THE LEBANESE PASSENGER AIR TRANSPORT INDUSTRY DURING 1952-1962

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PREFACE

The purpose of this thesis is to study the development of the Lebanese Air Passenger Industry during the period 1952-1962, the efficiency of its operation, and the problems facing this industry.

Data for this study was gathered mainly from the Lebanese Civil Aviation Direction, Digest of Statistics No. 100 (International Traffic), Middle East Airlines 1962 and 1963 Annual Reports. The Lebanese Airlines, other than Middle East Airlines, did not publish reports and had no available data for the requested information.

The significance of this study lies in the fact that the development of this industry has considerable bearance on the Lebanese economy, not only for its direct contribution to National Income, but also for indirect effects of the growth of travel and tourism.

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CHAPTER I

THE EVOLUTION OF PASSENGER AIR TRANSPORT (1952-1962)

This chapter will attempt to analyze, using simple statistical techniques, the growth of passenger air traffic centered around the Beirut International Airport and the three Lebanese passenger airlines.

Lebanese passenger air transport accounts for a small percentage of total international passenger flights in the world. This is because the Lebanese passenger airlines are still regional airlines in a region that accounts for a minor proportion of total international passenger transport in the world. Thus, of the 56.4 billion passenger-kilometers achieved in international passenger transport by all airlines in 1962, Lebanese airlines accounted for 0.4 billion passenger-kilometers or 0.71% of all passenger transport in the world.[1] This small passenger proportion,

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[1] Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, p. 19.

however, masks a very high rate of growth in the air passenger industry in Lebanon, estimated for the period 1959 to 1962 at an average of 12.9% every year (267,144,000 passenger-kilometers in 1959 as compared to 4,200,952,000 in 1962). This can be translated as an annual increase of embarking and disembarking passengers of approximately 24,828 passengers per year.

Passenger Air Transport Through The Beirut International Airport

Table 1 in Appendix B gives the actual number of passengers disembarking in the Beirut Airport for every month and year, from 1952 to December 1962.

Similarly, Table 2 in Appendix B shows the actual number of passengers embarking at the Beirut Airport during the same period.

These two tables bring out a number of interesting phenomena that could profitably be investigated. It is best, however, to observe the characteristics of the growth of the passenger air transport industry by referring to the graphic representation of these figures. This has been done in Chart 1 for disembarking, and Chart 2 for embarking, in Appendix A.

The graphs show that the trend is obviously increasing in both embarking and disembarking passenger traffic (see trend lines). Two recessions are also brought out: the first in 1956, while the second took place during the year 1958, during which abnormal events intervened to check the growth of the passenger air transport industry.

In 1956, the drop of embarking passengers was 7.2% and of disembarking passengers 8.9% of the expected value from the trend line. The drop in 1958 was 11.6% for embarking and 24.1% for disembarking.

The Suez aftermath resulted in a reduction in total movement into and out of Beirut starting with the month of October 1956 and ending in March and April of 1957 (see Tables 1 and 2 in Appendix B). This corresponds to the period of hostilities and the clearing of the then blocked canal. Immediately after the Suez crisis, passenger traffic picked up very fast and reached a peak in the summer of 1957 that was not to be improved upon before 1959.

The second major recession in the passenger air transport industry started during the second half of 1958 as a result of the Lebanese civil disturbances. In 1959, however, the aftermath of 1958 was spent, and

economic activity in general was restored to its former heights carrying with it the trend in the passenger air transport industry.

Another main characteristic brought out by these charts as well as by Tables 1 and 2, is the apparent increase of growth both in embarking and disembarking traffic after 1958. It seems that the solidity of the Lebanese economy, compared with the rest of the Middle East, has increased the number of business and holiday visits into Lebanon. This point, however, will be discussed statistically in a subsequent chapter.

A third characteristic of the figures in Tables 1 and 2 is the regularity of the fluctuations of the monthly figures for embarking and disembarking passengers around a generally rising trend line. Thus, July is the peak month for air passenger arrivals in Lebanon, while departures of passengers through the International Airport are at their peak during September of every year. February is the least active month.

Methodology of the Decomposition of the Time Series

In order for the study to proceed further, it is necessary to define a methodical plan of attack on the data, in order to enable us to extract from them their most important characteristics, in a manner that minimizes the chances of confusion arising from this complex nature of the data.

The time series presented in Tables 1 and 2, along with all similar time series is subject to four types of fluctuations and movements:

1. The long-term trend, in this case increasing.
2. The accidental fluctuation due in part or totally to wars, business cycles, or other similar events.
3. The seasonal fluctuations, in this case, the monthly fluctuations around the trend line.
4. Random changes due to uncontrollable and unpredictable events of short durations.

In order to isolate each of these components in the time series and thus make possible an intelligent analysis of the events quantified in them, it is

necessary to proceed by stages removing in the earlier stages the shorter term movements until they can be studied as fluctuations around a trend line.

The first step, therefore, is to define a trend line. Once this is done, deviations from it will be calculated for both the seasonal and the random changes, and the extent of the recessions or abnormal booms in the air transport industry will be measured.

Measurement of the Trend Line

Two different procedures have been followed and their results compared in this study:

1. The method of moving averages: This consists of taking a moving average for a period of months exceeding the duration of the seasonal as well as random changes, without obliterating the cyclical movements of 1956 and 1958. The period chosen is the 12 months moving average.

   This is so because random changes are due mostly to very short-run events like storms, strikes, pilgrimages, conferences, and the like. These cannot usually exceed in any one time a few days in length.

Seasonal fluctuations are by definition shorter than one year in length. For this reason, a twelve months moving average will always have in it the effects of twelve previous months, i.e. all the seasons of one year. Thus, the moving average for any one month using the twelve months moving average is the seasonally adjusted value for that month.

Accidental changes, namely, the Korean War Boom and the recessions of 1956-1957 and 1958-1959, are more severe than the seasonal fluctuations and are of longer durations. The twelve months moving average does not hide these deviations from the trend line.

Tables 3 and 4 in Appendix B give the month-by-month moving average for both embarking and disembarking passenger traffic in Beirut from January 1952 to December 1962.

The Charts 1 and 2 in Appendix A show the moving average in solid line super-imposed on the graph for the actual number of passengers during that period.

It is to be observed that with the exception of the three cycles mentioned above, the trend is remarkably smoothed.

2. The method of least squares: This method consists of fitting a straight line to the available data on the assumption that the trend line is a linear function. This is not always a true assumption. In this case, however, it was thought advisable to produce the line of best fit by the method of least squares and compare the results with the results from the moving average. This method has the advantage of giving an accurate value for the number of passengers embarking or disembarking from the Beirut Airport in a specified period of time, as long as that period lies within the scope of applicability of that straight line.

Perusal of the Tables 1 and 2 in Appendix B and the Charts 1 and 2 in Appendix A will immediately bring out an important characteristic of the air passengers industry in Lebanon. Previous to 1958, the rate of growth of the number of passengers (embarking or disembarking) was lower than the corresponding rate of growth after 1958. This is reflected in two different slopes in the corresponding segments of the moving averages.

The slope of the second segment is artificially exaggerated by the rapid recovery during the first part of 1959 from the ebb at the end of 1958.

Consequently, two alternative lines of best fit present themselves for each of the embarking and disembarking data:

a) To fit a straight line to the grouped data for all the period of eleven years and consider that all the changes in slope and the three major cycles outlined above are deviations from an expected outcome.

b) To fit two straight lines, one for each of the major segments of the data, i.e. one line for the period ending 1957, and one line for the period beginning 1958.

This second alternative poses a number of problems as well as some advantages. The first half of the period is characterized by two major events covering several years in the series. Thus, a straight line shows deviations from the moving average of up to 39.1% in 1951, while the "normal"

values expected from the line of best fit in the second half of the period produces results deviating from the actual figures by less than 2.0%. This is due to the absence of major recessions or booms during that period, especially if we disregard the data for 1958.

An attempt was made to calculate the line of best fit for each of these alternative approaches and the results are shown in the accompanying tables. The equation for embarking passenger traffic was found to be

$$Y = 2087 X + 15849 \qquad (1)$$

where X is 0 in 1957,

Y is the number of embarking passengers estimated from this curve.

Equation (1) was calculated by the method of least squares using the annual average number of passengers embarking during an average month of each year. The year 1957, being the middle year, was taken as 0, 1958 + 1, 1956 - 1, etc.. Thus, the estimated number for any year outside of the range 1952-1956 is the monthly average number of passengers embarking from

Beirut estimated from this equation for that year.

This value does not represent any actual monthly figure for that year unless it is multiplied by the factor of correction (see Table 6 in Appendix B) for the month.

Using the second alternative method of calculating the equation for the line of best fit separately for 1952-1957 and 1958-1962 we obtain for the former period equation (2):

$$Y = 1972\ X + 9754.6 \qquad (2)$$

for the period 1951-1957, where X and Y have the same significance as above. The curve for the latter period, 1958-1962, was found to be

$$Y = 3618\ X + 21764 \qquad (3)$$

Equations (1), (2), and (3) were studied and the following conclusions were found to hold:

1. Equation (1) shows big deviations from the moving average and this is due to a number of reasons. One, the Korean boom of the middle fifties; another having to do with the period 1956-1959 which was not a normal period; a third reason being the change in the rate of growth of passenger traffic

embarking from Beirut.

2. Equation (2) which was fitted to the annual monthly average of embarking passenger traffic during the period 1951-1957 also shows many deviations from the actual figures. The normal values expected from this curve deviate by a reasonable amount from the actual figures in the years 1953, 1954, 1955, and 1957. The biggest deviation for these years occurs during 1955 where the "normal" value is 3.6% below the actual number of passengers. In 1951, 1952, and 1956, however, the "normal" values are 139.1%, 82.4%, and 107.2% respectively of the actual published figures. These deviations are not acceptable, unless accompanied by valid reasons. It is easy enough to explain 1951 and 1952. This was the period of the Korean war; 1951 was much lower than expected from equation (2), while 1952 was 17.0% higher than expected. In 1956 there has been a distinct drop in the number of passengers embarking or disembarking in Beirut as compared with the numbers expected from equation (2), the reason being the

Suez war. Thus, the expected value is 7.2% higher than the actual. One might have expected that a war taking place as close to Lebanon, will have influenced air traffic by more than 7.2%, but the Suez war started in the last quarter of 1956 and ended during the same period. In the aftermath, a large number of passengers came into and left Beirut; this is due to the pent-up demand for business travelling, as well as pleasure, created by that short war. The full effects of the Suez war did not have time to work themselves out, because shortly afterwards, the unfortunate events of 1958 took place.

3. Equation (3) was fitted to the total numbers of embarking passengers during the period 1958-1962. This curve produces a good fit for the years 1960, 1961, and 1962. In 1958 and 1959 deviations from the estimate derived from this equation, are too big to be accepted. An alternative equation was therefore produced using the figures of 1959-1963. The normal value for 1958 was obtained by extrapolation. This method has the advantage of providing a measure of the cyclical effect of the

disturbances of the latter half of 1958. This was found to be 11.6% below the expected value.

4. Comparing the three curves represented by equations (1), (2), and (4), one can derive the differences in slope, i.e. in the rate of growth of the passenger air traffic embarking from Beirut based on the three assumptions. Equation (1), taking 1957 as a base, shows a rate of growth in the average monthly figures for the period under consideration of 2087 embarking passengers more on the average in year t_1 than t_0. This represents a rate growth of approximately 13.0% per year. Equation (2), gives a rate of increase between 1951-1957 of 1972 passengers per month per year, taking 1954 as a base. This represents a rate of growth close to 20.0% per year.

Equation (4) gives a rate of growth in embarking passenger traffic for the latter part of the period, of 3300 passengers per month per year, taking 1961 as a base. This represents about 13.0% increase per year where 1961 is equal to 100.0%. It is to be noted that the percentage rate of growth in the second

half of the period is lower than the same percentage in the earlier period. While this might seem, on the face of it, to contradict the earlier conclusion that the rate of growth has accelerated after 1958, it is to be noticed that the base on which the percentages were computed was also higher in equation (4) than in equation (2).

Up to this stage, equations relevant to embarking passenger traffic only have been calculated. The corresponding figures for disembarking passengers have been studied with a view to fitting a similar array of straight lines, by the method of least squares. Equation (5), corresponding to equation (1) was found to be

$$Y = 2049\ X - 15559 \qquad (5)$$

This equation shows a rate of increase of the average monthly numbers of disembarking passengers of 2049 per year. Using 1957 as a base, this represents slightly more than 13.0% per year.

Equation (6) shows the straight line formula for the years 1958-1962 while equation (7) shows the straight line formula for the years 1959-1963. It will be noticed that eliminating 1958 from the years for whose value the straight line is fitted produces a

higher base value of 25144 (for 1961) than equation (6), in which the base year is 1960. The value for 1961 in equation (7) is higher than the value for 1961 calculated from equation (6). This is due to the elimination of the low values of 1958 from the values of the years on which the least squares method was applied. Equations (6) and (7) are as follows:

$$Y = 3590.4\ X + 21288 \qquad (6)$$

$$Y = 3140.1\ X + 25144 \qquad (7)$$

Here again the same conclusion arrived at for embarking passengers apply. The extrapolated value of 1958 using equation (7) is found to be 20.1% above the actual value. This is a measure of the drop in the number of disembarking passengers due to the events of that year. The higher cyclical effect of 1958 on disembarking passengers than on embarking passengers is to be expected since people who are outside Lebanon will tend to be more frightened of the civil war in Lebanon, and would therefore postpone their visits until a later time. The corresponding reaction of a Lebanese or of a non-Lebanese resident in Lebanon will be to postpone any travelling he had planned to do until a later date. Business travelling would also be curtailed.

