THE DEMAND FOR BANANAS IN THE SYDNEY WHOLESALE MARKET *

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Marketing Section

1. SUMMARY

Wholesale prices of bananas in the City of Sydney Markets depend largely on the supply of this commodity. The relationship between supply and price has been remarkably stable during the period 1952 to 1957 (and figures available for 1958 suggest that this stability is continuing). It seems that during this period prices have been rather insensitive to such other factors as changes in costs, and changes in prices of competing products.

In the body of this paper an attempt is made to obtain quantitative relationships between supply and price. Changes in supply are shown to be responsible for 87 per cent of the variation in average monthly price. No significancant differences in the demand relationship were observed between the different seasons. However, there is some evidence that in November banana prices are higher than one would expect on the basis of the supply of bananas available.

The analysis suggests that marginal revenue for the industry as a whole (i.e., the additional gross revenue as supply increases) becomes zero when the monthly supply reaches 60,000 cases. It becomes negative if supplies increase beyond this level, but becomes positive again at a supply of approximately 90,000 cases or more.

2. INTRODUCTION

The banana is the only important fruit marketed in Sydney for which fairly reliable figures are available with regard to the price obtained and the quantity marketed. This note represents an attempt to measure the effect of changes in the quantity marketed on prices in the wholesale market.

McFarlane has already described the system of marketing bananas in this State.[1] It suffices to note here that until June 30, 1956, bananas were marketed in Sydney under the commission agent system, but since that date the Banana Growers Federation and its agents have been experimenting with a merchant system of trading whereby the amount returned to the grower is determined by a panel of growers and merchants' representatives who set a price range for each grade.

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[1] G. C. McFarlane, *Marketing N.S.W. Bananas,* 1955. This is a revised reprint of a series of articles in this *Review,* Vol. 19, Nos. 1, 2 and 3 (March, June and September, 1951).

Bananas are marketed in several grades according to size. These grades are "Small", "Sixes", "Sevens", "Eights" and "Nines", the number giving the length in inches. The prices collected daily by the Division of Marketing and Agricultural Economics of the New South Wales Department of Agriculture cover the most common grades of "Sixes", "Sevens" and "Eights". A weighted daily average for each grade is calculated, the weight being dependent on the reporting officer's assessment of the prices for each grade at which most sales occur. From these weighted daily averages an arithmetic monthly mean is calculated.

The prices used in this note, unless otherwise stated, are the monthly average prices in shillings per banana case for the grade "Sevens". It has been assumed that the price for this grade is a good indication of the price of bananas in general. The proportion of "Sevens" of the total supply shows some fluctuations, but these are not as wide as those of the proportion of either "Sixes" or "Eights".

The supply figures have been made available by the Banana Growers' Federation, which organisation arranges the transport of bananas from the main growing districts on the North Coast of New South Wales to Sydney. Supply figures for each month during the ten-year period from 1948 to 1957, inclusive, were available and were used for the estimates given below.

3. THE DEMAND CURVES

It may be noted that the curves obtained relate to wholesale demand and not to retail demand. Price fluctuations at the retail level are much smaller than at the wholesale level. Hence the demand relationship at the retail level will differ accordingly. However, retail prices suitable for analysis were not available.
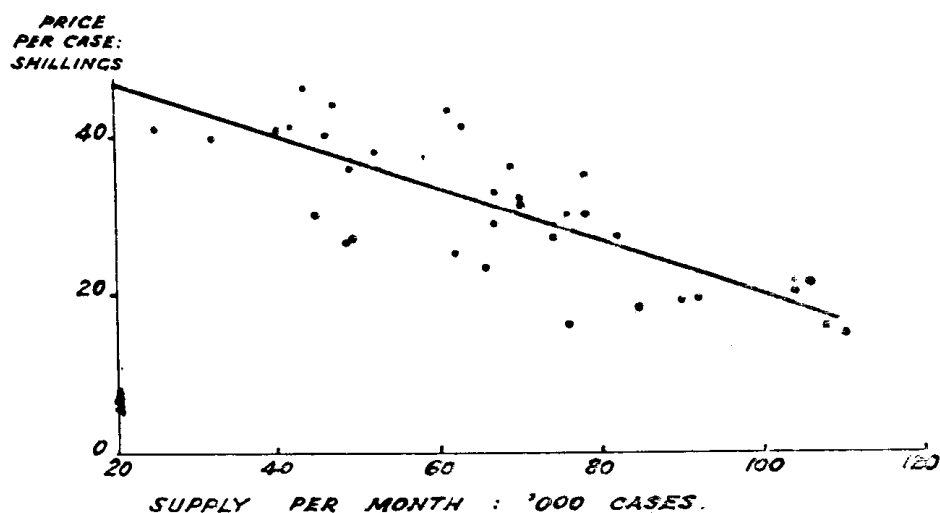

