If these special costs are matched with no change or a smaller reduction in normal labour and material expenses, total annual cost outlays will rise.

Nevertheless, the possible outcomes in regard to cost can still be narrowed. In the case where a firm's costs fall, it can be safely assumed that they will fall less than proportionally to the fall in production or, typically, to the number of days closed. Even for a period much longer than a week, a significant portion of firm's cost is fixed. One can be virtually certain that a portion, even a large portion, of a firm's expenses will not be avoidable for a closed-down period as short as a week or less.

In the light of these considerations, the following possible outcomes are treated in our analysis.

In regard to revenue:

(1) annual revenue will be unaffected (because no sales are lost or because any lost sales are fully made up after reopening);

(2) annual revenue will fall, but by less than in proportion of the number of days closed (because some but not all lost business is made up); or

(3) annual revenue will fall fully in proportion, or more, to the number of days closed.

In regard to cost:

(a) annual cost remains constant;

(b) annual cost rises because of special expenses; or

(c) annual cost falls, but less than proportionally to the number of days closed.

In order to see more clearly the effects on profit of these various changes in cost and revenue, they are set out in matrix form in Table 7.16. In each cell the change in profit due to the combination of the corresponding revenue

Table 7.16

The Possible Effects on Profit Due to a Sudden Interruption of Business According to Various Behaviors of Annual Cost and Annual Revenue

Revenue \ Cost	Cost Constant	Cost Rises	Cost Falls, but less than in proportion to days closed
Revenue Constant	A → no change in profit	B ↘ profit falls by increase in cost	C ↗ profit rises by reduction in cost
Revenue falls, but less than in proportion to days closed	D ↘ profit falls by reduction in revenue	E ↓ profit falls by sum of cost increase and revenue reduction	F ↗ → ↘ profit falls or rises according to relative magnitudes of revenue and cost reductions
Revenue falls in proportion to days closed or more	G ↘ profit falls by reduction in revenue	H ↓ profit falls by sum of cost increase and revenue reduction	I ↘ profit falls by difference between revenue reduction and cost reduction

N.B. The arrows indicate the direction of change in profit corresponding to each cell. The arrows in cell E and H are drawn vertically, to indicate that they represent worse outcomes for a given firm than cells in which only one component of profit has changed adversely. In general, the arrows can be compared across some cells but not across others. For example, for a given decrease in revenue, a firm is worse off in cell E than in cell D, or in cell H than in cell G. However, whether cell B is worse or better than cell D depends simply on the specific magnitudes involved and a general inference is not possible.

and cost changes is noted. For instance, if an increase in cost is combined with a decrease in revenue, the firm's profit will fall by the sum of the two changes, as noted in cell E and cell H. It can also be concluded that, for a given firm, cell H involves a larger reduction in profit than cell E. To allow easier reading of the table, an arrow is shown in each cell to indicate the direction of the change in profit. In the next section some survey data are presented in similar matrices and the arrows then serve as reminders in those tables.

Even when some effects on revenue and cost are eliminated from consideration, the impact of a sudden closing can still have the full range of possible effects on profits. Profit may be unaffected; it may fall; or it may rise.

7.5.5. An analysis of the impact on business profits

Information regarding the behavior of cost and revenue in response to the business closing was obtained by mailing the questionnaire shown in Appendix 2 to a random sample of firms in the evacuation area. Usable replies were received from 154 firms. The answers to questions 4 and 5 allow these firms to be allocated to the cells defined in Table 7.16. Table 7.17 shows this allocation in percentage terms and provides an interesting profile of the distribution of the impact of the business closing.

A hypothesis that all possible outcomes are equally probable would be clearly rejected on the basis of these data. Twenty-nine percent of the firms lost some revenue; 56% (86 firms) suffered a reduction at least in proportion to the numbers of days each was closed. More than three-fifths of the sample (96 firms) reported that their annual costs neither rose nor fell; one-third reported an increase in cost; and less than 5% reported a decrease in cost.

Table 7.17

Changes in Revenue and Cost Due to the Evacuation for Sampled Firms: Percentage Frequencies

Total number of firms = 154

Revenue \ Cost	(a) constant	(b) rises	(c) falls less than proportionally	
(a) constant	A → 24.7	B ↘ 4.5	C ↗ 0	29.2
(b) falls less than proportionally	D ↘ 9.1	E ↓ 5.2	F ↗→↘ 0.6	14.9
(c) falls proportionally or more	G ↘ 28.6	H ↓ 23.4	I ↘ 3.9	55.8
	62.3	33.1	4.5	100

Note: The designation (a), (b), and (c) correspond to the answers to question 4 of the survey questionnaires as they apply to the rows of the above matrix and to question 5 as they apply to the columns. The arrows indicate the direction of change in profit associated with each cell. (See Table 7.16 for further explanation).