Measurement of the Seasonal and Residual Variations

Given a series of monthly data over a long period of years the simplest and most direct, though not the best method of detecting the usual seasonal pattern is to add together all the values for all the Januaries, and divide by the number of Januaries, and then repeat the same process for each of the eleven months so that an average January value, an average February value, etc. can be calculated. In the case of the numbers of passengers embarking from or disembarking in Beirut, this has been done to provide a first measure of approximation of the seasonal pattern. This was plotted in Charts 3 and 4 (Appendix A) on the right hand side of the graph. Two such graphs were made for each of the embarking and disembarking passengers, one in the form of a bar diagram and the other in the form of an actual curve. These, however, are based not on the gross numbers of passengers but rather on a ratio of the average number of passengers travelling in any one month to the monthly average for all the period 1952-1962. In preparing these two diagrams, the idea was to obtain a factor of seasonal correction for each of the months, by which an average monthly figure could

be multiplied to obtain a seasonally inflated measure. These figures, however, proved to be too crude for that use. As a matter of fact this method has one major disadvantage; if there has been either an upward or a downward trend in the time series, the twelve monthly averages will surely have been affected by the trend, and might have changed in a specific manner in response to the growth in the general trend.

As a matter of fact, the hypothesis that the monthly average as well as the monthly average ratio have changed in some of the details, has been tested in Tables 7 and 8 in Appendix B, as well as in Charts 3 and 4 in Appendix A.

The procedure followed was to calculate the average for all Januaries by the method of moving averages for each five Januaries in succession. Thus, any random influence on any specific month would have been eliminated. The information in those tables were plotted on the left hand side of Charts 3 and 4 in Appendix A, respectively. These two charts portray a number of saliant facts. February is the lowest month of activity in both embarking and disembarking traffic. The peak month for arrival of passengers is the month of July and for departures the month of September. This

is a reflection of the summer vacations season from July to September. However, the months in between the peak and the trough of the year, have not always kept their rank. An analysis of these shifts might be worth undertaking.

It must be noticed that while Tables 7 and 8 in Appendix B give the absolute value of the average number of arrivals and departures from the Beirut Airport, the Charts 3 and 4 in Appendix A are based on the ratio of these months to the yearly average of the corresponding year.

Both procedures for studying the seasonality of passenger air transport explained above are still rather crude. For this reason, Tables 5 and 6 in Appendix B were designed to obtain a measure of the combined effect of the seasonal and residual variations. This was obtained by dividing the number of passengers of each month by the corresponding twelve months moving average. This method has the advantage of eliminating trend from the analysis of the seasonal factor. The results can be used as correction factors for the months in question, with the exception of 1952 in which the percentages are much too high due to the abnormally low number of passengers passing through Beirut in 1951. The correction

factors, i.e. the factors of seasonal variations, can be used to inflate the value of any average month to its seasonally inflated value. Thus, if a formula produces an estimate for 1962 of 10,000 passengers per month, the corresponding seasonally inflated figure for the month of May is 12,050 passengers (disembarking passengers) or 10,930 embarking passengers as the case may be.

Used in conjunction with Tables 5 and 6, and Tables 7 and 8 acquire an importance that they would not have, had they been used alone. It is now possible to make predictions about any month from the annual figures.

The information of Tables 5 and 6 have been plotted in diagram 5 as a per cent of the moving average. Analysis of this chart will provide an insight into the time-lag between arrivals and departures at the Airport of Beirut. There seems to be a fairly regular three months interval between these two events. In 1956, however, there are two peaks of departures, and similarly in 1957, indicating random influences.

Measurement of the Residual Component

It was pointed out above that besides the trend line, the cyclical and the seasonal variations, there is a fourth type of variations to which time series are

subject. This is the random influences. Statistically random influences are measured as residuals, after the magnitudes of the three other forms of variations have been eliminated. In this case, it is possible to refine the analysis one step further and isolate the residual from the seasonal variations. As a matter of fact, Tables 5-8, and Charts 3 and 5 contain all the information required to perform this analysis. It is necessary for this purpose to produce a normalized measure of seasonal variations, from which the values of Tables 5 and 6 can be subtracted. The remainder from the subtraction of these two values, i.e. the normalized and the current measures of seasonality, is the random effect. It is not thought, however, that in this paper such an analysis would be necessary.

CHAPTER II

THE LEBANESE AIR PASSENGER INDUSTRY 1952-1962

There are three Lebanese air passenger companies: Middle East Airlines, Lebanese International Airways, and Air Liban. This latter company merged with Middle East Airlines. There is, however, a licensed Lebanese airline called "Lebanese Air Transport" with one aircraft available for chartered flights only. This is ignored in our discussion.

The three Lebanese airlines made in 1962, 14,225 flights from and to Beirut covering a distance of 14,634,000 kilometers. They carried a total of 283,000 passengers,[1] which represented a 45% load factor. The three Lebanese airlines account for a large percentage of the total movements of aeroplanes as well as passengers from and to the airport of Beirut. In 1962, for example, the three Lebanese airlines accounted for 45.7% of all flights based

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[1] Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, p. 54.

on Beirut and 43% of the passengers embarking from or disembarking in Beirut.

The Growth of the Three Lebanese Companies Between 1952 and 1962

Tables 10 and 11 in Appendix B show the growth of capacity of the three Lebanese airlines in terms of seat kilometers available for use by passengers for the period 1954 to 1962; it also shows the utilization of this capacity in terms of passenger kilometers performed during the same period.

It will be seen from these tables that during the period 1954-1962 total seat kilometers available increased by slightly less than eight times, indicating a lower load factor for the same period.

The rate at which the three companies are growing in the aggregate can be estimated from the figures of passenger kilometers performed.

The percentage growth on the average is found to be 20.5% per year.[1]

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[1] A straight line has been fitted on the figures of passenger kilometers performed:

$$Y = 43{,}625\ X + 207{,}145{,}000 \qquad \text{(Eq. 1)}$$

where X is the year for which the projection is made counting from 1958 - 0, and Y is the normal value for the number of passenger kilometers.

The higher rate of growth of seat kilometers points to a decline in load factors.[1]

At this stage, our concept of seating capacity must be modified. Aeroplanes are not only vehicles of transport of passengers, but also of freight. For this reason, the average seating capacity of an air fleet may vary according to whether they carry more or less in terms of cargo.

Table 29 in Appendix B shows that the Lebanese air transport industry has been growing at the high rate of approximately 20% per year in terms of capacity. Still the load factors have not improved by actually show a small decline on the average. The reason for this is to be seen in Tables 40 and 41 in Appendix B.

Table 40 gives the average apparent seating capacity in the Lebanese air passenger fleet. This capacity has increased from 26.0 passengers per plane in 1954 to 60.8 in 1962, an increase of 133.8% approximately.

Table 41 shows the average number of passengers per aircraft voyage. This table shows that the

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[1] Load factor is the extent to which the available seat kilometers are utilized.

number of passengers in a plane has increased on the average from 12.1 in 1954 to 27.5 in 1962, an increase of 127.3%.

A Note on Technological Changes

During the period under consideration, a number of technological improvements have been introduced into the airline industry. As far as the Lebanese airline industry is concerned, the major changes can be classified into two categories: the first change took place in motive power, i.e. the type of engine. Until 1955, piston engine planes were in use; DC-3's and DC-4's were the most frequent types of planes for both passengers and cargo in most airlines.

In 1955, Middle East Airlines chartered one Viscount. This represented a major departure since the Viscount is propelled by a turbo-propellor engine of radical design for that period. In 1956 and 1957, the trend to turbo-props continued until 1960 when Middle East Airlines pioneered jet aircraft by introducing the Comet. In 1963, Middle East Airlines again introduced into their fleet the Caravelle, a short and medium range jet. Following in that direction, Air Liban

already had Caravelle planes.

The second major technological trend took place in the power of engines and air frame design, making it possible to operate larger planes. This trend is shown in Table 40 (Appendix B) in which the average apparent seating capacity of all Lebanese planes is shown. The actual rated seat capacity of aircrafts, now in use in the Lebanese air fleet, is as follows:

DC-3	28
DC-4	70
DC-7	71
Viscount	56
Caravelle	77
Comet	87
Boeing 720	123

These two technological changes have caused a number of problems and opened many opportunities for the airline industry. Of concern to us at this stage is the problem of operating cost versus capacity and load factor. By introducing such bigger jets, operating cost and capacity are directly increased, while load factor, or the utilization of the capacity, relative to the increased capacity tends to decrease.

The rated seat capacity of the various types of aircrafts in use is not as simple as shown above. Speed is a function of the higher power and stronger airframe design. The seat kilometers produced at cruising speed for the various types of aircrafts can be obtained by multiplying the speed of the aeroplane in kilometers by the rated seating capacity of the plane. This is given in the table below for four types of planes operated by Middle East Airlines.

PASSENGER KILOMETERS PRODUCED PER HOUR AT CRUISING SPEED

Type	Cruising Speed	Rated Seating Capacity	Passenger Kilometers/ Hour
Comet	833.8	87	72540.6
Caravelle	852.4	77	65634.8
Viscount	463.2	56	27467.7
DC-3	268.7	28	7523.6

Source: Middle East Airlines 1962 Annual Report.

This table highlights the remarks made above concerning the great increase of capacity of planes. Since passenger kilometers produced in an hour of flying at cruising speed is a more accurate measure of capacity than rated seat capacity, speed becomes of even greater importance. Thus, while the Comet is 3.1 times as big as the DC-3 in number of seats available, it produces 9.6 times the number of seat kilometers per hour at cruising speed.

Other considerations for taxying and take-off is proportionately higher in the case of the faster planes than in the case of the DC-3. This has to be taken into consideration in computing the actual sector speed, and therefore the number available due to all these factors presents the airline industry with the opportunity of cutting costs per passenger kilometer, while at the same time forcing on them the problem of utilizing their bigger inflexible capacity, i.e. capacity which, if non-utilized, will be totally lost.

Load Factors

The following table gives the total number of seat kilometers available on all three Lebanese

LOAD FACTORS IN ALL THREE AIRLINES

Year	Passenger Kilometer	Seat Kilometer	Load Factor
1954	52315	112113	46.7
1955	73351	159395	46.0
1956	114540	269288	42.5
1957	172761	388125	44.5
1958	173776	425937	24.5
1959	267144	579998	46.0
1960	252712	552663	45.7
1961	354753	836161	42.4
1962	402954	892701	45.1

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, p. 54.

airlines; it also shows the number of passenger kilometers performed during the period 1954-1962. These two sets of figures express statistically the elements discussed in the previous section. Thus, while total seat kilometers available increased from 11.2 million

in 1954 to 89.3 million in 1962, passenger kilometers actually operated were slightly less than half the capacity. The rate of growth of passenger kilometers was slightly slower than the rate of growth in capacity, from 52.3 million in 1954 to 40.3 million passenger kilometers in 1962.

This table shows the load factors for each of the nine years in the series. Load factors have declined from 1958 generally until 1961 when they resumed their previous improvement. The average load factor for the period is 42.6%, thus more than half of the capacity of the Lebanese aeroplanes as measured in seat kilometers was non-utilized.

The cost of operating these various planes involves a number of variables, discussion of which is postponed to a later stage of the analysis. At this point, however, a crude measure of the cost of flying the four major types of planes per flying hour is compared with the productive capacity of the planes in seat kilometers as well as with the load factor.

According to informed opinion in the industry, the following are the costs per flying hour for the four major types of aeroplanes.

Type of Plane	Cost per Flying Hour in L.L.
Comet	4000-4500
Caravelle	3000-3500
Viscount	1500-1800
DC-3	350- 400

These costs cover all fixed and variable elements within the range of sector length relevant to the Lebanese airlines.

Since the DC-3 has been operated for a long time and gave much satisfaction, it is worthwhile to compare newer aircrafts in performance and cost with the DC-3. The following table compares capacity in passenger kilometers per hour of cruising speed and costs per flying hour for the Comets, Caravelles, and Viscounts. Against an increase of 9.6 times the capacity of the DC-3, the Comet costs 11.7 times more per flying hour. The Viscount similarly costs more proportionately than the DC-3 per passenger kilometer per hour. Only the Caravelle adds as much to capacity as it adds to costs in DC-3 units.

COMPARATIVE TABLE OF DC-3 TO

OTHER PLANES

Type of Plane	Capacity Compared to DC-3	Costs as Compared to DC-3
DC-3	1.0	1.0
Comet	9.6	11.7
Caravelle	8.7	8.7
Viscount	3.6	4.4

Source: Middle East Airlines 1962 Annual Report.

The figures of cost in the above table assume comparable rates of utilization of the capacity produced (load factor). But the size of the aeroplane may become a disadvantage. It is easier to fill a plane like the DC-3 with a capacity of 28 passengers than to fill a Comet with a capacity of 87 passengers.

CHAPTER III

SHARE OF EACH OF THE LEBANESE AIRLINES IN PASSENGER AIR TRANSPORT

In the previous chapter the growth problems and loading of the Lebanese air passenger industry has been investigated from an aggregate point of view. In this chapter an analysis will be made of the growth of each of the three companies then in operation.

In Table 11 (Appendix B) we have seen that the Lebanese air transport companies in total have been growing at the rate of 43,625,000 passenger kilometers per year on the average. Two thirds of this growth or about 30 million passenger kilometers per year can be accounted for by the growth of Middle East Airlines, the remainder represents the growth of the rest of the local airlines as follows:

GROWTH IN PASSENGER KILOMETERS FOR

EACH LEBANESE AIRLINE

Growth in Passenger Kilometers per year		Name of Company
30,135,000		M.E.A.
5,625,000		L.I.A.
8,020,000		Air Liban
43,780,000	Total by Summation	
43,625,000	Total from Table 11 (Appendix B)	
155,000	Difference (Statistical Error)	

Source: Ibid.

