evacuation centres of $8 million.

Figure 7.3 shows the distribution of these income losses for persons one, two and three for each household. In the case of the first income earner, 95% of all households reported an income loss of $400 or less. However, half of the remaining 5% of households reported income losses in excess of $800 for person One and a few losses running into the thousands of dollars were indicated. Some of these large losses are likely to be due to reductions in the profits of businesses shut down by the evacuation.

The distribution of income losses for the second income earner in the household is somewhat similar to that for the first income earner with about 97% of all income earners reporting losses less than $300. Virtually all of the income losses for the third income earner of each household were less than $100.

7.2.4 Estimated additional costs borne by households using Evacuation Centres

In comparison with Table 7.2, Table 7.5 shows that, on average, households that went to evacuation centres incurred higher costs in each category and in total ($250) than did households going to private homes and hotels ($175-200). The difference is statistically significant at the .05 confidence level. Since about 3,775 households went to evacuation centres, the total costs to this component of the evacuated population is estimated at over $900,000.

7.2.5. Estimated additional costs borne by households using Evacuation Centres during the five days after returning home

Table 7.6 shows that almost 50% of families that went to evacuation centres did not incur any additional costs in the

FIGURE 7.3

CUMULATIVE DISTRIBUTION OF INCOMES LOST BY HOUSEHOLDS (that did not go to evacuation centres) DUE TO THE EVACUATION

