PART I

THE SETTING

CHAPTER 1

THE BACKGROUND TO THIS STUDY

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1.1 Some Comments on Economic Growth

The processes of economic growth have long been a major topic of interest among economists. A high rate of economic growth is considered desirable as the major source of higher living standards. Further, economic growth is a key component in alleviating difficulties and distress in developing countries. Despite the considerable attention directed to the study of economic growth, the growth process is still inadequately understood. As evidence one can cite the continuing low rates of economic growth in developing countries and the tendency for many advanced countries to experience what has been termed "stagflation", low rates of growth and rapidly rising prices. Of course there is a multitude of economic, social and political factors involved in these situations but this merely serves to emphasise the complexity of the growth process, and to show that economic factors alone are only part of the growth problem.

The study of economic growth can be justified on the basis of it being an important objective of Government policy, and that Government will frequently take decisions that will influence the rate of economic growth. The period when Adam Smith's [28] "invisible hand" was sufficient to guide the economy has long since passed. This has been supplanted by an attitude of much greater responsibility and action on the part of Governments stemming particularly from the publication by Keynes of his General Theory in 1936 [21]. But frequently, policies aimed at influencing economic growth have repercussions on other aspects of the economy such as the balance of payments, the distribution of income, the level of employment and so on. Similarly action on these particular matters have an affect on economic growth.

Thus, policy making involves Governments choosing between alternative policies and the study of economic growth should lead to the selection of better policy packages. That is, the chosen policies will lead to results which accord more closely to the objectives of the society the Government represents. Recent years have seen a broadening of those objectives in many countries to include not only the rate of economic growth but a range of "quality of life" factors such as the level of pollution.

The rate of economic growth has been of continuing concern in Australia for the past few decades. During the 1950's the level of activity of the economy fluctuated considerably as it passed through a sequence of booms and recessions. Following the recession of the early 1960's there was some dissatisfaction with the management and performance of the economy, and Australia was not in a favoured position on the "Growth League Table". This led to the establishment of the so-called Vernon Committee [5] which was charged with the responsibility of examining a number of issues associated with the Government's economic policy objectives of "... a high rate of economic and population growth with full employment, increasing productivity, rising standards of living, external viability, and stability of costs and prices ..." [5, Preface].

1.2 Economic Growth and Technological Change

The study of economic growth in the past few decades originated with a paper in 1939 by Harrod [16][1]. This led to the so-called Harrod-Domar model in which the emphasis was on fixed capital-output ratios, which meant that growth in output was directly linked to the growth in the capital stock. Since that time, growth theory has evolved to take account of a much larger range of factors, for

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1 The evolution of growth theory referred to in this paragraph has been extensively discussed, for example, see the introductory sections in Sen [27], Hahn [14], and Stiglitz and Uzawa [32].

example, the role of labour inputs, the importance of factors influencing savings, and production technologies.

In 1957, Solow [29] published an article which had the effect of focusing considerable attention on the nature and importance of technological change in increasing productivity. Solow devised a simple means of estimating technological change based on the aggregate production function concept. He applied this model to data for the American non-farm sector, and for the period 1909 to 1949, concluded [29, p.320]:

> "Gross output per man hour doubled over the interval with 87½ per cent of the increase attributable to technical change and the remaining 12½ per cent to increased use of capital".

On the other side of the Atlantic, major developments in the area of technological change took shape during the 1950's. These were published in an outstanding contribution by Salter [26] in 1970. His study was more micro-oriented than Solow's, but reached similar conclusions. Salter's conclusions [26, Ch.10] placed primary emphasis on technological change as the explanation of different productivity movements in different industries. He also suggested that economies of scale were important. Although these results supported the conclusions of Solow, the method of analysis used by Salter has not been extensively employed in subsequent research on technological change.

The findings of Solow had a major impact because they tended to reverse the generally accepted order of importance of factors which increased productivity by saying that new technology is more important than new capital inputs. Such a proposition did not pass unchallenged as the spate of literature on technological change testifies[1]. Before considering the main directions taken by this research, the Solow model is briefly considered.

