THE ECONOMIC FEASIBILITY OF AIR SHIPMENT OF PERISHABLE FRUITS AND VEGETABLES INTO CANADA

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by

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ABSTRACT

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In Canada there is an increasing per capita demand and total demand for fresh fruits and vegetables, with the demand for perishable fresh fruits and vegetables increasing even more rapidly. At the same time, Canadian perishable fruit and vegetable growers are unable to supply the amount of perishable fruits and vegetables that consumers demand. The difference between domestic supply and consumer demand is being increasingly filled by imported perishables.

The principal goal of this thesis was to determine the present and probably future role of air transportation in moving such perishables into Canada. Four main objectives were set out as guide lines for the study. These were:

(1) to determine transportation's role in distributing imported perishables from the producer to specific consumer centers as well as determining each mode's inherent advantages in carrying perishables.

(2) to determine current trends in utilization of the three basic transportation modes in the carrying of imported perishable fruits and vegetables.

(3) to analyze, using the Total Cost Concept, the ability of each transportation mode to compete effectively in the distribution of

perishable fruits and vegetables from producer source to destination.

(4) to identify the present and future role of air transportation in the distribution of perishable fruits and vegetables, and the problems that may be involved.

Analysis of the transportation needs for perishable fruits and vegetables showed that fresh fruit and vegetable shippers require aspects of service other than low rates. Characteristics of service such as flexibility, reliability and speed of service appear to be of particular interest. It is apparent that they are willing to trade-off (to a certain but yet unquantifiable degree) between less cost and better quality of service. This was made apparent from studying the increasing trend of trucking of perishables into Canada.

Groenewege and Heitmeyer's Total Cost Concept for analysing all costs of distribution of a commodity was chosen as the model for analysis. The Total Cost Concept is designed to take into account both quality and cost of service that a carrier provides on the particular route studied.

Six individual perishable fruits and vegetables (peaches, strawberries, grapes, cherries, tomatoes and lettuce) were chosen for specific analysis. California was designated the major import source of these perishables while Montreal, Toronto, Winnipeg and Vancouver were chosen as destination centers for the imports. On these chosen routes between California and Canada, road, rail and air carriers were compared using the Total Cost Concept. Results of the analysis showed that rail provided least-cost service to the shipper. Air provided the best quality of service to the shipper. However, motor carriers were com-

petitive with rail on rates while providing many of the quality of service aspects that air freighting can provide. This conclusion is substantiated by the fact that the quantity of the six perishables moving by truck into Canada has been increasing (both relatively and absolutely).

There are three basic limitations that presently restrict air freight's competitive position in hauling perishable fruits and vegetables into Canada. The technical limitations prevent rate reductions at the present time, and institutional limitation such as air franchises and dissimilar rate regulation among modes favoring trucks and the backhaul limitation must also be overcome for air freight to become competitive in shipping perishables from California into Canada.

While air freight is not presently a contender in shipping perishables into Canada, a promising area for air freight is that of exporting Canadian perishables to countries overseas. The only competition is from ocean-going ships. Such routes are in the area of market development and expansion in contrast to the established North America routes studied here.

Finally, a further area of study would be to analyse consumer demand for perishable fruits and vegetables. This analysis could include consumer reaction to such things as availability of vine-ripened fruit. Such a study could also indicate the amount of customer education that would be required to make consumers aware of the benefits of better transportation service such as shipping by air. Information of this type would enable one to develop more quantifiable results as to how much trade-off potential exists between cost and quality of service in best serving consumer wants.

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CHAPTER I

INTRODUCTION

A. STATEMENT OF PROBLEM

The fresh fruit and vegetable sector of agriculture in Canada is one that is characteristically different from other sectors of agriculture in Canada. While surplus conditions generally exist in other sectors of agriculture, there continues to be a deficit in fruits and vegetables which is increasing yearly. Additionally, a larger and larger portion of domestic demand for fruits and vegetables in the fresh form must be filled by import sources.

There are two reasons for this deficit. First, as consumers' relative income position increases, they are more able to pay for fresh fruits and vegetables. Therefore, there is an increase in per capita demand. The increase in demand is also augmented by the increase in population. The overall result is more people wanting more fresh fruits and vegetables. Secondly, on the supply side, actual production of most fresh fruits and vegetables is struggling to maintain a relatively constant proportion of the amount demanded. In some cases, production levels of various fresh fruits and vegetables are decreasing relatively.

The Federal Task Force on Agriculture prepared a paper on fruits and vegetables which stated the position of the fresh fruit and vegetable industry in Canada as follows:

> Located close to the large Canadian centres of population producing commodities which are usually bulky and often highly perishable and therefore expensive to transport, the Canadian industry would seem to

> have a ready-made opportunity for expansion. Furthermore, there is an expanding per capita and total demand for fruits and vegetables on the home market. On the other hand, climate is unfavourably cutting down the growing season, interfering with the much-wanted continuity of supply, causing highly seasonal and therefore high cost processing operations. Throughout every group of the fruit and vegetable industry, there runs the major question of international competitiveness particularly with the United States.[1]

Seasonality of Canadian production, as mentioned above, affects the output stream of fresh fruits and vegetables. Perishable fruits and vegetables are especially affected since they must be distributed from the producer to the consumer immediately after harvest. There is no long-run storage potential for perishables and in the case of grapes and lettuce there is no comparable processed form. Consequently, out-of-season perishables must be obtained from import sources.

The quality of perishable fruits and vegetables at the retail level is affected by two conditions: (1) the condition of the perishables when they are picked, and (2) the length of time and type of handling that takes place in moving from production to consumption. Since perishable fruits and vegetables deteriorate quickly, fast distribution is essential if the perishables are to remain in good condition. The role of transportation is of prime importance in the distribution of imported perishables. The more quickly that transportation of the good is completed, the less chance there is for quality deterioration.

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[1] Federal Task Force on Agriculture, "Fruits and Vegetables", paper presented to the Canadian Agriculture Congress (Ottawa, 1969), p. 7.

Generally, the quality of perishables received at the retail level in Canada during the off-season is relatively poor compared to the quality of in-season perishables. Part of this poorer quality may be attributed to the poorer quality of produce coming from the import source during the fall and winter months. However, a great quantity of imported produce has to be shipped to Canadian cities from the states of California, Arizona, and Florida which can be a trip of 1,000 to 3,000 miles depending on the destination. Using surface transport to carry the produce, it would take 2 to 10 days depending on the destination and mode used. To keep the produce fresh, refrigeration must be used while the goods are in transit.

Another method of slowing deterioration is to pick the produce while it is less than fully ripe and allowing it to ripen while being distributed. However, it is of general knowledge that "vine-ripened" fruit is of better quality than "ripened in shipment" fruit. Therefore, even if the latter arrives relatively non-deteriorated, better quality could be expected if "vine-ripened" produce were imported.

One way that "vine-ripened" fruits and vegetables could be made available is to ship fresh perishables by air. Shipments from California to Eastern Canada would take only a number of hours instead of a number of days. Shippers realize that for extremely perishable produce such as strawberries, speed of distribution is very important. "Shipments of agricultural commodities no longer move by air, only when the commodity is in short supply."[2] Air shipments of fresh fruits and

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[2]Mildred R. DeWolfe, "Recent Trends and Prospective Developments in Shipments of Agricultural Commodities", Marketing and Transportation Situation, Economic Research Service, U.S.D.A. (February, 1966), p. 18.

vegetables in the U. S. are increasing every year.

> A recent survey by some of the major U. S. airlines shows that the volume of fresh fruits and vegetables shipped by air during July-June 1964-65 was between 4 and 5 times that during 1961. These airlines expect a similar increase by 1970.[3]

The increasing air shipments of fresh produce as predicted by the airlines has generally come true, as indicated by the following statement:

> This (air shipments of California fresh fruits and vegetables in 1968) was an increase of 32.8 per cent over the volume in 1967 and was more than double the total of 1966.[4]

The pattern of air shipments of fresh produce from California showed that strawberries were by far the major commodity moved by air, accounting for 75 per cent of the total shipments. Geographically, 36.5 per cent of air shipments of all fresh fruits and vegetables from California went to New York, 18.5 per cent to Chicago and 20 per cent went to the four cities of Detroit, Philidelphia, Boston and Cleveland. Europe and the South Pacific accounted for approximately 10 per cent of the total air shipments of California fresh produce.[5] In total volume carried, "air shipments of California fresh fruits and vegetables during the calender year 1968 totalled 60,172,762 pounds billing weight, and 53,077,000 pounds net or product weight."[6] Shipments to Canada amounted to 80,770 pounds billing weight or 3.5 carlot equivalents with 2.8 car-

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[3] Ibid., p. 18.

[4] Air Shipments of California Fruits and Vegetables, 1968, Federal-State Market News Service. (San Francisco, California, 1968), p. 3.

[5] Ibid., p. 3.

[6] Ibid., pp. 5-6.

lot equivalents going to Toronto and .7 going to Vancouver.[7]

It would seem that there is a potential for air shipment of fresh produce into the Canadian market from an import source such as the U. S. A. Shipment time could be reduced from several days to effectively no more than one day of business. Quicker distribution would bring "vine-ripened" produce on the market, thus increasing the quality of the produce received by the Canadian consumer. Finally, consumption areas especially in Eastern Canada are situated with good airport facilities, thus enabling high density marketing in carload lots.

B. OBJECTIVES AND SCOPE OF THE STUDY

The overall objective of this study is to determine what role, if any, air shipment can play in transporting fresh fruits and vegetables into Canada. This will be done within the context of determining the most efficient method of distributing the present (and potential) volume of imported fresh fruits and vegetables into Canada while maintaining a high quality of product to the consumer.

The specific objectives of this thesis are:

(1) to determine transportation's role in distributing imported perishables from the producer to specific consumer centers as well as determining each mode's inherent advantages in carrying perishables.

(2) to determine current trends in utilization of the three basic transportation modes in the carrying of imported perishable fruits and vegetables.

(3) to analyze, using the Total Cost Concept, the ability of each transportation mode to compete effectively in the distribution of perishable fruits and vegetables from producer to destination.

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[7] Ibid., p. 6.

(4) to identify the present and future role of air transportation in the distribution of perishable fruits and vegetables, and the problems that may be involved.

This study is a descriptive analysis comparing methods of distributing imported fresh fruits and vegetables into Canada. When determining what area to study in this thesis, it was decided that analysis of the entire import sector of the fresh fruit and vegetable market in Canada was too large. Two steps were taken in narrowing the scope of the analysis. These were:

(1) to establish perishables as the group within the total fresh fruit and vegetable sector, and

(2) to determine, for each commodity analyzed, the one major production area outside Canada providing Canada with imports and to chose major consumption areas within Canada receiving the imported produce. Given these specifications, actual routes of shipment could be established and analyzed.

It was felt that perishable fruits and vegetables best satisfy the product characteristics of goods that are most suited for air transport, i.e. high value per pound relative to other types of fresh fruits and vegetables, wide market spread, and relatively fast deterioration over time. The three modes of transportation included in the comparative analysis were rail, road and air. Inter-modal combinations such as piggy-back service were excluded.

C. ORGANIZATION OF THE STUDY

The model used for comparative analysis in describing the distribution system for fresh fruits and vegetables was the Total Cost

Concept as articulated by Groenewege and Heitmeyer.[8] This concept was selected because it accounts for both cost of the service to the shipper as well as quality of the service received.

This study consists of two main sections. The first section is a general descriptive analysis of the fresh fruit and vegetable industry within Canada providing a background for the remainder of the study. Particular emphasis is placed on the perishables sector of the industry. The trend in the balance of trade with respect to imported perishables is of major importance. This trend was found by determining the surplus or deficit domestic production compared to domestic consumption of perishables. It was assumed that the difference in consumption and production domestically will be made up by either importing or exporting the difference. The major production areas of perishables imported into Canada along with the major Canadian consumption areas are determined in this section.

The second section deals with transportation's role in distributing imported perishables to the Canadian market. The importance of transportation to the producer as well as the consumer is described. Inherent characteristics of each mode in hauling perishables are outlined and the resulting trends in use of each mode to ship perishables are noted. A comparative cost analysis utilizing the Total Cost Concept

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[8]The expression "Total Cost Concept" as used by A.D. Groenewege and R. Heitmeyer in Air Freight: Key to Greater Profit, Middlesex, England: Aerad Printers and Publishers, 1964, describes a comparative model for taking account of the total costs involved in distributing a commodity.

is made to determine each mode's ability to compete both in cost and quality of service. Special mention is made of air shipment of perishables and the expected potential of this mode in distribution of perishables within Canada.

More specifically, the remainder of the study is organized as follows: Chapter II provides the background information. Chapter III describes transportation's aggregate and modal characteristics as they pertain to the shipment of perishables. It also shows the resulting roles of the modes in moving perishables from import to consumer source.

Chapter IV is a description of the Total Cost Concept. Chapter V is a comparative analysis, using the Total Cost Concept, of modal prices and quality of service characteristics to determine the most efficient mode in transporting perishables.

The feasibility of air shipment of perishables is discussed in Chapter VI in light of technical and institutional factors that effect its ability to compete with road.

Chapter VII concludes the study with a summary of the conclusions and implications. Areas of further research on the topic and problems encountered in the study are also mentioned.

CHAPTER II

THE FRUIT AND VEGETABLE SITUATION IN CANADA: PRESENT CONDITIONS AND FUTURE PROSPECTS

Chapter Two embodies section one of the study. The first part of this chapter looks at the fresh fruit and vegetable industry in Canada. From this general analysis of the fresh fruit and vegetable industry, emphasis is placed on a study of six specific perishables within the total industry. The six chosen perishables are used as the basic material for further analysis.

In Canada, fruit and vegetable consumption is an important part of total food consumption.

> At the food distribution level, fresh and processed fruits and vegetables account for more than one-third of the quantity of all food consumed in Canada and one-sixth of the value of food consumed.[1]

Although this study deals specifically with <u>fresh</u> fruits and vegetables, some element of importance of fresh fruits and vegetables in Canada may be assumed from the above quotation and justify a study of this type.

A. CONSUMPTION

Knowledge of the trend of fresh fruit and vegetable consumption in Canada is important to this thesis. The Canadian Agricultural Congress study on fruits and vegetables provides much needed, though by no

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[1] Federal Task Force on Agriculture, "Fruits and Vegetables" paper presented to the Canadian Agriculture Congress (Ottawa: 1969), p. 1.

means complete, current data on per capita consumption of fruits and vegetables as projected to 1980.

When studying total fruit and vegetable consumption data, it must be noted that potatoes account for forty-five per cent of the value of all fruits and vegetables consumed for the years 1963-1966.[2] Fortunately, sub-aggregate data, excluding potatoes, was published in the fruit and vegetable study. This made consumption data all the more relevant to this study.

By 1980, there is projected to be only a 2.5 pound per person increase in fresh fruit consumption compared to a 13.0 pound per person increase in processed fruit consumption as shown in Table 2:1. By 1980, fresh fruit consumption per person will have increased 2.6 per cent over the 1964-66 base year average. For the same period consumption of processed fruit is expected to increase 15.1 per cent over the base year. Total per capita fruit consumption (fresh and processed) is projected to be 9 per cent greater in 1980. Consumption of fresh fruit is expected to increase 2.6 per cent by 1980 while consumption of processed fruit is projected to be 15.1 per cent greater in 1980 compared to the 1964-66 base year average.

Per capita consumption of vegetables was projected to grow substantially more than per capita consumption of fresh fruit. The 1980 projections for vegetables (excluding potatoes) showed a 17 per cent increase in consumption over the base years. Fresh vegetables were projected at a 12 per cent increase while processed vegetables showed a

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[2] Ibid., p. 1.

TABLE 2:1

CANADIAN PER CAPITA CONSUMPTION OF FRUITS AND VEGETABLES

1964-1966 AND FORECAST 1975, 1980

Commodity	Base Average 1964-66 lbs	1975 lbs	1980 lbs	1980 as a % of base
Fruit				
Total	183.5	195.0	200.0	109.0
Fresh	97.5	100.0	100.0	102.6
Processed	86.0	95.0	99.0	115.1
Vegetables[1]				
Total	170.9	192.0	200.0	117.0
Fresh	85.7	93.0	96.0	112.0
Processed	85.2	99.0	104.0	122.1

[1]Excluding potatoes.

Source: Federal Task Force on Agriculture, "Fruits and Vegetables" paper presented to the Canadian Agriculture Congress. (Ottawa, 1969)

projected increase of 22.1 per cent.

The trend for fresh fruit and vegetable consumption in total was shown to be increasing but not to the extent of that of the processed segment of the industry. The 1980 projected per capita consumption increase coupled with an expected population increase of six million led to the conclusion that the aggregate demand for fresh fruits and vegetables should increase to a considerable degree over the next decade.

Consistent with narrowing the scope of the study, it was decided to take a look at one specific area within the fruit and vegetable group, namely perishable fruits and vegetables. Six perishables were chosen representing different types of perishables. Each type of perishable has different characteristics and the perishable chosen from the group type will have characteristics representative of members within that group. An example is the small fruit group type which includes strawberries, blueberries, raspberries and loganberries. The six perishables chosen coincide with the examples chosen by the paper on fruits and vegetables presented at the Canadian Agriculture Congress. Lettuce and tomatoes represent fresh vegetables, peaches and cherries represent tender fruit, strawberries represent small fruit and grapes are a type by themselves. Scarcity of complete data necessarily led to the choice of using data as published by the Canadian Agriculture Congress.

The figure used to represent domestic consumption was apparent domestic fresh disappearance (ADFD). This figure was found as follows:

ADFD = Domestic production + imports - exports - processed.

For all but one of the six chosen perishables, there was an increase in the apparent domestic disappearance average from 1956-60 to

1962-66 as shown in Table 2:2. Grapes increased 47 per cent, cherries 27 per cent, lettuce 25 per cent, strawberries 16 per cent, tomatoes 7 per cent while the 1962-66 average for peaches was 6 per cent lower than the 1956-60 average. These figures further supported the trend of increased demand for fresh fruits and vegetables in Canada. Even more important was the fact that (except for peaches and tomatoes) there was a larger increase in consumption for these particular perishables as compared to consumption of fresh fruits and vegetables in total.

Another characteristic of fresh fruit and vegetable consumption that was observed was that consumption of fresh fruits and vegetables appeared to be less seasonal and more constant on a year-round basis. For example, "Consumption (of lettuce) is fairly stable throughout the year."[3] A specific study of the Toronto fresh fruit and vegetable market found "monthly receipts of fresh fruits and vegetables in the Toronto market area today (1963) are relatively stable compared to 1935."[4]

Table 2:3 gives an indication of monthly fresh fruit and vegetable production as well as indicating what portion of consumption is imported. This table shows that the total receipts of fresh produce in the Toronto area remained relatively constant from one month to the next. However, at the same time, imports showed a cycling effect with peaks in winter and spring and troughs in summer and fall.

Two conclusions of major importance to this study were drawn

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[3] Ibid., p. 18.

[4] L.C. Rayner, S.E. Kidd and H. Wiejs, A Study of the Marketing of Fresh Fruits and Vegetables in Metropolitan Toronto. Economics Branch, Canada Department of Agriculture; and Farm Economics and Statistics Branch, Ontario Department of Agriculture (Ottawa: 1964), p. 4.