Growth of Passenger Traffic by Airline

The following table gives the passenger kilometers operated by each of the three airlines and their total for the period 1954-1962. It will be seen that in 1962 Middle East Airlines accounted for 66.4% of the total traffic by Lebanese carriers, Air Liban for 23.4%, and L.I.A. for the balance of 10.2%.

PASSENGER KILOMETERS OPERATED BY

LEBANESE AIRLINES

1954-1962

Year	Total (000)	M.E.A.	Air Liban	L.I.A.
1954	52315	24698	27618	-
1955	73351	29014	44337	-
1956	114540	55852	49197	9491
1957	172761	92292	66443	15022
1958	173776	110489	63287	37529
1959	267144	151978	77637	37529
1960	252712	134768	94349	-
1961	354754	232084	81938	40730
1962	402954	267540	94312	41101

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization published by the Secretary General of the International Civil Aviation Organization, Montreal, Canada, pp. 230-232.

The average rate of growth of the passenger kilometers operated by Middle East Airlines, for the period 1954-1962, was 24.8%.[1] For Air Liban, the average rate of growth of passenger kilometers during the same period was 12.0%.[2] This rate of growth of passenger traffic is less than half the rate at which M.E.A. traffic was growing. While for L.I.A., the average rate of growth during the same period was

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[1] In order to study the rates of growth of passenger kilometers performed by Middle East Airlines a straight line was fitted to grouped annual data of passenger kilometers performed from 1954 to 1962. Equation (1) gives the formula of the line of best fit calculated by the method of least squares:

$$Y = 30{,}135{,}000\,X + 122{,}080{,}000 \quad \text{Equation (1)}$$

in which X is the year counting from 1958 = 0, and

Y = the normal value of passenger kilometers performed.

This calculation is detailed in Table 36 in Appendix B.

[2] The study of the growth of passenger traffic performed by Air Liban has been made by fitting a straight line to the grouped annual data of passenger kilometers operated during the period 1954-1962 by the method of least squares. The average rate of growth during this period was found to be 12.0%.

19.5%.[1]

The above rate of growth of passenger traffic during the period 1954-1962 is partly due to the increase in demand for air transport, partly to the improvement of Beirut Airport, and partly to the increased capacity for carrying passengers acquired by the three Lebanese airlines.

Growth of Passenger Carrying Capacity of Each Airline

As explained in Chapter II, capacity may be measured in a number of ways, the most common measure, and in many ways the most accurate, is the number of seat kilometers for passengers traffic. A number of

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[1] Investigation of the growth of passenger traffic performed by L.I.A. was also made by fitting a straight line to the grouped annual figures of passenger kilometers operated by the method of least squares, during the period 1954-1962. The values for two years for which data are not available were estimated by interpolation using the straight line of best fit described in Equation (3) below. The equations for the lines of best fit for Air Liban and Lebanese International Airways are shown in Equations (2) and (3) respectively, in which X and Y have the same significance as in Equation (1) except for the year 0 in Equation (3).

$$Y = 8{,}020{,}000\,X + 66{,}570{,}000 \qquad \text{Equation (2)}$$

$$Y = 5{,}625{,}000\,X + 28{,}775{,}000 \qquad \text{Equation (3)}$$

In Equation (3) 1959 = 0.

variables go into the making of this measure but it can be safely said that when a plane flies it produces as many seat-kilometers of capacity as the number of seats on it, whether filled or unfilled, multiplied by the distance covered by the aircraft. The longer the use made of the aircraft by an airline in terms of hours per day, the higher is the capacity in seat-kilometers produced by that aircraft during that day. Here, as explained in Chapter II, speed is a very important factor in increasing seat and passenger kilometers. In adopting the measure of capacity as seat-kilometers we assume that an airline acts rationally and does not leave its planes lying idle when it can use them. At the same time it is assumed that an airline does not acquire from the very start aeroplanes the seating capacity of which exceeds the forecast market. Under special circumstances one or both of these assumptions may not be true.

The growth in total capacity of the industry is largely due to the growth of the Middle East Airlines fleet. The other two airlines have added together less than 27.0% of the total increase in seat kilometers available on the Lebanese air passengers fleet as shown in the table below:

AVERAGE ANNUAL INCREASE IN TOTAL SEAT KILOMETERS AVAILABLE FOR EACH LEBANESE AIRLINE

Airline	Average Annual Increase in Total Seat Kilometers Available	Share %
M.E.A.	71,800,000	73.5
Air Liban	15,306,000	15.5
L.I.A.	10,700,000	11.0
Total	97,806,000	100.0

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, pp. 230-232.

The average capacity in seat kilometers available on M.E.A. for every year during the period

1954-1962 was 280,422,000 seat kilometers.[1] The number of seat kilometers available in 1962 was over twice as much as the average capacity during this period.

The following table shows the number of hours that each type of aeroplane in use by M.E.A. was utilized. This table is interesting because it shows the phasing out of the DC-3 of which the average number of use per day dropped from 5:00 hours in 1955 to 1:55 hours in 1962; this reflects the impact of competition as well as the increase in maintenance required by these planes (the first DC-3 was produced in 1936). Similarly, the Viscounts were used 3:45 hours in 1955 but their use increased to 7:55 hours in 1960 then dropped to 6:10 hours in 1962.

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[1] In order to study the rates of growth of passenger kilometers operated by M.E.A., as well as the actual magnitude of growth on this airline, a straight line was fitted to the grouped annual data of seat kilometers available from 1954 to 1962. Equation (5) gives the formula of the line of best fit calculated by the method of least squares as shown in Table 33:

$$Y = 71{,}800{,}000\ X + 280{,}422{,}000 \qquad \text{Equation (5)}$$

The Y column of Table 33 gives the total annual seat kilometers available on M.E.A. for every year during the period 1954-1962.

DAILY UTILIZATION OF AIRCRAFTS BY M.E.A.

1955-1962

Aircraft	1955	1956	1957	1958	1959	1960	1961	1962
Comet	-	-	-	-	-	-	6:55	8:20
Viscount	3:45	6:35	6:30	6:15	7:50	7:55	6:00	6:10
DC-3	5:00	4:45	4:20	3:25	2:50	1:45	2:05	1:55
Hours Flown	11,652	11,879	15,158	21,003	23,702	22,885	21,800	20,646

Source: Middle East Airlines, 1962 Annual Report.

The Comet was used 8:20 hours in 1962 – its second year of operation.

The availability of seat kilometers on Air Liban has increased from 62.6 to 195.5 million between 1954 and 1962,[1] while the average number of seat kilometers available during the same period was 148.0 million.[2] However, the high rate of growth of seat kilometers available was not maintained all through this period, since between 1957 and 1959 there was an actual drop of 3.4 million followed by peak availability of 199.4 million in 1962. The available seat kilometers, in 1962, was 195.5 million or 33.0% more than the average availability during the period 1954-1962.

Lebanese International Airways started operations on January 1st, 1956, and has grown in capacity of passenger kilometers at a high percentage rate on the average during the period 1956-1962. The average rate of this growth during this

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[1] See Table 34 in Appendix B.

[2] Equation (6) gives the formula of line of best fit, calculated by the method of least squares detailed in Table 10 in Appendix B.

$$Y = 15{,}306{,}000\,X + 148{,}000{,}000 \qquad \text{Equation (6)}$$

period was 14.8%, based on an average availability of 72.1 million seat kilometers.[1] Figures of passenger kilometers for 1958 and 1960 are not available.[2]

It is to be noted that the figures of passenger kilometers available for each of the three airlines show a pattern of seasonality which is interesting to discuss. It is shown in Table 31 in Appendix B that the first quarter of every year is the lowest number of passenger kilometers available, while it is highest in the third quarter. This means that in the first quarter of every year, the airline is faced with a large number of unused seat kilometers available, a fact that adds to the difficulty in having a high load factor which is discussed in the following chapter. However, for a big airline, like American airlines, one would not expect to find such wide seasonal fluctuations due to the fact that a vast territory as that of the

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[1] See Table 29 in Appendix B.

[2] These years were calculated in Table 35 by interpolation from the formula of the line of best fit, by the method of least squares. The equation for this line is:

$$Y = 10{,}700{,}000\,X + 72{,}120{,}000 \qquad \text{Equation (7)}$$

U.S.A. there exist many sectors, and aeroplanes can be easily transferred from one sector to another. A relatively small airline operating in Lebanon, which is less than 0.1% of the area of the U.S.A. cannot hope to achieve the same performance.

Load Factors

As has been stated above, the three Lebanese airlines, and in spite of the many legs of journeys they make outside the Middle East area, are still typically regional airlines. It was found in Chapter II that traffic in the Beirut Airport, of which the three Lebanese airlines control 40%, varied considerably between one season and another. These factors are the classic elements in lowering the rate of utilization of available capacity and thus lead to a low load factor. This is on the demand side.

On the supply side, the three Lebanese airlines – now reduced by amalgamation to two – have gone into a big program of expansion in number of aircrafts and in total mileage covered. The output of an airline is a service measured in seat kilometers, i.e. it provides the passenger capacity in a defined number of seats per

aircraft over distances that vary from one sector to another. The length of the journey and point of arrival depend not only on traffic demand but also on the availability of airports, of suitable size for the aircrafts, and landing and uplifting rights granted to the airline by the local government. Usually these rights have to be reciprocated by the Lebanese Government. The right to land and uplift passengers from an airport outside Lebanon increases the number of seat kilometers available by the extent of the distance of the additional leg multiplied by the seating capacity of the plane. The seating capacity, as well as the distance travelled are, therefore, the determinants of the total service available by the passenger airline.[1] When a whole fleet of aeroplanes is being considered we must calculate, rather, the average seating capacity of the fleet and the average distance covered by it during the period of account.[2]

One can calculate the average number of passengers per flight from the figures of aircraft kilometers

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[1] Chapter III.

[2] Chapter II.

performed and passenger kilometers performed by the three Lebanese companies, using the figures of the International Civil Aviation Organization (See Table 41 in Appendix B).

The load factor can be calculated either by dividing total passenger kilometers performed by the seat kilometers available, or by dividing the number of passengers per aircraft by the seating capacity of the average aircraft.

The following table shows that during the period 1959-1962, load factors for Air Liban were higher than load factors for M.E.A. The load factors for Air Liban decreased continually from 1955-1958 – the period of the largest growth in the history of this company – but went up from 38.7% in 1958 to 48.2% in 1959 and remained at about the same level in the following three years.

The above mentioned table shows the comparative load factor for each of the three Lebanese passenger carriers for every year during the period 1954-1962, and load factor for all three airlines. It will be seen that the load factor is practically always below 50%. The load factor is the most important index of the efficiency of utilization of aeroplanes and

COMPARATIVE LOAD FACTORS FOR
EACH LEBANESE AIRLINE
1954-1962

Year	Total	M.E.A.	Air Liban	L.I.A.
1954	46.7	50.0	44.1	-
1955	46.0	45.0	46.7	-
1956	42.5	44.5	41.5	37.4
1957	44.5	49.7	40.2	40.2
1958	55.0	42.1	38.7	-
1959	46.0	46.6	48.0	40.7
1960	45.7	41.0	47.3	47.4*
1961	42.4	40.6	47.9	43.9
1962	45.1	43.9	48.2	46.7

* The quarter only.
Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, pp. 230-232.

therefore the profitability of the airline. Taking the international traffic as a whole, the load factor is on the average above 50% and is often as high as 60%.

The following table gives the overall load factor on all M.E.A. flights for passenger, cargo, and

OVERALL AND PASSENGER LOAD FACTORS

FOR MIDDLE EAST AIRLINES

1955-1962

Year	Overall Load Factor	Passenger Load Factor	Difference
1955	52	45	7
1956	49	45	4
1957	62	50	12
1958	49	42	7
1959	55	47	8
1960	51	41	10
1961	48	41	7
1962	53	44	9

Source: Middle East Airlines 1962 Annual Report.

other services. It will be seen that while these figures are higher than the passenger load factor alone, the differences (due to non-passenger services) do not exceed 12%.

CHAPTER IV

STRUCTURE OF THE INDUSTRY

As discussed in the previous chapters, the industry is composed of three active companies, i.e. Middle East Airlines, Air Liban, and Lebanese International Airways.

The industry as a whole operates a fleet of diversified aircrafts including DC-3's, DC-4's, DC-7's, Viscounts, Caravelles, Comets and a Boeing 720. Each of these types of aircrafts has different seating capacity, speed and utilization and, therefore, produces different seat kilometers per given time intervals.

The fleet operated by the industry, owned or chartered, is composed of aircrafts as in the following table.

This fleet was acquired by the airline industry over a long period of time (1945-1964), but through a process of buying, chartering, selling and releasing, the industry settled at the end of 1964 with the fleet referred to in the above mentioned table.

COMPOSITION OF THE LEBANESE AIRLINES FLEET END 1964

Type	Number
DC-3	5
DC-4	1
DC-7	4
Viscount	4
Caravelle	3
Comet	4
Boeing 720	1

Source: Middle East Airlines 1964 Annual Report.

The process of growth and decline in the number of aircrafts of individual companies in the industry can best be grasped by a study of the information in the table below.