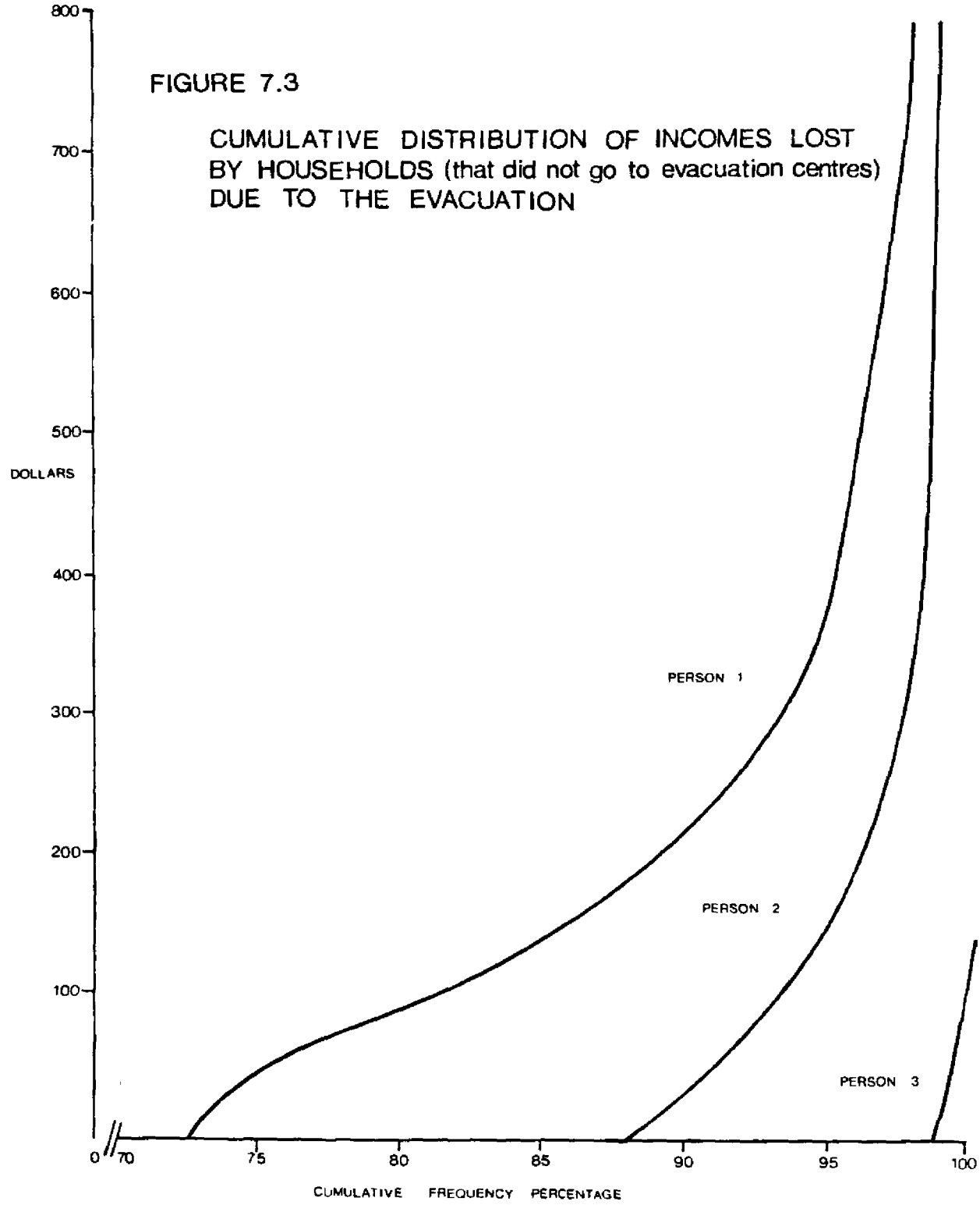

Table 7.5

ESTIMATED ADDITIONAL COSTS BORNE BY HOUSEHOLDS[1] USING EVACUATION CENTRES DURING THE EVACUATION PERIOD

Cost Category	% of Households Reporting $0	% of Households Reporting Less Than $40	Average per Household ($)	Estimated Total Cost for Evacuation Zone ($ thousand)
- Accommodation	59	66	53.8	203.1
- Food	18	40	91.6	345.8
- Travel	32	77	23.0	86.8
- Other	26	43	84.7	319.7
- Total (calculated)	-	-	253.1	955.5
- Total (reported)	4	18	247.1	932.8

[1] 3775 households

Table 7.6

ESTIMATED ADDITIONAL COSTS BORNE BY HOUSEHOLDS[1] USING EVACUATION CENTRES DURING THE 5 DAYS AFTER RETURNING HOME

Cost Category	% of Households Reporting $0	% of Households Reporting Less Than $40	Average per Household ($)	Estimated Total Cost for Evacuation Zone ($ thousand)
- Accommodation	96	97	2.3	8.7
- Food	58	73	29.2	110.2
- Travel	89	98	2.5	9.4
- Other	79	90	14.9	56.2
- Total (calculated)	-	-	48.9	184.6
- Total (reported)	48	67	49.9	188.4

five day period after returning home. However, compared with those households that did not go to evacuation centres, a larger proportion did report additional costs. (The difference is statistically significant at the 0.5 confidence level). The average additional cost to households using Centres is estimated at almost $50. This corresponds to a total additional cost in the post-evacuation period of about $185,000 for this group.

7.2.6. Estimated income lost by households using Evacuation Centres

Table 7.7 shows that the majority of income earners in these households did not incur any income losses as a result of the evacuation. In comparison with the families that went directly to a private home or hotel, a somewhat larger percentage of evacuation centre users reported income losses. The average loss per household was $136.3. The difference is not statistically significant at the .05 level. The total income loss for those families that went to evacuation centres was over $510,000.

7.2.7. Economic costs of the evacuation: willingness to pay versus compensation

One way of interpreting the estimates of the out-of-pocket expenses and income losses presented above is to argue that people would have been willing to pay at least these sums to have avoided the evacuation. Many people might have been willing to pay far more than this to have avoided the disruption to their lives and the anxiety it may have caused them. On the other hand for some the evacuation was also a positive experience and these people may have been willing to pay less than their extra expenses and income losses. Considering only estimated costs and (post-tax) income losses

Table 7.7

ESTIMATED INCOME LOST BY HOUSEHOLDS IN THE EVACUATION ZONE THAT WENT TO THE EVACUATION CENTRES[1]

Income Earners in Household*	% of Households Reporting on Income Loss for Person Indicated	Average per Household ($)	Estimated Total Income Lost ($ thousand)
Person 1	64	94.6	357.1
Person 2	82	33.5	126.5
Person 3	95	8.2	31.0
Total	-	136.3	514.5

[1] 3775 households

[2] Households can have up to 3 income earners

Note: The reply "Can't remember" was dropped from sample; "no answer" was counted as $0.

(Tables 7.2-7.7 and summarized in Table 7.8), households within the evacuation zone would have been willing to pay between $22.5 and $24.5 million to have avoided the evacuation. This corresponds, on average, to $306 per household for those that did not go to an evacuation centre and $411 per household for those that did.

This estimate allows an interesting comparison to be made. Since the work of J.R. Hicks and others in the 1940's, economists have believed that monetary measures of the economic value of something undesirable will tend to vary depending on whether one looks at people's willingness to pay to avoid a cost, or, in the event that the cost has already been incurred, at the compensation they would require in order to feel no worse off.