TABLE 2:2

APPARENT DOMESTIC FRESH DISAPPEARANCE OF SIX SELECTED FRUITS AND VEGETABLES

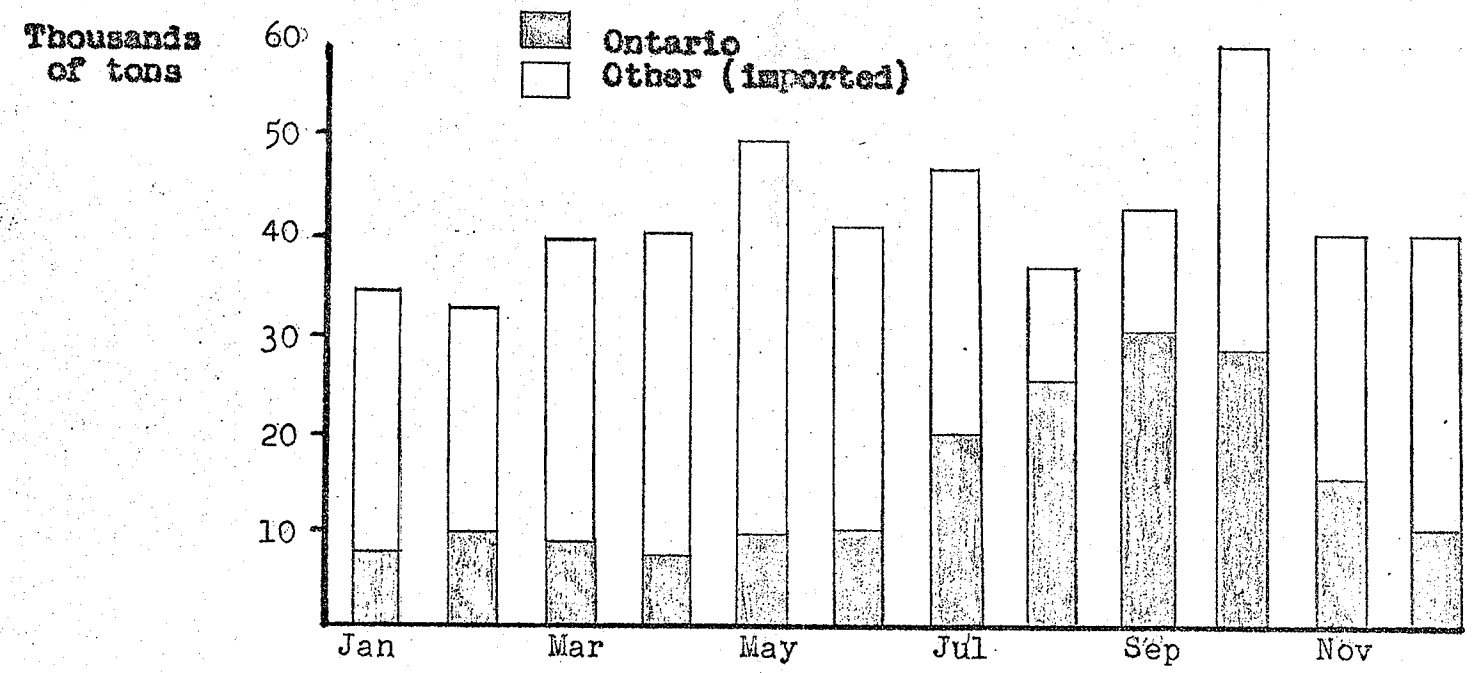
(millions of pounds)

	Lettuce	Grapes	Strawberries	Peaches	Tomatoes	Cherries
Average 1956-60	207	165	32	101	270	11.9
Average 1962-66	257	242	37	95	288	14.9
Per Cent Change	25%	47%	16%	-6%	7%	25%
1962	240	189	40	87	295	14.8
1963	242	221	37	99	287	14.2
1964	258	N.A.	41	100	286	23.0
1965	269	N.A.	31	92	290	10.6
1966	274	279	35	99	282	13.7

Source: Federal Task Force on Agriculture, "Fruits and Vegetables" paper presented to the Canadian Agriculture Congress. (Ottawa, 1969)

TABLE 2:3

COMPARISON OF RECEIPTS OF FRESH PRODUCE FROM ONTARIO AND OTHER SOURCES WITHIN THE TORONTO AREA, BY MONTHS, 1963



Source: L. C. Rayner, S. E. Kidd and H. Wieja. A Study of the Marketing of Fresh Fruit and Vegetables in Metropolitan Toronto. Economics Branch, Canada Department of Agriculture and Farm Economics and Statistics Branch, Ontario Department of Agriculture (Ottawa: 1964).

from the section on consumption. First, demand for fresh fruits and vegetables will continue to increase due to projected increases in per capita consumption and increases in total population. The demand for the perishable group of fresh fruits and vegetables is expected to grow even faster than the demand for all fresh fruits and vegetables. The second conclusion was that seasonal changes in demand for fresh fruits and vegetables are showing signs of becoming less important. This trend is likely due to factors such as higher, and more equitably distributed, incomes for consuming families allowing them to buy apparent "luxury" goods such as imported perishables out of season.

B. PRODUCTION

Consumption patterns having been analyzed, the next step is to analyze Canadian fresh fruit and vegetable production and its ability to fulfill Canadian consumer demand. An analysis of Canadian production showed that in fruit and vegetable groups the supply was generally less than demand. A more extensive study was made of production of the six chosen perishables.

One basic problem in the production of fruits and vegetables in Canada is the seasonality of climate. Canada has mostly a continental climate of varying degrees of severity. One characteristic of this climate is a relatively short growing season. Therefore, the fruits and vegetables that are produced in Canada tend to be marketed all at one time in the late summer or fall. However, there has been a movement by agencies such as the Vegetable Growers Association of Manitoba to install cooling facilities to allow domestically grown produce to enter the market at a more constant rate through the year. However, the types of

vegetables affected by this in most cases are not of the perishable type.

Production increases and decreases from 1956-60 to 1962-1966 were as follows:[5] Lettuce production decreased 4 per cent and peach production decreased 11 per cent. The largest increase in production was for cherries which increased 45 per cent. The next largest increase was in strawberries with 26 per cent, followed by grapes with 25 per cent, and tomatoes with 8 per cent.

A more relevant production figure used in this study was Apparent Available Domestic Fresh Production (ADFP). It was found using the formula:

ADFP = Domestic Supply - Processed in Canada - Exported from Canada.

Apparent Available Domestic Fresh Production figures gave an indication of how much of the Canadian production was available to meet the fresh fruit and vegetable consumption demand. In all cases, there was little or no gain in apparent available domestic fresh production from the 1956-60 average to the 1962-66 average as shown in Table 2:4. Two exceptions were strawberries and cherries which had 29 per cent and 24 per cent increases respectively. Peaches declined 9 per cent and tomatoes declined 22 per cent. Apparent available domestic fresh production of grapes remained constant from 1956-60 to 1962-66 while lettuce increased only 2 per cent.

In the case of lettuce, as noted, apparent available fresh

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[5]Federal Task Force, op. cit.

TABLE 2:4

APPARENT AVAILABLE DOMESTIC FRESH PRODUCTION OF SIX SELECTED FRUITS AND VEGETABLES

(millions of pounds)

	Lettuce	Grapes	Strawberries	Peaches	Tomatoes	Cherries
Average 1956-60	54	19	14	68	150	10.3
Average 1962-66	55	19	18	62	117	12.5
Per Cent Change	2%	0%	29%	-9%	-22%	24%
1962	63	4	18	56	134	12.6
1963	53	29	16	63	118	11.5
1964	56	N.A.[1]	20	81	117	20.4
1965	57	N.A.	15	45	119	7.4
1966	48	17	20	65	95	10.4

[1] N.A. = Not Available

Source: Federal Task Force on Agriculture, "Fruits and Vegetables" paper presented to the Canadian Agriculture Congress. (Ottawa, 1969)

domestic production increased. However, in the later sixties it was found "that lettuce growing in Canada is a slowly declining industry with falling acreage and output."[6] The year 1962 with its unusually high production of lettuce tended to make the average higher for 1962-66 than the trend would indicate. It was also stated that "as a proportion of Canadian consumption domestic production, (lettuce) has fallen from 29 per cent in 1956-60 to 22 per cent in 1962-66 and to 18 per cent in 1966."[7] While actual output is falling off another characteristic of domestic lettuce production was observed. "The nature of U.S. import competition is not primarily price based."[8] Even in peak summer months, Canada still imported lettuce and,

> this continuing demand for the imported product, even when large quantities of the domestic product are widely available at similar or lower prices, seems to indicate a demand for a superior quality product with a continuity of supply.[9]

Peach production followed the same trend as lettuce production. The apparent available fresh domestic production between 1956-60 and 62-66 declined 9 per cent while "between 1956-60 and 1962-66 production declined 11 per cent."[10] The apparent available fresh product declined less than real production as peaches used for processing also declined in 1962-66. In the peach industry "the estimated number of trees has fallen steadily; exports remained negligible; and imports grew as a proportion of total supply in the Canadian market."[11] However, there is a

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[6] Ibid., p. 18.
[7] Ibid., p. 18.
[8] Ibid., p. 18.
[9] Ibid., p. 18.
[10] Ibid., p. 29.
[11] Ibid., p. 29.

"continuing major proportion of peach production sold to the fresh market."[12] This movement to the fresh form in peaches is contrary to the projected trend to the processed form for fruits and vegetables generally.

Canadian strawberry production was found to be the most vigorous and viable of the six chosen perishables and of the domestic fruit and vegetable industry in general. "Between 1956-60 and 1962-1966 production and prices both increased by one-quarter."[13] During the same period, the apparent available fresh domestic production increased 29 per cent. This production occurred in the late summer and early fall. The greater increase in apparent available fresh production occurred due to a relatively greater increase in Canadian production along with a relatively smaller increase in strawberry processing. To continue to be a vigorous and viable industry, greater market duration and availability of product at the retail level combined with higher quality production appeared to be desirable for the strawberry producers.[14]

The grape industry also showed signs of viability. Production increased 23 per cent from 1956-60 to 1962-66. At the same time apparent available fresh domestic production remained unchanged. The unchanged trend was due to an increase in the grapes processed combined with increased exports. At the fresh level "the Canadian grapes supply only about 10-20 per cent of the 'true' fresh-grape market (after deducting the estimated home-wine supplies)."[15] A prominent fact about

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[12] Ibid., p. 29.

[13] Ibid., p. 35.

[14] Ibid., p. 35.

[15] Ibid., p. 40.

grapes in Canada is that there are two basic types of grapes constituting two different products. "Imported grapes differ considerably from domestically produced grapes - the imported vinifera grapes have a different taste, a higher sugar content, and produce a different sort of wine."[16] Finally,

> Because grapes are highly perishable and seasonal in production, the supply of both domestic and imported grapes is limited to three months - September, October and November . . . domestic supplies are concentrated in September and October.[17]

Little information other than production figures were found on cherries and tomatoes. It was especially difficult to find data on fresh eating tomatoes. There was an increase of 8 per cent in tomato production for the years 1962-66 from the years 1956-60. However, during the same time there was a decrease of 22 per cent in apparent available fresh domestic production of tomatoes. In the case of cherries, there are two types, sweets and sours, with the sours being used exclusively for processing. Production increased 45 per cent while apparent available fresh domestic production increased 24 per cent.

In summary, four of the six perishables increased their real production from 1956-60 to 1962-66. In that similar time span, two of the six perishables decreased their apparent available fresh domestic production while one of the six remained constant in the category. Of importance is the fact that the three most important perishables in total volume (lettuce, grapes and tomatoes) either increased negligibly or decreased their apparent available domestic fresh production. It was

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[16] Ibid., p. 40.

[17] Ibid., p. 40.

concluded from these facts that producers of Canadian perishables were unable to keep up relatively or expand significantly their production of perishables for fresh consumption. Also, it was concluded that Canadian producers are severely restricted in marketing opportunities on a year-round basis due to climatic conditions forcing a short seasonal crop.

C. IMPORTS

Physical quantities of imports are very important to this study. Import trends are needed to develop the trend of the movement of fresh perishables into Canada. The figures shed some light on the expected changes in physical volume of perishables that will have to be moved by the carriers. In previous sections of this chapter, apparent fresh domestic disappearance was chosen as the figure to represent domestic consumption. Apparent available fresh domestic production was used to represent domestic production that was available to supply the consumption demand. The difference between the two gave the amount of that particular perishable that was imported, regardless of a net export or import position for that particular perishable on the national accounts. The equation for imports was derived as follows:

Set:

Apparent Domestic Fresh Disappearance	=	ADFD
Apparent Available Domestic Fresh Production	=	ADFP
Imports	=	Im
Processed Perishables	=	Pr
Exports	=	Ex
Total Domestic Production	=	TP

Import Position = IP

The import position will always be equal or greater than zero and within the equation IP is not dependent on the export position. By definition:

$$ADFD = TP + Im - Pr - Ex$$

$$ADFP = TP - Pr - Ex$$

Again, the difference of DD and DP is the import position. The assumption was made following facts on consumption and production of perishable fruits and vegetables in Canada that demand for perishables was greater than the domestic supply and the equation follows:

$$ADFD - ADFP = IP$$

$$(TP + Im - Pr - Ex) - (TP - Pr - E) = IP$$

$$Im = IP$$

One basic problem from using this derivation occurred in allocating the imported perishable for either fresh or processed use. However, the assumption for this study was that imported perishables, if finally processed, moved in the fresh form to the domestic processing plant (unless otherwise specified). An exception to this would be imported frozen strawberries whose actual portion of the import trade of fruits and vegetables is small relative to tomatoes and lettuce.

Imports increased substantially for four of the six chosen perishables, as shown in Table 2:5. Lettuce imports increased 32 per cent from 1956-60 to 1962-66 while grape imports increased 53 per cent, tomato imports increased 45 per cent and cherry imports increased 75 per

TABLE 2:5

FRESH IMPORTS OF SIX SELECTED FRUITS AND VEGETABLES INTO CANADA

(millions of pounds)

	Lettuce	Grapes	Strawberries	Peaches	Tomatoes	Cherries
Average 1956-60	153	146	18	33	118	1.6
Average 1962-66	202	223	19	33	171	2.8
Per Cent Change	32%	53%	6%	0%	45%	75%
1962	177	185	22	31	161	2
1963	189	192	21	33	169	3
1964	201	N.A.	21	19	169	3
1965	212	N.A.	16	47	171	3
1966	226	262	15	34	187	3

Source: Derived from Tables 2:2 and 2:4.

cent. Lettuce and grapes had the greatest movement in physical terms with both having an average import total per annum of over 200 million pounds for the years 1962-1966. Tomato imports also were quite substantial with movements averaging over 170 million pounds for the selected time span. Although cherries showed a dramatic percentage increase, the actual physical increase from 1956-60 to 1962-66 was only 1.2 million pounds. The remaining two perishables showed a slight increase with strawberry imports increasing 6 per cent and peach imports remaining constant. In physical terms, strawberries and peaches combined only make up a little over 50 million pounds of perishable imports per year.

The conclusions from the consumption and production sections of this chapter substantiate the result of increased imports of perishables. Consumption trends showed a greater than average increase in demand for perishables within total fresh fruit and vegetable consumption. Also, the trend of this demand showed strong signs of becoming constant through the year rather than being seasonal and coinciding with production. These two consumption trends call for increased supply on a yearly rather than seasonal basis. As far as domestic supply is concerned, it was concluded that Canadian perishable producers were unable to keep up relatively or significantly expand their production of perishables for fresh consumption. This gap, then, between domestic consumption and production has led to increased imports of perishables and the projected trend is for these imports to increase due to a further widening of the gap between supply and demand.

A rough projection, in terms of carload lots actually hauled, can be made using data from Table 2:1 and Table 2:5. The projection

takes into account both population and per capita consumption increase. The population for 1964-1966 was taken as 19.7 million and the projected population for 1980 is 26.0 million.[18] Per capita consumption and import data were taken from Table 2:1 and Table 2:5 respectively.

Average total fresh fruit consumption for the years 1964-1966 of 1,921 million pounds was determined using a per capita consumption of 97.5 pounds and a population of 19.7 million. Average total fresh vegetable consumption for the years 1964-1966 of 1,688 million pounds was determined using a per capita consumption of 85.7 pounds with the same population. In total, the average total fresh fruit and vegetable consumption for 1964-1966 was 3,609 million pounds. The six chosen perishable imports constituted an average of 704 million pounds or slightly less than 20 per cent of total fresh fruit and vegetable consumption. Figures for 1964-1966 for the selected imports were obtained from Table 2:5.

The estimated total fresh fruit and vegetable consumption in 1980 was calculated using the same method. Per capita fresh fruit consumption was projected to be 100 pounds by 1980, per capita fresh vegetable consumption was projected to be 96 pounds and total population to be 26 million. The total fresh fruit and vegetable consumption was thus projected to be 5,096 million pounds by 1980. If the six selected imported perishables remain at least at the same portion of total consumption as in 1964-1966, there will be slightly over 1,000 million

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[18] Z. Yankowsky, J.P. Cavin and Frank Shefrin, Demand-Supply Projections for Canadian Agriculture - 1980, Economics Branch, Canada Department of Agriculture (Ottawa: 1968), p. 6.

pounds imported in 1980 or an increase of approximately 300 million pounds over 1964-1966.

The import figures of the six selected perishables were converted to carload lot equivalents of 40,000 pounds net weight. The 1966 import of the six selected perishables was 18,100 carload lots. The projected 1980 import of the same was 25,600 carload lots, an increase of 7,500 carload lots per annum just for the six selected perishables.

As mentioned earlier, the volume of physical movements in the fresh form is important to this study so as to establish transportation needs of the perishables. Since exports of perishable fruits and vegetables are relatively insignificant, attention was focused on imports of these commodities. Therefore, part of the transportation question has now been answered in that an estimate of the volume of fresh fruits and vegetables to be imported has been made.

D. MAJOR ORIGINS AND DESTINATIONS OF SIX SELECTED PERISHABLES IMPORTED INTO CANADA

The remaining question is to establish the major origins and destinations of imported perishables into Canada. Tables 2:6 and 2:7 give the results of calculation of major sources of Canadian perishable imports. Out of the twenty-four possible combinations of routes and particular perishables hauled on the route in the study, twenty-one of the combinations had California as the major origin.

The four Canadian cities used as destinations were chosen for three reasons:

(1) they represent the four largest urban centres in Canada;

TABLE 2:6

MAJOR IMPORT SOURCES FOR SELECTED PERISHABLE FRUITS IMPORTED INTO MONTREAL, TORONTO, WINNIPEG AND VANCOUVER AND THE PERCENTAGE OF THE TOTAL IMPORTS OF THESE PERISHABLE FRUITS SUPPLIED BY THE MAJOR IMPORT SOURCE, 1963-68

		Montreal		Toronto		Winnipeg		Vancouver	
		%	Source	%	Source	%	Source	%	Source
Grapes	1963	81	Cal[1]	55	Cal	91	Cal	63	Cal
	1964	88	"	44	"	93	"	52	"
	1965	86	"	47	"	87	"	53	"
	1966	85	"	40	"	87	"	53	"
	1967	83	"	34	"	82	"	49	"
	1968	68	"	33	"	79	"	44	"
Cherries	1963	61	Cal	88	Cal	100	Cal	80	Cal
	1964	66	"	83	"	75	"	75	"
	1965	95	"	100	"	100	"	80	"
	1966	59	"	62	"	40	"	40	"
	1967	52	"	59	"	100	"	100	"
	1968	59	"	51	"	100	"	60	"

[1] Cal abbreviation for California
Mex abbreviation for Mexico
Flor abbreviation for Florida
S.C. abbreviation for South Carolina

TABLE 2:6 (continued)

MAJOR IMPORT SOURCES FOR SELECTED PERISHABLE FRUITS IMPORTED INTO MONTREAL, TORONTO, WINNIPEG AND VANCOUVER AND THE PERCENTAGE OF THE TOTAL IMPORTS OF THESE PERISHABLE FRUITS SUPPLIED BY THE MAJOR IMPORT SOURCE, 1963-68

		Montreal		Toronto		Winnipeg		Vancouver	
		%	Source	%	Source	%	Source	%	Source
Peaches	1963	41	S.C.	63	S.C.	100	Cal	89	Cal
	1964	40	"	74	"	90	"	80	"
	1965	40	"	41	Cal	96	"	100	"
	1966	31	"	34	"	89	"	76	"
	1967	33	"	31	"	97	"	86	"
	1968	41	"	40	S.C.	81	"	89	"
Strawberries	1963	57	Cal	93	Cal	100	Cal	100	Cal
	1964	56	"	89	"	100	"	100	"
	1965	31	Flor	61	"	100	"	100	"
	1966	44	Cal	75	"	100	"	100	"
	1967	68	"	78	"	100	"	100	"
	1968	75	"	91	"	100	"	100	"

Source: Annual Unload Report Fresh Fruits and Vegetables on 12 Canadian Markets, 1963-1968, Production and Marketing Branch, Markets Information Section, Canada Department of Agriculture.

TABLE 2:7

MAJOR IMPORT SOURCES FOR SELECTED PERISHABLE VEGETABLES IMPORTED INTO MONTREAL, TORONTO, WINNIPEG AND VANCOUVER AND THE PERCENTAGE OF THE TOTAL IMPORTS OF THESE PERISHABLE VEGETABLES SUPPLIED BY THE MAJOR IMPORT SOURCE, 1963-68

		Montreal		Toronto		Winnipeg		Vancouver	
		%	%	%	%	%		%	
		Cal	Arizona[1]	Cal	Arizona	Cal		Cal	
Lettuce	1963	46	47	43	53	62		96	
	1964	47	44	55	44	63		91	
	1965	44	44	54	44	65		91	
	1966	48	35	62	35	74		93	
	1967	61	27	48	43	80		96	
	1968	57	32	52	40	82		97	
		Flor	Mex	Flor	Mex	Cal	Mex	Cal	Mex
Tomatoes	1963	33	27	37	40	27	52	45	49
	1964	39	24	38	39	30	51	49	48
	1965	38	24	44	39	28	48	43	50
	1966	33	32	37	45	33	44	43	52
	1967	34	31	40	40	24	55	38	52
	1968	31	29	26	43	49	39	47	42

[1]Cal and Arizona indicates that two import sources are of major importance to that block.

Source: Annual Unload Report Fresh Fruits and Vegetables on 12 Canadian Markets, 1963-1968, Production and Marketing Branch, Markets Information Section, Canada Department of Agriculture.

(2) they are spread across Canada thus representing various cultural and geographic situations; and

(3) they are all major termini for all three modes of transportation being studied namely air, rail and road.

From this data, it was assumed that California is Canada's most important source of fresh perishable fruits and vegetables. For the purpose of studying transportation of perishables into Canada, California was chosen as the origin terminal and Montreal, Toronto, Winnipeg and Vancouver were chosen as destination terminals.[19]

E. MARKETING OF FRESH FRUITS AND VEGETABLES IN CANADA

Finally, a general summary was made of the grower to retail marketing chain of fresh produce in Canada with special emphasis on imported fruits and vegetables. The basic source of data used was "A Study of the Marketing of Fresh Fruits and Vegetables in Metropolitan Toronto."[20] As Toronto is one of the largest fresh produce markets in North America, it was assumed that the trend of marketing linkages investigated in Toronto could generally be assumed for the three other Canadian cities chosen for this thesis.

The Toronto study determined that there were two main systems of produce distribution existing in the Metropolitan Toronto market.

The system which is growing in importance is that associated with the movement of produce from shipping point directly to warehouse, or retail outlets of the

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[19]California is not the major source of imported tomatoes for Montreal and Toronto. However, California is the third major source for these areas, and for purposes of this study it will be used as the origin.

[20]L.C. Rayner, S.E. Kidd and H. Wiejs, op. cit., p. 25.