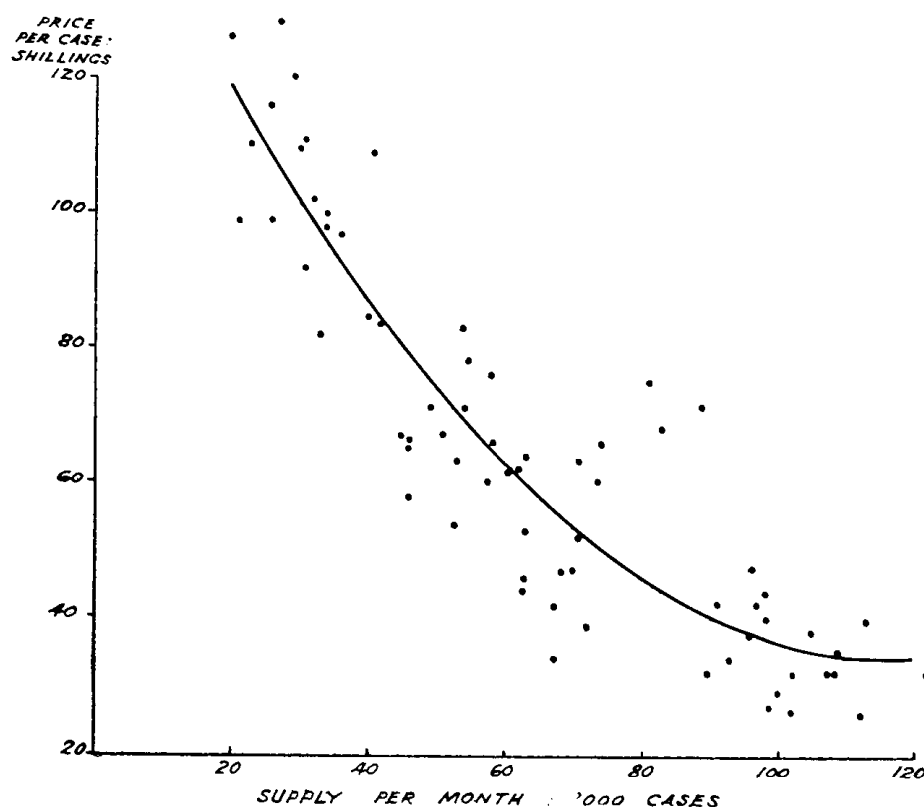Fig. 1. The Demand Relation for Bananas, 1948-50

Fig. The Demand Relation for Bananas, 1952-57

When the relevant data were plotted on a scatter diagram it became apparent that the ten-year period fell into two parts, namely, the period from 1948 to 1950 and the period from 1952 to 1957. The first period is shown in Figure 1, the second in Figure 2.

As might be expected in a period of inflation, the prices realised for a given quantity of bananas were considerably higher during 1952-57 than during the earlier period. In addition, demand was more elastic during 1948-50—in other words, a given increase in the quantity of bananas supplied to the market led to a relatively smaller reduction in price in 1948-50 than in 1952-57. The year 1951 was excluded from both periods used in the analysis because it appeared to be a year of transition.

