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A STUDY
OF
THE AGGREGATE SUPPLY FUNCTION
OF
NEW ZEALAND WHEAT

by

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INTRODUCTION

The acreage of wheat in New Zealand fluctuates quite markedly from year to year. The acreage grown depends upon economic conditions at the time of planting and certain technical factors. In this thesis an attempt has been made to identify the specific influence of certain of these economic and technical variables.

Reducing the discussion to its simplest terms, the aim of this thesis has been to answer such questions as:

"What is the effect on wheat acreage of 1d rise in the price of wheat?" or

"If the fat lamb schedule next year is 1/3d per lb., what will the effect on wheat acreage be?" or

"Given such and such conditions, what is the best estimate of the acreage which will be sown in wheat?"

and "What conditions are necessary in order that New Zealand should produce 100,000/200,000/300,000 acres of wheat?"

Answers to these questions are useful on two counts. Passively, administrators will wish to forecast domestic production when making arrangements to import wheat; and acreage has a big influence on production. Actively, administrators, or the Government, may wish to influence production and answers to the above questions will tell them the conditions under which this may be done.

The factors determining the price of wheat have been studied, as it was felt that the supply function for wheat could not properly be understood without some mention of these factors.

In attempting to estimate the influence of specific economic and technical factors on the acreage of wheat, there are two alternative methods which may be used. A sample of farmers can be asked how they reacted to different factors and which ones they considered to be the most important; or past records of important economic variables may be related to wheat acreage by statistical means.

The sampling method has a number of disadvantages. Firstly, it is only open to the investigator to discover what the farmer thinks is important in determining his production plans. Secondly, there are distinct "fashions" in farming opinion, so that a factor, say the shortage of labour, which looms large one year may be almost forgotten a year later. Thirdly, it is extremely difficult to aggregate the results of a survey as there is no common denominator to which replies of "not important", "very important" and "occasionally considered" can be reduced. The advantage of the survey approach is that it brings the investigator into close contact with producers, thus giving him a "feel" for farmer's behaviour and often revealing attitudes which would never have been deduced from purely theoretical considerations.⁽¹⁾

The disadvantages of the statistical or econometric approach are that lack of contact with producers may lead the

(1) For a very interesting survey of wheat farmers see: D.B. Williams, Ross Parish and A.G. Bollen, "Attitudes and Expectations of Wheatgrowers in New South Wales". Review of Marketing and Agricultural Economics, Vol. 21, (1953).

investigator to neglect one or more important variables, that satisfactory data may not be available for certain of the factors which should be used, and that changes in the structure of the economy may invalidate the estimates.

The main advantage of the econometric method is that numerical estimates of the influence of the different factors are obtained, and these estimates reflect the way farmers have behaved in the past, and not the way they think they have behaved.

These two alternative approaches are, of course, complementary. The time available for this thesis, however, meant that only one of the alternatives could be presented in any detail.

It was felt that the econometric approach would give a more useful answer to the problem being studied, or, in simpler terms, the answers to the questions outlined above would be simpler, more precise, and less subject to personal bias, if the econometric method were used.

That this conclusion was reached is not surprising as the writer was essentially interested in the econometric approach and the methodological problems involved in its practical use, and chose his subject accordingly. Had he been interested in problems of sampling or survey method he would have chosen another topic.

Another question which received consideration was whether to study certain "marginal areas" or total wheat acreage. It is, of course, the behaviour of the marginal areas that determines the changes in acreage from year to year and, in this sense, a study of them might provide an adequate answer to the questions asked. The marginal areas approach was rejected, however, as it was felt

that the designation of particular areas as marginal would be arbitrary, that the data for the "marginal areas" would be no more satisfactory than for total acreage, that after the 1951 harvest of 90,000 acres it was doubtful if the whole of the Dominion's wheat land should not be considered to be marginal, and that, in any case, it was the behaviour of total acreage which was of prime interest.

Chapter 1 shows that the price and quantity of wheat are not determined simultaneously, but successively. This means that the supply and demand functions may be considered separately.

The demand function has altered too often to be treated in any but a descriptive way. Thus, Chapter II is a survey of the factors which have determined the price of wheat in the period 1919-1953. This chapter does not claim to be a detailed essay in the economic history of the period, but it does present an account of the marketing arrangements over this period. The author had to make himself familiar with this material in order that he should be able to "feel at home" with the data used for the supply function. The information in this chapter is not essential to an econometric thesis, except as an argument against using econometric estimates to obtain a "supply function". It seemed possible, however, that a later student of the Wheat Industry might be saved considerable labour by the inclusion of this chapter.

The rest of the thesis is concerned with the estimation of the Supply Function for New Zealand Wheat. Chapter III deals in a general way with problems of specification, of multicolli-

nearity, and of auto-correlation of the error term.

Chapter IV discusses the specification of the supply function and the variables to be explored.

Chapter V presents the results of empirical testing of the data together with the results of a number of different hypotheses as to the supply function. All of the hypotheses are, of course, consistent with the empirical data.