> corporate chains and voluntary group organizations. The second, more diverse, distribution system is that associated with the movement of produce from growers or shipping point to various other marketing firms to independent retail outlets, institutions or out-of-town truck jobbers all of whom are principally small-lot buyers of produce.[21]

The study continued,

> The first system mentioned above is characterized by large co-ordinated central buying programs geared to serve the needs and merchandizing objectives of an extensive retail system. Organizations in this distribution system place a premium on factors that aid in the management of their distribution and merchandizing program. Uniform quality within large quantities, the degree of prepackaging or preparedness for display, the reliability and continuity of supply, price stability and uncomplicated financial and delivery details are all factors of importance to this distributive system.[22]

To verify the increasing shift to corporate-chain buying, the study added that the Metropolitan Toronto population

> increase is forecast to occur primarily in the outer suburbs, 85 per cent in North York, Etobicoke and Scarborough, 8.6 per cent in the nine inner suburbs and 6.2 per cent in the City of Toronto. As the new food store in the suburbs is predominantly the corporate and voluntary group chain supermarket, the expressed expansion plans of the chain organizations of a magnitude at least equal to population growth may be assured.[23]

On the other hand, the second distributive system of independent retail stores

> influenced largely by the density of population in the inner suburbs and the Toronto city area and by consumer custom, may experience little growth over the next decade. A decline in total volume is possible as larger independents become affiliated with voluntary groups.[24]

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[21] Ibid., p. 25.

[22] Ibid., p. 26.

[23] Ibid., p. 30.

[24] Ibid., p. 31.

From the results of data in the Metropolitan Toronto study, it was assumed for purposes of this study that movement of perishables would be through a market chain starting with the California grower and moving directly through to a Canadian corporate chain warehouse in all four of the Canadian cities studied.

CHAPTER III

AGGREGATE AND MODAL DEMAND FOR TRANSPORTATION OF FRESH FRUITS AND VEGETABLES: A GENERAL DESCRIPTION

Transportation is an integral part of providing fresh fruits and vegetables to the consumer. Transportation costs are important to the shipper, the consumer and the carrier itself. The first section of this chapter deals with the role of transportation in marketing agricultural products and with the effect on shippers and consumers of fluctuations in transport rates. The second section focuses on modes of transportation. Given the aggregate demand for transportation within the industry, it is necessary to determine which mode is most able to fulfill the requirements of the perishable fruit and vegetable industry. The requirements studied here were demand aspects as related to quality of service provided. The final section describes modal trends in the transportation of perishable fruits and vegetables.

A. THE ROLE OF TRANSPORTATION IN MARKETING AGRICULTURAL PRODUCTS

The role of transport in any industry is to move the product from an area of production to an area of consumption. This results in place utility. A commodity generally has little utility if it is left at the production site; it acquires utility when it is in the consumer's hand. During the early history of man, when little or no transportation

existed, all goods had to be grown or produced adjacent to the consumer. In most cases the consumer was the producer. As transportation technology increased and relatively more efficient transportation systems emerged, areas of production and consumption began to be separated. Areas suitable for production could be used to maximum benefit and surplus product not used by nearby communities could be transported to outer surrounding areas for consumption. How far it could be transported would depend on the price of transportation. Areas of production specializing in one type of product emerged. "Specialization of production has been dependent on the degree of efficiency in transportation."[1]

Transportation is of special importance to producers of agricultural commodities. "In recent years the transportation bill (in the U.S.A.) for all foods has amounted to more than $5 billion annually. Thus, the cost of transportation amounts to about 10 per cent of all food marketing charges."[2] As transportation forms a significant part of marketing charges of agricultural products, any changes in transportation costs may have major consequences on both the shipper and carrier.

Transportation and the Producer

The impact of transportation rates on producers is illustrated by the following:

> Consider a single product such as potatoes, where transportation charges average nearly 30 per cent of the

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[1] L.B. Darrah, Food Marketing (New York: The Ronald Press Company, 1967), p. 187.

[2] Ibid., p. 187.

> wholesale price - about half as much as the grower receives. To the grower, a 10 per cent saving in transportation costs could mean about a 5 per cent increase in his sale price, if other costs and prices did not change.[3]

In the report "The Economics of Farm Products Transportation," by Ivon W. Ulrey, a specific study of farm products transportation was done. Some of the conclusions follow:

> The special characteristics which make agriculture producers uniquely dependent on an adequate and flexible transportation system may be grouped into two categories. One is the extent to which agricultural products depend on geographic movement to acquire their market value. Frequently, these movements are over long distances, and perishable commodities have short time tolerances. The other, even more critical is the extent to which climate or weather determines where, when and in what quantities transportation services will be needed. Similar problems confront producers and users of non-agricultural commodities but in agriculture they are continuously present and the producer's dependence on their successful resolution is so great in degree that it constitutes a difference in kind.[4]

To further strengthen the notion that transportation is important to farm producers, Ulrey adds,

> Farm products depend on transportation more than manufactured goods for the creation or preservation of their value. Place utility - the value added to goods by moving them from where they are abundant relative to demand to where they are less so - constitutes a much higher share of their final value . . . For products of agriculture, over 8 per cent of that value (wholesale) represented freight charges in 1959 - the last year of which these data were available. This was much less than the value for mine and forest products, but more than double that for manufactured goods.[5]

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[3]Ivon W. Ulrey, The Economics of Farm Products Transportation, Marketing Research Report No. 843, Economic Research Service, U.S. Department of Agriculture (Washington: 1969), p. 2.

[4]Ibid., p. 2.

[5]Ibid., p. 2.

Further on this topic of "dependence on transportation service; the ratios change much higher for perishable than for semiperishable products."[6] Up to this point, emphasis has been placed on the problem of value of transportation relative to market value, however, the study directs,

> Important though it is, the high ratio between transportation charges and final market values is not the most important aspect of agriculture's dependence on transportation service. Agriculture's demands upon transportation are seasonal, variable and so unpredictable that they require a high degree of flexibility on the part of the carriers. Producers can control these uncertainties only to a very limited extent.[7]

Furthermore,

> Add to these complexities the problems of timing. Not only do demands on suppliers fluctuate widely and unpredictably, but shippers must depend on having those services available in adequate quantity when and where they are needed. In many cases, a saving of hours - not days or weeks - in transportation time can mean better prices for the producer or distributor, longer shelf life for the product and better satisfied customers. Stated the other way around, when transportation service is needed and is not available, the effect is loss of market value in part or in full. This means loss of income to agricultural producers and to those between them and the consumer; for the consumer it means higher prices, lower quality, and smaller supply.[8]

Finally,

> Despite technical improvements in the storage life of many perishables agriculture's needs for seasonal transportation remain urgent in terms of time and are largely unpredictable.[9]

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[6] Ibid., p. 2.

[7] Ibid., p. 2.

[8] Ibid., p. 3.

[9] Ibid., p. 4.

Ulrey's study outlined the needs of agricultural producers in the field of transportation as well as outlining why transportation at a low cost is essential to the producer. This gave the producer's side of the story. Following is a short description of how transportation rates affect the consumer of the product and how much of the good produced will be consumed if there are transportation tariff changes.[10]

Freight Rate Increases and the Consumer

The effect of freight rate increases on the consumer is determined by three sets of conditions; elasticity of demand for the product shipped, elasticity of supply for the commodity shipped, and the nature of the supply curve of the commodity shipped as reflected by cost of production. A freight rate increase is assumed here as being a constant additional cost that is added to the existing cost schedule. In other words, it is shown as an upward shift of the supply curve by the amount of the freight rate increase.

Assuming a normally sloped supply curve, the elasticity of demand for the product determines the effect of a freight rate increase in the following way. When the demand for a good is perfectly elastic, any freight rate increases must be born by producer or shipper. The only effect to the consumer is that there will be less quantity supplied at the same price. If demand for the good is perfectly inelastic the consumer pays the entire amount of the freight rate increase. However, the quantity demanded remains the same. Between these two limits of

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[10]Most of the following section can be broadened by referring to any transportation economics text.

elasticity of demand, the final price to the consumer resulting from an increase in freight rates tends to be greater, the less elastic the demand for the product.[11]

The second set of conditions is determined by the elasticity of supply of production of the commodity, assuming a normally sloped demand curve. If supply is perfectly inelastic, then the producer bears all of the increase in freight rates and there is no change in quantity demanded. If supply of the commodity is perfectly elastic, the freight rate increase is shifted completely to the consumer, also, the amount demanded decreases. Between these two limits, the more elastic the supply of the commodity, the greater the tendency is for consumers to pay a greater proportion of freight rate increases.

Whether the supply curve is positively or negatively sloped, assuming a normal demand curve, is the third set of conditions determining how much of a rate increase the consumer will bear. In an industry with increasing long run marginal costs of production the supply curve is correspondingly upward sloping to the right. With this type of curve, disregarding the extreme cases of perfect inelasticity or elasticity, the unit price to the consumer rises by less than the amount of the freight rate increase. An increase in freight rates brings a decrease in quantity demanded of the product. Such a reduction moves the equilibrium position of demand and supply to the left of the original equilibrium. With increasing costs, a leftward movement puts production in an area of lower per unit costs. Thus while the freight

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[11] A.W. Currie, Canadian Transportation Economics (Toronto: University of Toronto Press, 1967), p. 257.

rates have increased costs of production, the other production costs are now lower, and the freight rate increase is partially offset.

A freight rate increase brings the opposite effect when the long run marginal costs of production are decreasing and there is a downward sloping supply curve. A decrease in quantity demanded leads to higher per unit costs. Thus, the consumer must pay the freight rate increase as well as paying for the higher costs of production due to a decrease in quantity of the product demanded.

Some general conclusions follow below and are illustrated in Figures 3.1 and 3.2:

1. If demand is elastic and long run average costs are increasing, the effect to consumers is a change in price less than the freight rate increase.

2. If demand is elastic and long run costs are decreasing, the change in price to consumers is greater than the increase in freight rates.

3. If demand is inelastic, the consumer pays a major portion of the amount that freight rates increase.

The first category of general conclusions appears to be most relevant to the perishable fruit and vegetable industry as studied here. The elasticity of demand for particular perishables are generally considered to have an elasticity greater than unity. "One can conclude from the available results that the price elasticity of demand for most individual fruits at retail is unity or higher. The elasticity for such products as fresh peaches, plums and Bartlett pears may exceed -2.0."[12] Brandow further explains that elasticity of demand for particular vege-

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[12] G.E. Brandow, Interrelations Among Demands for Farm Products and Implications for Control of Market Supply. Bulletin 680, Interregional Publication for the State Agricultural Experiment Stations (University Park, Pennsylvania, August, 1961), p. 40.

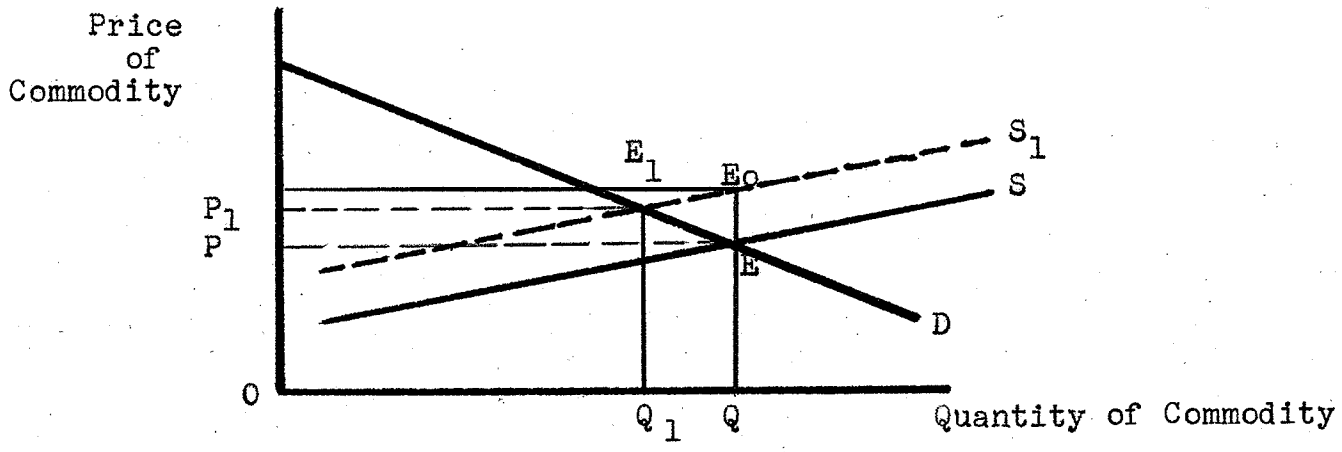

FIGURE 3.1

ILLUSTRATION OF THE EFFECT OF A FREIGHT RATE INCREASE ON THE CONSUMER WHEN CONSUMER DEMAND IS RELATIVELY ELASTIC AND LONG RUN COSTS OF PRODUCTION ARE INCREASING[1]

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[1]The initial situation had a demand curve D and a supply curve S (upward sloping to the right due to increasing costs of production) intersecting at equilibrium point E and a corresponding price P. An increase of transportation charges EEo was introduced. This gave a new supply curve S_1 with E_1 becoming the new point of equilibrium. P_1 was the new price, an increase over P of PP_1. PP_1 is less than EEo. Therefore, the effect of the freight rate increase EEo was that the consumer ended up paying less than the freight rate increase.

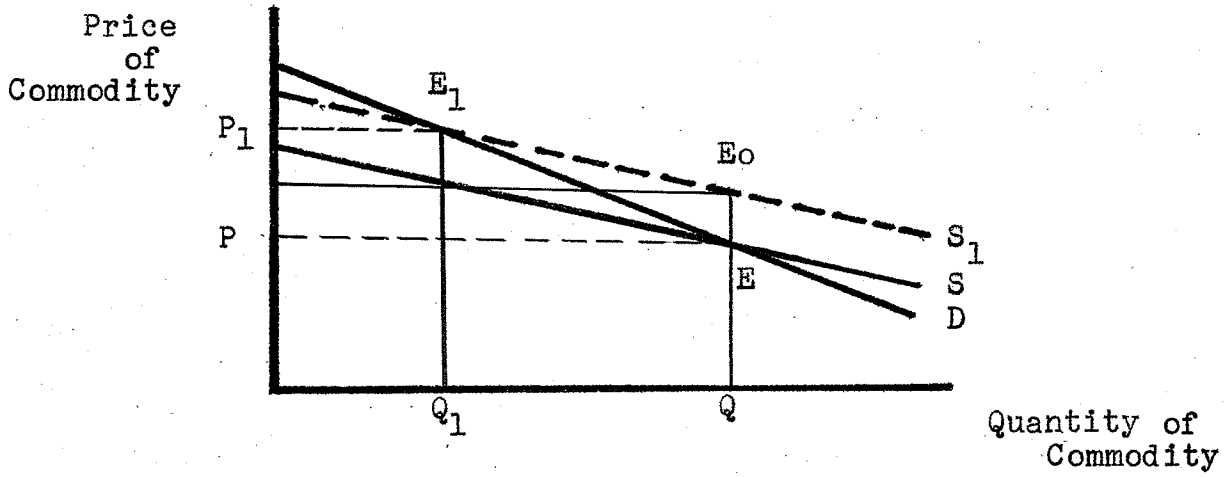

FIGURE 3.2

ILLUSTRATION OF THE EFFECT OF A FREIGHT RATE INCREASE ON THE CONSUMER WHEN CONSUMER DEMAND IS RELATIVELY ELASTIC AND LONG RUN COSTS OF PRODUCTION ARE DECREASING[1]

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[1]The initial situation had a demand curve D and a supply curve S (downward sloping to the right due to decreasing costs of production) intersecting at equilibrium point E with a corresponding price P. An increase of transportation charges EEo was introduced. This gave a new supply curve S_1 with E_1 becoming the new point of equilibrium. P_1 was the new price, an increase over P of PP_1. PP_1 is greater than the freight rate increase EEo. Therefore, the effect of the freight rate increase EEo was that the consumer ended up paying more than the freight rate increase.

tables is not as elastic as for particular fruits but that the vegetable group has a demand elasticity of -.6. Specific vegetables, however, should generally have a greater elasticity of demand than the vegetable groups itself. This is due to the greater substitutability of a product within a group as compared to substituting one product group for another.

Fruit and vegetable producers are generally considered to be in a purely competitive type of industry structure which is characterized by increasing costs of production. There are many producers growing a relatively homogeneous product all of which the market will take. The situation of elastic demand and increasing costs of production gives the theoretical result of both producer and consumers sharing the effect of an increase in freight rates.

B. INHERENT CHARACTERISTICS OF ROAD, RAIL AND AIR: Special Reference to the Movement of Fresh Fruits and Vegetables

So far discussion has centered on aggregate demand for transportation by producers and shippers. A more detailed analysis follows on the inter-modal demand characteristics as displayed by consignees and shippers. There are definite inherent advantages to all three modes considered in this study. These inherent advantages are in the form of direct cost advantages and quality of service advantages. The direct cost advantages are discussed in Chapter IV. In this chapter the inherent characteristics of quality of service are analyzed. Characteristics studied are reliability of service, frequency of service, availability of service and speed of service. A general description of the various aspects of service to be considered when choosing a transporta-

tion mode for shipment of freight is given by Richard B. Hefflebower.

> Making a choice among transport modes involves not only their respective planning cost functions, compared to traffic volume, but also their adaptability to various combinations and routings of traffic, and type of commodity, particularly as to perishability and adaptability to bulk handling. Routings depend on two major items: degree of the mode's adaptability to a wide variety of points of origin and destination, and whether or not the mode can pick up and deliver at shippers' and consignees' places of business and thereby avoid a local transfer haul. Further, for particular areas, adaptability of the mode to particular conditions of terrain, soil properties, and weather must be appraised.[13]

When analyzing these characteristics, an ordinal ranking was used to assess each mode's advantages over the others.

Reliability and dependability of service deal with a mode's ability to perform on schedule and deliver the shipment in good shape. To most users of the mode, this does not mean perfect co-ordination of timing or no form of deterioration at all but performance within acceptable limits. Within the category of reliability and dependability of service, there are two sets of conditions. There are the controllable conditions and the uncontrollable conditions.

The uncontrollable conditions, i.e. weather and accidents, tend to affect airplanes more than rail and road. The airlines are much more sensitive to weather than either of the other modes. Also, in the case of accident the whole airplane is grounded whereas by road and rail component parts such as cab and trailers or individual boxcars can be inter-changed. This problem of aircraft having one integral part also affects the plane when controllable conditions become adverse.

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[13]Richard B. Hefflebower, "Characteristics of Transport Modes," Transport Investment and Economic Development, ed. Gary Fromm (Washington, D.C.: The Brookings Institution, 1966), p. 61.

One factor benefiting aircraft is that they are generally more accident free than surface transport. Rail and truck generally perform the same through uncontrollable conditions.

With regard to controllable conditions, motor carriers generally offer better service. Trucks are maintained and depend upon relatively fewer people than air or rail and also produce results more efficiently. They also have more direct routing with no switching. A rail shipment has more chance of going wrong due to too much volume at bottlenecks within the system. Air also has this bottleneck problem especially in clearing freight at terminals but it is not as serious as rail. Overall, trucks provide the best service from the standpoint of reliability and dependability of service, with rail and air placing second and third respectively.

Trucking has the inherent advantage for the characteristic of frequency of service. The only limiting factors are city pairs between which the run is being made and if there is a serious backhaul problem. Contract and private truckers can move at anytime so that service is immediately available. Air service is fairly frequent with almost all major city pairs in the U.S. and Canada having connections within a 24 hour period. Many city pairs can be served as often as eight and ten times a day. Rail seems to have less of an advantage in this regard than the other two modes. Except on the mainlines, there would not be once a day service. Added to this, the amount of time needed for switching and marshalling gives rail the poorest performance within the category of frequency of service.

Availability of service is again best provided by truck. Airlines are committed to airports which are usually located in large urban

centres due to air's dependence on passenger travel. All cargo shipped by air must be picked up and delivered by truck. Rails are confined to existing rail lines and can only serve a particular location if there is a spur line available. A substantial contract between shipper and the railroad is usually needed before a spur will be constructed. Trucks have far fewer restrictions than either rail or air. Truckers' only restrictions are the highway systems. In most new construction and industrial parks, highways are built to serve the dual purpose of providing a right of way for trucking freight as well as for access by passenger vehicle.

Air freight definitely has the inherent advantage of speed, especially over a long distance. As the length of haul increases, the average block-speed approaches nearer the average cruising speed of the aircraft. However, more important than block-speed is the door-to-door delivery speed. On a short hop of a few hundred miles, the jet aircraft may lose some of its advantage due to time taken for pick-up and delivery.

With respect to speed, trucking is running a very distant second to air. Trucks can travel 65 - 70 miles per hour on four-lane highways but on winding, double lane highways, this speed is reduced. The average speed of trucks has been calculated at around 35 miles per hour. Finally, trains have an average speed of around 20 miles per hour giving them third place in speed capability

A definite inherent advantage of rail is in commodity movement capability. It can carry more bulk than the other modes. Also, it has more specialty cars allowing it to cater to special shipments. There

used to be restrictions on boxcars but new jumbo type cars have been built which are reducing some of the restrictions on rail commodity movements. Trucks have no advantage on bulk movements in most cases (except where rail is regulated more than truck but that is a pricing structure problem). They lack the specialty cars of rail although they are improving, especially in mechanically refrigerated units. Also, trucks, especially in Canada, can face seasonal weight restrictions on the highways.

Air freight is most severely restricted in commodity movement capability. There are the restraints of lift-off power to overcome the weight. This places a restriction on the density of goods hauled. Also, freight must fit the configuration of the fuselage. Finally, there has not been a workable refrigeration system for aircraft developed as of yet.