Where y is the price in shillings per case of "Sevens" and x the monthly supply in thousands of cases, the curve of best fit for the period from 1948 to 1950 is given by the equation: $y = 53 - 0.293x - 0.0003x^2$ and for the period from 1952 till 1957 by: $y = 157 - 2.125x + 0.0092x^2$. The coefficients of multiple correlation were $R = 0.8104$ and $R = 0.9310$, respectively.

Further work was done only with the demand relation for the years 1952 to 1957. This equation was plotted on a logarithmic scale in Figure 3, so that the percentage change in price in response to a percentage change in supply can be read off easily.
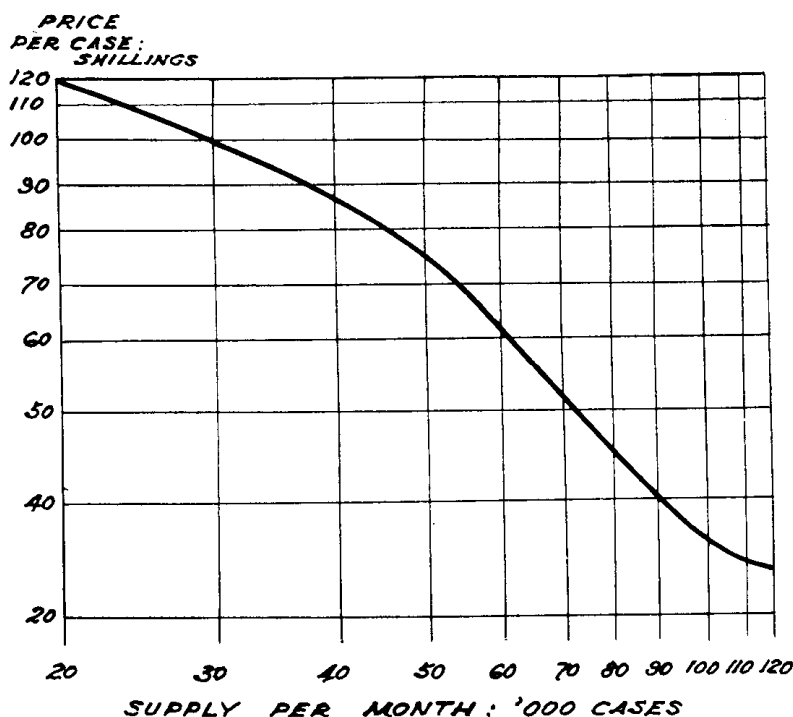
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PRICE
PER CASE:
SHILLINGS

SUPPLY   PER   MONTH : '000 CASES

**Fig.3.   Th Demand Curve for Bananas, 1952-57**
Double Logarithmic Scale

4. PRICE LEVEL ADJUSTMENT

To allow for the possibility that changes in price levels in the economy as a whole affected banana prices between 1952 and 1957, the latter were deflated by means of the Commonwealth Statistician's Wholesale Price Index of Basic Materials and Foodstuffs (all groups). However, when the adjusted prices were plotted against the supply on a scatter diagram (Figure 4) it soon became evident that the points for the last few years, which were adjusted downwards considerably, had a tendency to widen the scatter along the curve. It was apparent that prices for bananas had not followed the general trend upwards. This suggests that buyers and sellers tend to think in absolute prices rather than in prices adjusted to the price level in the economy as a whole. It was therefore decided to continue the analysis with unadjusted prices.

5. SEASONAL DIFFERENCES

It has been shown that the price of bananas exhibits a very strong seasonal pattern.[2] As prices and supplies of competing commodities are also subject to seasonal fluctuations, the possibility that the demand curve for bananas changes through the seasons, was examined. In order to determine whether these seasonal demand curves change significantly, the data were subjected to an analysis of variance. For this purpose four seasonal groups of three months were taken: Season I included the months of January, February and March, 1952 till 1957; Season II, April, May and June of the same years; Season III, July, August and September; and Season IV, October, November and December.