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1 For a synopsis of this literature and a comprehensive bibliography, see Kennedy and Thirlwall [20].

The Solow model in its simplest form can be expressed as [23]:

$$\frac{\Delta A}{A} = \frac{\Delta y}{y} - W_k \frac{\Delta k}{k}$$

where $\frac{\Delta A}{A}$ = technological change between two time periods,

$\frac{\Delta y}{y}$ = change in output per labour unit between two time periods,

$\frac{\Delta k}{k}$ = change in capital per labour unit between two time periods, and

W_k = the elasticity of production with respect to capital.

In essence, this attributes to technological change any output increase that cannot be explained by increases in capital and labour inputs. Within this model are assumptions which do not allow the technological change to be labour or capital saving (that is, the technological change is neutral between factors), that technological change is independent of factor inputs (that is, disembodied), that constant returns to scale apply, and that the factor markets are in equilibrium implying optimal use of inputs.

The Solow model, with its implied aggregate production function, is obviously involved in the controversy surrounding the aggregate production function concept. Likewise, the more refined models for studying technological change which are couched in an aggregate production function framework, are also involved[1]. In essence, this controversy revolves around the problems of aggregating heterogeneous inputs and outputs. While most of the literature relates specifically to the aggregation of capital, the problems also apply to the

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[1] These developments are referred to later in this section.

aggregation of labour and output. Furthermore, the multiplicity of types of capital, labour and output, makes most empirical analysis dependent on some form of aggregation. In this study, which is essentially empirical in nature, neo-classical aggregation procedures are employed and accepted as essential in carrying out the study. But at the same time, the imperfect nature of the aggregation procedures are recognised[1].

Following the original work of Solow the investigation of technological change has taken two general directions. The first has laid stress on aspects of the model used to estimate technological change and in particular has considered the following:

(i) Whether technological change has been neutral or non-neutral with respect to changing the labour capital ratio,

(ii) Whether technological change is disembodied, or embodied in the inputs,

(iii) Whether the ease with which input factors may be substituted for one another has changed or is important (measured by the elasticity of factor substitution), and

(iv) Whether economies of scale are important.

On each of these topics there has been considerable discussion, and substantial methodological developments have occurred. One important development was the constant elasticity of substitution (C.E.S.) production function which has provided a basis for analysis of some of the points listed above [1, 3]. The C.E.S. model has been quite extensively employed because of its relative ease of estimation and manipulation. But more generalised production functions which impose

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1 These few comments are merely intended to note the controversy and to establish the attitude taken in this study without getting involved in the intricacies of the debate. Those interested in the details will find Harcourt [15] an excellent starting point.

less restrictions on the form of the relationship, such as those discussed by Zellner and Revankar [35] for example, are not so easily used[1].

The Solow model identifies two sources of increased labour productivity, increased capital and "all other factors" termed "technological change" or the "residual". In effect this term gathers up a whole range of factors that influence labour productivity (including errors in the data and the model) and is of limited use in identifying areas where policy action may be taken to nurture and encourage technological change. Thus, the second main direction of development has been in identifying the components of technological change. The work of Denison [6, 7, 8], Griliches [9, 10, 11] and Jorgenson and Griliches [19] is notable in this regard[2], and considerable progress has been made, given the aggregated nature of the data and analysis. However, it might be speculated that further developments in identifying the sources of technological change are less likely to occur through aggregate analysis. Detailed data and models able to handle this detail are likely to be limiting in this regard. More successful research in terms of identifying sources of technological change and its repercussions is likely to come from more disaggregated analysis[3]. Slater's [26] methodology may be a useful starting point in this area.

So far, the discussion has been of general aspects relating to the economy as a whole. Attention now turns to the rural sector.

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1 More detailed discussion of these aspects along with comprehensive reference lists can be found in Brown [3] and Lave [23] for the period up to the mid-1960's and in review articles such as Nadiri [25] and Kennedy and Thirlwall [20] for more recent developments.