Five general characteristics have been discussed in view of freight transport demand for the various modes. How do these characteristics apply to the shipment of perishables? Air is a potential carrier of perishables and its applicability to carriage of perishables will be discussed later. It is generally viewed that air has qualities needed by transporters of perishables, but the price is too high. At this point, for convenience, comparisons on the quality aspects of service of transporting perishables will be made between road and rail.

A study by Robert M. Bennett on "Interstate Hauling of California-Arizona Fresh Fruits and Vegetables by Rail and Truck" listed the advantages and disadvantages of shipping by rail and truck. The advantages for trucks in order of importance were as follows:

(1) Due to more rapid service, fruits and vegetables shipped by truck often arrive in better condition. Risk of a price change while in transit is reduced by the shorter transit time of trucks.

(2) Multiple pickups and deliveries can be accomplished by truck, and are not practical by rail.

(3) Motor carriers provide more uniform refrigeration, and the incidence of loss or damage is below that of rail. Claims against truckers can usually be settled immediately, while the process is more time consuming with rail.

(4) In many instances, a truck can be loaded at less cost than a rail car and can be obtained faster than some types of rail equipment. Expensive stripping and bracing material and heavy containers needed in rail transit are not used as much in loading truck shipments.

(5) Truck charges are lower for short hauls of full lots, and are well below rail charges for part lots whatever the distance.

(6) Rail regulations governing the size and type of containers or methods of loading have no parallel among truckers. Truckers will accept practically any shipment regardless of how it is packaged.[14]

The disadvantages of trucks, in order of importance were as follows:

(1) Truck operators cannot be depended upon to meet prearranged loading schedules. This disrupts shipping routine, and creates labor problems by requiring irregular hours. Truckers insist on immediate departure and this places the shipper at a disadvantage in meeting his other loading commitments.

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[14]Robert M. Bennett, Interstate Hauling of California-Arizona Fresh Fruits and Vegetables by Rail and Truck, Marketing Research Report No. 673, Economic Research Service, U.S. Department of Agriculture (Washington, D.C.: 1964), p. 23.

(2) As truck charges for hauling exempt products are not regulated, a bargaining situation exists. Shippers said that limited knowledge of truck availability impairs their ability to judge whether a charge quoted is reasonable.

(3) The financial responsibility of some truck operators is uncertain.

(4) The lack of uniformity in truck equipment, as opposed to rail equipment, causes more of a problem when scheduling equipment for large loads.

(5) Trucks, more than railroads, have delaying emergencies in route such as accidents, breakdown or of equipment, delays resulting from traffic or weight violations, etc.

(6) Diversion in route is not practical with trucks, because such service as a general rule is very costly.

The comments listed above are not to be taken as the only advantages or disadvantages attached to rail and truck service. They merely represent those characteristics that the shipping firms felt were the prime factors functioning for or against the selection of either carrier.[15]

It seems that trucks are able to provide better service in four of the five categories developed in this chapter. Rail is only able to hold its own in the aspect of commodity movement capability. However, even this is being eroded by trucks as they compete with tandem trailers with modern refrigeration units. The current situation appears to be a trade-off problem between quality of service and price. However, as truck prices become more competitive (as they do in hauling perishables due to such items as the agriculture commodity exemption tariff), trucking should become more popular for hauling perishables. Road transport's ability to compete away traffic from rail is shown in the next section of this chapter.

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[15] Ibid., p. 23.

C. MODAL TRENDS IN TRANSPORTING FRESH FRUITS AND VEGETABLES INTO CANADA

For the fruit and vegetable industry, Table 3:1 and Figures 3.3 and 3.4 show what percentage of total import unloads in 12 major Canadian cities were attributed to truck and rail. For total import unloads of all fruits and vegetables, the trend showed imports being hauled increasingly more by truck with a corresponding decrease in the railroads portion of import unloads. In 1963, the railroads carried 58 per cent of the total unloads of imports while trucks carried 42 per cent. By 1968, however, trucks unloaded 55.5 per cent of the traffic while the railroads had slipped down to 44.5 per cent of import unloads of all fruits and vegetables. In actual physical volume, trucks handled 35,000 import unloads in carload equivalents and railroads handled 28,000 carload equivalent import unloads during 1968.

For the six perishables studied in this thesis, it was found that three perishables had more rail than truck unloads while the opposite occurred for the remaining three perishables. Cherries, grapes and lettuce were predominantly handled by rail while peaches and strawberries were handled almost exclusively by truck at the import level. In the case of tomatoes, the trend followed the general fruit and vegetable trend with rail slowly losing out to trucks and trucks finally gaining the major portion of import unloads by 1968.

There was another facet of unloads that has to be mentioned to keep actual quantity movements in proper perspective. Although rails had majorities in only three of six perishable movements, their majorities were in lettuce and grapes of which an average of over 200 million

TABLE 3:1

THE PERCENTAGE OF TOTAL UNLOADS OF THE SIX SELECTED PERISHABLES FOR THE YEARS 1963-68 ATTRIBUTABLE TO MOTOR CARRIERS AND RAIL

	Cherries		Grapes		Lettuce		Peaches		Strawberries		Tomatoes	
	Rail	Truck	Rail	Truck	Rail	Truck	Rail	Truck	Rail	Truck	Rail	Truck
1963	73.7	26.3	77.9	22.1	77.1	22.9	57.1	42.9	52.1	47.9	70.3	29.7
1964	72.5	27.5	80.7	19.3	73.8	26.2	42.5	57.5	48.9	51.1	59.2	40.8
1965	62.6	37.4	81.0	19.0	70.3	29.7	32.2	67.8	30.3	69.7	59.6	40.4
1966	74.7	25.3	78.6	21.4	70.7	29.3	26.7	73.3	30.0	70.0	59.0	41.0
1967	83.3	16.7	81.7	18.3	70.1	29.9	19.7	80.3	37.7	62.3	54.2	45.8
1968	69.7	30.3	77.7	22.3	69.1	30.9	13.5	86.5	9.4	90.6	45.1	54.9

Source: Annual Unload Report Fresh Fruit and Vegetables on 12 Canadian Markets, 1963-1968 Production and Marketing Branch, Markets Information Section. Canada Department of Agriculture.

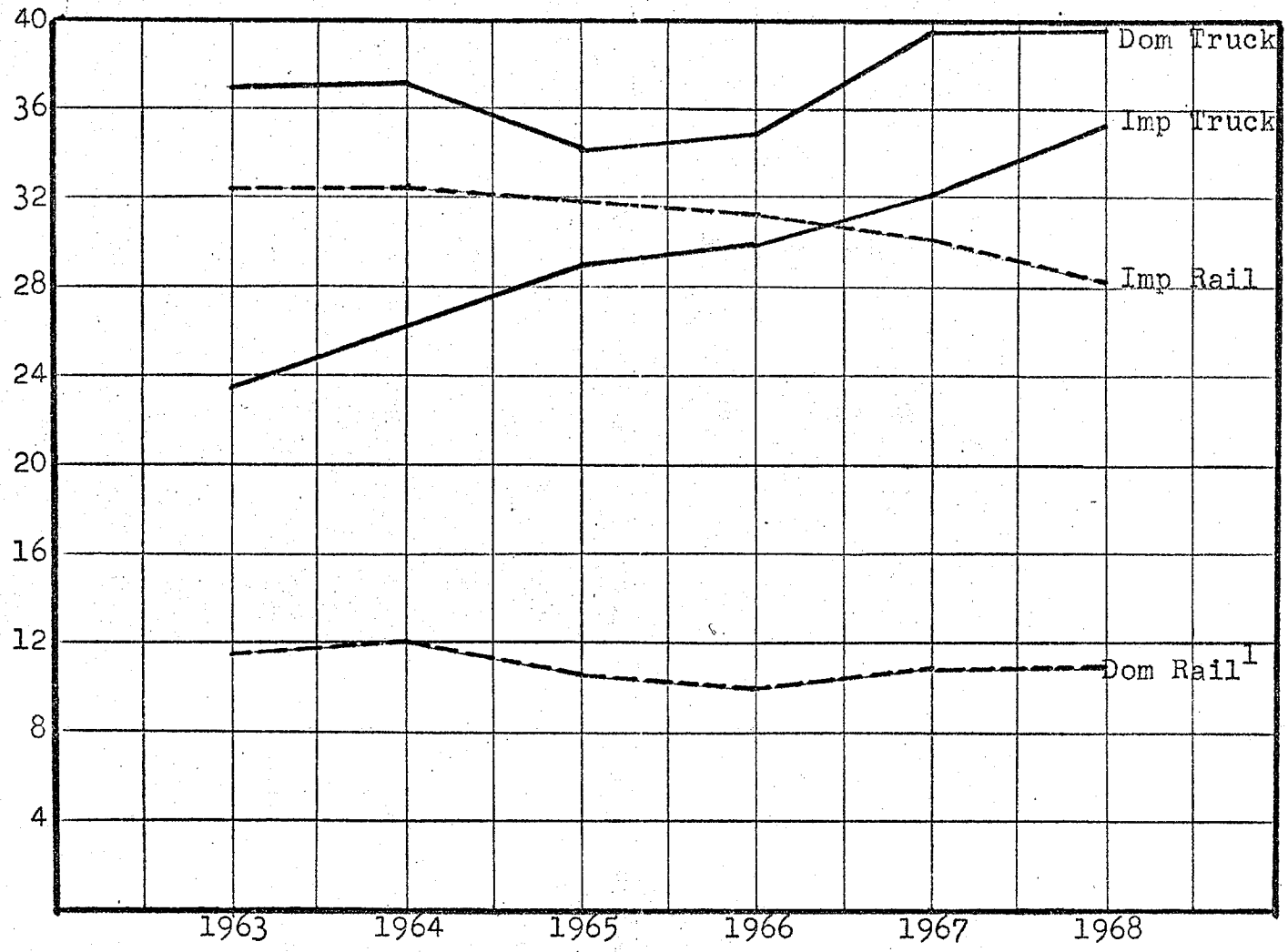

FIGURE 3.3

TOTAL IMPORTED AND DOMESTIC UNLOADS FROM TRUCK AND RAIL OF ALL FRUIT AND VEGETABLES IN 12 CANADIAN CITIES, 1963-1968

[1]Dom Rail: In 1968 there were 10,700 carload lot equivalent unloads made by rail in 12 major Canadian centres of all domestically grown fresh fruit and vegetables.

Source: Same as Table 3:1.

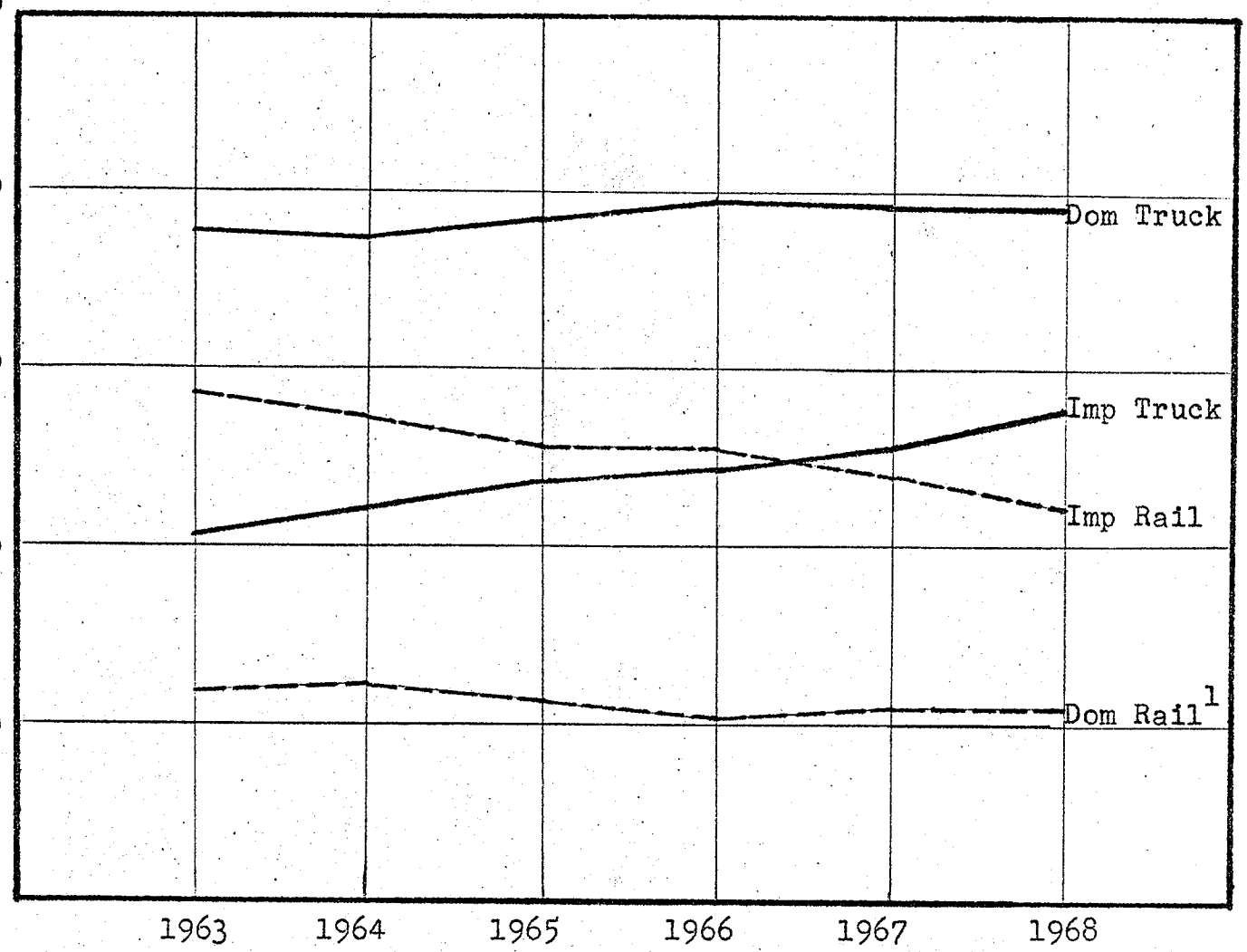

FIGURE 3.4

PERCENTAGE OF TOTAL IMPORTED AND DOMESTIC UNLOADS BY TRUCK AND RAIL OF ALL FRUIT AND VEGETABLES IN 12 CANADIAN CITIES, 1963-1968

[1]Dom Rail: In 1968, 22 per cent of all domestically grown fresh fruit and vegetables unloads in 12 Canadian centres were made from rail.

Source: Same as Table 3:1.

pounds per year were imported in the years 1962-1966. For tomatoes, which had an average of over 170 million pounds for the same time period, trucks were just barely ahead of rails. From this it was concluded that rails were still the major mode of transport for the six chosen perishables.

In the case of perishables, the transport trend showed to be increasingly in favour of trucks. Strawberries and peaches had definite continuing trends toward trucks. Cherries, lettuce and tomatoes showed only a slight trend to trucks. In 1968, 70 per cent of cherries, 78 per cent of grapes and 69 per cent of lettuce were imported via rail. Eighty-six per cent of peaches, 90 per cent of strawberries and 56 per cent of tomatoes were imported via highway motor carrier.

A possible reason for continued rail transport could very well be that much of the import fruits and vegetables have been traditionally wholesaled through Chicago brokers. Chicago has efficient, direct major rail links between itself and both Florida and California. Thus, Chicago is in a good position to receive the produce. Secondly, Chicago has direct rail service to Toronto and other parts of Eastern Canada. Eastern Canada is also the area of Canada with the greatest population concentration. This pattern of marketing through Chicago has developed over the years. However, with direct grower to retailer chains developing, especially in Western Canada, wholesales such as those in Chicago are beginning to lose their prominence.

Producers of perishables require low-cost efficient transportation that is able to adopt to the seasonal climatic variations that can effect the quantity and geographical position of a crop within a

producing area. Consumers tend to have an elastic demand for perishables and are faced by a relatively inelastic supply curve in a season, that is of increasing costs. An increase in freight rates leads to a decrease in quantity demanded and the producer is forced to cover part of the freight rate increase himself. A common goal to both but especially the producer is to have low-cost transportation. Although there are other considerations, the above mentioned considerations may be a major factor why truck hauling of perishables is increasing. Other reasons for the switch to trucks are discussed in Chapter V.

CHAPTER IV

THE TOTAL COST CONCEPT MODEL FOR COMPARATIVE-COST ANALYSIS OF TRANSPORTATION

This chapter introduces the Total Cost Concept as developed by Groenewege and Heitmeyer. The first section of the chapter relates the history of aircraft technology as applied to air freight and the need for acknowledgement of air freight's speed potential. The second section of the chapter describes the principle of the Total Cost Concept. The final section of this chapter deals with procedure of using the Total Cost Concept to evaluate air freight's potential of competing in shipping a given product on a certain route.

A. THE ORIGIN OF THE TOTAL COST CONCEPT

Air transportation has been relatively costly since its implementation in the early 1930's. Goods shipped by air have had to pay a premium tariff over the years. In fact, until the end of the last decade, air freighting of a commodity was done only on an emergency basis. The development and introduction to commercial use of four-engined jet aircraft in the late 1950's revolutionized the air industry.

Four-engined jets such as the DC-8 and Boeing 707 enabled the aircraft to become much more competitive in hauling regular cargo. These aircraft more than doubled the speed in miles per total airborne

hour while almost tripling the miles per total block hour[1] over piston-engined aircraft such as the DC-6. The jets increased the range of aircraft substantially while also increasing capacity from an average of 14.4 tons on a DC-6 to 42 tons on the average for the four-engined jets.[2]

A comparison of direct operating cost versus productivity of the DC-6 and the DC-8 take the above mentioned variables into account. The DC-6 had an average direct operating cost of 21 cents per available ton-mile with an according productivity of 1800 available ton-miles per revenue hour. The DC-8 had direct-operating costs of 9.5 cents per available ton-mile to a corresponding 8000 available ton-miles per revenue hour.[3] Figure 4.1 shows the trend of direct operating costs versus productivity. Although only direct costs are mentioned, this curve indicates the advances in aircraft development that have allowed the airplane to compete with some surface transport on a regular basis.

With the introduction of potential air shipment of commodities on a regular basis, the standard evaluation criteria for comparing the abilities of various modes of transport were not sufficient. When place utility is created by transportation of a good, there are three components or variables that determine how much utility is produced. The

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[1]Average block hour speed is determined by dividing the total number of miles covered during a flight by the total hours it takes the aircraft to move from terminal to terminal. Average airborne hour speed is determined by dividing the total number of miles covered by the total hours of flight between take-off and touchdown.

[2]Data on aircraft taken from Direct Operating Costs and Other Performance Characteristics of Transport Aircraft in Airline Service, Calender Year 1965. Office of Policy Development, Federal Aviation Agency (Washington: 1966).

[3]Ibid., p. 6.

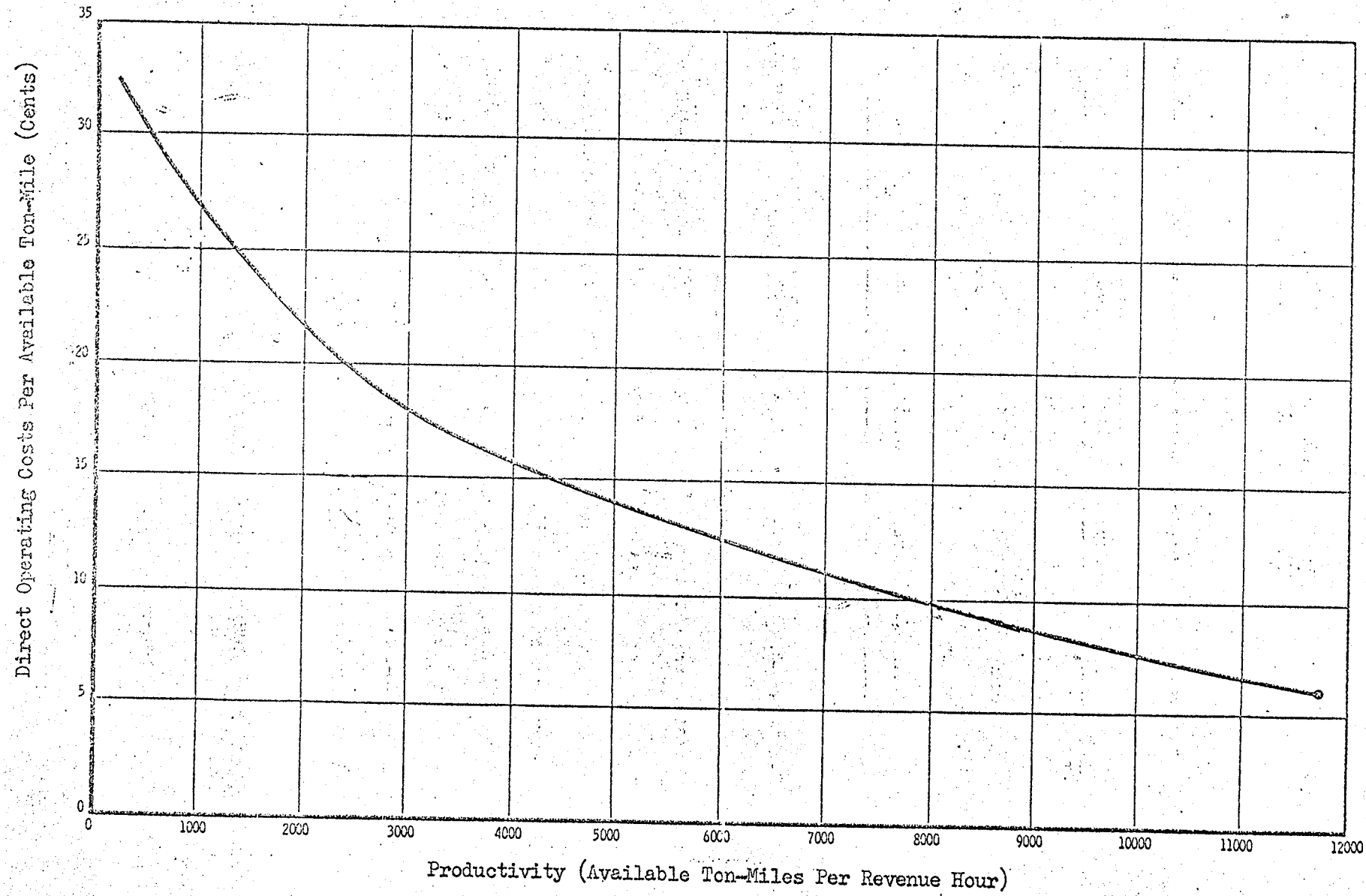

Figure 4:1 Direct Operating Costs Vs. Productivity of Selected Commercial Aircraft.