COMPOSITION OF THE FLEET BY TOTAL INDUSTRY AND OPERATING COMPANIES

Year	Type	M.E.A.	Air Liban	L.I.A.
1952	DC-3	6	n.a.	
1955	Viscount	1 (chartered)		
	DC-3	6		
1956	DC-4	-		1
	DC-6	-	n.a.	1
	DC-3	6		-
	Viscount	1		-
1957	DC-3	6	n.a.	-
	Viscount	4		-
	DC-4	-		1
	DC-6	-		1

TABLE--Continued

Year	Type	M.E.A.	Air Liban	L.I.A.
1958-1960	DC-6		3	1 (chartered)
	DC-4		1	1
	DC-3		3	
1960	DC-3	6		
	Comet	2 (1 chartered)		
	Viscount	4		
1961	DC-3	6	3	-
	Viscount	4		-
	Comet	4		-
	DC-7	-		-
	Caravelle	-	1	-
	DC-6	-	2	-
	DC-4	-	1	-

TABLE--Continued

Year	Type	M.E.A.	Air Liban	L.I.A.
1962	DC-3	6		-
	Viscount	5		-
	Comet	4		-
	Caravelle		1 (chartered)	-
	DC-6		2	-
	DC-4		1	-
	DC-3	6	3	-
	DC-7	-	-	4
	Boeing	-	-	1
1963	DC-3	7	-	-
	DC-4	1	-	-
	DC-7	-	-	4
	Caravelle	3 (1 chartered)	-	-
	Comet	4	-	-
	Viscount	4	-	-
	Boeing	-	-	1

TABLE--Continued

Year	Type	M.E.A.	Air Liban	L.I.A.
1964	DC-3	5	-	-
	Viscount	4	-	-
	DC-4	1	-	-
	DC-7	-	-	4
	Caravelle	3	-	-
	Comet	4	-	-
	Boeing	-	-	1

Source: Middle East Airlines 1964 Annual Report.

The growth in the industry in as far as capacity is concerned can be seen from the above table as well as from the figures of seat kilometers available for the same period. These figures are shown in Table 39 in Appendix B.

In 1962, seat kilometers available for the whole air passenger industry in Lebanon was 892,701,000, while for M.E.A. alone this figure was 609,194,000 or 68.2% of the total seat kilometers available for the industry.

Capital

Authorized capital of M.E.A. was LL 18,750,000 as at 31st December 1963,[1] while operating profit was LL 7,083,918 or 37.8% of authorized capital. Basic of net profit for the year 1963, to capital as at 31st December, 1963, was 18.5%.[2]

Figures of capital and profit for L.I.A. and Air Liban are not available.

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[1] Toward the end of 1964, M.E.A. increased its capital to LL 25,000,000.

[2] 1963 Annual Report, published by Middle East Airlines.

Employment

During the years 1960-1962, the airline industry employed on the average about 3000 employees.

In 1962, the total employment in the industry was 3500 employees drawing salaries of LL 18,000,000.

> "The average salary in the industry is about LL 5200 a year or over LL 430 per month. This compares in the government with the salaries of a head of a section. The total annual expenditure on the staff including salaries amounts to over LL 25,000,000."[1]

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[1] Alamuddin, Sheikh Najib, "Air Transport Particularly as it Applies to Lebanon," Lecture December 13th, 1962.

CHAPTER V

CONCLUSIONS

The Beirut International Airport has been handling an ever increasing traffic. Thus, between the year 1955 and 1962 embarking passengers increased from 145,971 to 343,192, while disembarking passengers increased from 149,279 to 331,684 an increase of 135 per cent in embarking and 122 per cent in disembarking passengers.

Charts 1 and 2 in Appendix A show this growth in passenger traffic handled by the Beirut International Airport, and indicate a consistent increase in both embarking and disembarking passengers except for two recessions in 1956 and 1958 caused by the Suez Canal war and the local political disturbances respectively.

Concurrent with this general growth, the Lebanese airline industry also grew. Thus, between the year 1955 and 1962, embarking passengers using Lebanese airlines increased from 58,044 to 152,496,

while disembarking passengers increased from 56,004 to 148,535, an increase of 180 per cent in embarking and 165 per cent in disembarking passengers.

Thus, the Lebanese airline industry has been handling a bigger proportion of total traffic embarking from and disembarking in the Beirut International Airport.

To meet this general rise in traffic, the capacity of the Lebanese airlines had to grow. The fleet was expanded to include more planes, and, with the technological advances and the selective demands of passengers, faster and bigger planes were needed. This in turn necessitated longer trips, and therefore more sectors and longer legs were operated.

In 1955, the Lebanese airline industry offered a total capacity measured in seat kilometers of 159,395,000 increasing year by year to reach 892,701,000 in 1962 – an increase of 460 per cent over 1955. In 1955, the total Beirut International Airport passengers carried by the Lebanese airlines was 114,048 while in 1962 this figure increased to 301,000 as against a total Beirut International Airport traffic of 295,250 and 674,875 respectively.

The increase for the Lebanese airlines in the eight years starting 1955 was 164 per cent as against an increase in total traffic of 128 per cent.

It is obvious therefore that the Lebanese airlines are handling an increasing share of the traffic emanating from or ending in the Beirut International Airport.

Between 1955 and 1962 the capacity of the Lebanese airline industry expressed in terms of seat kilometers available increased by 460 per cent. The actual utilization of this capacity expressed in passenger kilometers actually performed increased from 73,351,000 to 402,954,000 or an increase of 450 per cent. The load factor dropped from 46 per cent in 1955 to 45.1 per cent in 1962, but the change in the load factor was not the same for all Lebanese airlines. Middle East Airlines, the biggest of the three companies, showed a load factor of 46.0 per cent in 1955 and 43.9 per cent in 1962, while Air Liban improved its performance from 46.7 per cent to 48.2 per cent during the same period. Lebanese International Airways showed a still better improvement from 1956 to 1962 of 37.4 per cent to 46.7 per cent. The reason why L.I.A. had a higher improvement in load factor lies in the fact that it was not in that

period a member of International Air Transport Association (I.A.T.A.), and could therefore offer cheaper fares.

None of the Lebanese airlines, however, had a load factor approximating the international average which was above 50 per cent. This low load factor for the three Lebanese airlines is chiefly due to competition among them, which in turn resulted in low profitability. Recently, however, Middle East Airlines and Air Liban amalgamated, and it is expected that both load factor and profitability will improve. Lebanese International Airways will continue to compete with M.E.A.-Air Liban until there will be amalgamation or a central authority to provide better sector planning and more efficient use of capacity.