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[2] "Some Economic Aspects of Fruit Marketing", this *Review*, Vol. 26, No. 2 (June, 1958), p. 81.
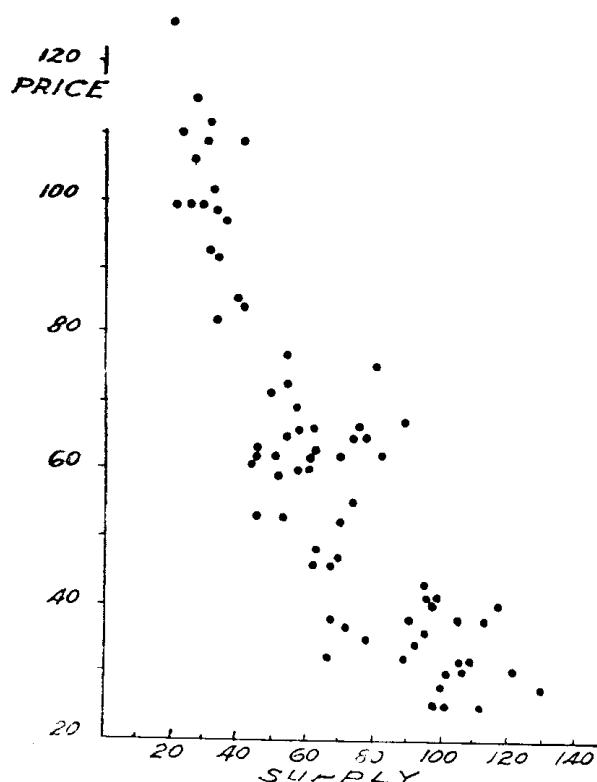
Fig. 4. Scatter Diagram of Adjusted Prices and Supply, 1952-57
Prices in Shillings per Case of "Sevens", Supply in '000 Cases per Month

The following regression equations were obtained: —

Season I—
$$y = 154.0 - 2.120x + 0.009328x^2, \quad R = 0.9168$$

Season II—
$$y = 153.9 - 2.182x + 0.010550x^2, \quad R = 0.9061$$

Season III—
$$y = 180.9 - 3,120x + 0.016174x^2, \quad R = 0.9442$$

Season IV—
$$y = 157.5 - 1.810x + 0.006183x^2, \quad R = 0.8462$$

It may be noted that Season IV, October, November and December, has a lower correlation coefficient than the other seasons. This is probably due to the fact that the observations for the month of November widen the scatter. Generally, prices obtained in November are higher than would be expected on the basis of the demand relationship shown here. This is probably caused by the fact that the supply of other fruit in the market at this time is rather small. Stocks of apples and pears in cool store are diminishing, while supplies of stone fruit do not yet arrive on the market in any great quantity.
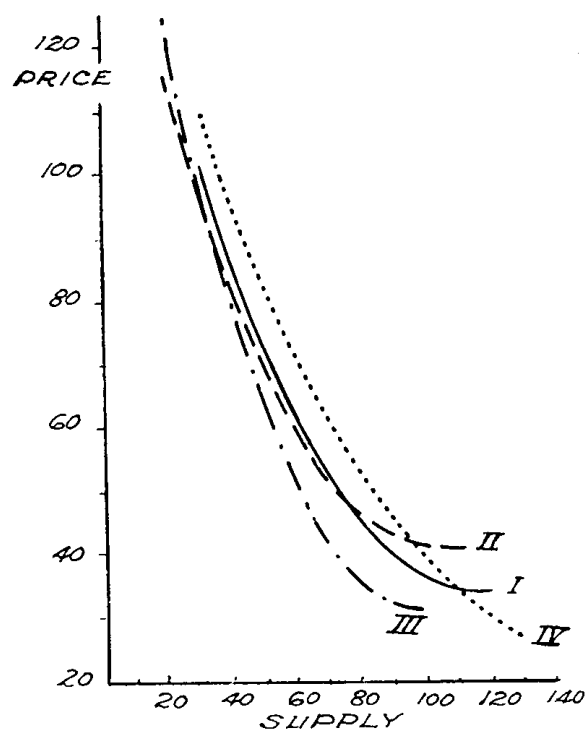
Fig. 5. Seasonal Demand Curves, 1952-57
I. January, February, March.   II. April, May, June
III. July, August, September.   IV. October, November, December