Source: Direct Operating Costs and Other Performance Characteristics of Transport Aircraft in Airline Service, Calendar Year 1965. Office of Policy Development, Federal Aviation Agency (Washington: 1966).

components are weight moved, distance travelled, and the speed with which the weight was moved over the distance.

Surface modes use ton-miles as the demand unit but when one studies ton-miles, there are only two of the three variables mentioned, weight and distance. Speed is not included but is assumed a constant in that truck and rail for most intents and purposes move goods at approximately the same speed.

Aircraft travel approximately ten times faster than conventional surface transport. This speed variable is air transport's most important characteristic. It became readily apparent in the mid 1960's that the tremendous speed differential of aircraft over other modes could affect the whole distribution pattern of an industry or company. The role of air transportation in the distribution system had to be analyzed.

Analysis and study of the distribution and marketing sections of business is a relatively new field.

> Time and motion studies have brought about enormous savings in manufacturing costs. But production costs are only part of the story. A similarly critical examination of company distribution systems can also bring to light more efficient methods, with accompanying savings. Even in more efficiently managed firms there may be some misdirected marketing effort. As distribution accounts for up to 50 per cent and more of product selling price, even small percentage reductions represent substantial savings.[4]

Some of the effects of reducing distribution costs are as follows: if demand for a consumer good is elastic, a price reduction by

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[4]Adrianus D. Groenewege and Roderick Heitmeyer, Air Freight: Key to Greater Profit (Middlesex, England: Aerad Printers and Publishers, 1964), pp. 52-53.

decreasing distribution costs will encourage people to buy more of the good resulting in an increase in total revenue. Furthermore, the good can be distributed through a greater market range geographically for the same final consumption price due to either more transportation for less money or using the saving from some other aspect of distribution to purchase more transportation. Thus, more people are within the market and potentially more of the good may be sold. In an industry with economies of scale or at least no diseconomies of scale, added sales mean more profit.

The basic role of transportation in distributing goods is to move the good physically from the point of production to the point of sale. For raw materials, freight charges in 1959 were calculated at 28.13 per cent of the wholesale price of mining products, 14.21 per cent of the wholesale price of forest goods, and only 3.94 per cent of the wholesale price of manufactured goods.[5] The more natural a state the commodity is in, the more important actual transportation charges are relatively. The more value a good has, the less important actual transportation charges are in total. However, transportation charges per pound may be much higher for the high-priced good. Transportation charges are only one aspect of distribution, and with high-value commodities the other aspects would seem to have more relative importance. Other areas of conventional distribution systems are warehousing, inventories, retailing and wholesaling to name a few.

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[5]Ivon W. Ulrey, The Economics of Farm Products Transportation, Marketing Research Report No. 843, Economic Research Service, U. S. Department of Agriculture (Washington: 1969), p. 3.

One problem in distribution is the bottle-necking at shipping and receiving points at the producer, wholesaler and retailer level. There are always problems in sorting out which package goes where and often many items are misplaced or lost during switching, loading or unloading. Rail shipment of goods is the most serious offender in this area. The reason lies in the characteristic of the mode itself. There are many carloads of different commodities on one train and there is also switching between different trains and lines and until quite recently, there was no quick accurate electronic system to account for each car, its contents and its destination.

Less-than-carload lot shipping gives rise to problems in that another series of handlings has to be made by consolidators or forwarders. The packages from various shippers are consolidated by the freight forwarders into one carload lot. This lot is broken down at some further intermediate destination and individual packages are delivered. The more handlings and accountings that must be made, naturally, the more chance there is for damage, lost or misplaced shipments. Finally, the excessive amount of handling and paper work takes time.

One effect of this time-consuming procedure is to allow more time for depreciation of the good while in the distribution chain. For most commodities this is no problem as there is not an excessively short depreciation time-lapse. However, such commodities as perishables deteriorate relatively quickly even with refrigeration. Some items such as published materials or fashions become relatively obsolete overnight. Rapid distribution is very important for these commodities.

The two biggest problems in distribution according to Groenewege and Heitmeyer[6] and Lewis and Culliton[7] are the carrying of inventories and the warehousing system. It is common knowledge that there is a carrying charge in keeping up an inventory. However, when the system depends on conventional transport an inventory must be carried so that immediate possession of a good may be given to the consumer. Most companies have specialized production in specific areas while markets are all across the country. This, coupled with the facts that there are often long distances between these consumption and production areas and conventional rail and road transportation being relatively slow, leads to the need for inventories to enable immediate fulfillment of a consumer's purchase contract. Air freight can change this type of inventory system by cutting down the need for carrying parts and inventory. Using air freight, a distributor can have goods shipped from the production area to the consumption area within hours. Surface transport is unable to achieve this if a long distance is involved.

Conventional warehousing has a fundamental purpose of providing a basic link in the producer to retailer chain of distribution. It serves as a storage depot for goods and as a back-up supply to the retailer's inventory to instill consumer confidence. There are practical problems with this system in that it tends to be costly. Lewis and Culliton estimate that for many companies, warehousing costs are upwards

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[6]Groenewege and Heitmeyer, op. cit., p. 70.

[7]Howard L. Lewis and Jamis W. Culliton, The Role of Air Freight in Physical Distribution (Boston: The Alpine Press, Inc., 1956), p. 67.

of 2 per cent of gross sales.[8] Also, warehouses can conceivably add to transport costs in that warehousing makes necessary two relatively more expensive short hauls instead of one less expensive long haul. These short hauls necessitate two more handlings.

With regard to storage, it is conceivable that with good management and correct traffic controls, the short term storage could be provided while the good is in transit. Long-term storage, if needed, can be provided at the plant. Using air freight, shipment from plant to consumer can be made quickly to fulfill contracts. Warehousing could be reduced. However, there is the problem of customer confidence in a no-warehouse system in that the customer wants to be assured of quick delivery.

One answer to some of these distribution problems is the use of air transportation. It is a relatively new mode that has brought the characteristic of speed of transport of freight to the front. Although, it is not the answer to all distribution problems for all industries, it is a proposal that must not be cast aside simply on the grounds that it is too expensive. The very fact that air transportation is so much faster than conventional transportation should lead one to treat it with due respect. It would be a great fallacy to compare road and rail and air on a strict cost of transport basis.

As the idea of air freight for regular freight shipments became accepted, researchers and businessmen recognized that air freight challenged the efficiency of conventional distribution systems. Groenewege and Heitmeyer collaborated to develop a system of evaluating air

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[8] Ibid., p. 77.

freight within a company's distribution system. The system developed is aptly titled the Total Cost Concept and deals specificially with the potential ability of air freight to increase the overall efficiency of distribution.

> Air freight must also be looked at from the point of view of the consignee, as well as the shipper. The position of the consignee at destination is extremely important to efficient marketing. Air freight can frequently improve the consignee's competitive position and thereby expand his sales.[9]

B. THE PRINCIPLE OF THE TOTAL COST CONCEPT

The Total Cost Concept was developed to enable businessmen and managers to evaluate the full effect of air transportation as a competitive mode in hauling a given commodity. Groenewege and Heitmeyer suggested that a comparison of air freight with surface transport, from the total cost point of view, be undertaken in three phases:

(i) Direct Shipping Costs

Packing and crating, including labour, pick-up, transfer and delivery charges, insurance premiums, charges for documentation and customs clearance, actual transportation charges, transit warehousing and wharfage, customs duties where applicable, and interest on capital invested in shipments en route.

(ii) Indirect Costs

Capital invested in storage warehousing facilities and their maintenance or storage warehousing charges for rented space, capital invested in inventories, inventory control and administration, obsolescence and deterioration in storage.

(iii) Intangible Factors

Door-to-door delivery time, punctuality,

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[9] Groenewege and Heitmeyer, op. cit., p. 58.

> dependability and frequency of arrivals and departures, competitive advantage and sales turnover, better service and greater customer satisfaction, flexibility in adapting to changing demand, damage, theft and pilferage.
>
> The first emphasis must be placed on full direct cost comparisons to show up differences in cost and savings. Although these direct cost comparisons may or may not show up a saving in favour of air transport, they assist considerably in evaluating air freight and at arriving at proper management decisions. These direct cost comparisons can, if necessary, be followed by an examination of the indirect and intangible factors to complete the picture. It is important to remember that indirect costs and intangible factors can be of over-riding importance and tip the balance. Only a comprehensive look at the entire marketing and distribution process, including time periods, will show the full effect of air freight on sales and profit.[10]

C. THE PROCEDURE OF THE TOTAL COST CONCEPT

Direct Costs

The first area of comparison is the direct costs which include all the items listed under direct shipping costs. These cost elements can have an actual cost expressed in monetary figures attached to them and thus allow for an objective decision.

Transport charges. First, it is necessary to define as clearly as possible the commodity that is being shipped. Following that, the lowest rate actually in effect for the commodity may be chosen. Minimum weight and volume levels at the quoted rate should be noted. The rates should be determined as to whether they apply to weight, volume or a combination of both. The rates applicable may range from general class rates to specific commodity rates.

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[10] Ibid., pp. 54-55.

Packing and crating costs. The extent of packing and crating requirements affect two dimensions of costs in distribution: labour costs and material costs. Shipments moving by air usually require less crating and packing materials than other modes. This means less cost for the actual packing and less transportation costs as the billing weight is lighter although net weight for each mode would remain the same. Secondly, as air requires less packing and crating, there is less time and labour spent in packing and unpacking.

Pick-up, transfer and delivery charges. Direct costs are to include all phases of transportation from the producer through to the wholesale or retail outlet. It is necessary then to include pick-up and delivery as well as transfer costs. Straight transportation charges are often quoted on a terminal to terminal basis neglecting pick-up and delivery.

Transfer charges are charges levied by surface modes when a commodity must be changed from one mode to another. These charges are especially prevalent in the case of an ocean-land link-up. There are charges for transferring from ocean ship to rail or vice-versa. Air freight is covered by one air waybill and no transfer charges are made on goods within the specified journey.

Insurance premiums. The rate of such premiums on goods shipped air freight can be obtained from the shipping airline, as airlines provide insurance. Most railroads in North America also provice their own insurance. Insurance for goods shipped by truck or by railroads not carrying their own insurance plan may be obtained from insurance brokers. Premiums for insuring a good vary depending on the mode used.

Premiums on each mode should be calculated due to this variance. Air freight insurance premiums will tend to be lower "because of the smooth handling, shorter travel times and therefore less exposure to risks, greatly reduced breakage and pilferage."[11]

Interest charges. It is important to determine the amount of working capital tied up while the good is in transit. A common procedure for this is as follows: First, the effective interest rate or opportunity cost per day is established. Secondly, the value of the commodity in transit is determined. Thirdly, by multiplying the second by the first, the total interest charges per day are calculated. Finally, the total interest charges for the length of time in transit are determined by multiplying interest charges per day by the number of days in transit.

Also of relevance is the rate of turn-over of capital. The longer that capital is tied up in the goods being shipped, the more opportunity is lost for it to be put to use in another area of the firm or in purchasing more goods for sale. The faster that a shipment is made, the faster that capital may be turned over.

Warehousing and inventory costs. There are two classes of warehouses and three types of inventories that normally exist within a conventional distribution system. The prevalence of such warehousing and inventories can affect the cost of distribution. There are storage and transit warehouses. Stored within these warehouses are three types of

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[11] Ibid., p. 65.

inventory; "firstly, that situated at the factory or close to it; secondly, that maintained in the field, or by the wholesaler, to supply particular market areas; and thirdly, inventory maintained by retailers."[12]

When determining the total cost of distribution, one must look at warehousing and inventory both in the short-run and the long-run. Within the short-run, the distribution system has to be accepted in the present state of existence. The conventional system is designed primarily for surface and ocean transport. In most cases, the three previously mentioned areas of warehousing and inventory storage would be involved.

The concern in the short-run is to eliminate any in-transit warehousing that occurs when shipping between any combination of inventory storage. In-transit warehousing is that warehousing that may occur when using different modes within one complete shipment. Transit warehousing generally occurs during shipments requiring ship transport. It is the inherent characteristic of ships to have a very low frequency of departure. It is decidedly very difficult to co-ordinate the arrival of one mode and the departure of another within such a system. Therefore, there is a requirement for in-transit warehousing to store the goods between movements.

Transit warehousing is usually rented but to some shippers that use this warehousing continually, the space is bought outright. For the purpose of cost-comparison, in-transit warehousing should be calculated

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[12] Ibid., p. 71.

on a rental basis. The short-run in-transit warehousing can thus be calculated as a direct cost.

The second group of savings is concerned with the long-run situation where fixed investments in inventory and warehousing may be changed. It may be reasonable to reduce or eliminate entirely existing inventories and/or warehousing facilities. Considerable savings may be involved. This long-run area, however, is best considered under indirect costs. Decisions on long-run warehousing and inventory are of major importance within the overall plan of the firm, and any decisions on long-run warehousing and inventory must only be made after considerable study of the implications.

Charges for documentation. Savings in this area most frequently occur on international shipment using transport modes other than air. Air freighting requires no other commercial documentation other than the Air Waybill. "This covers shipment from door-to-door, regardless of distance and the number of participating airlines."[13] Also, no charge is made for cutting the waybill.[14]

Surface transport requires much more documentation than air, especially if more than one mode is utilized. For ocean shipping, significant charges exist for cutting Bills of Lading. Also, one does not have to physically possess the Air Waybill to establish possession of the shipment as is necessary with Bills of Lading, thus making air

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[13] Ibid., pp. 73-74.

[14] "Cutting the Waybill" is the industry term for drawing up the shipping contract.

freight more convenient. To make a comparison of air and surface it is necessary to determine all such types of billings and their cost.

Custom clearance costs. Within this area, procedures for air and surface shipped goods are similar. However, when calculating the applicable duty, there are different methods used. If gross volume or weight is used for calculation of duty, air transport has an advantage due to less packing and crating giving either less billing volume or weight. "However, where import duties are assessed c.i.f. value, custom charges maybe somewhat higher for air in view of relatively higher freight rates."[15] Finally, it is usually more convenient shipping by air across international borders as customs procedures seem to be more streamlined for air service than for surface transportation.

Groenewege and Heitmeyer have developed a chart for comparing direct shipping costs. A reduced version of such a chart is used in Tables 5:1 - 5:4. Once the direct costs are determined, a short-run decision on the feasibility of air freight within the distribution system can be made. The authors of the comparative system believe that if the direct-cost comparison shows the difference between surface and air transport only being 10 per cent or less, than it would be wise to use air freight for the immediate advantage it possesses. If direct-cost comparisons favour air shipment, the choice is made in terms of straight economics. If air freight direct costs are above surface direct costs by more than 10 per cent, a decision-maker must turn to the indirect costs and intangible factors. They may affect the long-run

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[15] Ibid., p. 75.

distribution picture of the company.

Indirect Costs

As mentioned above, the determination of indirect costs and intangible benefits is required if air freight direct costs are more than 10 per cent above surface costs. The indirect costs cannot be calculated quickly to give an instant decision basis as is possible with Groenewege and Heitmeyer's direct-cost comparison. Indirect costs are basically concerned with the costs of storage warehousing and inventory which are fixed costs in the short run. To make indirect costs variable, they must be considered in the long-run.

To be able to determine what indirect cost savings air freight can make, a detailed systematic study must be made of a firm's present warehousing and inventory situation. A prime requisite for the determination of such costs is a good set of records giving company transactions in warehousing and inventory. For many firms, such records are non-existant. The areas of inventory and warehousing studied are capital invested in such areas, maintenance and repair of warehousing and/or charges for rented space. The savings determined in this area would be on a yearly basis and would not be attributable to one load as are direct costs. Therefore, the importance of storage warehousing and inventory savings is negligible in the short-run decision-making span.

The indirect costs related to obsolescence and deterioration are dependent on the product involved. To such items as perishables or newspapers, the indirect cost of deterioration or obsolescence is quite considerable. For other products, these costs are generally negligible. Again, a detailed study by the organization involved will be needed to

determine just how much effect air freighting can have on such costs. Unlike storage warehousing and inventory, these costs may be determined in the shorter run.

Intangible Costs

The procedure of calculating intangible benefits is highly subjective. Factors, such as speed of delivery, flexibility, and service to customers, are completely dependent on the situation. A factor that may be worth an extra 10 cents per pound direct cost to one firm may be worth nothing to the next firm. The calculating procedure is to determine what intangible factors are relevant to the particular transport situation and try and weigh the benefits of the extra transport service against an increase in the rate for the transport service.

There is one prime factor to remember when calculating the intangible benefits. While the shipper may feel the extra costs are justified by the intangible benefits of air freight, the consumer may not be willing to pay the price.

CHAPTER V

AN INTER-MODAL COST COMPARISON OF TRANSPORTING PERISHABLE FRUITS AND VEGETABLES FROM CALIFORNIA INTO CANADA

The Total Cost Concept as described in the previous chapter is used as the model in studying the transportation of perishable fruits and vegetables to Canada. The objective of this comparison is to determine if air freight can economically compete with rail and truck in hauling perishables. Also, a further objective is to determine which mode most suitably performs the task of transporting perishables. It is conceivable that air freight could be economical enough to fulfill the second objective. On the other hand, if it is not, the objective is to determine which other mode is best suited for the job.

To use the Total Cost Concept, specific routes for comparison must be chosen. In this study, California has been determined as the main import source of perishable fruits and vegetables. In determining the routes for comparison, Los Angeles and San Francisco were chosen as terminal cities as they maintain major terminals for all modes under study. The Canadian destination cities are Vancouver, Winnipeg, Toronto and Montreal.

Canadian air carriers are used as the source of air transport in this study. The franchises available to the Canadian companies dictate the actual routes studied for comparison. CP Air has the San Francisco-Vancouver and the San Francisco-Vancouver-Winnipeg routes. Air Canada

has a direct route of Los Angeles-Toronto and Los Angeles-Toronto-Montreal. Air rates that are posted on a route of a circuitous path are the same as those that would prevail if it was a direct route. Thus, the routes for comparison are Los Angeles-Montreal, Los Angeles-Toronto, San Francisco-Vancouver and San Francisco-Winnipeg.

The inter-modal comparison is set up in two sections. The first section is a direct-cost comparison. The second section deals with comparing indirect costs and intangible factors as related to the modes involved. As actual precise cost data is only available for rail and air, these modes are the only two compared using Groenewege and Heitmeyer's calculation and comparison table. Truck data is incomplete and of a general nature. A general direct cost-comparison between truck and the other two modes follows the direct-cost tables. Truck, rail and air are all included within the indirect cost and intangible factors section.

A. DIRECT COST COMPARISON

In calculating the direct cost comparison each element within the comparison is dealt with individually. However, the analysis in this study differs somewhat from the analysis as set up by Groenewege and Heitmeyer. The bench-mark for comparison is rail transport. If an element compared has the same cost whether by rail or air, the corresponding element on the table is left blank. The comparison then, is a difference in costs as related to rail rather than the total cost by each mode.

Transportation charges. The commodity being shipped is perishable fruits and vegetables. The particular species studied are cherries, grapes, peaches, lettuce, tomatoes and strawberries. The effective rail rates are specific commodity tariffs for these particular commodities. Effective air rates are general commodity tariffs[1] that include any general commodity shipped. They do not pertain specifically to perishable fruits and vegetables. In addition, the rate for truck and air depended upon backhaul unless otherwise stipulated.

Packaging and crating. It was determined for purposes of comparison that packaging and crating requirement for each mode were similar. Perishable fruits and vegetables for air shipment have to be packed at least for truck requirements as pick-up and delivery at the respective terminals are performed by truck. Secondly, it was determined that truck and rail packaging requirements were the same. Logically it follows that packaging and crating requirements for all concerned modes are similar. In substantiation, equality of packaging in each mode was the consensus of spokesmen for rail, road and air.[2]

Pick-up, transfer and delivery charges. The comparison was done on a terminal-to-terminal basis. It involved a shipment from one

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[1] Information on specific commodity rates for air freight is presented in sub-section C of this chapter.

[2] The contacted spokesmen referred to in this study are Mr. Stan Howe, Cargo Sales Promotion Manager, Air Canada; Mr. Joe Laverty, Cargo Supervisor, CP Air; Mr. H. Wortman, Regional Freight Sales Manager, C.N.R.; and Mr. George Smith, owner and operator of George Smith Transport. Mr. Howe and Mr. Laverty were personally interviewed while Mr. Wortman and Mr. Smith were interviewed by telephone.

terminal in either of the California cities to one terminal in one of the Canadian consumption centres. It was assumed that costs of pick-up and delivery to and from the respective modal terminals were equal. It could be argued that this assumption gives an advantage to air as it omits a loading and unloading series by pick-up and delivery equipment. Railroads generally have spur lines that connect producer co-operative warehousing set-ups to the main city railroad switching terminals. With such a procedure, railroads would not require the pick-up and delivery that air freight shippers would require. On the other hand, pick-up and delivery to the air terminal could be made from the individual producer's field thus by-passing the warehousing system. Although this advantage is to air, it was felt that the added value would not alter the final decision by any measurable amount. Finally, neither rail nor air has transfer charges as both modes provide direct service on the rates quoted.