Just under one-quarter of the firms, those in cell A, were not affected by the closing. However, exactly the same number fall into cell H, which is the worst possible outcome from a given firm's point of view: cost has risen, and revenue has fallen to the greater of the two extents allowed for in the questionnaire. The most frequent outcome is G, which involves a substantial loss, but a smaller one for any given firm than would have occurred if it fell into cell H. In total, almost 75% of the firms in the sample suffered some losses, almost 25% suffered no losses and under 1% (the one firm in cell F) could either have lost or gained.

The low frequency of entries in column (c), including the complete absence of firms in cell C, is surprising. While the continuance of normal wage payments was common, it is also known that many people lost wages. Thus, one would expect a considerable number of firms to have reduced wage costs. Two explanations are plausible. First, it is possible that firms that did not pay their workers for lost time also had unusual costs, such as inventory spoilage or overtime pay that more than offset the wage savings. The second possiblity is that the survey question on cost was sometimes misunderstood. A respondent may view the act of not paying an employee when he is not working as keeping cost constant (and avoiding an increase in cost) rather than as a reduction in cost. It is the latter that is consistent with the accounting framework used here. This would suggest an upward bias in column (a) as well as a downward bias in column (c).

The experience of losses due to the closing could vary systematically across different types of activity; for example, retail sales versus manufacturing. Respondents were asked to identify which category best describes their activities (question 3). Two problems arise in interpreting

the answers. First, the distinction between retail and service activities is difficult to make and often arbitrary. Into which category, for instance, would a service station for cars fall? Second, the number of respondents engaged in wholesaling and manufacturing was very small, 15 and 12 (out of the total of 154) respectively. The sample was chosen randomly out of a street directory and the problem is in part simply that a high proportion of the population of firms are in service and retailing activities. However, there is reason to believe that the 16% of our sample in manufacturing and wholesaling is lower than the actual proportion of such firms operating in Mississauga.

Inferences from the data for these two categories a consequently somewhat questionable, especially in regard to entries in individual cells of the tables. In order to reduce the impact of both of these problems, the four categories are aggregated into two: a retail-service category (denoted by R-S) and a manufacturing-wholesale category category (denoted by M-W).

Table 7.18 shows the breakdown of the sample by cell into the two activity categories. In each cell the top number applies to R-S firms, the bottom number to M-W firms. In regard to inferring whether firms in one category are more probable to lose profits than firms in the other, the results are ambiguous. For example, a higher percentage of M-W firms than R-S firms maintained constant revenue during the closing. On the other hand, the R-S percentage total in column (b) is lower than the M-W percentage, meaning that M-W firms were more likely to have increased costs due to the closing. Similar ambiguities arise if individual cells are compared. However, the frequencies are not sufficiently different to warrant the conclusions that behaviour in the two categories differs (chi--square = 7.54 with 8 d.f).

Table 7.18

Cost and Revenue Experience of Retail-Service firms and Manufacturing-Wholesale firms: Percentage Frequencies

Number of retail-service firms = 128
Number of manufacturing-wholesale firms = 26

Revenue \ Cost	(a) constant	(b) increased	(c) decreased	
(a) constant	A → R-S: 22.7 M-W: 34.6	B ↘ 3.9 7.7	C ↗ 0 0	26.6 36.4
(b) fell less than proportionally	D ↘ R-S: 8.6 M-W 11.5	E ↓ 5.5 3.8	F ↗ → ↘ 0.8 0	14.8 18.2
(c) fell proportionally or more	G ↘ R-S: 32.0 M-W: 11.5	H ↓ 21.9 30.8	I ↘ 4.7 0	58.6 45.5
	R-S: 63.3 M-W: 57.7	31.3 42.3	5.5 0	100 100

A small store owner.....

For the operator of a variety store very near the scene of the accident, the experience of the emergency began dramatically. He was preparing to close the store when the first explosion occurred and, despite having taken shelter in a ditch, felt the heat of the second explosion. The owners of other small retail stores may not have had to run for their safety but the impact on their businesses was probably not very different.

This store lost an estimated $7,000 in gross revenue. When spoiled inventory and other special expenses are added, the total gross loss was in the neighbourhood of $10,000. Suppliers who normally replace spoiled merchandise would not take responsibility for spoiled milk, bread, cheese, and meat in this case. Another "perishable" good of note was lottery tickets that could not be sold by the date of the draw.

The store had no insurance coverage for such losses, and at the time of this interview, had not filed a claim in the courts, though some hope was expressed that a claim could eventually be filed once others had set precedents.

After re-opening, the store still had some difficulty due to the emergency. Its cash inflow had stopped for a week, but there were still bills to pay and re-stocking to be done. Extended credit was not automatically obtainable.