There are two ways in which the four seasonal curves could differ. Firstly, the regression coefficients may be different (i.e., the elasticity of demand as between different seasons) while, secondly, even if the slopes were comparable, the location of the curves relative to the axes may not be the same. The figures were therefore submitted to an analysis of variance.[3] As the values F, both for the differences in regression coefficients and for distances between the regression curves are lower than the 5 per cent. points, the evidence available would suggest that the one curve for the whole period, i.e., $y = 157 - 2.125x + 0.009187x^2$ fits the data as well as four separate seasonal curves. The result of the analysis of variance is given below:

Source of Variations	df	Sum of Squares	Mean Square	F	5% Points
Ascribable to regression	2	45,876	22,938	..	..
Differences in regression coefficients	6	987	164·5	1·34	2·25
Distances between regressions ..	3	772	257·3	2·11	2·76
Unaccountable	60	7,320	122·0..	..	..
Totals	71	54,955			

[3] M. H. Quenouille, M.A., *Associated Measurements* (London: Butterworths Scientific Publications, 1952), pp. 75-79.

The scatter diagrams and the equations for the four seasons are shown in graphs in the Appendix. Figure 5 shows the four seasonal equations superimposed on the one graph for purposes of comparison. As can be seen in Figure 5 there is little difference between the equations for seasons I, II and III whilst the equation for season IV stands apart somewhat from the others.

6. MARGINAL REVENUE

If one estimates the return to the grower by rather arbitrarily postulating a margin of 10 per cent. for rail freight and other marketing charges, a marginal revenue curve may be calculated (Figure 6). This curve shows the increase in total revenue in shillings for each additional case added to the supply at the Sydney wholesale markets. It may be noted here that when production units are small, as they are in the banana growing industry, the marginal revenue curve facing each individual grower is horizontal and equal to the price. The marginal revenue curve here pertains to the return to the industry as a whole.
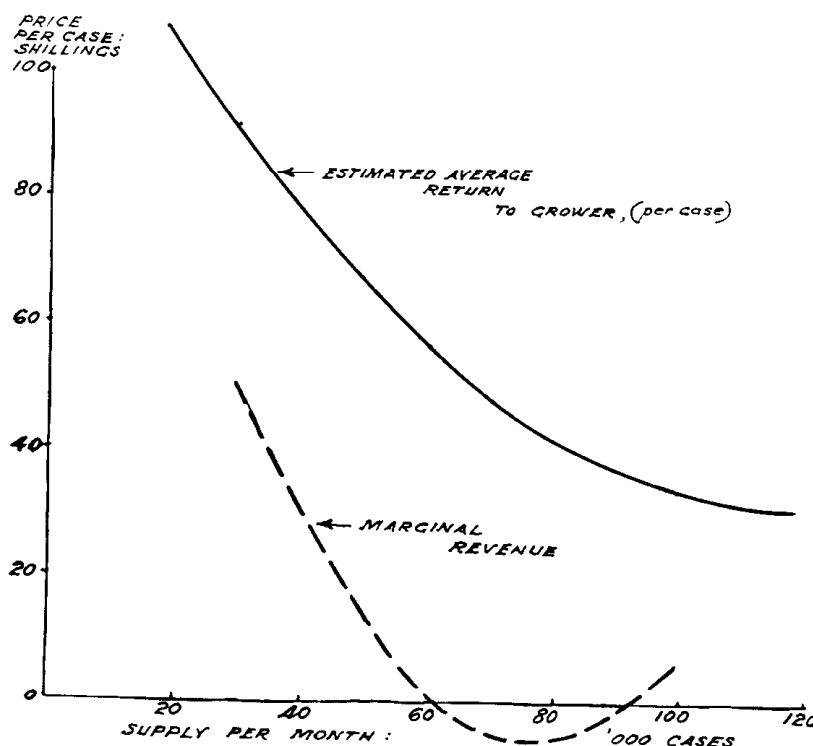

Fig. 6. Gross Return and Marginal Revenue, 1952-57

Underlying this curve, however, is the rather unreal assumption that the composition of the supply with regard to grades does not vary. This assumption is unreal because, usually, when supplies are high—that is during the summer months—the proportion of "Eights" will increase, while under less satisfactory growing conditions, there will be more "Sixes".