Insurance premiums. Insurance on perishable fruits and vegetables is very high. On routes between points in North America, Air Canada quoted a premium of $1.73 per $100 of insured value of perishable fruits and vegetables, while durables on the same run were covered for $.07 per $100 of insured value. This coverage was for "natural" causes such as deterioration or rotting.

"Unnatural" causes of peril such as aircraft breakdown or a refrigerator unit malfunctioning and causing damage are covered by insurance provided by the carrier. For comparison of modes, unnatural causes are similar. However, there is a choice of acquiring insurance for "natural" causes. A shipper has the option to buy insurance or to

proceed at owner's risk. For purposes of this study, the assumption was then made that perishables are shipped at owner's risk. This, in turn, gave no difference in insurance premiums between modes.

Transit warehousing and wharfage. First, neither mode includes water travel thus there are no wharfage charges. Secondly, as the shipments are of relatively short duration, are by one mode only, and are direct shipments there is no need on either mode for warehousing cost comparisons.

Interest charges. Such charges were calculated as follows: The net weight of the load carried was multiplied by the 1969 average yearly U.S. farm price for the particular perishable concerned. It was felt that use of these particular prices would give the actual cost of the load or replacement of the load to the retailer or wholesaler. The amount of capital borrowed or the actual amount of capital tied up in the load would be a direct result of these farm prices. This step determined the cost of the load. Next, using a 30 day month and a yearly interest rate of 9 per cent,[3] a daily interest rate was obtained. Using the daily interest rate times the load cost times the days in transit, the total interest charge for the money tied up in transit inventory was calculated.

The results of the rail-air comparative analysis of direct costs are contained in Tables 5:1 - 5:4.

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[3]The 9 per cent rate was determined during a telephone interview with Mr. E.A.F. Scott, Manager, Campus Branch, Bank of Montreal, Fort Garry, Manitoba.

TABLE 5:1

DIRECT COST COMPARISON OF SHIPPING THREE GROUPS OF PERISHABLE FRUITS AND VEGETABLES BY RAIL AND AIR FROM SAN FRANCISCO TO VANCOUVER[a]

	GROUP I[1]		GROUP II		GROUP III	
	Rail	Air	Rail	Air	Rail	Air
A. Minimum weight for commodity rates[2]						
Weight	26,000 lbs.		20,000 lbs.		20,000 lbs.	
Declared Value[3]	$2,083.00		$2,600.00		$5,884.00	
Door-to-door Delivery Time	5th morning	1 day	5th morning	1 day	5th morning	1 day
Packing or Crating incl. Labour						
Pick-up and Delivery Charges						
Transfer Charges						
Freight Charges	426.40	2,262.00	346.00	1,740.00	328.00	1,740.00
Insurance						
Documentation Charges						
Interest on Capital	2.60	.52	3.25	.65	7.35	1.47
Transit Warehousing						
Refrigeration	114.99		98.55		114.99	
Total	543.99	2,262.52	447.80	1,740.65	450.34	1,741.47
B. Minimum Carload Weights[4]						
Weight	40,000 lbs.		40,000 lbs.		40,000 lbs.	
Declared Value	$3,204.00		$5,200.00		$11,768.00	
Door-to-door Delivery Time	5th morning	1 day	5th morning	1 day	5th morning	1 day
Packing or Crating incl. Labour						
Pick-up and Delivery Charges						
Transfer Charges						
Freight Charges	492.00	3,480.00	492.00	3,480.00	492.00	3,480.00
Insurance						
Documentation Charges						
Interest on Capital	4.00	.80	6.50	1.30	14.70	2.94
Transit Warehousing						
Refrigeration	114.99		98.55		114.99	
Total	610.99	3,480.80	597.05	3,481.30	621.69	3,482.94

[a]Footnotes and Source, see pages 82 and 83.

TABLE 5:2

DIRECT COST COMPARISON OF SHIPPING THREE GROUPS OF PERISHABLE FRUITS AND VEGETABLES BY RAIL AND AIR FROM SAN FRANCISCO TO WINNIPEG[a]

	GROUP I[1]		GROUP II		GROUP III	
	Rail	Air	Rail	Air	Rail	Air
A. Minimum weight for commodity rates[2]						
Weight	26,000 lbs.		20,000 lbs.		20,000 lbs.	
Declared Value[3]	$2,083.00		$2,600.00		$5,884.00	
Door-to-door Delivery Time	8th morning	1 day	8th morning	1 day	8th morning	1 day
Packing or Crating incl. Labour						
Pick-up and Delivery Charges						
Transfer Charges						
Freight Charges	787.80	4,555.00	484.00	3,504.00	760.00	3,504.00
Insurance						
Documentation Charges						
Interest on Capital	4.16	.52	5.20	.65	11.67	1.47
Transit Warehousing						
Refrigeration	138.53		114.99		138.53	
Total	930.49	4,555.52	604.19	3,504.65	910.20	3,504.47
B. Minimum Carload Weights[4]						
Weight	40,000 lbs.		40,000 lbs.		40,000 lbs.	
Declared Value	$3,204.00		$5,200.00		$11,768.00	
Door-to-door Delivery Time	8th morning	1 day	8th morning	1 day	8th morning	1 day
Packing or Crating incl. Labour						
Pick-up and Delivery Charges						
Transfer Charges						
Freight Charges	1,056.00	7,008.00	780.00	7,008.00	1,520.00	7,008.00
Insurance						
Documentation Charges						
Interest on Capital	8.40	.80	10.40	1.30	23.52	2.94
Transit Warehousing						
Refrigeration	138.53		114.99		138.53	
Total	1,202.93	7,008.80	905.39	7,009.30	1,682.05	7,010.94

[a]Footnotes and Source, see pages 82 and 83.

TABLE 5:3

DIRECT COST COMPARISON OF SHIPPING THREE GROUPS OF PERISHABLE FRUITS AND VEGETABLES BY RAIL AND AIR FROM LOS ANGELES TO TORONTO[a]

	GROUP I[1]		GROUP II		GROUP III	
	Rail	Air	Rail	Air	Rail	Air
A. Minimum weight for commodity rates[2]						
Weight	30,000 lbs.		30,000 lbs.		30,000 lbs.	
Declared Value[3]	$2,403.00		$3,900.00		$8,826.00	
Door-to-door Delivery Time	10th morning	1 day	10th morning	1 day	10th morning	1 day
Packing or Crating incl. Labour						
Pick-up and Delivery Charges						
Transfer Charges						
Freight Charges	921.06	4,542.00	930.24	4,542.00	900.00	4,542.00
Insurance						
Documentation Charges						
Interest on Capital	6.00	.60	9.80	.98	22.10	2.21
Transit Warehousing						
Refrigeration	129.27		106.47		129.27	
Total	1,056.33	4,542.60	1,046.51	4,542.98	1,051.37	4,544.21
B. Minimum Carload Weights[4]						
Weight	40,000 lbs.		40,000 lbs.		40,000 lbs.	
Declared Value	$3,204.00		$5,200.00		$11,768.00	
Door-to-door Delivery Time	10th morning	1 day	10th morning	1 day	10th morning	1 day
Packing or Crating incl. Labour						
Pick-up and Delivery Charges						
Transfer Charges						
Freight Charges	1,126.08	6,056.00	1,089.36	6,056.00	1,126.08	6,056.00
Insurance						
Documentation Charges						
Interest on Capital	8.00	.80	13.00	1.30	29.40	2.94
Transit Warehousing						
Refrigeration	129.27		106.47		129.27	
Total	1,263.35	6,056.80	1,208.83	6,057.30	1,284.75	6,058.94

[a]Footnotes and Source, see pages 82 and 83.

TABLE 5:4

DIRECT COST COMPARISON OF SHIPPING THREE GROUPS OF PERISHABLE FRUITS AND VEGETABLES BY RAIL AND AIR FROM LOS ANGELES TO MONTREAL[a]

	GROUP I[1]		GROUP II		GROUP III	
	Rail	Air	Rail	Air	Rail	Air
A. Minimum weight for commodity rates[2]						
Weight	30,000 lbs.		30,000 lbs.		30,000 lbs.	
Declared Value[3]	$2,403.00		$3,900.00		$8,826.00	
Door-to-door Delivery Time	11th morning	1 day	11th morning	1 day	11th morning	1 day
Packing or Crating incl. Labour						
Pick-up and Delivery Charges						
Transfer Charges						
Freight Charges	902.70	6,051.00	n.a.	6,051.00	975.94	6,051.00
Insurance						
Documentation Charges						
Interest on Capital	6.60	.60	10.78	.98	24.31	2.21
Transit Warehousing						
Refrigeration	144.49		n.a.		144.49	
Total	1,053.79	6,051.60		6,051.98	1,144.74	6,053.21
B. Minimum Carload Weights[4]						
Weight	40,000 lbs.		40,000 lbs.		40,000 lbs.	
Declared Value	$3,204.00		$5,200.00		$11,768.00	
Door-to-door Delivery Time	11th morning	1 day	11th morning	1 day	11th morning	1 day
Packing or Crating incl. Labour						
Pick-up and Delivery Charges						
Transfer Charges						
Freight Charges	1,101.60	8,068.00	n.a.	8,068.00	1,255.42	8,068.00
Insurance						
Documentation Charges						
Interest on Capital	8.80	.80	14.30	1.30	32.34	2.94
Transit Warehousing						
Refrigeration	144.49		n.a.		144.49	
Total	1,254.89	8,068.80	n.a.	8,069.30	1,432.25	8,070.94

[a]Footnotes and Source, see pages 82 and 83.

FOOTNOTES FOR TABLES 5:1 - 5:4

[1]The six selected perishables for this study have been broken into three groups by the rail companies when quoting rates. Each group is a commodity group and members of the group meeting the specified requirements are eligible for the group commodity rate. Members of Group I are grapes, cherries and peaches. Group II consists of lettuce and tomatoes, while Group III's only member is strawberries. These rail groupings are used as all air freight rates are general rates and there is no difference in rates between perishables.

[2]Section A of the table is a cost comparison between rail and air of hauling a weight of perishables that is the minimum weight required to be eligible for rail commodity rates, i.e. 26,000 pounds is the minimum weight of Group I perishables that must be hauled on a trip between San Francisco and Vancouver to be eligible for the lower commodity rates.

[3]The declared value consists of the replacement value of the perishable hauled. It is determined by multiplying the net weight of the perishable shipment times the average 1969 farm price for the perishable hauled. Peaches represent Group I with a price of 8.01¢ a pound, tomatoes from Group II at 13.00¢ per pound and strawberries with an average 1969 farm price of 29.42¢ per pound. This declared value is then used in determining the interest on capital cost.

[4]Section B of the table is a cost comparison of rail and air of hauling a load that is of a weight that is the minimum weight to qualify as a carload lot for this study's purposes. The weight is 40,000 pounds. This was the weight referred to by truckers when quoting the data they had available. Use of this weight in the air - rail comparison allowed for some comparison with truck costs later in the chapter.

SOURCE FOR TABLES 5:1 - 5:4

Rail Rates: San Francisco to Vancouver and San Francisco to Winnipeg rates were obtained from the Economic Research Department, Safeway Stores, Incorporated, Oakland, California.

Los Angeles to Toronto rates were obtained from Canadian National Railways, Freight Sales, Toronto Area.

Los Angeles to Montreal rates were obtained from Canadian National Railways, Freight Sales, Montreal Area.

Air Rates: All air rates were obtained from Mr. Stan Howe, Air Canada, Winnipeg.

Product Prices: Agricultural Prices Jan. - Nov. 1969, Crop Reporting Board, Statistical Reporting Service, U.S. Department of Agriculture, (Washington, D.C.).

Format of Table: Adrianus D. Groenewege and Roderick Heitmeyer, Air Freight-Key to Greater Profit, (Middlesex, England: Aerad Printers and Publishers, 1964).

To this point the comparison has included only rail and air. However, one cannot totally disregard trucking. Exact rate data for highway carriers was not available as in the case of rail and air. A basic reason for this is the U.S. Government policy of having "exempt" highway carriers. If a trucking firm has a certain percentage of its movements carrying agricultural products, it is ruled as an exempt carrier. This gives the highway carrier rights similar to a private carrier. One important right is the freedom from rate regulation.

The usual procedure for "exempt" carriers is for each truckload rate to be bargained for between the shipper and carrier. A result of this is that price per truckload or truck-journey (rather than price per hundred weight) can vary according to season, availability of substitute transportation, the carrier's alternatives and a host of other reasons.

A trucking spokesman, Mr. George Smith, was able to give me relevant truckload rates that may be used for comparison with rail and air rates. The information follows:

Vancouver: The average rate per truckload from California to Vancouver is $600. The net weight for the load would approximate 40,000 lbs. Of course, the weight and price could vary somewhat due to the fruit or vegetable carried. This price would include refrigeration by mechanical means. There was 2nd morning service by truck.

Winnipeg: The average rate per refrigerated truckload from California to Winnipeg runs at $1000-1300 per 40,000

lbs. Again, the price will vary according to the vegetable or fruit carried. Another rough estimation given by a fruit and vegetable wholesaler was $3.00 to $3.25 per cwt. Winnipeg has 3rd morning service by truck.

Mr. Smith explained that trucking of perishables into Toronto and Montreal is almost negligible. He related this to the more severe motor carrier regulation imposed within the provinces of Ontario and Quebec. Government surcharges can add up to over $150 per truckload. A second important reason for absence of trucking is the lack of reciprocity[4] of Ontario and Quebec with California. Without reciprocity, truckers find it uneconomical at present competitive rates for either front-haul or back-haul between these areas.

The results of the direct-cost comparison are summed up in Table 5:5. In each route, the ratio of air rates to rail rates were approximately 5 to 1. In the case of truck data, a general comparison shows truck rates to approximate rail rates. However, truck rate data was only available for the western routes.

Spokesmen from the air cargo section of Air Canada in Winnipeg feel that if the freight traffic warranted, special commodity air freight rates for perishable fruits and vegetables from California to Canada could be instituted and these rates could conceivably drop to as low as two-thirds of the general commodity rates presently in effect.

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[4]Reciprocity: "A mutal exchange of privileges; a recognition by one of two countries or institutions of the validity of licenses or privileges granted by the other." Webster's Seventh New Collegiate Dictionary, (Springfield, Mas.: G & C Merriam & Co., 1963), p. 715.

TABLE 5:5

AVERAGE TERMINAL-TO-TERMINAL DELIVERY TIME AND AVERAGE COST FOR SHIPPING 40,000 POUNDS OF THE SELECTED PERISHABLE FRUITS AND VEGETABLES GROUPS FROM CALIFORNIA TO CANADA BY ROAD, RAIL AND AIR

Route:	San Francisco Vancouver		San Francisco Winnipeg		Los Angeles Toronto		Los Angeles Montreal	
	Cost (Dollars)	Delivery Time	Cost (Dollars)	Delivery Time	Cost (Dollars)	Delivery Time	Cost (Dollars)	Delivery Time
Rail	610	5th morning	1,263	8th morning	1,252	10th morning	1,325[1]	11th morning
Truck[1]	600	2nd morning	1,000-1,300	3rd morning	N.A.	4th morning	N.A.	4th morning
Air	3,482	1 day	7,010	1 day	6,052	1 day	8,069	1 day

[1]Approximately

Source: Tables 5:1 - 5:4

Even if such rates were to be instituted, however, the ratio of air direct costs to rail direct costs would still be greater than 3:1. For example, present rail direct costs to Winnipeg are $1263 while air direct costs are $7010 giving a ratio of 5.8:1. If air freight rates dropped 1/3, air direct costs would then be $4672 but the ratio of air to rail direct costs would be 3.7:1.

The effective time in transit for all four destinations stayed the same for air. Both truck and rail effective times in transit increased as the distance between California and the Canadian cities increased. Of importance is the fact that truck time in transit continued to remain less than half that of the time in transit of rail.

B. INDIRECT COST COMPARISON

The second step in comparing modes in the role of transporting perishable fruits and vegetables was to consider indirect costs. Such costs include capital invested in inventory, inventory control and administration, obsolescence and deterioration. These costs have to be viewed in the long run.

Storage warehousing for perishable fruits and vegetables at the production end is not affected by which mode hauls the produce to the consumer. The perishable fruits and vegetables have to be picked and then placed in coolers to remove field heat regardless of which mode finally transports them. After the cooling process is finished, the produce is moved to either truck, rail or air terminals for delivery.

At the destination centre there is a correlation between the

need for inventory and the required storage. Lewis and Culliton[5] proposed that a combination of reliability of transport and speed of transport can lead to less in-plant inventory. Speed of transport affects the inventory of perishable fruits and vegetables that is required. First, with conventional surface transport, mainly rail, a precautionary inventory is required to compensate for those fruits and vegetables that rot during transport and storage.

Secondly, with slow transport it is necessary to ship non-vine ripened fruits and vegetables and to finish the ripening process during transfer and storage. Slow transport is not suitable for vine-ripened fruit. Thus, a ripening inventory is necessary.

Relatively slow transportation does not permit retailers to follow the consumer market demand as closely as would be possible if there were speedier service. The faster the service between the producer and retailer, the less need there is for retailers to carry inventory. The speedier service allows the retailer to decrease the lag response between consumer market demands and the retailer's obtaining the commodity from the producer. A prime function of inventories is to allow the retailer to cover for this lag between producer and consumer. However, if the retailer uses a faster transportation system, there is less chance of him being caught with too much or too little inventory to lower the lag response. Such a situation can be damaging in terms of heavy inventory costs on one hand or loss of customers through dissatisfaction with service on the other.

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[5]Lewis and Culliton, op. cit., p. 65.

Finally, the transport mode that carries the perishables has to be reliable due to the very fast deterioration of the commodity carried in transit. Break-downs or missed scheduling are very costly. Also, the storage life of perishables is not long compared to other fruits and vegetables, so a reliable supply chain is required.

Fast, reliable service affects the required inventory and storage facilities. First, with speedy movement, considerably less of the perishable will deteriorate to an unusable level. Therefore, the precautionary inventory is reduced or eliminated. Secondly, vine-ripened fruits and vegetables may be shipped. There is thus less need for a ripening inventory. Reliable service assures that the perishables ordered are received as planned. The more reliable and faster that a particular mode is, the more the mode tends to reduce the indirect costs of storage and inventory. These are the important factors within indirect costs.

Air shipment of perishables provides the fastest service. The service is progressively better as the distance increases. Air freight provides one business-day service to major points in North America. Direct-truck service is slower than air but considerably faster than rail. Times in transit shown in Table 5:5 confirm this point. For example; California to Vancouver transit time by air is one day, 2nd morning by truck and the 5th morning by rail. California to Toronto, a greater distance than the previous route, shows increases in truck transit time to the 4th morning and rail time in transit to the 10th morning. Air time in transit remains at one working day. In discussing the inherent advantages of each of the modes, it was determined that

truck is considered the most reliable of the three modes. However, in North America, air and rail are not significantly less reliable.

In conclusion, air shipment of perishable fruits and vegetables provides the best overall potential for reducing costs in the category of indirect costs. However, trucking is fast enough to most major areas in North America that it can perform almost as well as air within this category. An important fact that has been determined is that both air and truck have an advantage over rail in that their effective speed allows them to transport "vine-ripened" perishables.

C. INTANGIBLE FACTORS

As previously outlined, intangible factors include: door-to-door delivery time; punctuality; dependability and frequency of arrivals and departures; competitive advantage and sales turnover; better service and customer satisfaction; flexibility in adapting to changing demand; damage, theft and pilferage.

Door-to-door delivery time. While the actual average block-speed by air is much greater than by truck or rail, door-to-door delivery time by air within North America is at least one day. Business and labour do not operate on a full 24 hour basis, thus, while the actual shipment may only take a few hours, pick-up and delivery by the air carrier and shipping and receiving by companies concerned account for the extra time. Rail door-to-door delivery time of perishable fruits and vegetables is slow compared to both air and highway carrier.

Dependability and frequency of arrivals and departures. Highway motor carriers definitely have the advantage in this area. A study of

interstate fruit and vegetable transportation by Robert M. Bennett found "Truck transportation is not only faster than rail, but truckers may possibly be more consistent even with delaying emergencies in meeting scheduled commitments."[6] Air and especially rail have tended to lag somewhat behind in dependability but the problem is not vary significant to air carriers and "rail schedules are being greatly improved and the change is narrowing the advantage of fast service held by motor carriers."[7]

One of the prime inherent advantages of trucking is flexibility in scheduling and pick-up and delivery. This intangible factor can be quite important to shippers of perishable fruits and vegetables. Due to this flexibility trucks are better suited to handling less-than-carload lots and mixed lots. Patterns of types of shipments of fresh fruits and vegetables show that about 1/3 of all interstate hauling in 1960 was in full mixed loads or part loads.

> The ability of truckers to move such shipments at a rate per hundredweight generally equal to that charged for full lots encourages this practice. Because of the greater speed and mobility of trucks, operations costs are not substantially altered by consolidating loads, and it is possible for them to carry the smaller shipments at full load rates. Railroads cannot offer similar charges because they are not physically equipped to effect consolidations as expeditiously or as economically as motor carriers. The capacity of truckers to jointly service small shipments of separate shippers is one of

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[6]Robert M. Bennett, Interstate Hauling of California-Arizona Fresh Fruit and Vegetables by Rail and Truck, Marketing Research Report No. 673, Economic Research Service, U.S. Department of Agriculture, (Washington: 1964), p. 19.