This businessman expressed some bitterness about the aftermath of the closing. He felt it was longer than necessary, that help promised by government officials was not forthcoming, and that the various inquiries into the accident were too reticent about laying blame.

That is, the experience of retail-service firms and manufacturing-wholesale firms cannot be distinguished on the basis of the answers to questions 2 and 4.

As a further experiment, the attributes of two categories of firms were set out: those that would be expected to have a high potential for loss in the event of an interruption (referred to below as HL firms), and those that would be expected to have a low potential for loss (LL firms). Each questionnaire returned was then classified into one of these categories on the basis of the answers given to questions 2 and 3. The attributes used for this classification were as set out in Table 7.19.

Clearly there is much overlap across these attributes. To develop and apply them more finely, it would be necessary to design a far more complex questionnaire. On the basis of our simple questions it is possible to assign confidently only some firms in the sample. For instance,restaurants are clearly HL firms; similarly, retail clothing stores were classified as HL, because they are assumed to depend significantly on customers in their local areas. Customers could have made purchases outside the area during the evacuation period, and also could have returned home with reduced amounts of income available for discretionary purchases. An example of an ambiguous case is that of physicians. They can easily have both HL and LL attributes. They were classified as HL in this exercise, as were dentists,construction and contracting firms, and plumbers. Hardware and furniture stores were classified as LL. In total there were 85 HL firms and 69 LL firms.

Table 20 shows the replies to questions 4 and 5 broken down by HL and LL firms. There is some evidence in support of the a priori classification. This can be seen clearly by examining the first row of the table: the percentage of LL firms

TABLE 7.19

Characteristics of Firms with High and Low Loss Potentials

Attributes of a Firm with High Loss Potential

--produces goods or services that are purchased on a quasi-continuous basis

--holds inventories of perishable goods

--produces goods that cannot be easily and cheaply held in large inventories

--sells its product outside the closed-down area and has many competitors outside the area

--supplies intermediate and consumer goods to firms and households located within the evacuated area

--its revenues depend on continual efforts to find new customers

--produces a service, especially one that is paid for per unit time (e.g., on an hourly basis)

--normally has little excess capacity in mid-November

Attributes of a Firm with Low Loss Potential

--produces tangible commodities that are not perishable

--deliveries of its product are normally made at widely-separated and flexible points in time

--its product can be held in large inventories and deliveries can be easily postponed

--produces durable goods

--sells its product outside the closed-down area and has few competitors located outside the closed-down area

--tends to enter sales contracts

--normally has some excess capacity in mid-November

Table 7.20

Cost and Revenue Experience of Firms in Two Categories: Those with a High Probability of Loss (HL) and those with a Low Probability of Loss (LL)

Number of HL firms = 85
Number of LL firms = 69

Revenue \ Cost	(a) Constant	(b) Increased	(c) Decreased	
(a) constant	A → HL:16.5 LL:34.8	B ↘ 3.5 5.8	C ↗ 0 0	20.0 40.6
(b) falls less than proportionally	D ↘ HL: 8.2 LL:10.1	E ↓ 7.1 2.9	F ↗ → ↘ 1.2 0	16.5 13.0
(c) falls proportionally or more	G ↘ HL:36.5 LL:18.8	H ↓ 23.5 23.2	I ↘ 3.5 4.3	63.5 46.4
	HL:61.2 LL:63.8	34.1 31.9	4.7 4.3	100 100

that experienced no change in revenue is more than twice the percentage of HL firms. While 64% of the HL firms lost revenues at least in proportion to the days closed, 46% of the LL firms fell into this category. Cells A and G show striking differences in the hypothesized direction. These cells together contain just over half of the firms in each of the HL and LL categories. On the other hand, cell H casts some question on the hypothesis, since it refers to the outcome involving the largest loss, contains almost one-quarter of the firms, but shows approximately equal entries. Moreover, the column totals indicate that there is little difference between the HL and LL categories in regard to cost. For example, 61% and 64% of the firms in each category experienced no change in cost.

The null hypothesis that there is no overall significant difference between the HL and LL frequency distributions, on a cell-by-cell comparison, was used to calculate a Chi-square statistic. It is 11.97, which does not allow rejection of the hypothesis at either the 5% or 10% levels of significance. The hypothesis that the row totals do not differ significantly leads to a Chi-Square statistic of 7.75 with 2 degrees of freedom. This allows rejection of the hypothesis at the 2.5% level. For the column totals the Chi-square statistic is 0.11, which does not allow the null hypothesis to be rejected.

Thus one can conclude that the classification scheme used here makes it possible to distinguish in rough terms the type of firm that is likely to be hurt by a sudden closing from the type that is not likely to be affected. But such a <u>a priori</u> distinction is effective <u>only in regard to revenue changes</u>. The classification scheme would have to be developed further if it is to be effective in regard to effects on cost.