The marginal revenue curve in Figure 6 was derived graphically from the supply curve. The curve suggests that with a monthly supply of some 60,000 cases the marginal revenue is zero ; it becomes negative if supplies increase, but becomes positive again at a supply of approximately 90,000 cases or more.

No estimates pertaining to the marginal cost of producing and marketing bananas are at present available and therefore it is impossible to define where a marginal cost curve would cross the marginal revenue curve, *i.e.*, the optimum point as far as total return to growers is concerned. Figures collected at the Department of Agriculture's Duranbah Demonstration Plot over the year 1956-57 suggest that this curve lies somewhere near 20s. 0d.[4] This would suggest that with a supply of some 45,000 to 50,000 cases per month, the growers as a whole would maximise their incomes. While the return to the individual grower will increase if he supplies more fruit to the market, the total net return to all growers will diminish.

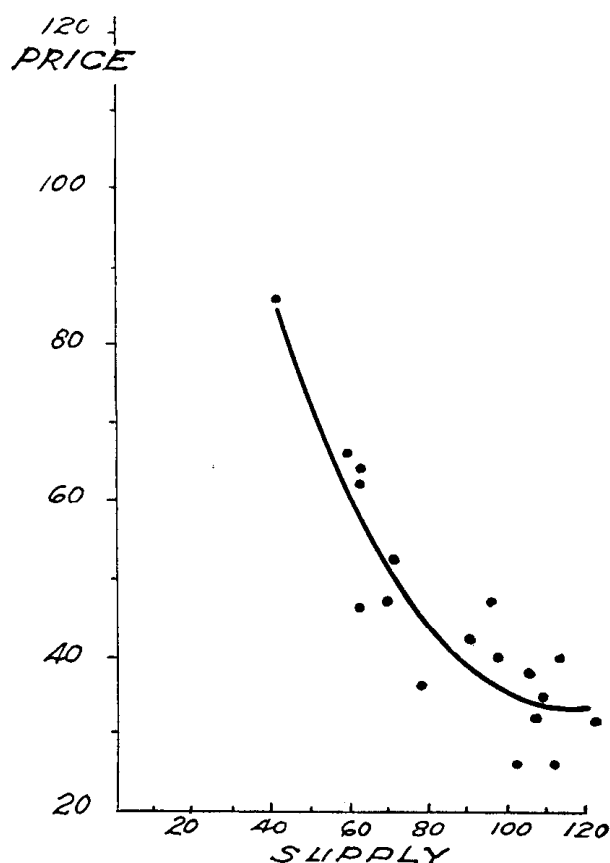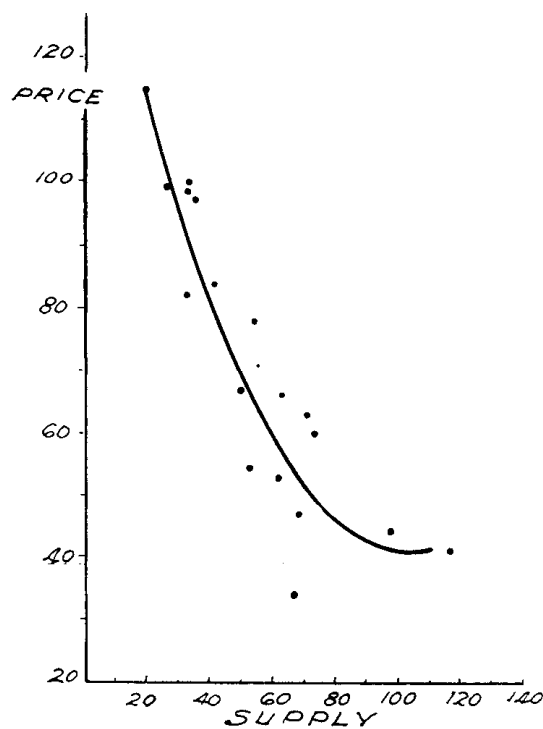## 7. APPENDIX, SEASONAL SCATTER DIAGRAMS AND EQUATIONS