A P P E N D I C E S

APPENDIX A CHART I

PASSENGERS EMBARKING 1952-1962 FROM BEIRUT AIRPORT

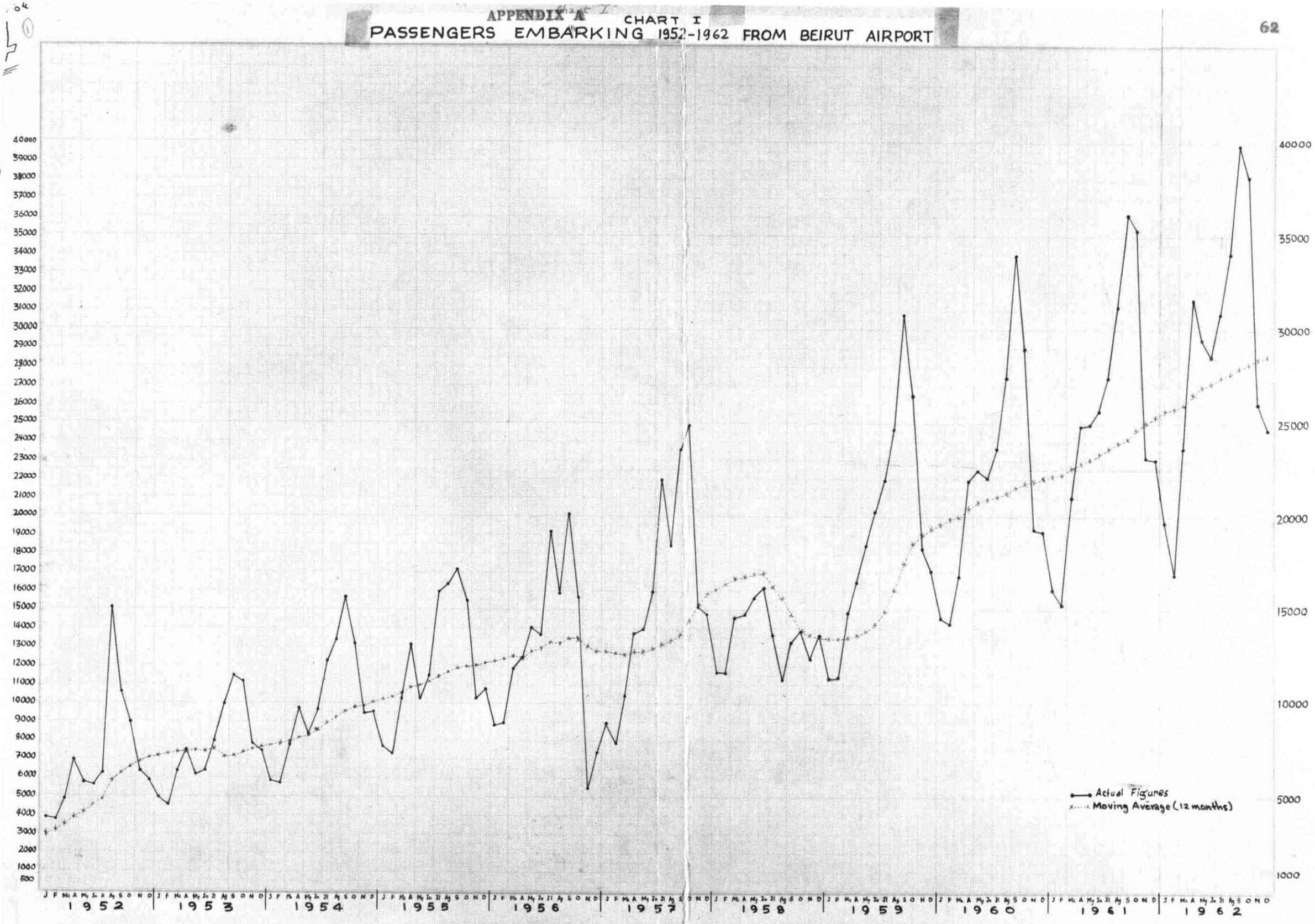


CHART II

PASSENGERS DISEMBARKING 1952-1962 IN BEIRUT AIRPORT

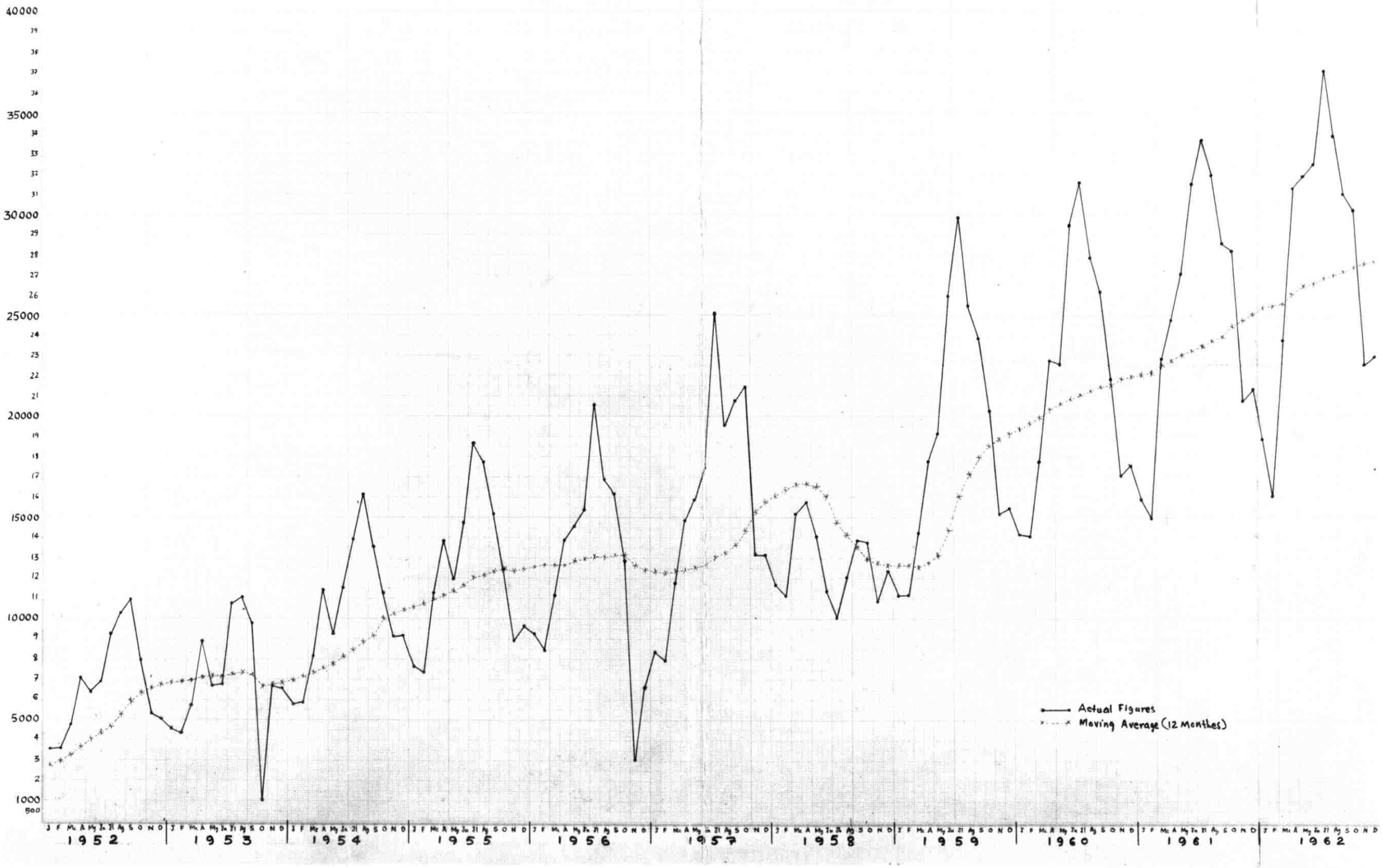


CHART III

SEASONAL PATTERN - PASSENGERS DISEMBARKING IN BEIRUT AIRPORT

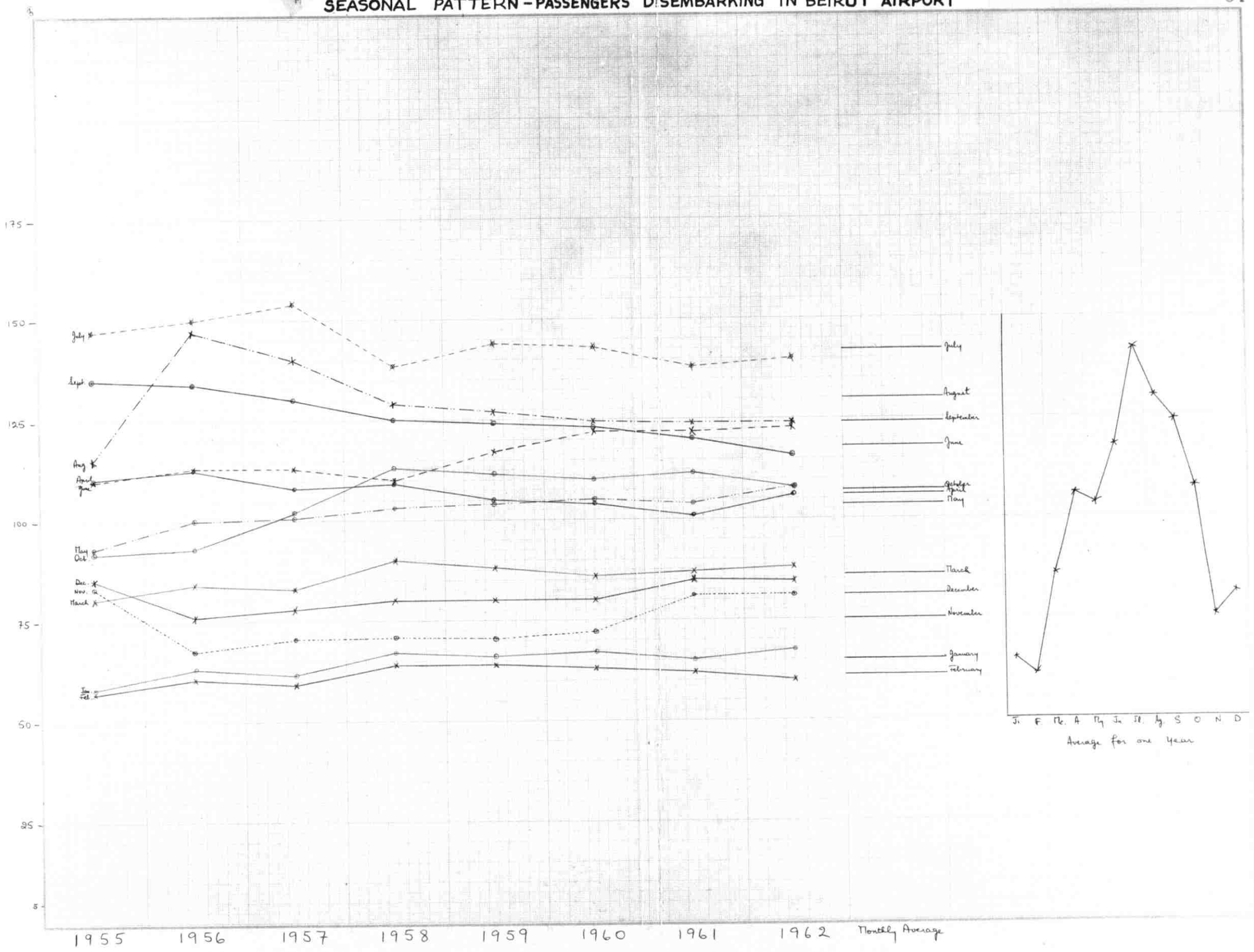


CHART XV

SEASONAL PATTERN - PASSENGERS EMBARKING FROM BEIRUT AIRPORT

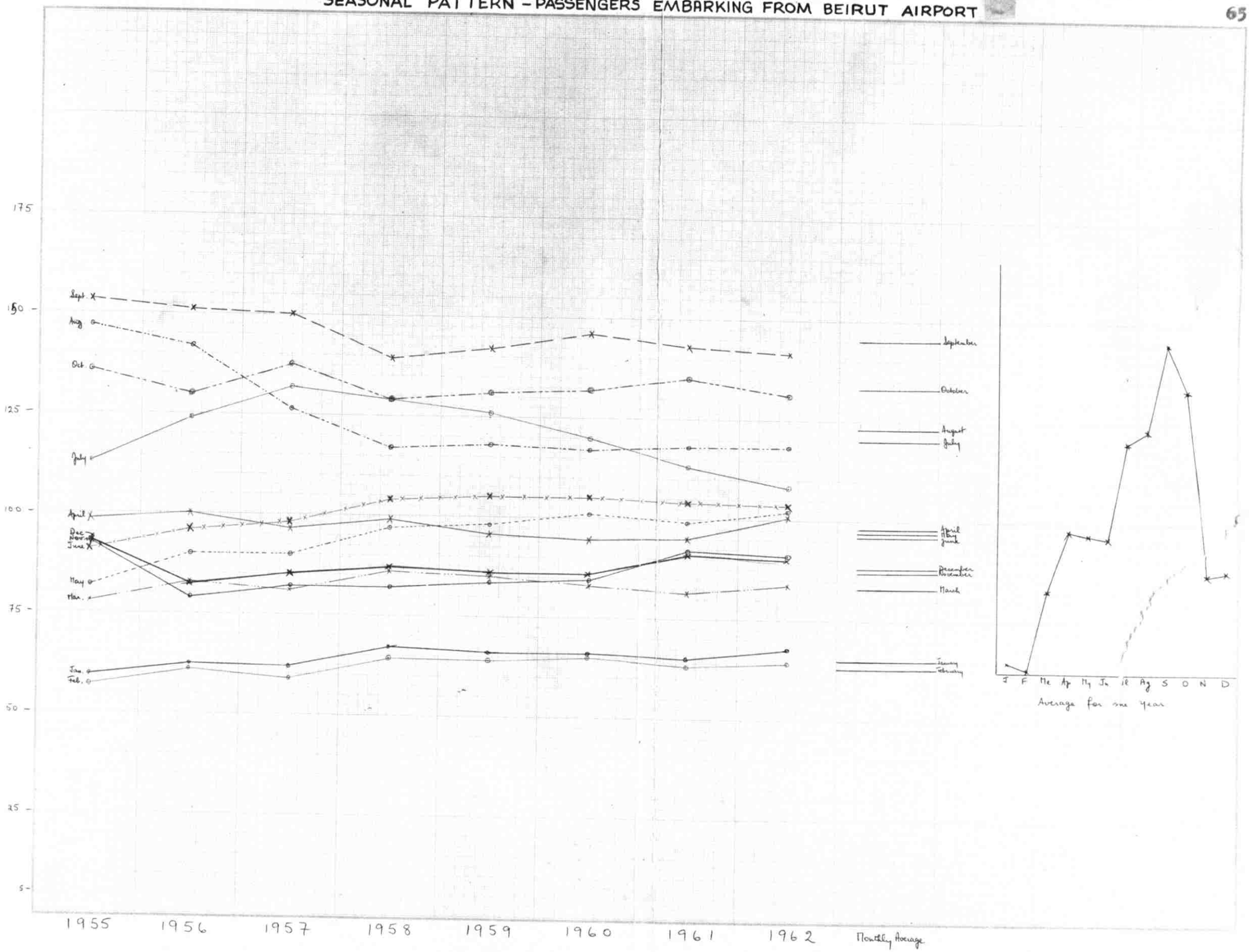
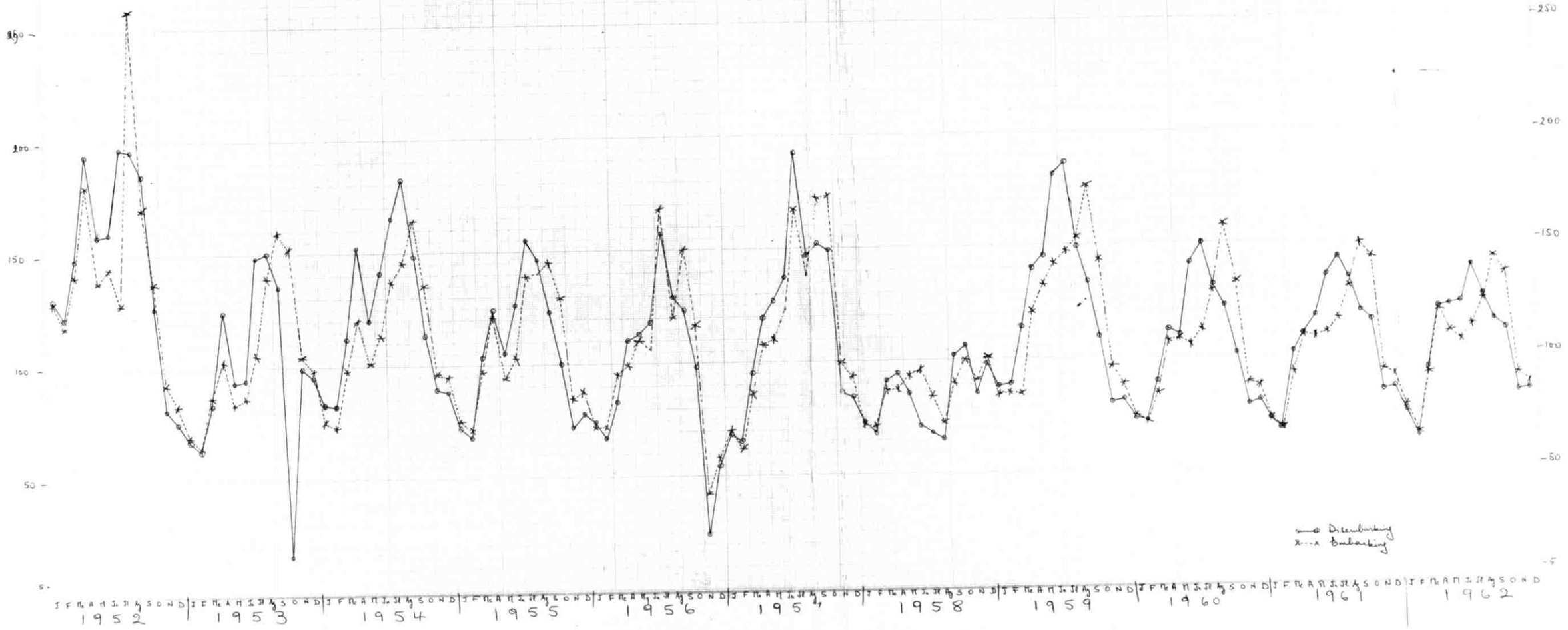


CHART V

SEASONAL FLUCTUATIONS FOR THE YEARS 1952-1962.
PASSENGERS EMBARKING & DISEMBARKING



APPENDIX B

TABLE 1

DISEMBARKING PASSENGER TRAFFIC (BEIRUT AIRPORT) - BY MONTH, BY YEAR

1952-1962

Year	January	February	March	April	May	June	July
1952	3540	3584	4769	7072	6311	6892	9218
1953	4593	4335	5772	8800	6677	6724	10781
1954	5766	5868	8189	11477	9278	11505	13921
1955	7625	7338	11287	13805	11943	14726	18676
1956	9293	8462	11172	13898	14561	15340	20588
1957	8351	7993	11753	14811	15871	17442	25065
1958	11676	11105	15179	15724	14083	11333	10055
1959	11139	11196	14259	17769	19122	25944	29866
1960	14190	14040	17760	22765	22591	29421	31548
1961	15008	14977	22838	24705	27076	31449	33601
1962	18865	16091	23724	31262	31899	32407	37060

Source: Direction of Civil Aviation, Lebanon.

TABLE 1--Continued

Year	August	September	October	November	December	Total for the Year
1952	10286	10912	7953	5311	5038	80886
1953	11026	9765	1044	6682	6537	82736
1954	16152	13570	11282	9103	9151	125262
1955	17733	15135	12458	8910	9643	149279
1956	16840	16162	12867	3037	6648	148868
1957	19581	20783	21449	13180	13180	189459
1958	12088	13877	13781	10809	12393	152103
1959	25482	23876	20214	15112	15482	229461
1960	27863	26186	21865	17064	17592	262885
1961	31910	28521	28199	20752	21314	301150
1962	33823	30971	30169	22509	22904	331684

Source: Direction of Civil Aviation, Lebanon.

TABLE 2

EMBARKING PASSENGER TRAFFIC (BEIRUT AIRPORT) - BY MONTH, BY YEAR

1952-1962

Year	January	February	March	April	May	June	July
1952	3831	3742	4829	6933	5738	6547	6218
1953	4957	4589	6352	7498	6176	6358	7949
1954	5810	5707	7795	9703	8343	9694	12272
1955	7671	7300	10212	13117	10277	11466	15945
1956	8805	8949	11877	12402	14005	13694	19176
1957	8975	7887	10889	13710	13942	15904	21973
1958	11617	11606	14580	14622	15634	16172	13631
1959	11311	11396	14837	16458	18416	20245	21911
1960	14557	14217	16763	21864	22453	22031	23661
1961	16018	15242	21092	24877	24912	25679	27413
1962	19641	16819	23606	31596	29440	28520	30843

Source: Direction of Civil Aviation, Lebanon.