2 For further references, see Kennedy and Thirlwall [20].

3 The conclusions of Kennedy and Thirlwall [20] support this view.

1.3 Technological Change in the Rural Sector

After Solow, the study of technological change was soon directed to sectors of the economy, such as the rural sector. For example, in 1962 Chandler [4] and Lave [22] published estimates of technological change for the United States rural sector. These tended to confirm the over-riding importance of technological change as a source of increased labour productivity. In 1964, Herr [17] published results from the first study along these lines for Australian agriculture. These results indicated that technological change was of considerable importance in increasing the productivity of the Australian rural sector, but not to the same extent as for the United States, and correspondingly, capital formation was relatively more important. In 1966, Herr [18] compared Australia and the United States and suggested that technological change had been much less important in Australia than in the United States because of significant differences in the structure of the two agricultures, differing rates of out-migration of labour from the rural sector, and differences in the composition of output.

These findings suggest reasons why the study of technological change is important. Herr [18] commented that similar efforts to encourage technological change such as through research and education, may yield quite different responses in different countries. Likewise, different regions and even different rural industries may give different responses. It is then important to know why these differences exist. For example, is it because of the structure of industry? Is it because of institutional, or social factors? Is it the nature of the production processes in these industries? These are only some of the questions that can be posed, and answers to them are important in framing policies to counteract the adverse effects of technological change.

If technological change had uniform effects on labour productivity in rural industries throughout the world, the problems

created by technological change would be less acute. But because there are differences, those countries or industries which experience low rates of technological change, and low rates of growth of labour productivity will be disadvantaged. For example, as a result of technological change a country may find it is less competitive on world export markets; a particular industry may find itself less able to compete with other industries for resources; or a particular region may find itself unable to compete with other regions. An example of this latter case is provided by the N.S.W. North Coast dairy industry which was studied by Standen [30]. He concluded, [p.275]:

> "It was shown that more rapid technological advancement has probably occurred on dairy farms in other regions of Australia. This circumstance could have caused the North Coast to lose her comparative advantage in producing manufactured dairy products."

Relatively low rates of technological change, and slow growth in labour productivity, give rise to low farm incomes, possibly inefficient use of resources due to rigidities preventing rapid adjustment of resource use, and other related problems such as reduced educational opportunities for farm children. Government policies may therefore be needed to offset these undesirable results. These policies could entail appropriate welfare programmes as well as policies designed to remove impediments to more rapid technological change and to facilitate changes in the structure of farms, resource use and the like. The formulation of successful policies for these purposes is at least partly dependent on a thorough understanding of the agricultural development process of which technological change is an important component. Furthermore, the reverse may also be studied, that is, the impact of past policies on the rate of technological change, as a means of assessing the effectiveness of those policies. From these points of view, the studies of Herr were only a beginning in Australia.

1.4 The Beginning of This Study

This study began in 1968 and grew out of the earlier work of Herr [17, 18]. It had the general objective of analysing more fully the nature and effects of technological change in Australian agriculture to develop a greater understanding of the role and growth of the rural sector. The project was originally conceived to cover four aspects.

(i) To examine the data used by Herr for any deficiencies, to fill gaps in the capital series and extend the analysis beyond 1959.

(ii) To examine the Solow model used by Herr to check that the findings were not biased by the assumptions of that model.

(iii) To conduct a more detailed disaggregated analysis of the agricultural sector by considering regions and/or industries so far as data allowed.

(iv) To test additional hypotheses relating to factors influencing the rate of technological change such as those suggested by Standen and Musgrave [31], and to reassess those studied by Herr in the light of additional data and alternate models.

The early work was directed to the first two objectives outlined above. Initially, attention was directed to improving the data series, and this was achieved by extending Gutman's estimates [13] to 1966-67 using essentially the same procedures as Gutman. The resulting series were reported in Wilson [33] who used these data in a partial productivity analysis of the rural sector. This did not include any estimates of technological change.