[7]Ibid., p. 19.

the factors contributing to their popularity as carriers of fresh produce.[8]

Trucks are also able to move right into the producers farm or plant. Rail is at a disadvantage here as it is limited to the trackage laid. If track is not available, then railroads must use trucks to pick-up and deliver to suitable rail connections. Air very commonly uses trucks for pick-up and delivery to consolidate shipments and to break down and deliver at the destination. Thus, both air and motor carriers benefit from the truck's mobility.

The remaining elements of the intangible factors namely competitive advantage and sales turnover, better service and greater customer satisfaction, flexibility in adapting to changing demand, damage, theft and pilferage were treated as a unit. The benefits of these elements are linked quite closely with the indirect cost elements of inventory and warehousing.

The sales turn-over in perishable fruits and vegetables is naturally rapid due to the deterioration characteristic of the product. To provide adequate stock for such turn-over, one must be assured of fast, reliable service. As discussed earlier, this is most aptly supplied by air carriers.

Competitive advantage is only relative to the sector of business one is studying. Within the industry itself, individual producers compete with each other. An enterprising producer may get an advantage over his competitors by using air freight. However, at the industry level competitive advantage is not as important. It is considered that

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[8] Ibid., p. 17.

one mode generally services the industry best. All producers within the industry are assumed to use this mode thus all producers have equal competitive advantage. However, if a competitive substitute product is taking away sales, revamping transportation within the industry to remain competitive may be a means of regaining a competitive advantage.

Flexibility in adapting to demand, as mentioned, is mostly a problem of inventory and storage warehousing. One must be able to keep inventories low and be assured of fast replacement. Also, it is reasonable to assume that the faster the service and the less handlings required, the less chance there is of damage, theft or pilferage. In conclusion then, air seems to provide the most intangible benefits.

Better service and customer satisfaction are the most qualitative elements discussed. Air shipment definitely gives the best service and customer satisfaction as long as speed is an essential criteria. Deterioration of the product is best counteracted by fast transportation. Secondly, if "vine-ripened" fruits and vegetables are considered the best quality of fruits and vegetables available, fast transportation is needed to provide such commodities. Air shipment is best able to provide the type of fast service needed. Trucks have enough speed to transport "vine-ripened" fruits and vegetables. However, trucks are not as proficient as air in doing so. Rail, as it is relatively slower than truck or air, is not generally able to provide the service at all. In conclusion, in the area of quality of service, air shipment seems to provide the most, railways the least, and trucking is in between.

The final analysis of all intangible factors shows that air shipment gives more intangible benefit than rail and truck when shipping

perishable fruits and vegetables. The intangible benefit is considerably greater by air than when shipping by rail. However, the added benefits of shipping by air are not all that much greater than shipping by truck. While there were no intangible factors in which rail served best over truck and air, there were some categories in which truck performed best and the remainder were served best by air shipment.

In summary, the total cost comparison gave the following results: The direct cost comparison showed rail was the most economical mode for carrying perishable fruits and vegetables to all four Canadian destination cities. Trucks were quite competitive at Vancouver and Winnipeg. At Montreal and Toronto, provincial highway and motor carrier tariffs removed much of the trucks' competitiveness. Air freight direct-costs were very noncompetitive. Further elaboration on this point will be brought forth in the following chapter.

Air shipment had an advantage in the areas of indirect costs and intangible benefits. A most important point to be mentioned is that trucks were able to perform most services that air could provide but rails were not. Rail shipment was not felt to be competitive with either air or motor carriers in these areas.

Rail and air were both best qualified in one of the cost areas while being dismally out-classed in the other cost area. A close runner-up in both categories was trucking. The problem is to determine which category is most important or if a trade-off between the two categories is the answer. If the former is the answer, then either rail or air is best suited depending on the category selected.

However, the general analysis in Chapter III showed that while

cost was an important criteria in determining what type of transportation to use, other quality of service criteria should also be considered. This indicates a willingness on the part of the shipper to trade-off between price of service and quality of service. Motor carriers are best able to fulfill shipper demands if shippers are willing to pay a higher price for more service. Motor carrier rates are generally near being competitive with rail rates while providing many of the quality of service aspects that air freighting can provide.

D. LIMITATIONS OF THE TOTAL COST CONCEPT

There were some problems associated with using the Total Cost Concept in this study. The total cost comparison was designed to help the individual shipper determine which mode was able to meet his particular transportation needs by including both elements of cost of service and quality of service. The inter-modal comparison conducted in this study compared the cost of hauling one load of 40,000 lbs. by each participating mode. It is very important that this fact be kept in mind when stating conclusions about the study. What is good for the individual is not always good for the aggregate. Any applications of the results of the one-load comparison to the entire tonnage of imported perishable fruits and vegetables must carry suitable explanation and restrictions.

One important restriction is that the few loads of an individual shipper must be considered marginal loads for the transportation mode carrying them. These loads are thought of by the carrier, especially rail carriers, as filling excess capacity within the system. However,

when one considers transportation demand of the whole fresh fruit and vegetable industry, there is no longer any marginal traffic connotation. The estimated total tonnage hauled by a particular mode determines important factors such as specific commodity rates and extra services provided. As mentioned in Chapter II, the total transportation just for the imported quantity of the six selected perishables was approximately 18,000 carload lots in 1966 and was projected to at least 25,000 carload lots by 1980. It is generally agreed that the position of the air carriers at the present time is one of capacity for serving a relatively small portion of the total tonnage but not having the capacity of serving all shippers within the industry. Truck capacity is increasing to meet demand while rail is considered to have excess capacity.

Complete aggregation to a country's need can also be misleading. While the carload lots required for Canada are quite large, these requirements are spread between at least twelve major centres and twenty million people across 3,000 miles of land. Decisions on indirect costs could well call for complete removal of warehousing using a country size scale. However, at the city level many small businesses may still require the warehouse service. The prime restriction on the Total Cost Concept is that every situation has its peculiarities and it is imperative that these peculiarities are considered.

Rate data posed another type of problem. The Total Cost Concept calls for the use of the lowest rates that are in effect at the present time. Rail and motor carriers have been in the business long enough to have determined specific commodity rates for almost any good carried. This is not so for air carriers. Air freight is trying to become com-

petitive with the surface modes. It is breaking into areas as a relative newcomer and has not been in the particular commodity shipping business long enough to have a system of specific commodity rates. Air freight carriers are willing to negotiate such rates if the volume of business warrants it. However, until such a time as negotiations are completed exact data is unavailable and the air carriers are forced to quote their effective rates in the form of the higher general commodity rates.

The difference in the extent of rate regulation between truck, rail and air posed problems for this particular comparison. Complete rate data for all modes was unavailable. The more regulated the mode, the easier it was to obtain the data required. A common set of air rates are published internationally as all but two airlines in the world are members of IATA. Rail rates in domestic North America are controlled by the I.C.C. in the U.S. and the C.T.C. in Canada. All rail rates are published. Rates for motor carriers in domestic North America are traditionally very loosely regulated and in most cases not published.

In the case of this thesis, exempt motor carriers qualify to haul the commodity from the U.S. Such carriers are not required to publish rates and are not required to schedule operations. They have the rights of private truckers. "As a result of the exemption plus growth of private and contract carriers, nearly two-thirds of all motor carriers of all motor vehicle traffic is exempt from rate regulation."[9]

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[9]Charles F. Phillips Jr., The Economics of Regulation (Georgetown, Ontario: Irwin-Dorsey Ltd., 1969), p. 510.

The fact that the motor-carrier mode was represented by exempt carriers from the U.S. presented problems in conducting the cost-comparison study. First, with exempt carriers, each truckload rate is bargained for presenting potentially a different rate for every load. A range of rates could be provided for each route considered. However, the range in some instances was three hundred dollars depending on conditions.

A final problem concerns the overall general ability of the Total Cost Concept as described by Groenewege and Heitmeyer to apply to this study. In the direct cost section which was strictly an economic comparison, six out of nine cost elements were found to be equal, and thus not recorded. This left only three cost elements to determine the direct cost comparison. Of these, one element, interest on capital, was insignificant. In practice, the comparison ended up as a freight charge comparison.

From the type of cost elements included in the direct cost portion of the model, it would seem that the Total Cost Concept is not adaptable to relatively short, direct routes that do not involve water movements, modal changes or international border crossings.

Packing and crating differences can be sizeable when comparing water and air. Transfer charges are applicable only to modal changes such as in a rail-water-rail movement. Documentation charges again are aimed at water carriers with international border crossings, as is transit warehousing. Finally, interest on capital only becomes important when a shipment that normally takes weeks is reduced to a few days for delivery.

The indirect costs and intangible factors were more applicable but again are geared to a longer time span for movement of the comparative mode such as in an air versus water movement. This is especially evident in the storage and inventory comparison. It was shown that significant increases in transit speed can affect these elements tremendously. On a short haul of a perishable good, storage facilities and inventory are not a problem. Intangible factors again can be greatly different between water and air especially with respect to time of delivery. As shown in this thesis, the difference in actual speed of transit was quite significant. But, in the short hauls studied, the effective speed differences between modes was not nearly as dramatic. A rail trip of a number of days was reduced to an air journey of one day. On the other hand, with a long ocean haul, there could be a substantial reduction from months or weeks to two or three days.

CHAPTER VI

PRESENT LIMITATIONS AND FUTURE PROSPECTS FOR SHIPPING PERISHABLE FRUITS AND VEGETABLES BY AIR

A cost comparison study to evaluate which mode is best able to provide transport service for importing perishable fruits and vegetables into Canada at the lowest cost (from the shipper's standpoint) with the most quality of service benefits has been completed. It was determined that using motor carriers for hauling the perishables best suited the purpose.

An objective of the intermodal cost comparison was to specifically study the economic feasibility of air freighting perishable fruits and vegetables into Canada. It was found that although air shipment of perishable fruits and vegetables provides much superior quality of service relative to the other modes, it is very expensive in most cases of North American movements of perishables.

The objective of this chapter is to evaluate the additional factors that may either generally limit the air industry in competition in this field or that may specifically limit airlines from competing on this study's chosen routes. A second objective is to determine how the non-competitive position of air transportation of perishable fruits and vegetables can be made more competitive, if at all, in the future.

There are two types of problems limiting the competitiveness of air freight in this area. There is the problem of making air freight

rates lower in general. This is done by a combination of reducing the cost per ton-mile by increasing capacity, and/or reducing present costs on existing capacity. Secondly, there are institutional problems affecting the specific routes and situations studied that must be overcome.

A. TECHNOLOGICAL LIMITATIONS

Handling and packaging of perishables and capacity of the actual aircraft are two areas in which improved technology could further air freight's competitive position. First of all, there are three main ways in which bottlenecking and inefficient handling and packaging of perishables may occur: "Cubing-out" of cargo, lack of a fully-functional container system, and the clearing of freight at airport terminals.

Problems of handling and packaging. "Cubing-out" is the trade term explaining the weight-to-volume ratio in aircraft when the volume is too great for the weight carried. In other words, the cargo takes up too much of the limited space available on an aircraft without having adequate weight to go with its volume. When the total volume available for cargo in the aircraft does not contain the maximum allowable payload weight, the lift-off capacity of the aircraft is not fully utilized. Understandably, the air carriers would prefer to have a more dense cargo. As the sales-unit is in ton-miles, it follows that the air carrier would prefer maximum weight to maximum volume so as to insure itself a maximum revenue on any given shipment.

Shipments of perishables will "cube-out" for several reasons. First, most aircraft have cylindrical fuselages. Second, perishables

are presently shipped in rectangular or square cartons. Loading the "square" cartons into the "round" aircraft leaves unused space at the top, bottom and sides of the hold. A further requirement is that there must be air spaces left between layers of cartons so that perishables may breath and are not crushed. For these same reasons, areas to the top and side must be left empty.

Air carriers feel that they would be much better off if they could ship durable goods or frozen foods that could be packed tightly. This way the weight capacity would be filled and less handling and packaging precautions would have to be taken. One method of removing the problem of "cubing-out" is by either having aircraft that can be operated more cheaply per ton-mile so that these less dense perishables can be carried or creating a system whereby perishables can be packed tighter.

The transportation industry has proposed an answer to the handling and "cubing-out" problem through the introduction of containers. Containers are a concept whereby cargo may be unitized thus simplifying handling. The idea is that these containers are to be interchangeable, thus reducing handling costs on intermodal shipments. This characteristic would be especially beneficial to air freighters as most commodities shipped by air are intermodal as they are picked up and delivered by truck. The use of intermodal containers would allow air shipments, once packed and loaded in a container, to be picked up at the shipping warehouse and deposited at the destination terminal without any more handling except that of moving the container itself. There is even the potential of refrigerated containers. Finally, as the carrier

is hauling containers that differ only in weight and it is of no consequence, in most cases, of what is inside the container, the air carriers could develop rates for container shipments conceivably much lower than present commodity or class rates.

Ideally, the container concept seems to be the revolutionary answer to problems in the transportation industry. Containers are expected to reduce the cost of shipping by air as well as other modes by reducing theft and pilferage and consequently insurance rates, and by reducing handling and packing costs thus leading to a reduction in freight rates themselves. Developments in containerization would seem to be a major step in making air carriers more competitive in the shipping of perishable fruits and vegetables by air. However, problems have occurred that have hindered the progress in instituting containerization to air at the present time.

The inability of containers to function in the air industry has been noted by many air carrier officials. Containerization has been no easy answer to shippers' problems. H.T. Gaynor, manager of air cargo traffic for Air Canada at Montreal stated that use of containers has effectively reduced the actual capacity of aircraft by 27 per cent yet it "didn't save a nickel".[1]

The fact that air containers are not turning out to be as acceptable intermodally as had been hoped has resulted in yet further problems. Air containers are not the same shape as for other modes. Because of the fuselage design, containers for aircraft must be rounded

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[1] Winnipeg Free Press, November 14, 1968, p. 26.

on top. However,

> Commercial users don't have the facilities for a half moon shape that doesn't have wheels, and can't be moved around because its so awkward. So we're going to have to develop low profile dollies that are easy to move around, or a wheelbarrow igloo, or something of the sort. Then I think we will see a dramatic increase in the use of containers.[2]

This is the position of containerization within the air industry as projected by Thomas P. Gallagher Jr., director of freight sales and advertising, American Airlines.

Mr. Gallagher continued, "If I had to weigh the problem in attracting commercial shippers to containerization, I'd say that it was 70 per cent technology and 30 per cent money."[3] As shown, containers have great potential, in theory, of reducing handling and packing costs; however, present implementation of containers has not been smooth. Future progress in containerization could conceivably make air shipment of perishable fruits and vegetables to Canada competitive.

One movement in reducing handling costs has been the development of a special pallet for use in U.S. domestic hauling of strawberries. It was done through co-operation of perishable shippers and air carriers. They have built a pallet capable of carrying 10,000 pounds of strawberries. This pallet reduces handling costs especially on full loads. However, one reason this is possible is due to the relatively

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[2]"Special Report: Air Cargo." Distribution Manager, July 1969, p. 36.

[3]Ibid., p. 36.

high density of strawberries.[4]

A factor that is perhaps institutional as well as technical is that of handling air freight at the terminal. This problem does not affect Canadian terminals nearly as much as the large U.S. terminals, although Montreal's Dorval Airport and Toronto's International Airport are clearing increasing amounts of cargo yearly. Perishable goods must be transported as quickly as possible to ensure maximum quality of the product. If there are handling tie-ups at either the origin or destination terminals, the time spent by the perishables in the transportation system naturally increases. This increased time in transit can lead to a deterioration of the perishable. The expectation of loss in quality by such tie-ups could well deter the air carrier's position as a competitor.

There have been handling problems at major U.S. airports that typify the above mentioned problem. For example,

> For the past six months, air members have been increasingly concerned by conditions at John F. Kennedy International Airport. They have been disturbed by the amount of time it takes for delivery of air freight shipments after arrival; by the number of shipments that turn out to be "lost"; by the way cargo is often left out in the open, unprotected from the elements; by the complex U.S. Custom Clearance procedures; by the theft and pilferage; and by the problems with truckers who deliver cargo from the airport to the consignee after it has cleared customs.[5]

Although this does not affect Canadian air terminals as severely as John

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[4]Mildred R. DeWolfe, "Recent Trends and Prospective Developments in Shipments of Agricultural Commodities," Marketing and Transportation Situation, Economic Research Service, U.S.D.A. (February, 1966), p. 21.

[5]Distribution Manager, op. cit., p. 32.

F. Kennedy Airport, it could do so in the future. Presently, there is the possibility of U.S. origin terminals in California having clearance problems and thus affecting shipments to Canada.

The technical areas of concern in the handling and packaging of air freight have been presented. Following is an evaluation of the technical area of most concern to the air industry, the aircraft itself. The revenue ton-mile capacity of the equipment must be increased to allow economies of scale. There are two characteristics of aircraft that affect the revenue ton-miles performed; speed of the aircraft and capacity of the aircraft. However, capacity at the present level of aircraft technology is a more prospective characteristic that can be developed to increase revenue ton-miles.

> Recent reports on aircraft that will be available in from four to eight years (1970-1974) claim direct operating costs of two to four cents per ton-mile and freight rates comparable to trucks. If such rates materialize, air cargo may have much to offer for all types of perishable cargo movements.[6]

It is obvious that if such future aircraft are able to lower air freight rates to a competitive position similar to motor carriers, most of the present cost limitation on the competitive position of air carriers in the transportation of perishable fruits and vegetables will have been effectively removed. Aircraft of the type referred to are the Boeing 747 and more importantly the L-500, Lockheed's commercial version of the C-5A military transport.

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[6] Overseas Transportation of Perishable Foods, Committee of Transportation of Perishable Foods of the Maritime Transportation Research Board, (Washington, D.C.: June 1966), p. 4.

For the future of air freight carriers, it seems the L-500 will provide the impetus. Mr. Gallagher of American Airlines suggested,

> The 747 is a passenger plane. It wasn't designed for freight. Boeing is trying to take a new look at the aircraft to convert it into a more logical freight carrier. But in my opinion, from the standpoint of capacity, we will need a plane that takes at least 300,000 pounds of payload for the next generation of freighters. From that point, the L-500 with a lift capacity of 300,000 pounds looks good.[7]

Mr. Stan Howe of Air Canada stated that while the L-500 is still on the drawing boards, "This aircraft has an indicated 320,000 pound payload. This compares with the current DC-8-54 cargo aircraft in use which has an average payload capacity of 60,300 pounds."[8]

Theoretically, the indication is that the new generation of aircraft will make air carriers competitive. However, these new freighters will bring additional problems that will have to be overcome. First, runways and other facilities at airports, especially in Canada, will have to be strengthened and terminals adjusted to accommodate the new aircraft. Secondly, all concerned in handling present air freight shipments will have to adjust to handling loads of five times the size.

The areas of operation where technology can improve economic efficiency and thus decrease costs to make air freight of perishable fruits and vegetables more competitive have been discussed. However, even if the required improvements in technology are made, there are two other sets of factors that can affect an air carrier's ability to compete. These factors are first, institutional factors and secondly,

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[7] Distribution Manager, op. cit., p. 38.

[8] Personal correspondence with Mr. Howe.

traffic flow factors, better known as front and backhaul.

B. INSTITUTIONAL LIMITATIONS

Air Franchises

Two institutional factors that affect air carriers' competitive position in hauling perishables into Canada are franchise agreements with the U.S.A. and tariff regulations within the air industry. At present, two of the four destination cities in Canada considered in this analysis, namely Toronto and Vancouver, are served directly from California by a Canadian carrier. One city, Montreal, is serviced seim-directly from California via Toronto while Winnipeg is not on a direct run from California by a Canadian carrier and must be serviced by a domestic regular flight from either Vancouver or Toronto.

The bilateral agreements with the U.S.A. give Canadian carriers rather limited access to California cities. On the other hand, U.S. carriers tend to have more connecting flights to Canada. One may argue that there is no difference who serves a route as long as it is served. One suggestion is that conceivably there could be a competitive difference if the particular routes considered are serviced by a Canadian airline system such as Air Canada or CP Air compared to being serviced by a U.S. domestic trunk line.

To the Canadian carriers the California routes can act as feeder systems to Canadian domestic routes that are more profitable. The Canadian airlines may be more willing to take on perishable fruit and vegetable traffic on these feeder routes at a lower rate than U.S. carriers. Also, Canadian air carriers are comparatively better geared

to air freight than most U.S. domestic trunk lines that fly into Canada. Therefore, it would seem likely that Canadian carriers would be more competitive to obtain freight for this reason. Therefore, the result of more Canadian airline franchises with the U.S. would probably increase the chances of air shipment of perishable fruits and vegetables becoming competitive with surface modes of transport.

Modal Regulation

Institutional arrangements regarding regulation of modes carrying perishables from California to Canada are not uniform. At the present time, both rail and air are generally much more regulated than even the most regulated of motor carriers. In the case of shipment of agricultural commodities, including perishable fruits and vegetables, there is negligible regulation of trucks hauling such a commodity. As a result, these carriers are in a very advantageous position with respect to rate competition.[9]

Airline freight rates are regulated through the International Air Transport Association. All rates for all routes in the world must be published with IATA. In addition, member airlines of IATA, includes all Canadian and U.S. air carriers, must file any proposed rate change through IATA for scrutiny by other member carriers. This means in fact that there is a bureaucratic system whose workings can delay actual implementation of proposed rates.