Fig. 7.   Scatter Diagram—January, February, March, 1952-57
Prices in Shilling per Case of "Sevens", Supply in '000 Cases per Month

[4] Case 1s. 4d., other packing materials and freight 8s. 6d., labour for cutting and packing 6s. 0d., total 18s. 7d. per case.

Fig. 8. Scatter Diagram—April, May, June, 1952-57
Prices in Shillings per Case of "Sevens", Supply in '000 Cases per Month
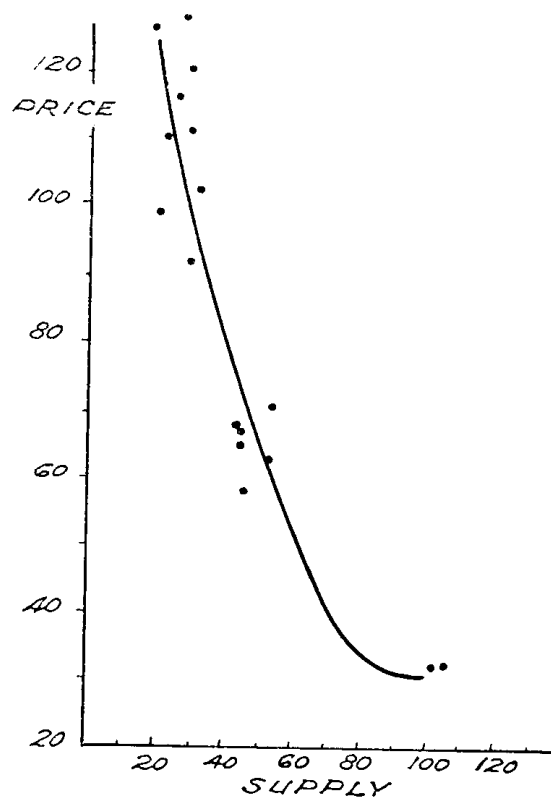
Fig. 9. Scatter Diagram—July, August, September, 1952-57
Prices in Shillings per Case of "Sevens", Supply in '000 Cases per Month
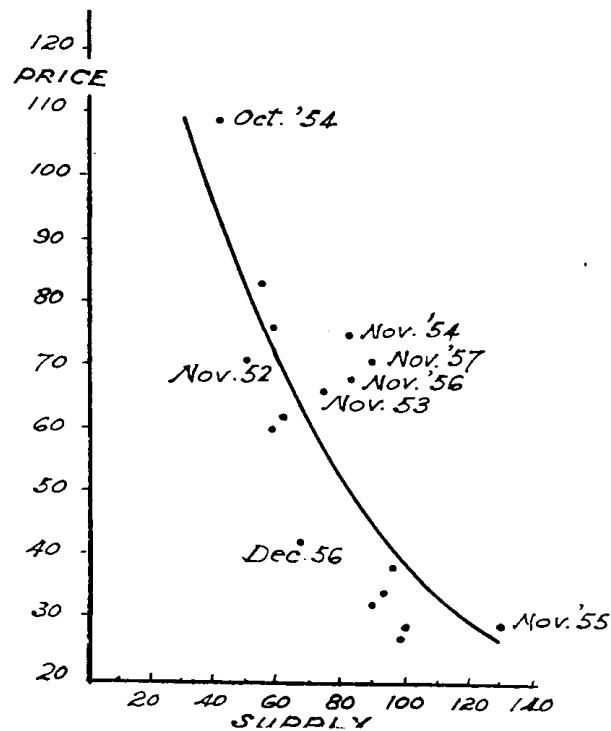
Fig. 10. Scatter Diagram—October, November, December, 1952-57
Prices in Shillings per Case of "Sevens", Supply in '000 Cases per Month