TABLE 2--Continued

Year	August	September	October	November	December	Total for the Year
1952	15057	10542	8988	6315	5853	84593
1953	9915	11427	11193	7820	7482	91716
1954	13395	15675	13173	9484	9520	120571
1955	16352	17156	15448	10260	10767	145971
1956	15884	20101	15645	5485	7386	153409
1957	18413	23525	24896	15123	14776	190013
1958	11263	13264	13879	12383	13639	162290
1959	24681	30759	26451	18247	17079	231791
1960	27460	33971	28996	19282	19160	264415
1961	31205	36100	35332	23199	23081	304150
1962	34050	39842	38172	26013	24650	343192

Source: Direction of Civil Aviation, Lebanon.

TABLE 3

TWELVE MONTHS' MOVING AVERAGE FOR DISEMBARKING PASSENGER TRAFFIC

1952-1962

Month	1952	1953	1954	1955	1956	1967
January	2722.7	6828.2	6992.4	10593.4	12578.9	12327.7
February	2932.0	6890.8	7120.2	10715.9	12672.6	12288.1
March	3214.1	6974.4	7321.6	10974.1	12663.0	12336.4
April	3643.4	7118.4	7544.7	11168.1	12670.7	12412.5
May	4003.3	7148.9	7761.4	11390.2	12888.9	12521.7
June	4329.0	7134.9	8159.8	11658.6	12940.1	12696.9
July	4686.5	7265.2	8421.5	12054.8	13099.4	13070.0
August	5256.9	7326.8	8848.7	12186.6	13025.0	13298.4
September	5902.6	7231.2	9156.7	12317.0	13110.6	13683.4
October	6302.8	6655.5	10018.9	12415.0	13144.7	14398.6
November	6556.4	6769.7	10220.7	12398.9	12655.2	15243.9
December	6740.5	6894.7	10438.5	12439.9	12405.7	15788.2

TABLE 3--Continued

Month	1958	1959	1960	1961	1962
January	16065.3	12630.4	19375.9	22041.9	25350.6
February	16342.6	12638.0	19613.0	22120.0	25443.4
March	16610.1	12561.4	19904.7	22543.2	25517.2
April	16686.2	12731.8	20321.1	22704.8	26063.6
May	16537.2	13151.7	20610.2	23078.6	26465.6
June	16028.1	14369.3	20899.9	23247.6	26545.4
July	14777.3	16020.2	21040.1	23418.7	26833.7
August	14152.9	17136.3	21238.5	23755.9	26993.1
September	13577.4	17969.6	21431.0	23950.5	27197.2
October	12938.4	18505.7	21568.6	24478.3	27361.4
November	12740.8	18864.3	21731.2	24785.7	27507.8
December	12675.2	19121.7	21907.1	25095.8	27640.3

Source: Computed from Table 1 of this thesis, p. 67.

TABLE 4

TWELVE MONTHS' MOVING AVERAGE FOR EMBARKING PASSENGER TRAFFIC

1952-1962

Month	1952	1953	1954	1955	1956	1957
January	2970.9	7143.2	7714.1	10202.7	12258.7	12798.2
February	3174.3	7213.8	7807.2	10335.4	12396.2	12709.7
March	3436.6	7340.7	7927.5	10536.8	12534.9	12627.4
April	3861.3	7387.8	8111.2	10821.3	12475.3	12736.4
May	4170.6	7424.3	8291.8	10982.5	12786.0	12731.2
June	4550.4	7408.6	8569.8	11130.2	12971.7	12915.3
July	4865.3	7552.8	8930.1	11436.2	13240.9	13148.4
August	5827.0	7124.3	9220.1	11682.7	13201.9	13359.2
September	6214.6	7198.1	9574.1	11806.1	13447.3	13644.5
October	6549.1	7381.8	9739.1	11995.7	13463.7	14415.4
November	6833.1	7507.2	9877.7	12060.3	13065.8	15218.6
December	7049.4	7643.0	10047.6	12164.2	12784.1	15834.4

TABLE 4--Continued

Month	1958	1959	1960	1961	1962
January	16054.6	13498.7	19586.4	22156.3	25647.7
February	16364.5	13481.2	19821.5	22241.7	25779.2
March	16672.1	13502.6	19982.0	22602.5	25988.7
April	16748.1	13655.6	20432.5	22853.6	26548.6
May	16889.1	13887.4	20768.9	23058.5	26925.9
June	16911.4	14226.8	20917.7	23362.5	27162.7
July	16216.2	14916.8	21063.6	23675.2	27448.5
August	15620.4	16035.0	21295.2	23987.2	27685.6
September	14765.3	17492.9	21562.8	24164.7	27997.4
October	13847.2	18540.6	21774.9	24692.7	28234.1
November	13618.9	19029.2	21861.2	25019.1	28468.6
December	13524.2	19315.9	22034.6	25345.8	28599.3

Source: Computed from Table 2 of this thesis, p. 69.

TABLE 5

CORRECTION FACTOR FOR THE MONTH-BY-MONTH

DEVIATION OF THE NUMBER OF PASSENGERS DISEMBARKING IN BEIRUT FROM THE

MOVING AVERAGE FOR THE CORRESPONDING MONTH

Month	1952	1953	1954	1955	1956	1957
January	130.0	67.3	82.5	72.0	73.9	67.7
February	122.2	62.9	82.4	68.5	66.8	65.0
March	148.4	82.8	111.8	102.8	88.2	95.3
April	194.1	123.6	152.1	123.6	109.7	119.3
May	157.6	93.4	119.5	104.8	113.0	126.7
June	159.2	94.2	141.0	126.3	118.5	137.4
July	196.7	148.4	165.2	154.9	157.2	191.8
August	195.7	150.4	182.5	145.5	129.3	147.2
September	184.8	135.0	148.0	122.9	123.3	151.9
October	126.2	15.7	112.6	100.3	97.9	149.0
November	81.0	98.7	89.1	71.9	24.0	86.5
December	74.7	94.8	87.7	77.5	53.6	83.5

TABLE 5--Continued

Month	1958	1959	1960	1961	1962
January	72.7	88.2	73.2	71.7	74.4
February	68.0	88.6	71.6	67.7	63.2
March	91.4	113.5	89.2	101.3	93.0
April	94.2	139.6	112.0	108.8	119.9
May	85.2	145.4	109.6	117.3	120.5
June	70.7	180.6	140.8	135.3	122.1
July	68.0	186.4	149.9	143.5	138.1
August	85.4	148.7	131.2	134.3	125.3
September	102.2	132.9	122.2	119.1	114.0
October	106.5	109.2	101.4	115.2	110.3
November	84.8	80.1	78.5	83.7	81.8
December	97.8	81.0	80.3	84.9	82.9

Source: Computed from Table 1 of this thesis, p. 67.

TABLE 6

CORRECTION FACTOR FOR THE MONTH-BY-MONTH

DEVIATION OF THE NUMBER OF PASSENGERS EMBARKING IN BEIRUT FROM THE

MOVING AVERAGE FOR THE CORRESPONDING MONTH

Month	1952	1953	1954	1955	1956	1957
January	128.9	69.4	75.3	75.2	71.8	70.1
February	117.9	63.6	73.1	70.6	72.2	62.0
March	140.5	86.5	98.3	96.9	94.8	86.2
April	179.6	101.5	119.6	121.2	99.4	107.6
May	137.6	83.2	100.6	93.6	109.5	109.5
June	143.9	85.8	113.1	103.0	105.6	123.1
July	127.8	105.2	137.4	139.4	167.7	167.1
August	258.4	139.2	145.3	140.0	120.3	137.8
September	170.0	158.7	163.7	145.3	149.5	172.4
October	137.2	151.6	135.3	128.8	116.2	172.7
November	92.4	104.2	96.0	85.1	42.0	99.4
December	83.0	97.8	94.7	88.5	57.8	93.3

TABLE 6--Continued

Month	1958	1959	1960	1961	1962
January	72.4	83.8	74.3	72.3	76.6
February	70.9	84.5	71.7	68.5	65.2
March	87.4	84.4	83.9	93.3	90.8
April	87.3	120.5	107.0	108.9	119.0
May	92.6	132.6	108.1	108.0	109.3
June	95.6	142.3	105.3	109.9	105.0
July	84.0	146.9	112.3	115.8	112.4
August	72.1	153.9	129.0	130.1	122.9
September	89.8	175.8	157.5	149.4	142.3
October	100.2	142.7	133.2	143.1	135.2
November	90.9	95.9	88.2	92.7	91.4
December	100.8	88.4	87.0	91.1	86.2

Source: Computed from Table 2 of this thesis, p. 69.

TABLE 7

FIVE MONTHS' MOVING AVERAGE FOR DISEMBARKING PASSENGER TRAFFIC

Month	1955	1956	1957	1958
January	4522.4	6163.4	7125.6	8542.2
February	4439.4	5917.4	6799.2	8153.2
March	6280.2	8237.8	9634.6	11516.0
April	8614.8	11010.4	12558.2	13943.0
May	7240.2	9754.0	11666.0	13147.2
June	8566.2	11037.4	13147.4	14069.2
July	11504.8	14636.8	17806.2	17661.0
August	11727.6	14407.4	16266.4	16478.8
September	10509.2	13108.8	15083.0	15905.4
October	7177.4	9120.8	11820.0	14367.4
November	6454.8	6608.6	8182.4	9007.8
December	6639.6	7403.4	9031.8	10203.0
Yearly Average	7806.4	9783.9	11593.4	12749.5

TABLE 7--Continued

Month	1959	1960	1961	1962	Monthly Average
January	9616.8	10929.8	12232.8	14335.6	9183.6
February	9218.8	10334.4	11731.2	12728.4	8665.2
March	12730.0	14024.6	16357.8	18752.0	12191.6
April	15201.4	16993.4	19154.8	22445.0	14990.1
May	15116.0	17245.6	19748.6	22954.2	14609.0
June	16957.0	19896.0	23117.8	26110.8	16612.7
July	20850.0	23424.4	26027.0	28426.0	20042.0
August	16344.8	20370.8	23384.8	26233.2	18401.7
September	17966.6	20176.8	22648.6	24686.2	17510.6
October	16153.8	18035.2	21101.6	22845.6	15077.7
November	10209.6	11840.4	15383.4	17249.2	10617.0
December	11469.2	13059.0	15992.2	17937.0	11466.9
Yearly Average	14486.2	16360.9	18906.7	21225.3	14114.0

Source: Computed from Table 1 of this thesis, p. 67.

TABLE 8

FIVE MONTHS' MOVING AVERAGE FOR EMBARKING PASSENGER TRAFFIC

Month	1955	1956	1957	1958
January	4714.6	6214.8	7242.4	8575.6
February	4527.8	6057.4	6886.4	8289.8
March	6174.0	8213.0	9425.0	11070.6
April	7817.4	9930.6	11286.0	12710.8
May	6512.2	8907.8	10548.6	12440.2
June	7210.8	9551.8	11423.2	13386.0
July	8964.6	12312.0	15463.0	16599.4
August	11647.2	14120.6	14791.8	15061.4
September	12138.2	14980.2	17576.8	17944.2
October	10763.2	12897.4	16079.0	16616.2
November	7357.2	7872.8	9634.4	10547.0
December	7375.8	8201.6	9986.2	11217.6
Yearly Average	7933.6	9938.3	11695.2	12871.6

TABLE 8--Continued

Month	1959	1960	1961	1962	Monthly Average
January	9675.8	11053.0	12495.6	14628.8	9326.1
February	9427.6	10811.0	12069.6	13856.0	8990.7
March	12479.0	13789.2	15632.2	18175.6	11869.8
April	14061.8	15811.2	18306.2	21883.4	13975.9
May	14454.8	16890.0	19071.4	22171.0	13874.5
June	15496.2	17609.2	20006.2	22529.4	13651.6
July	18527.2	20070.4	21717.8	23491.8	17143.3
August	17318.6	19540.2	22604.4	25731.8	17602.0
September	20961.0	24324.0	27523.8	30787.2	20779.4
October	19271.8	21981.4	25918.8	28574.0	19012.7
November	12299.6	14104.0	17646.8	19824.8	12410.8
December	12729.4	14408.0	17547.0	19521.8	12623.4
Yearly Average	14725.2	16699.3	19211.6	21764.6	14271.6

Source: Computed from Table 2 of this thesis, p. 69.

TABLE 9

PASSENGER KILOMETERS
FOR THE MIDDLE EAST REGION
1952-1962
(by Quarters)

Year	Quarters in Thousands			
	1st	2nd	3rd	4th
1952	56283	60994	67192	63473
1953	78033	80807	97108	90865
1954	65201	108279	127296	87322
1955	86596	130137	165936	101110
1956	91453	142194	215946	140424
1957	120191	190755	275276	189204
1958	170541	269714	279909	206688
1959	188607	316590	376091	241372
1960	217858	340009	411789	289638
1961	248075	382701	546068	335809
1962	289677	524002	660538	370860

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, p. 19.

TABLE 10

PASSENGER KILOMETERS

FOR TOTAL TRAFFIC, LEBANON,

1952-1962

(by Quarters)

Year	Quarters in Thousands			
	1st	2nd	3rd	4th
1952	...	...	...	...
1953	...	...	...	...
1954	9791	12710	18221	11595
1955	10747	19370	26157	17077
1956	15797	25752	47267	25724
1957	23301	41486	61851	47123
1958+	34147	46840	47737	45771
1959	43579	66826	88362	68378
1960x	41407[a]	69979[a]	81370	59956
1961	59226	85893	120507	89128
1962	73113	112588	127990	89262

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, p. 54.

... Data not available.

\+ Excludes data for LIA (which accounted for about 15% of total operations in 1959).

x Provisional data.

a Excludes data for LIA for the months of January to March and April.