The Wilson series provided the basis for the next stage of the project which included Solow model estimates of technological change, and some further estimates using the C.E.S. production function [2, 24]. The Solow estimates were quite similar to those of Herr [17], but this was not surprising given that the data used in both studies was essentially the same. The C.E.S. estimates

provided more interesting results, particularly in regard to the non-neutrality of technological change. Apart from some estimational difficulties associated with the C.E.S. functions, most reservations related to the data series.

The early phase of the project can be summed up as "false starts" and "learning by doing". Somewhat too much emphasis was placed on analysis using models other than that of Solow, while the poor quality of the data was overlooked at the beginning, but became apparent as the project proceeded. The resulting change in emphasis was implemented with the commencement of work on the subject matter of this thesis in 1972.

1.5 The Data Problem Reappraised

Apart from the extension of Gutman's data series by Wilson, no comprehensive set of input-output data for Australian agriculture has been published in recent years. Some data was compiled as part of the Monash study [12], while Young [34] compiled a series for the period 1948-49 to 1967-68, but did not publish the series. A number of other less comprehensive studies exist which will be referred to in the course of this study. However, a real need for a comprehensive compilation and assessment of the data appeared to exist.

In addition, there was a number of points relating to the existing series of Gutman [13] and Wilson [33] that caused concern. These included:

(i) the definition and measurement of output that did not take account of changing livestock inventories, or the on-farm production of capital goods (as distinct from current outputs for sale),

(ii) the measurement of labour input which did not take account of unemployment in the rural workforce, the amount of labour used in capital works as distinct from that used in current production, work performed off the farm, and variations in the intensity with which available labour was used,

(iii) the use of award wage rates rather than average earnings which will influence the allocation of output between capital and labour,

(iv) the estimates of the value of land and improvements to land, including the development of satisfactory price deflators to estimate these values in constant prices,

(v) the estimated stock of plant and machinery which was based on only some of the available information,

(vi) the livestock component of capital that included an unsatisfactory adjustment which deducted slaughterings from the estimated numbers of livestock in an endeavour to separate the capital and goods in process components of livestock capital,

(vii) the measurement of total capital input which made no allowance for the intensity of use of this capital, and for the use of capital, particularly plant and machinery, for effecting additions to farm capital, and

(viii) the inclusion of current costs unadjusted for that portion used for effecting capital works.

The points listed above cannot be considered complete but merely examples of the problems considered in reviewing all aspects of the data series. But they are fundamental considerations in measuring inputs and outputs, so that the compilation of the revised set of data began from first principles.

1.6 The Scope and Outline of This Study

The research was redefined to focus primarily on the compilation of a consistent set of input-output data for the Australian rural sector for the 50 year period 1920-21 to 1969-70. This was the major task and underlay the objectives relating to the analysis of technological change as outlined when this research commenced in 1968. Part II contains details of the compilation of the series.

In Part II, the research is reported in such a way as to achieve the following objectives.

(i) To check and clarify the concepts and definitions used, taking care to identify particular features which arise from the special characteristics of the agricultural sector;

(ii) to recognise the main inadequacies in the raw data and the estimates compiled therefrom;

(iii) to compile estimates using all available data so far as is possible. This will entail reconciling alternative estimates where possible, and if reconciliation is not possible, presenting alternative estimates;

(iv) to discuss the method and annotate the sources of all series in detail. This will facilitate the extension and revision of the series as more data becomes available. It will also make clear to other researchers, whether researching technological change or not, the precise basis of each estimated series. This is to minimise problems associated with using inappropriate data in analysis, and/or facilitate the ready modification of the series to an appropriate form;

(v) to discuss the estimated series in the context of available knowledge and comment on the development of Australian agriculture.

This part begins with a discussion of the concepts used in measuring inputs and outputs for the rural sector. A framework is presented to ensure consistency in the measurement of inputs and outputs. Subsequent chapters discuss the compilation of the individual series. Labour inputs are considered first in Chapter 3, followed by estimates of total labour payments. The capital components land and improvements, livestock and plant and machinery are considered in Chapters 5 to 7 respectively. The final chapter in this part considers the estimates of rural output.