An important reason for this difference is that people's willingness to pay is constrained by their income, whereas compensation required is not so affected. Consequently, the difference between willingness to pay and compensation measures of cost can be expected to depend on the ratio of the cost to total income.

To arrive at an estimate of the total amount of compensation required by all households in the evacuation zone (Table 7.9), several assumptions were made in regard to responses to a question asking for the sum required to compensate households fully for all effects of the evacuation:

- the mid-point of each range given in the questionnaire was used as the average compensation required by that group;
- for the over $2,000 range, $2,500 was assumed to be the average compensation required
- the households responding that no sum would fully compensate them were dropped from the sample for this exercise.

Table 7.8

SUMMARY OF THE ESTIMATED COSTS
TO HOUSEHOLDS IN THE EVACUATION ZONE

	High[1]	Low[2]
	(million)	
Households that did not go to Evacuation Centres		
- Additional costs during evacuation period	14.3	12.6
- Additional costs in 5 days after returning home	2.0	1.8
- Income lost (post-tax)[3]	6.6	6.6
Sub Total:	22.9	21.0
Households that did go to Evacuation Centres		
- Additional costs during evacuation period	1.0	0.9
- Additional costs in 5 days after returning home	0.2	0.2
- Income lost (post-tax)[3]	0.4	0.4
Sub Total:	1.6	1.5
TOTAL:	24.5	22.5

1. Based on 'reported' estimates of total expenses.

2. Based on 'calculated' estimated of total expenses.

3. In 1978, income tax was 18% of total income in Mississauga: (Ontario Statistics 1980, p. 365.) Income post-tax is estimated to be 82% of income lost. If the marginal tax rate for the whole population exceeds this average tax rate, this procedure over estimates the post-tax income lost.

Table 7.9

ESTIMATED SUM OF MONEY CONSIDERED NECESSARY BY HOUSEHOLDS TO FULLY COMPENSATE THEM FOR ALL THE EFFECTS OF THE EMERGENCY

Sum Required to Fully Compensate the Household for all the Effects of the Emergency ($)	Proportion of Households	
	Not Going To Evacuation Centres	Going to Evacuation Centres
0	39	28
1 - 500	32	24
501 - 1,000	10	11
1,001 - 2,000	4	8
over 2,000	3	7
No amount can fully compensate	12	22
	100	100

Under these assumptions, the average compensation required by each household going directly to private houses and hotels is $346; for those going to the evacuation centres it is $573. The total sum required by all households is estimated to be $27 million. This estimate does not fairly reflect the view of those households who reported that no sum of money would fully compensate them.

This finding that the total compensation required by the evacuated households exceeds the willingness to pay to have avoided the evacuation (as estimated from their out-of-pocket expenses and income lost) is consistent with economic theory. However, it is a result that must be treated with caution since the estimate for compensation probably includes some allowance for disruption and anxiety, factors that were excluded from the willingness to pay estimate.

Another interesting inference from the responses to the survey question on compensation is the suggestion that people who went to evacuation centres felt that they bore a greater cost on average than those who went elsewhere. Table 7.9 indicates that the distribution of required compensation is skewed upward for the sample of households that went to the centres, relative to the sample of households that did not.

These results do not indicate whether people ought to pay something to avoid evacuations (though through taxes and other means they do) or whether they should be compensated if they are evacuated. Neither does this estimate of compensation required have any direct bearing on the claims for compensation that were submitted to CP Rail. As Table 7.10 shows, these claims amounted to an average of $157 per household, for those that did not go to evacuation centres and $250 per household for those that did. These sums are only about 45% of what people

Table 7.10

CLAIMS SUBMITTED TO CP RAIL AND COMPENSATION RECEIVED

Households	CLAIMS			RECEIPTS		
	% Households Reporting $0	Average per Household ($)	Estimated Total ($ million)	% Households Reporting $0	Average per Household ($)	Estimated Total ($ million)
That did not go to evacuation centres	43	156.9	11.3	45	113.9	8.2
That did go to evacuation centres	30	250.0	0.9	32	170.2	0.6
Total	-	-	12.2	-	-	8.8

say would have fully compensated them (neglecting those for whom no such sum was reported). Furthermore, on average, only 73% of the sums claimed were actually paid by CP Rail (the total compensation paid as estimated in the questionnaire survey, $8.8 million, is not significantly different from the figure of $9.6 million reported by CP Rail at the .05 confidence level). The cumulative distribution of these claims and receipts are shown in Figures 7.4 and 7.5.