TABLE 11

CALCULATION OF STRAIGHT LINE BY METHOD OF LEAST SQUARES

PASSENGER KILOMETERS
FOR TOTAL TRAFFIC (1954-1962)
BY ALL LEBANESE AIRLINES

Year	Total (000) Y	Deviations From Middle X	Deviations Squared X^2	
1954	52315	- 4	16	- 209260
1955	73351	- 3	9	- 220053
1956	114540	- 2	4	- 229080
1957	172761	- 1	1	- 172761
1958	173776	0	0	0
1959	267145	1	1	267145
1960	252712	2	4	2505424
1961	354754	3	9	1064262
1962	402953	4	16	1611812
N = 9	$\frac{1864307}{9}$ = 207145	(0)	60	2617489

$a = \frac{\Sigma Y}{N} = 207145$

$b = \frac{\Sigma XY}{\Sigma X^2} = 43625$

$Y = 43625\ X + 207145$

TABLE 12

EMBARKING PASSENGERS

Year	Deviation from Middle Year X	Deviations Squared X^2	Traffic Average of Embarking Passengers Y	XY
1958+	- 3	9	(13524)+	
1959	- 2	4	19316	- 38632
1960	- 1	1	22035	- 22035
1961	0	0	25346	-
1962	1	1	28599	28599
1963	2	4	32569	65138
Σ		10	127865	33070

$$\frac{\Sigma Y}{N} = \frac{127865}{5} = 25573 \qquad \frac{\Sigma XY}{X^2} = \frac{33070}{10} = 3307$$

$$Y = 3307\ X + 25573$$

+ Estimated by projection from the straight line formula.

TABLE 13

CALCULATION OF STRAIGHT LINE TREND BY METHOD OF LEAST SQUARES EMBARKING PASSENGER TRAFFIC, BEIRUT, 1952-1962

Year	Deviation from Middle Year X	Deviations Squared X^2	Traffic: Average of Embarking Passengers Y	XY
1952	- 5	25	7049	- 35249
1953	- 4	16	7643	- 30572
1954	- 3	9	10048	- 30144
1955	- 2	4	12164	- 24328
1956	- 1	1	12784	- 12784
1957	0	0	15834	0
1958	+ 1	1	13524	+ 13524
1959	+ 2	4	19316	+ 38632
1960	+ 3	9	22035	+ 66105
1961	+ 4	16	25346	+ 101384
1962	+ 5	25	28599	+ 142995
N = 11	0	110	174342	229567

$$a = \frac{\Sigma (Y)}{N} = \frac{174342}{11} = 15849.3$$

$$b = \frac{\Sigma XY}{X^2} = \frac{229567}{110} = 2087$$

$$Y = 2087\ X + 15849$$

TABLE 14

CALCULATION OF TREND LINE BY METHOD OF LEAST SQUARES DISEMBARKING PASSENGER TRAFFIC, BEIRUT, 1959-1963

Year	Deviation from Middle Year X	Deviations Squared X^2	Traffic: Average of Embarking Passengers Y	XY
1959	- 2	4	19122	- 38244
1960	- 1	1	21907	- 21907
1961	0	0	25096	0
1962	+ 1	1	27640	+ 27640
1963	+ 2	4	31956	+ 63912
N = 5		10	125721	31401

$a = \frac{\Sigma Y}{N} = \frac{125721}{5} = 25144.2$ (annual rate of growth)

$b = \frac{\Sigma XY}{X^2} = \frac{31401}{10} = 3140.1$ (yearly increase)

$Y = 3140.1\ X + 25144$

TABLE 15

CALCULATION OF TREND LINE BY METHOD OF LEAST SQUARES DISEMBARKING PASSENGER TRAFFIC, BEIRUT, 1958-1962

Year	Deviation from Middle Year X	Deviations Squared X^2	Traffic: Average of Disembarking Passengers Y	XY
1958	- 2	4	12675	- 25350
1959	- 1	1	19122	- 19122
1960	0	0	21907	0
1961	+ 1	1	25096	+ 25096
1962	+ 2	4	27640	+ 55280
N = 5	0	10	106440	35904

$$a = \frac{\Sigma Y}{N} = \frac{106440}{5} = 21288 \text{ (annual rate of growth)}$$

$$b = \frac{\Sigma XY}{X^2} = \frac{35904}{10} = 3590.4 \text{ (yearly increase)}$$

$$Y = 3590.4\ X + 21288$$

TABLE 16

CALCULATION OF TREND LINE BY METHOD OF LEAST SQUARES EMBARKING PASSENGER TRAFFIC, BEIRUT, 1951-1957

Year	Deviation from Middle Year X	Deviations Squared X^2	Traffic: Average of Embarking Passengers Y	XY
1951	- 3	9	2760	- 8280
1952	- 2	4	7049	- 14098
1953	- 1	1	7643	- 7643
1954	0	0	10048	0
1955	+ 1	1	12164	+ 12164
1956	+ 2	4	12784	+ 25568
1957	+ 3	9	15834	+ 47502
N = 7	0	28	68282	55213

$$a = \frac{\Sigma Y}{N} = \frac{68282}{7} = 9754.6$$

$$b = \frac{\Sigma XY}{\Sigma X^2} = \frac{55213}{28} = 1972$$

$$Y = 1972\ X + 9754.6$$

TABLE 17

CALCULATION OF TREND LINE BY METHOD OF LEAST SQUARES EMBARKING PASSENGER TRAFFIC, BEIRUT, 1958-1962

Year	Deviation from Middle Year X	Deviations Squared X^2	Traffic: Average of Embarking Passengers Y	XY
1958	- 2	4	13524	- 27048
1959	- 1	1	19316	- 19316
1960	0	0	22035	0
1961	+ 1	1	25346	+ 25346
1962	+ 2	4	28599	+ 57198
N = 5	0	10	108820	36180

$$a = \frac{\Sigma Y}{N} = \frac{108820}{5} = 21764 \text{ (annual rate of growth)}$$

$$b = \frac{\Sigma XY}{X^2} = \frac{36180}{10} = 3618 \text{ (yearly increase)}$$

$$Y = 3618\,X + 21764$$

TABLE 18

CALCULATION OF TREND LINE BY METHOD OF LEAST SQUARES DISEMBARKING PASSENGER TRAFFIC, BEIRUT, 1952-1962

Year	Deviation from Middle Year X	Deviations Squared X^2	Traffic: Average of Disembarking Passengers Y	XY
X 1952	- 5	25	6740	- 33700
1953	- 4	16	6894	- 27580
X 1954	- 3	9	10438	- 31314
1955	- 2	4	12440	- 24880
1956	- 1	1	12406	- 12406
X 1957	0	0	15788	0
X 1958	+ 1	1	12675	+ 12675
1959	+ 2	4	19122	+ 38244
1960	+ 3	9	21907	+ 65721
1961	+ 4	16	25096	+ 100384
1962	+ 5	25	27640	+ 138200

N = 11

$$a = \frac{\Sigma Y}{N} = \frac{171147}{11} = 15558.8 \text{ (annual rate of growth)}$$

$$b = \frac{\Sigma XY}{X^2} = \frac{225344}{110} = 2048.6 \text{ (yearly increase)}$$

$$Y = 2049\ X + 15559$$

TABLE 19

PASSENGER KILOMETERS
PERFORMED BY THREE LEBANESE COMPANIES
1952-1962
(by Quarters)

Year	Quarters in Thousands			
	1st	2nd	3rd	4th
1952+	2799	4062	4323	3811
1953	...	...	...	...
1954x	9791	12710	18220	11595
1955x	10748	19368	26156	17079
1956	15799	25750	47267	25724
1957	23301	41487	61851	47123
1958x	33428	46841	47737	45770
1959	43575	66825	88362	68382
1960	41407x	66447x	81371	51697x
1961	59226	85893	120506	89127
1962	73113	112588	127990	89262

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, p. 54.

\+ Data only for M.E.A.

... Data not available for all three airlines

x Data excludes LIA

TABLE 20

SEAT KILOMETERS AVAILABLE ON M.E.A.
1952-1962
(by Quarters)

Year	Quarters in Thousands			
	1st	2nd	3rd	4th
1952	6003	6909	7673	9440
1953	...	...	...	...
1954	12073	12173	13128	12107
1955	12752	14016	19389	18358
1956	22590	29916	45489	27447
1957	28153	46017	57378	54209
1958	43749	78739	70356	69691
1959	70800	82206	88441	84717
1960	80403	83724	87387	76866
1961	124368	146430	155367	146169
1962	142624	156444	160445	149681

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, p. 232.

... Data not available.

TABLE 21

SEAT KILOMETERS AVAILABLE ON AIR LIBAN

1952-1962

(by Quarters)

Year	Quarters in Thousands			
	1st	2nd	3rd	4th
1952	...	...	...	...
1953	...	...	...	...
1954	15277	14362	19606	17392
1955	14412	25642	30007	24819
1956	19508	30705	44024	24199
1957	26115	40152	52066	46720
1958	35168	47237	43276	37721
1959	34692	49043	37143	40784
1960	37383	63210	52989	45812
1961	34425	45988	48140	42479
1962	39356	53598	54511	48025

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, p. 230.

... Data not available.

TABLE 22

SEAT KILOMETERS AVAILABLE ON L.I.A.

1956-1962

(by Quarters)

Year	Quarters in Thousands			
	1st	2nd	3rd	4th
1956*	4997	7559	9545	8309
1957	7894	11418	11879	6264
1958	...	...	...	...
1959	20947	22802	26166	22257
1960	...	...	...	...
1961	21222	21719	27601	22253
1962	18981	22744	24055	22237

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1962 International Civil Aviation Organization published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, p. 231.

... Data not available.

* Started scheduled operations on January 1st, 1956.

TABLE 23

PASSENGER KILOMETERS PERFORMED BY M.E.A.

1952-1962

(by Quarters)

Year	Quarters in Thousands			
	1st	2nd	3rd	4th
1952	2799	4062	4323	4911
1953	...	...	...	...
1954	5506	6379	7356	5457
1955	5351	7370	9321	6972
1956	7414	11678	23554	13206
1957	12037	21257	32488	26515
1958	21019	31449	28938	29083
1959	25613	36500	50760	39105
1960	26218	37998	41973	28576
1961	37501	54537	80560	59486
1962	52307	75413	84027	55793

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, p. 232.

... Data not available.

TABLE 24

PASSENGER KILOMETERS PERFORMED BY AIR LIBAN

1952-1962

(by Quarters)

Year	Quarters in Thousands			
	1st	2nd	3rd	4th
1952	...	...	...	...
1953	...	...	...	...
1954	4285	6331	10864	6138
1955	5397	11998	16835	10107
1956	7835	11935	19659	9668
1957	8037	15850	24724	17832
1958	12409	15392	18799	16687
1959	13552	22543	23245	18297
1960	15189	28449	27590	23121
1961	15552	22418	24247	19721
1962	15230	26803	29107	23172

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, p. 230.

... Data not available.

TABLE 25

PASSENGER KILOMETERS PERFORMED BY L.I.A.

1956-1962

(by Quarters)

Year	Quarters in Thousands			
	1st	2nd	3rd	4th
1956+	550	2137	3954	2850
1957	3227	4380	4639	2776
1958	...	...	...	...
1959	4410	7782	14357	10980
1960	...	...	11808	...
1961	6173	8938	15699	9920
1962	5576	10372	14856	10297

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, p. 231.

\+ Started scheduled operations on January 1st, 1956.

... Data not available.

TABLE 26

PASSENGER LOAD FACTORS OF M.E.A.

1952-1962

(by Quarters)

Year	Quarters in Percentage			
	1st	2nd	3rd	4th
1952	41.1	58.8	56.3	40.4
1953	...	...	...	...
1954	45.6	52.4	56.0	45.1
1955	42.0	52.6	48.1	50.8
1956	32.8	39.0	51.8	48.1
1957	42.8	46.2	56.6	48.9
1958	49.2	39.9	41.1	41.7
1959	36.2	44.4	57.4	46.2
1960	32.6	45.4	48.0	37.2
1961	30.2	37.2	51.9	40.7
1962	36.7	48.2	54.4	37.3

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, p. 232.

... Data not available.

TABLE 27

PASSENGER LOAD FACTORS OF AIR LIBAN

1952-1962

(by Quarters)

Year	Quarters in Percentage			
	1st	2nd	3rd	4th
1952	...	...	...	...
1953	...	...	...	...
1954	38.0	44.1	55.4	35.3
1955	37.4	46.8	56.1	40.7
1956	40.2	38.9	44.9	40.0
1957	30.8	39.5	47.5	38.2
1958	35.3	32.6	43.4	44.2
1959	39.1	46.0	62.6	44.9
1960	40.6	45.0	52.1	50.0
1961	45.2	48.7	50.4	46.4
1962	38.7	50.0	53.4	48.2

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, p. 230.

... Data not available.

TABLE 28

PASSENGER LOAD FACTORS OF L.I.A.

1956-1962

(by Quarters)

Year	Quarters in Percentage			
	1st	2nd	3rd	4th
1956+	11.0	28.3	41.4	34.3
1957	40.9	38.4	39.1	44.3
1958	...	...	...	...
1959	21.1	34.1	54.9	49.3
1960	...	...	47.4	...
1961	29.1	41.2	56.9	44.6
1962	29.4	45.6	61.8	46.3

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, p. 231.

\+ Started scheduled operations on January 1st, 1956.

... Data not available.

TABLE 29

SEAT KILOMETER AVAILABLE ON M.E.A.,

AIR LIBAN, AND L.I.A.

1954-1962

Year	Total	M.E.A.	Air Liban	L.I.A.
1954	112113	49476	62637	n.a.
1955	159395	64515	94880	n.a.
1956	269288	125442	118436	25410
1957	388125	185757	165053	37315
1958	425937	262535	163402	n.a.
1959	579998	326164	161662	92172
1960	552663	328380	199394	n.a.
1961	836161	572334	171032	92795
1962	892701	609194	195490	88017

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, pp. 230-232.