Exempt motor carriers, on the other hand, are completely open to

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[9]W. Miklius, Comparison of For-Hire Motor Carriers Operating Under the Agricultural Exemption with Regulated Motor Carriers, Marketing Research Report No. 769, Economic Research Service, U.S. Department of Agriculture (Washington: 1966), p. 4.

bargain on every truckload at any reasonable price. The result is that motor carriers are much more flexible in quoting competitive rates at any given time. This flexibility of motor carriers is a short-run situation. The long-run situation for motor carriers is that they will have to cover average costs, and rates based on these costs will determine the competitive ability of the motor carriers. If air rates are competitive, then in the long run the motor carriers must compete with such rates.

C. BACKHAUL LIMITATIONS

One of the most severe limitations to air carriers' competitiveness not covered in the cost comparison of Chapter V is that of uneven traffic volume in both directions on a specific route. In transportation, the prime volume and corresponding route direction is referred to as the fronthaul. The secondary volume and directional flow in the opposite direction to fronthaul is referred to as backhaul. Naturally, the most uneven traffic flow occurs when there is no backhaul at all.

If the case of no existing backhaul is prolonged into the long run, there is an effect on the rates for goods being shipped on the fronthaul. The rates that are charges for goods moving on the fronthaul must then cover the cost of returning the modal units empty from the fronthaul destination to the fronthaul origin. How much the fronthaul rates are affected depends upon the organizational structure of the transportation mode concerned.

If fixed costs relative to variable costs are high, as in the case of rail, the added cost of empty backhaul is relatively low. However, in the case of air and motor carriers, the variable costs are

a very considerable part of total costs and the variable costs of running empty or full, especially for trucks, are not much different. A.W. Currie suggests that the costs of driving a truck back home "are substantially the same whether empty or filled."[10] The effect of no truck backhaul forces the carrier to require fronthaul shippers to pay almost double rates due to the high cost of running empty.

The short-run effects of uneven traffic flow is not as precise as in the long-run. Carriers will take on freight in either direction on a route to initiate a service. Volumes of shipments made in either direction will then be analyzed and a trend of traffic flows determined. In the event of one direction of the route having more volume and being assigned the term fronthaul, an attempt is made to develop backhaul freight to equalize flows.

The method by which equalization of flows is accomplished depends upon the classification of the carrier that is hauling. Private and exempt carriers have the option of turning down any one-way freight if it will aggrevate the backhaul situation. The shipper would have to either pay for the carrier's empty trip back or assure the carrier of a backhaul load. In the case of rail, air, and regulated motor carriers, the situation is different as these carriers are classified as common carriers. Common carriers include those carriers who "hole themselves out to carry freight for all members of the public up to a limit of the

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[10] A.W. Currie, Canadian Transportation Economics, (Toronto: University of Toronto Press, 1967), p. 450.

capacity of their vehicles, provided the freight toll is paid in legal tender."[11]

As stated, common carriers must accept freight whether it be fronthaul or backhaul. If the direction of freight shipped aggrevates an even traffic flow, then common carriers may react by giving the shipper poor service and trying to disuade further freight in that direction. On the other hand, carriers with backhaul problems will try and encourage or develop backhaul freight to even out the directional traffic flows. For rail and motor carriers, developing backhaul is not as big a problem as for air carriers. Air carriers are limited to certain types of high value goods that they may carry.

The very nature of Canada's economic geography determines basic traffic flows. As stated, air freight currently is used for shipping very dense, high value products such as electronic and machine parts. However, Canada is a basic producer of raw material products. These raw material products are generally of high volume, low density and low value including such commodities as forest products, grains, and ore concentrates. Such materials are characteristic of freight that is best suited to be moved by rail. This general situation would suggest uneven air freight flows between U.S. and Canada with more air freight coming to Canada than leaving due to the U.S. shipping manufactured goods to Canada while Canada ships raw materials to the U.S. In Canada itself, Western Canada is more raw material oriented than Eastern Canada so there is a tendency for more air freight to move west than east.

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[11] Ibid., p. 485.

As can be expected, there is an uneven air freight traffic flow between California and Canada. Local air carrier spokesmen[12] tend to agree on approximately a 90-10 ratio of air freight shipped on the chosen routes in favor of the California to Canada direction. This simply means that hauling perishables from California to Canada would further aggrevate the imbalance of freight flow. Consequently, Canadian air carriers tend to discount California perishable shipments unless such shipments are able to afford a rate that will compensate for the lack of backhaul on the route. In contrast, air freighting of perishable fruits and vegetables is becoming popular in the U.S. as such freight from California to the Eastern U.S. seaboard is helping to alleviate the backhaul problem.

The limitations on the competitiveness of air freighting of perishable fruits and vegetables from California to Canada have been shown as ones that are of a general industry nature, such as cost of aircraft operation as well as ones that are specific to the routing concerned; namely institutional and backhaul factors. Such limitations present a rather difficult situation to the air carriers involved. Even if technology and efficient management were to allow reduction of air freight rates to a competitive level, the backhaul and institutional factors would still have to be overcome.

To be competitive, the air freight rates have to come close to matching the rates of hauling by motor carrier. However, generally the assumption is that such freight will have backhaul. If there is no

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[12]Views on the backhaul situation in Canada were expressed by Mr. S. Howe, Air Canada, and Mr. J. Laverty, C.P. Air.

backhaul, however, the air carrier is obliged to charge a rate that compensates for the empty backhaul. Such higher rates then become non-competitive. A vicious-circle type of pricing policy for air freight becomes apparent. The air carriers, in the study's particular case of hauling perishable fruits and vegetables from California to Canada, are faced with certain choices or options. They have to either lower costs of shipping to the point of being competitive as well as being remunerative with no backhaul; or, create backhaul traffic to go along with the addition to the fronthaul; or put an emphasis on other types of freight.

Even if the backhaul problems are removed, the insititutional factors must be faced. The air carriers must seek approval of extended or new franchises to be able to operate in a flexible enough manner. Also, once air carriers become competitive, the exempt motor carriers will provide stiffer competition.

It becomes obvious at this point in the study that the situation studied here of transporting perishable fruits and vegetables from California to Canada by air freight is not representative of the general situation facing air freight's entrance into the perishable shipping field nor is it a situation where air freight's inherent characteristics can be put to maximum advantage. In fact, the chosen routes for the study, because of their extra competitive limitations, will require much more lowering of present air freight rates than on most any other routes in order to become competitive in hauling perishable fruits and vegetables.

D. AIR FREIGHT ROUTES CURRENTLY HAULING PERISHABLES

Route situations can be made more suitable for air freight in several ways. First, routes where there are no backhaul or institutional limitations to be overcome once competitive air freight rates have been achieved. Second, routes where the perishable fruits and vegetables take the form of backhaul and could possibly afford to have more competitive rates. Such a situation exists in Canada in British Columbia. Perishables that could be shipped by air are cherries from the Okanagan Valley and blueberries from the peatmoss near Vancouver.

> So anxious are the airlines to get business out of Vancouver that they are prepared to talk special rates to entice potential shippers. In other words, if there is a farm product that could be air shipped if given a rate concession, the airlines will do their utmost to engineer that concession.[13]

Third, and perhaps the area with the most potential for shipping fruits and vegetables is that of trans-ocean shipping. The only other mode of transportation now available to service these routes is ocean-going vessels. However, most ocean-voyages are relatively hard and rough on the freight; are in terms of weeks for door-to-door delivery; have very infrequent arrivals and departures; and handling, packing and refrigeration costs are high. Often the result of such a voyage is to have considerable spoilage and deterioration of a shipment such as perishables. Perishable fruit and vegetable producers feel that there is little gain by shipping their commodity by ship due to the above factors.

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[13] "Report: Marketing: How the Jet Age is Boosting Fruit Sales," Family Herald, No. 22, October 26, 1967, p. 5.

Air carriers believe that such routes over long distances of water would best be suited to the inherent advantages of air freight. This is the area in which they hope to expand and develop markets. Besides, quite often perishable fruit and vegetable flights could well be helping provide backhaul on overseas routes.

As mentioned,[14] C.P. Air has had trouble finding out-going freight from Vancouver. They have started to fly cherries to London, Hong Kong, Manchester and various other European cities. By using air freight, "B.C. cherries hit the market before the local crop was ready and buyers turned a blind eye towards the premium price to get their first taste of the season."[15] By co-ordination between the airline and B.C. Tree Fruit Ltd., "cherries picked in the Okanagan on a Monday morning were on sale in Manchester on the Wednesday morning."[16] C.P. Air has also started overseas shipments of blueberries. They ship these to Europe as well as Tokyo and the Far East.

The shipment of perishable fruits and vegetables from Canada started as an "emergency distribution of a crop normal markets could not absorb."[17] However, such shipments have expanded to become regular freight items. Also, Canadian air carriers would like to start taking advantage of the opposite growing season between the Northern and Southern hemispheres and ship fruits and vegetables from the in-season area to the off-season area.

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[14] Ibid., p. 5.

[15] Ibid., p. 5.

[16] Ibid., p. 5.

[17] Ibid., p. 5.

CHAPTER VII

CONCLUSIONS AND IMPLICATIONS

While this thesis was basically a descriptive and exploratory study, some general conclusions and implications can be drawn with respect to transportation of perishable fruits and vegetables into Canada at the present time. Most of the conclusions from this study have been drawn within the individual chapters. As a result, the first portion of this chapter is a reiteration and consolidation of the conclusions made throughout the study. The second portion of the chapter deals with some general implications that may be drawn from the study with respect to transportation of perishable fruits and vegetables in general and the role of air in transporting such perishables.

A. CONCLUSIONS

The ability of domestic producers of fresh fruits and vegetables to satisfy the Canadian consumer's demand for fresh fruits and vegetables is decreasing. In the last few years, imports have been used increasingly to meet Canadian consumer demand for perishables. Consumer demand for perishables has been increasing for two reasons. First, the standard of living has risen over the last two decades. As a result more and more people have been able to afford the relative luxury of fresh produce. Another facet of having more income is the willingness and ability of the consumer to purchase fresh produce on a year-round basis if it is available. The end result is an increased per capita demand for fresh produce. A natural cause of increased consumer demand

is the increase in the number of consumers through population increases.

Canadian production, on the other hand, has not been able to provide either enough fresh produce or a constant year-round supply of fresh produce to keep up with demand. The deficit must be made up in fresh produce imports. Perishable fruits and vegetables have a very low storage time capacity and therefore must be imported on a year round basis. Thus, the shortage of domestic perishables to satisfy a constant consumer demand must be met by imported perishables.

Along with a demand for imports, there is the ensuing derived demand for transportation of the imports. It was concluded that even if the imported proportion of total consumption of the six selected perishables in this study remains constant, by 1980 there will be a 7,500 carload lot increase in required transportation here, alone. Along with this increase in the actual amount of transportation required, there is a developing trend towards shippers demanding greater quality of service from the carriers providing the transportation.

Shippers of perishables are becoming more willing to trade-off a lower freight rate for more quality of service at a higher freight rate. However, the amount that they are willing to trade in price has a limit. Transportation costs are fairly significant within the total cost of providing perishables. This means that an increase in freight rates is transmitted to the price of the good either in total or a proportion depending upon demand and supply elasticities for the commodity. The demand for perishables is considered more elastic than the demand for food in general. The end result assuming a normal supply curve is that a freight rate increase will increase the commodity's overall cost

and thus decrease the quantity of the commodity demanded. A decrease in quantity of the commodity demanded leads to a decrease in transportation required. These characteristics, then, prevent shippers from trading-off past a certain level. However, shippers of perishables have determined that the better quality of product that they can provide, the more profit there is to be made. Shippers are thus requiring faster, more flexible service from the carriers.

Air freight supplies the highest quality of service but traditionally its rates have been too high to allow for a price-quality trade-off. Rail presently has the lowest rates for shipping perishables. Motor carriers, while not possessing all the quality of service attributes of air carriers, have considerably better quality of service features than rail at a price much closer to rail than air freighting. For this reason, shippers are willing to trade-off the lower cost of rail transportation for the slightly higher priced motor carrier transportation of better quality. Consequently, trucking of perishable fruits and vegetables from California to Canada is increasing. For instance, over 90 per cent of the strawberries Canada imports are shipped by truck.

To determine the transportation situation in shipping perishable fruits and vegetables into Canada, a cost comparison study (from the shipper's standpoing) was made on the most commonly used routes for shipping perishables from California into Canada. The results of this comparison on the four California to Canada routes showed that railroads provided the lowest rates for the service while airlines provided the most quality of service. However, air transport of fresh fruits and

vegetables was highly unlikely at present air freight rates while rail was out-classed by motor carriers in providing quality of service. The ability of motor carriers to excell in this area was confirmed. Motor carriers were close to being competitive with rail on rates while providing many of the quality of service benefits of air. As shippers appear willing to trade-off some price for service, it was concluded from the present rate structure and quality of service structure of the three modes that motor carriers are best suited to fulfill the needs of both the shipper and consumer in transporting perishables into Canada.

While trucking generally is rate competitive with rail there are certain institutional factors that may prevent motor carriers from shipping from California into Eastern Canada. Provincial regulations on highway transport effectively limit trucking's competitiveness by placing surcharges on loads coming into Eastern Canada. Also, there is a lack of reciprocity between these Eastern Provinces and California which also tends to thwart motor carrier hauling between the two areas. Until reciprocity is established, rail will likely continue servicing these centers. However, piggy-back hauling is being used to achieve some of the advantages of shipping perishables by motor carrier.

The competitiveness of the aircraft in hauling fresh fruits and vegetables is affected by its inability to match direct costs of truck and rail on these and other routes as calculated in this study. However, there are technological innovations on the horizon that may enable air carriers to become more competitive on at least some routes. Of major importance is the development of the commercial version of the C-5A transport. It will increase the payload capacity of an aircraft

to over seven times that of commercial air freighters presently being used. People in the air industry feel that such aircraft will enable air carriers to quote air freight rates that will be competitive with current motor carrier rates.

On the routes studied in this thesis, the air freight rates are but one factor affecting air carriers in competing for perishable fruit and vegetable traffic. Also important are the institutional and backhaul factors. Presently there is a general lack of franchise arrangements between Canada and the U.S. allowing Canadian air carriers access to California. This lack of franchises restricts the potential service that Canadian air carriers could give perishables shippers. The intensity of regulation among the three modes tends to favor truck hauling of perishables relative to rail and air. Motor carriers hauling perishable fruits and vegetables are granted "exempt" classification. One of the rights of this classification is no rate regulation.

Finally, shipments of perishable fruits and vegetables from California to Canada aggravate the backhaul problem on the particular routes chosen in this study. As a result, either a more even traffic flow must be developed before perishables will be accepted as regular air freight, or air freight rates must drop low enough so that air carriers can charge for no backhaul and still remain competitive.

Further investigation of air freight's ability to generally compete in the shipment of perishable fruits and vegetables showed that the routes analyzed in this study are of the type where air freight will have the hardest job in becoming competitive due to the added institutional and backhaul problems. Routes on which air competes with

ocean travel and on which perishable freight taken on moves in a direction such as to help alleviate backhaul problems are the type of routes on which air carriers have the best chance of becoming a more competitive mode in shipping perishable fruits and vegetables.

B. PROBLEMS RELATED TO THE STUDY

Other conclusions and problems related to the mechanics of the study became evident throughout the course of research on the topic. The following section of this chapter deals with such conclusions and problems so as to familiarize the reader with their presence.

The original topic of the study was broad in scope. One of the first problems was to narrow this scope. An inductive approach was used whereby specific routes would be studied and results obtained. From these results then, a general application of the feasibility of air shipment of fresh fruits and vegetables could be made. The model chosen for the cost of distribution-comparison was the Total Cost Concept. This model seemed appropriate in that it allowed for both a price and quality of service comparison on a specific route.

However, there were drawbacks in using this model in this particular study. The drawbacks were in the mechanics of the model itself, and the lack of data available to be put to use in the model. The Total Cost Concept model was basically designed to evaluate the economic feasibility of air freighting a commodity from the standpoint of a specific shipper. It is not completely suited to an intermodal comparison which was an integral part of the objectives of this study. Also, it was found that the Total Cost Concept was designed for comparing

shipping by air over long routes on which the competing surface transport mode would constitute ocean-going ships. Because of the short overland route (California to Canada), many of the cost elements were the same for all three modes and consequently the intermodal comparison was essentially a comparison of transportation rates. The restrictions of this model thus affected any conclusions or generalizations that may result from its use.

As in most economic analyses the lack of adequate rate data was a particular drawback in the use of this model. As well, it was a general drawback to the whole study. Rate data on motor carrier shipments of perishables to Canada was hard to obtain. Any study concerning itself with rates of "exempt" motor carriers has to face the possibility of scarce data. Such carriers, as mentioned, are not required to file rates. Rate bargaining is done for each truckload carried by "exempt" carriers with no exact data kept of rates agreed upon. Any available information on such shipments was obtained from Canadian trucking sources. The lack of truck data tended to make the total cost comparison less complete than could have been possible had such data been available.

Even if complete freight rates were available on motor carriers, other relevant data were not immediately available. Firms do not usually keep complete records on such items as handling and packing charges. Unless a specific study has been done on such charges, the data are not readily accessable. Indirect costs on warehousing and inventory are also not usually kept and if they are kept, they usually are not of precise enough quality for use in a total cost comparison.

Also, if one wanted such information, he would have to acquire it over a long term. However, the Total Cost Concept was developed for short-run analysis.

In a descriptive study of this type, it is important that a view to the practical be maintained. It is necessary to try and develop a sense of what is happening in the industry at the present time. One of the best ways discovered to develop this sense was to have personal interviews with persons connected and engaged with the topic at hand. Such people were able to give insight into the problem areas associated with this topic. Views obtained from such interviews were used to formulate the scope of this study.

C. IMPLICATIONS

The trucking industry must prepare to increase capacity for carrying perishable fruits and vegetables in the next few years. This is due to the expected increase in demand for perishables and the corresponding expected switch to trucking from rail in the future. Motor carriers must be able to meet the new demand while at the same time maintaining or increasing their current quality of service. For the rails, on the other hand, the future of rail shipment of perishable fruits and vegetables looks pessimistic. To compete in hauling these perishables, it is imperative that railroads improve their quality of service. Air shipment of fresh fruits and vegetables is not seen as a contender in the California to Canada routes perhaps until introduction of the new jumbo-jet stage of aircraft.

For Eastern Canada to share in the shift from rail to motor carrier shipment of perishable fruits and vegetables, reciprocity

treaties will have to be made with California, the prime supplier of Canada's perishable imports. Currently, as has been mentioned, there are institutional restrictions in the form of load surcharges and lack of reciprocity that are keeping motor carriers from hauling to Ontario and Quebec. One factor that might bring about change is the introduction of federal regulation of extra-provincial trucking. "It could lead to more effective bargaining between Canada and the U.S. on the opening up of cross-border trucking runs. Transborder trucking is shaping up as the big growth area for the industry."[1]

As air freight direct costs are high compared to similarly calculated rail and road direct costs on the routes studied, air carriers are not likely to become major transporters of perishables in the foreseeable future. Also, the airlines, to become more competitive on the California to Canada routes, will have to contend with the additional institutional and backhaul factors. For these reasons, air carriers will not become regular perishable fruit and vegetable carriers on the short domestic routes to Canada. However, under certain special conditions such as emergencies, limited amounts of the commodity could move by air.

Due to the additional problems existing on the selected routes, air carriers should and will turn to routes on which new markets can be developed and established markets extended. Such markets are those where new freight is helping to alleviate backhaul problems. As Canada generally has more air freight coming into it than going out, it would seem that air carriers should be investigating the possibility of

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[1] The Financial Post, December 27, 1969, p. 1.

shipping out Canadian perishable fruits and vegetables by air. This would help Canada's balance of trade as well as air carriers. Some shipments of this type to overseas countries have been made. As Canada has a backhaul problem on European and Japanese air routes and these countries are experiencing significant increases in their standards of living (a condition under which perishable produce consumption generally increases), Canadian air carriers could conceivably further develop these markets. Ocean shipping usually cannot provide fresh produce due to the deterioration of quality of the good on such a long haul. Air freight, however, can provide two day service and introduce fresh, high quality produce into such foreign markets.

D. SUGGESTIONS FOR FURTHER STUDY

An area of further study would be to analyze Canadian perishable producers' potential in developing and expanding markets for their perishables in overseas countries. Of particular interest would be the Japanese-Canadian trade possibilities. Airline companies are very interested in this type of research. They feel that air freight's role is not to take away freight from other modes, but to develop and expand markets for new types of freight which to this time have been unprofitable. This analysis could be broadened to include a wider range of commodities that are suitable for shipment by air.

Throughout this study, rates as quoted by the carriers were used as costs <u>to the shipper</u> of moving perishables. A further extension of this study would be to look at costing and rate-making within each mode with special emphasis on the transportation of perishables. If

transportation rates were established on a cost basis, it would be possible to make some recommendations as to which mode is the most efficient from the standpoint of long-run allocation of resources for the transportation of perishables. However, this would not be an easy task. Not only is the determination of transport costs very difficult, but transportation economists have different views as to how transport services should be priced. That is, should the price of transport services be based on full costs or less than full costs?[2]

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[2]For a more complete description of this controversy, the interested reader is referred to John R. Meyer, Merton J. Peck, John Stenason and Charles Zwick, The Economics of Competition in the Transportation Industries (Cambridge, Mass.: Harvard University Press, 1959). Charles F. Phillips Jr., The Economics of Regulation (Rev. Ed.), (Georgetown, Ontario: Irwin-Dorsey Ltd., 1969). Roy J. Sampson, "The Pricing of Transportation Services," Proceedings of the Colloquium Series on Transportation, 1967-1968, (Center for Transportation Studies, University of Manitoba, Winnipeg, Vol. I, June, 1968).

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