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CHAPTER I

THE AUTONOMOUS NATURE OF THE SUPPLY AND DEMAND FUNCTIONS

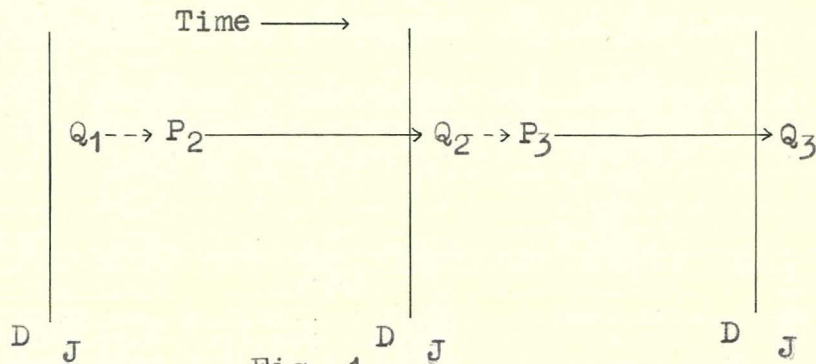
In this chapter certain salient features of growing and marketing wheat in New Zealand are discussed.

1.1 An Annual Crop.

Wheat is an annual crop, with a comparatively long period of production. Wheat is sown between April and July and is harvested in January-February. Preparations for sowing start as early as March so that the production period is, effectively, March-April to January-February. The decision to produce, which must be taken about March, will depend upon economic and technical factors. Once the acreage has been decided upon, the yield will respond almost exclusively to technical factors; that is to say, economic factors in or prior to March may affect the quantity of wheat produced by farmers the following January-February. Subsequent to March economic factors will have little effect on the quantity produced. There is an exception to the latter statement in that a very low price might lead farmers to refrain from harvesting their wheat.

When the production decision is made, there are two alternatives: either wheat price for the subsequent harvest is known or it is not. If wheat price for the subsequent harvest is known at planting it follows that it must be determined without

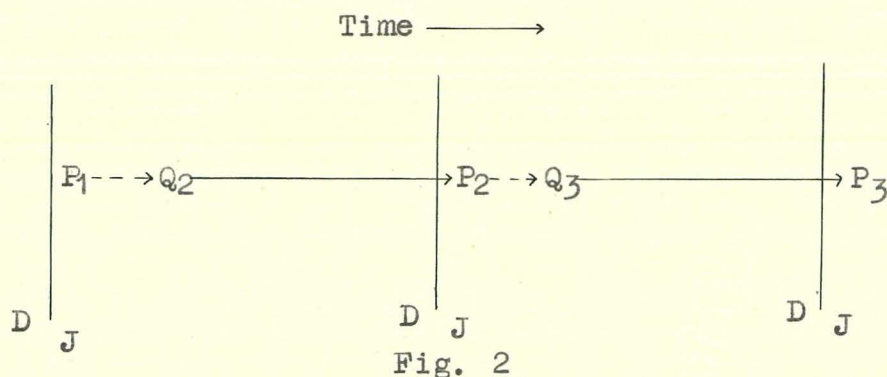
knowledge of the quantity produced. In this case wheat price will be independent of the quantity produced. Wheat acreage, however, will probably be affected by the price fixed. The price fixed for the next harvest may well have been influenced by the production or acreage of the last harvest. Thus this alternative might be represented diagrammatically



Where the Q's represent the quantity of wheat produced, either in bushels or acres, the P's represent the price fixed and the subscripts indicate that the P's and Q's refer to the same harvest. It will be noticed that the arrows indicate a one way causal relationship. In the diagram the full arrow indicates a definite, firm relationship, while the dotted arrow indicates a more tenuous relationship. Thus, in Fig. 1 wheat price for period two, P_2 , may be affected by the quantity produced the previous harvest, Q_1 . This tenuous relation is indicated by a dotted arrow, while the firm relation of the effect of P_2 on the quantity produced in the second period, Q_2 , is indicated by a full arrow.

The other alternative is that the price to be paid for next harvest is not known at planting. In this case the price for the previous harvest will probably influence the acreage sown, because producers tend to take present price as the best estimate

of future price, and the quantity produced at harvest will probably influence the price for that harvest. In this case the system might be represented:-



Again, this is a set of one-way causal relations. The essential difference between Figs. 1 and 2 is that in Fig. 1 P_2 affects Q_2 , while in Fig. 2 Q_2 affects P_2 .

The important point about these systems is that in neither case are price and quantity determined simultaneously. Either price affects acreage, or acreage (together with yield) affects price, but the situation where the same price and quantity affect each other contemporaneously does not occur. This means that it is possible to distinguish between the factors affecting price and the factors affecting quantity.

1.2 The Factors Determining Wheat Acreage.

Just which are the important factors determining the acreage of wheat, and just how important each factor is, are the main subjects studied in this thesis. For the moment it suffices to establish the fact that the acreage of wheat sown for threshing depends upon economic and technical considerations in the March prior to harvesting; that is, the acreage of wheat may be considered to be the dependent variable in the supply function for New Zealand wheat.

If price at harvest ever fell so low that it did not pay some farmers to harvest their crops, then price and quantity would be determined simultaneously, as the low price would tend to reduce the supply, while the reduced supply would prevent price falling further. In this case a system of simultaneous equations would have to be used. There is no evidence that this situation has occurred during the period studied.

In the next chapter the marketing of wheat for the period 1920-1953 is described. The number of times these marketing arrangements have been changed means that the demand function for New Zealand wheat is not susceptible to estimation by econometric methods.