TABLE 30

SEAT KILOMETERS AVAILABLE ON
M.E.A., AIR LIBAN, AND L.I.A.
1952-1962

Year	M.E.A. Quarters			
	1st	2nd	3rd	4th
1952	6803	6909	7673	9440
1953	n.a.	n.a.	n.a.	n.a.
1954	12073	12173	13128	12107
1955	12752	14016	19389	18358
1956	22590	29916	45489	27447
1957	28153	46017	57378	54209
1958	43749	78739	70356	69691
1959	70800	82206	88441	84717
1960	80403	83724	87387	76866
1961	124368	146430	155367	146169
1962	142624	156444	160445	149681

TABLE 30--Continued

Year	AIR LIBAN Quarters			
	1st	2nd	3rd	4th
1952	n.a.	n.a.	n.a.	n.a.
1953	n.a.	n.a.	n.a.	n.a.
1954	11277	14362	19606	17392
1955	14412	25642	30007	24819
1956	19508	30705	44024	24199
1957	26115	40152	52066	46720
1958	35168	47237	432276	37721
1959	34692	49043	37143	40784
1960	37383	63210	52989	45812
1961	34425	45988	48140	42479
1962	39356	53598	54511	48025

TABLE 30--Continued

Year	L.I.A.+ Quarters			
	1st	2nd	3rd	4th
1952	n.a.	n.a.	n.a.	n.a.
1953	n.a.	n.a.	n.a.	n.a.
1954	n.a.	n.a.	n.a.	n.a.
1955	n.a.	n.a.	n.a.	n.a.
1956	4997	7559	9545	8309
1957	7894	11418	11879	6264
1958	n.a.	n.a.	n.a.	n.a.
1959	20947	32802	26166	22257
1960	n.a.	n.a.	24889	n.a.
1961	21222	21719	27601	22253
1962	18981	22744	24055	22237

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, pp. 230-232.

+ Started scheduled operations on January 1st, 1956.

TABLE 31

PASSENGER KILOMETERS PERFORMED BY

M.E.A., AIR LIBAN, AND L.I.A.

1952-1962

(by Quarters)

Year	M.E.A. Quarters in Thousands			
	1st	2nd	3rd	4th
1952	2799	4062	4323	3811
1953	n.a.	n.a.	n.a.	n.a.
1954	5506	6379	7356	5457
1955	5351	7370	9321	6972
1956	7414	11678	23554	13206
1957	12037	21257	32488	26515
1958	21019	31449	28938	29083
1959	25613	36500	50760	39105
1960	26318	37998	41973	28576
1961	37501	54537	80560	59486
1962	52307	75413	86027	55793

TABLE 31--Continued

Year	AIR LIBAN Quarters in Thousands			
	1st	2nd	3rd	4th
1952	n.a.	n.a.	n.a.	n.a.
1953	n.a.	n.a.	n.a.	n.a.
1954	4285	6331	10864	6138
1955	5397	11998	16835	10107
1956	7835	11935	19759	9668
1957	8037	15850	24724	17832
1958	13409	15392	18799	16687
1959	13552	22543	23245	18297
1960	15189	28449	27590	23121
1961	15552	22418	34247	19721
1962	15230	26803	29107	23172

TABLE 31--Continued

Year	L.I.A.+ Quarters in Thousands			
	1st	2nd	3rd	4th
1952	n.a.	n.a.	n.a.	n.a.
1953	n.a.	n.a.	n.a.	n.a.
1954	n.a.	n.a.	n.a.	n.a.
1955	n.a.	n.a.	n.a.	n.a.
1956	350	2137	3954	2850
1957	3227	4380	4639	2776
1958	n.a.	n.a.	n.a.	n.a.
1959	4410	7782	14357	10989
1960	n.a.	n.a.	11808	n.a.
1961	6173	8938	15699	9920
1962	5576	10372	14856	10297

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, pp. 230-232.

+ Started scheduled operations on January 1st, 1956.

TABLE 32

CALCULATION OF STRAIGHT LINE BY METHOD OF LEAST SQUARES SEAT KILOMETERS AVAILABLE FOR ALL LEBANESE AIRLINES 1954-1962

Year	X	X^2	Y	XY
1954	- 4	16	112113	- 448452
1955	- 3	9	159359	- 478077
1956	- 2	4	269288	- 538576
1957	- 1	1	388125	- 388125
1958	0	0	425937	0
1959	1	1	579998	+ 579998
1960	2	4	552663	+ 1105326
1961	3	9	836161	+ 2508483
1962	4	16	892701	+ 3570804
N = 9	6	60	4216347	5911381

$a = \frac{4216347}{9} = 468483$

$b = \frac{5911381}{60} = 98523$

$Y = 98523000\ X + 468483000$

TABLE 33

CALCULATION OF STRAIGHT LINE BY METHOD OF LEAST SQUARES SEAT KILOMETERS AVAILABLE FOR M.E.A. 1954-1962

Year	Total (000)	Deviations from Middle Year Y	Deviations Squared X^2	XY
1954	49476	- 4	16	- 197904
1955	64515	- 3	9	- 193545
1956	125442	- 2	4	- 250884
1957	185757	- 1	1	- 185757
1958	262535	0	0	0
1959	326164	1	1	326164
1960	328280	2	4	656760
1961	572334	3	9	1717002
1962	609194	4	16	2436776
N	2523797	0	60	4308612

$$a = \frac{\Sigma Y}{N} = \frac{2523797}{9} = 280422$$

$$b = \frac{\Sigma XY}{\Sigma X^2} = \frac{4308612}{60} = 71800$$

$$Y = 71800\ X + 280422$$

TABLE 34

CALCULATION OF STRAIGHT LINE BY METHOD OF LEAST SQUARES SEAT KILOMETERS AVAILABLE FOR AIR LIBAN 1954-1962

Year	Total (000)	Deviations from Middle Year Y	Deviations Squared X^2	XY
1954	62637	- 4	16	- 250548
1955	94880	- 3	9	- 284640
1956	118436	- 2	4	- 236872
1957	165053	- 1	1	- 165053
1958	163402	0	0	0
1959	161662	1	1	161662
1960	199394	2	4	398788
1961	171032	3	9	513096
1962	195490	4	16	781960
N	1331986	0	60	918393

$$a = \frac{\Sigma Y}{N} = 148000$$

$$b = \frac{\Sigma XY}{\Sigma X^2} = 15306$$

$$Y = 15306\ X + 148000$$

TABLE 35

CALCULATION OF STRAIGHT LINE BY METHOD OF LEAST SQUARES SEAT KILOMETERS AVAILABLE ON L.I.A.
1956-1962

Year	Total (000)	Deviations from Middle Year Y	Deviations Squared X^2	XY
1956	25410	- 3	9	- 76230
1957	37315	- 2	4	- 74630
1958	(61420) (estimated)	- 1	1	-
1959	92192	0	0	0
1960	(82820) (estimated)	1	1	-
1961	92795	2	4	185590
1962	88017	3	9	264051
N	360598	0	28	298781

$$a = \frac{\Sigma Y}{N} = 72120$$

$$b = \frac{\Sigma XY}{\Sigma X^2} = 10700$$

$$Y = 10700\ X + 72120$$

TABLE 36

CALCULATION OF STRAIGHT LINE BY METHOD OF LEAST SQUARES PASSENGER KILOMETERS PERFORMED BY MIDDLE EAST AIRLINES 1954-1962

Year	Total (000)	Deviations from Middle Year Y	Deviations Squared X^2	XY
1954	24698	- 4	16	- 98792
1955	29014	- 3	9	- 77042
1956	55852	- 2	4	- 111704
1957	92292	- 1	1	- 92292
1958	110489	0	0	0
1959	151978	1	1	151978
1960	134765	2	4	269530
1961	232084	3	9	696252
1962	267540	4	16	1070160
N	1098712	0	60	1808090

$$a = \frac{\Sigma Y}{N} = 122080$$

$$b = \frac{\Sigma XY}{\Sigma X^2} = 30135$$

$$Y = 30135\ X + 122080$$

TABLE 37

PASSENGER KILOMETERS PERFORMED

BY AIR LIBAN

Year	Y	Deviations from Middle Year X	XY	X^2
1954	27618	- 4	- 110472	16
1955	44337	- 3	- 133011	9
1956	49197	- 2	- 98394	4
1957	66443	- 1	- 66443	1
1958	63287	0	0	0
1959	77637	1	77637	1
1960	94349	2	188798	4
1961	81938	3	245814	9
1962	94312	4	377248	16
N = 9 (Σ)	599118	0	481177	60

$$a = \frac{\Sigma Y}{N} = \frac{599118}{9} = 66570$$

$$b = \frac{\Sigma XY}{X^2} = \frac{481177}{60} = 8020$$

$$Y = 8020\ X + 66570$$

TABLE 38

PASSENGER KILOMETERS PERFORMED

BY L.I.A.

Year	Y	X	XY	X^2
1956	9491	- 3	- 28473	9
1957	15022	- 2	- 30044	4
1958	23150 (estimated)	- 1	-	4
1959	37529	0	-	-
1960	34400 (estimated)*	- 1	-	-
1961	40730	2	+ 81460	4
1962	41101	3	+123303	9
N	143873	0	146246	26

$$a = \frac{\Sigma (Y)}{N} = \frac{143873}{5} = 28775$$

$$b = \frac{\Sigma XY}{X^2} = \frac{146246}{26} = 5625$$

$$Y = 5625\ X + 28775$$

* Estimated Normal Values.

TABLE 39

PASSENGER KILOMETERS FOR TOTAL TRAFFIC
BY ALL LEBANESE AIRLINES
1952-1962
(by Quarters)

Year	Quarters in Thousands			
	1st	2nd	3rd	4th
1952	n.a.	n.a.	n.a.	n.a.
1953	n.a.	n.a.	n.a.	n.a.
1954	9791	12710	18221	11593
1955	10747	19370	26137	17077
1956	15797	23752	47267	25724
1957	23301	41486	61831	47123
1958	34147	46040	57737	45771
1959	43579	66826	88362	68378
1960*	41407[a]	69979[a]	81370	59956
1961	59226	85893	120507	89128
1962	73113	112588	127990	89262

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, p. 54.

a For the months of January to March, and April 1960.

* Excludes data for L.I.A. (which accounted for about 15% of the total operations in 1959).

TABLE 40

AVERAGE SEATING CAPACITY IN THE LEBANESE AIR PASSENGER FLEET
1954-1962

Year	Total Seat Kilometers Available	Total Aircraft Kilometers	Average Seating Capacity
1954	112113	4310	26.0
1955	159395	4513	35.2
1956	269288	6119	43.4
1957	388125	8956	43.4
1958	425937	7961	53.5
1959	579998	12304	47.0
1960	552663	13810	40.2
1961	836161	14911	56.2
1962	892701	14632	60.8

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, pp. 230-232 and p. 54.

TABLE 41

PASSENGERS PER AIRCRAFT IN THE SCHEDULED

LEBANESE AIRLINES

1954-1962

(in Thousands)

Year	Aircraft Kilometers	Passenger Kilometers	Average Number of Passengers Per Aircraft
1954	4310	52315	12.1
1955	4513	73351	16.3
1956	6119	114540	18.7
1957	8956	172761	19.3
1958	7961	173776	21.8
1959[a]	12304	267145	21.7
1960[a]	13810	252712	18.3
1961	14911	354754	23.8
1962	14632	402954	27.5

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, p. 54.

Excludes data for L.I.A. (which accounted for 15% of total operations in 1959).

a For months of January to March, and April 1960.

TABLE 42

PASSENGER LOAD FACTORS
OF M.E.A., AIR LIBAN, AND L.I.A.
1952-1962
(by Quarters)

Year	M.E.A. Quarters in Percentage			
	1st	2nd	3rd	4th
1952	41.1	58.8	56.3	40.4
1953	n.a.	n.a.	n.a.	n.a.
1954	45.6	52.4	56.0	45.1
1955	42.0	52.6	48.1	50.8
1956	32.8	32.0	51.8	48.1
1957	42.8	46.2	56.6	48.9
1958	49.2	39.9	41.1	41.7
1959	36.2	44.4	57.4	46.2
1960	32.6	45.4	48.0	37.2
1961	30.2	37.2	51.9	40.7
1962	36.7	48.2	52.4	37.3

TABLE 42--Continued

Year	Air Liban Quarters in Percentage			
	1st	2nd	3rd	4th
1952	n.a.	n.a.	n.a.	n.a.
1953	n.a.	n.a.	n.a.	n.a.
1954	38.0	44.1	55.4	35.3
1955	37.4	46.8	56.1	40.7
1956	40.2	38.9	44.9	40.0
1957	30.8	39.5	47.5	38.2
1958	35.3	32.6	43.4	44.2
1959	39.1	46.0	62.6	44.9
1960	40.6	45.0	52.1	50.5
1961	45.2	48.7	50.4	46.4
1962	38.7	50.0	53.4	48.2

TABLE 42--Continued

Year	L.I.A. Quarters in Percentage			
	1st	2nd	3rd	4th
1952	n.a.	n.a.	n.a.	n.a.
1953	n.a.	n.a.	n.a.	n.a.
1954	n.a.	n.a.	n.a.	n.a.
1955	n.a.	n.a.	n.a.	n.a.
1956	11.0	28.3	41.4	34.3
1957	40.9	38.4	39.1	44.3
1958	n.a.	n.a.	n.a.	n.a.
1959	21.1	34.1	54.9	49.3
1960	n.a.	n.a.	47.4	n.a.
1961	29.1	41.2	56.9	44.6
1962	29.4	45.6	61.8	46.3

Source: Digest of Statistics No. 100, (Traffic Scheduled Services) Traffic, 1951-1963 International Civil Aviation Organization, published by the authority of the Secretary General of the International Civil Aviation Organization, Montreal, Canada, pp. 230-232..

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