Finally, it seems possible that the probability of a firm being harmed by an emergency closing would increase with the duration of the closing. To see whether this holds true, the firms in the sample were classified by the number of days each was closed. To simplify the discussion, tables showing this classification fully cross-tabulated by the combined effects on revenue and cost, as in Tables 7.15 -7.18, are not presented here. Instead the effects on revenue and cost are considered separately in Tables 7.21 and 7.22.

In Table 7.21 the effect of the duration of the closing on revenue is shown. The likelihood that a firm experienced a decline in revenue increases with the number of days closed. For example, of the 32 firms that reported being closed for 2 days, 14 (44%) of them lost no revenue, while the remaining 18 reported that revenue fell. Of the 35 firms that reported closing for 5 days, only 5 (14%) reported no effect on revenue, while 30 reported that revenue fell.

In Table 7.22 a similar analysis of change in cost is presented. Again clear patterns are evident. The percentage of firms reporting no change in cost (column (3)) decreased monotonically as the duration increases. Since the total number of firms reporting a decrease in cost was very small (only 7 of 154), this pattern is combined with an increasing percentage of firms that suffered cost increases due to the closing (column (4)).

In sum, on both the revenue and cost sides, the likelihood of a firm's profit being reduced appears to increase as the duration of the closing increases. Tables 7.21 and 7.22 suggest, however, that the effect of a longer closing is greater in regard to falling revenue than rising cost. This

Table 7.21

Effects on Revenue for all Firms Classified by the Number of Days Closed

Number of Days Closed	Number of firms	Percentage of firms in column (2) for which revenue was	
		Constant	Decreased
(1)	(2)	(3)	(4)
1 or less	9	89	11
2	32	44	56
3	42	29	71
4	11	27	73
5	35	14	86
more than 5	25	12	88
	154		

N.B. Percentages may not add across to 100% due to rounding.

Table 7.22

Effects on Cost for all Firms Classified by the Number of Days Closed

Number of Days Closed	Number of Firms	Percentage of firms in column (2) for which cost was:		
		Constant	Increased	Decreased
(1)	(2)	(3)	(4)	(5)
1 or less	9	89	11	0
2	32	75	22	3
3	42	69	29	2
4	11	64	27	9
5	35	54	37	9
more than 5	25	40	56	4
	154			

N.B. Percentages may not add across to 100% due to rounding.

can be inferred by comparing column (4) of Table 7.21 with column (4) of Table 7.22. The percentage of firms showing decreased revenue rises to a higher level and more rapidly (from 11% to 88%) than does the percentage of firms showing increased cost (from 11% to 56%).

7.6. CONCLUSIONS

The impact of the evacuation on Mississauga's households and businesses and on various public agencies has been considered in some detail. Where cost estimates have been presented considerable effort has been made to explain prcisely to what and to whom the cost refers. For the household sector, only costs to households within the evacuation area were estimated. Costs incurred by households outside the evacuation zone which received evacuees have not been included. The business sector costs considered in the study were borne by a rather different set of people, including owners and employees who live outside of the evacuation zone but whose place of work within the zone was closed down. No attempt was made to estimate any gains to other businesses that experienced an increase in sales due to people shifting their expenditures elsewhere. Finally, the public sector costs were incurred at the municipal, regional and provincial levels, again involving many people beyond the borders of the evacuation zone.

For a number of reasons the confidence one can have in the cost estimates also varies. One is particularly aware of the difference between the household and public sector estimates on the one hand and the business sector estimates on the other. In the former cases it was possible to obtain much of the necessary data directly from participants in the evacuation. In the case of the business sector, quantitative

data sufficent to construct comparable estimates were not collected. The estimates based on the aggregate annual net production in Mississauga provide a rough guide to business losses, but they are not the same as estimates based on the actual experience of businesses during the evacuation period.

The total estimated cost considered in this study is about $70 million dollars, as set out in Table 7.23. Because the largest component of this total is more hypothetical than its two smaller components, and because only costs incurred within the evacuated area have been focused upon, this amount should be viewed as a tentative and incomplete measure of the overall economic costs of the evacuation. Nevertheless the total and its components provide some indication of the costs borne by people who live, own businesses and work in the evacuated area and who pay taxes to the governments that financed the public sector costs.

Table 7.23

Total Estimated Costs of the Mississauga Evacuation

Sector	Source Table	$ Million
Household[1]	7.2, 7.3, 7.5, 7.6	$16.5
Public[2]	7 13, 7 14, 7 15	2.0
Business	7.16	50.2
Total		$68.7

1. Income losses of $ 8 million are excluded. These are included in the business sector costs based on decline in value added.

2. Direct damages to City of Mississauga buildings are excluded since these are not attributable to the evacuation *per se*.