Part III undertakes a limited amount of analysis of the series. The analysis centres on capital formation in the rural sector and technological change. These two aspects are closely related in that there is a strong interaction between technological change and capital formation, and as indicated earlier, these are the key ingredients of increased labour productivity. Neither the study of capital formation, nor technological change reported in this part is complete. The discussion serves to open up these topics for further research and to provide a basis for discussing the trends in the series compiled in Part II.

Chapter 9 begins by bringing together the individual component series compiled in Part II. Estimates of net and gross capital formation in the rural sector are then compiled. These are reconciled with other estimates of rural investment. Some capital formation results from the use of on-farm capital, labour, and purchased current inputs. Estimates are made of the amount of on-farm capital production, and of the amount of labour, capital and purchased current inputs used for these purposes. The chapter concludes with a discussion of the estimates of investment in relation to events both within the rural sector, and in the economy generally.

Technological change is considered in Chapter 10. In this chapter the main emphasis is on Solow model estimates of the rate of technological change for the rural sector. Estimates are calculated using a number of alternative data sets which include some checks on the sensitivity of the estimated rate of technological change to variations in the estimates of the main variables.

The concluding chapter is a brief review and evaluation of the results obtained in this study. The final section specifies a range of research topics that may be developed using the data series developed in this study and makes some suggestions for further study of technological change in Australia's rural sector.

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PART II

THE DATA

CHAPTER 2

AN OVERVIEW OF THE DATA PROBLEM

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2.1 The Main Data Sources

The Australian Bureau of Statistics (A.B.S.)[1] is the main source of rural statistics in Australia. They are based on two major sources of data, namely the Agricultural and Pastoral Census (A & P Census), and taxation returns.

A & P Census based statistics are available for the whole period covered by this study. Each State statistical office collects statistics for its particular State and since 1943, these activities have been co-ordinated so that all states collect a relatively uniform set of statistics. Prior to that date, there were differences in collection date, questions asked, and the like. The census is intended to cover all farms, but the coverage is usually less than that. A further deficiency is that farmers fill the forms in themselves. These factors give rise to the possibility of error as discussed by Youngman [21]. While the size of these errors is likely to be small, actual evidence of this is lacking. The data collected is mainly referred to as physical with very little financial data being collected. Up to the 1940's, data on the value of plant and machinery was collected, while wages paid data was collected in some States throughout the 1920-21 to 1969-70 period. The data from the A & P Census have been published in the annual Rural Industries Bulletin[2].

The physical production data, along with estimated product prices at the wholesale markets, provide the basic data for estimating

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1 Formerly the Commonwealth Bureau of Census and Statistics.

2 Over the period covered in this study, the title of this Bulletin has changed several times; see reference [4] for details.

the gross value of farm production. Youngman [21] discussed aspects of the collection of wholesale prices and pointed to possible differences in method employed by various States, but where there was a marketing scheme involving pricing arrangements such as for wheat and dairy products, there were less problems in establishing uniform price estimates. This estimate is available throughout the period, as are estimates of certain costs. A disaggregation of costs into marketing costs, seed and fodder, and materials is available since 1932-33. However, Youngman [21] warns that these costs are not based on survey data but are compiled in the office from information that is already available. Thus, the cost estimates are suspect. In recent years, these estimates have been published in the Value of Production Bulletin[1].

Additional financial data has been available in the A.N.A. [1] since 1948-49[2]. Some items including the gross value of farm production, marketing costs and seed and fodder expenses are basically identical to those published in the Value of Production Bulletin. However, the A.N.A. estimates employ a wider definition of costs for which a variety of sources are used including taxation statistics, and Bureau of Agricultural Economics (B.A.E.) farm surveys[3]. The A.N.A. estimates of depreciation are based on taxation rates which have been subject to variation for policy purposes and so need not reflect actual depreciation rates. Likewise, the difficulties of separating the operations of the farm business from the farm household will introduce certain

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1 The title of the publication containing these estimates has also varied over the period; see reference [5] for details.

2 A limited amount of A.N.A. data is available since 1938-39 [1].

3 See Youngman [21] for details of the compilation of certain farm sector statistics for the 1947-48 to 1951-52 period, and Juhasz and Hillsdon [13] for the 1948-49 to 1960-61 period.

biases into cost estimates as farmers attempt to attribute farm household costs to the farm business to reduce taxation payments. Finally, taxation statistics are biased because of the omission of non-taxables from the estimates.

The A.N.A. estimates also contain the only published official estimate of gross fixed capital expenditure This estimate is primarily taxation based, is not disaggregated into various classes of investment and does not include capital created by the use of on-farm resources. Furthermore, there is a tendency for some expenditures, which are essentially of a capital nature, to be allocated to current expenditure. These aspects have been noted before [8] and are more fully discussed in this chapter.

In recent years, the A.B.S. has been developing an Agricultural Finance Survey to obtain a wide range of financial statistics. Unfortunately the survey is of little use for the present study as the earliest year for which some information is available is 1969-70. Subsequently, this information may be used to revise some of the estimates made in this study but such revisions would need to be based on evidence from several years and are therefore impractical at present.

Other A.B.S. sources are used extensively in this study to estimate the size of the rural labour force. The Population Census [2] is the main source, with the Labour Force Survey [3] and A & P Census providing supplementary data. A variety of other miscellaneous A.B.S. publications have been used and these will be detailed later.

Outside of the A.B.S. the B.A.E. is an important source of data. Information is compiled on prices paid and received by farmers and estimates made of farm income, exports, and the like. Farm surveys by the B.A.E., which include the continuous Australian Sheep Industry

Survey[1] (A.S.I.S.) and numerous ad hoc surveys of rural industries and regions, provide useful information on most aspects of farm operations. Where appropriate, these sources have been used to supplement and check A.B.S. based estimates.

In the early 1960's Gruen, Campbell and Crawford [10] prepared a report for the Australian Agricultural Economics Society on the shortcomings of financial statistics for the agricultural sector. They noted a number of major deficiencies in the then available data.

(i) The lack of details on how the estimates are compiled.

(ii) The lack of details on the composition of farm expenditure.

(iii) The absence of any estimate of actual depreciation as distinct from the taxation based estimates.

(iv) The exclusion of changes in livestock inventory from farm income estimates.

(v) The lack of information on the incomes of farmers by commodity group.

(vi) The lack of information on capital formation and levels of farm indebtedness.

The report concluded that the most urgent requirements related to data on farm current and capital expenditure and levels of capital consumption. The situation is little changed up to 1969-70, but from the early 1970's a larger amount of financial data will be available from the Agricultural Finance Survey.

2.2 The Data Framework

Here, the foundation is laid for the detailed compilation of all the individual data components assembled in the following chapters. The purpose is to ensure that the concepts are clearly defined and

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1 Particular publications relating to this survey will be referenced when the statistics are used in the present study.

that the subsequent estimates of inputs and outputs are consistent and appropriate for the analysis of productivity and the estimation of technological change.

2.2.1 The Basic Framework

Following Solow [18], this can be represented in an aggregate production function framework,

$$Y = f(X_i)$$

where Y = aggregate output from the rural sector, and

X_i = aggregate input of the ith input into the rural sector.

Leaving aside issues relating to the specification of this function, the main task is identifying and measuring the outputs and inputs of the rural sector.

Traditionally, the factors of production, or inputs, have been defined as labour, land and capital[1], and are used in the production process to create goods of value. Additional to these inputs, the production process will generally entail the use of inputs purchased from other enterprises, such as fertiliser, fuel and seed. In the national accounting sense, output is measured as the amount of value added to inputs through the use of factors of production, and the value added constitutes the return to those factors of production. These concepts are shown schematically in Figure 2.1 as an aid to the discussion in the following paragraphs.

Inputs are allocated to two groups titled factor and non-factor inputs. The non-factor inputs are purchases other than capital and labour purchases, and are materials or services that are used up within the production period in which they are employed. These may be purchased from other farmers or from outside the rural sector. The factor

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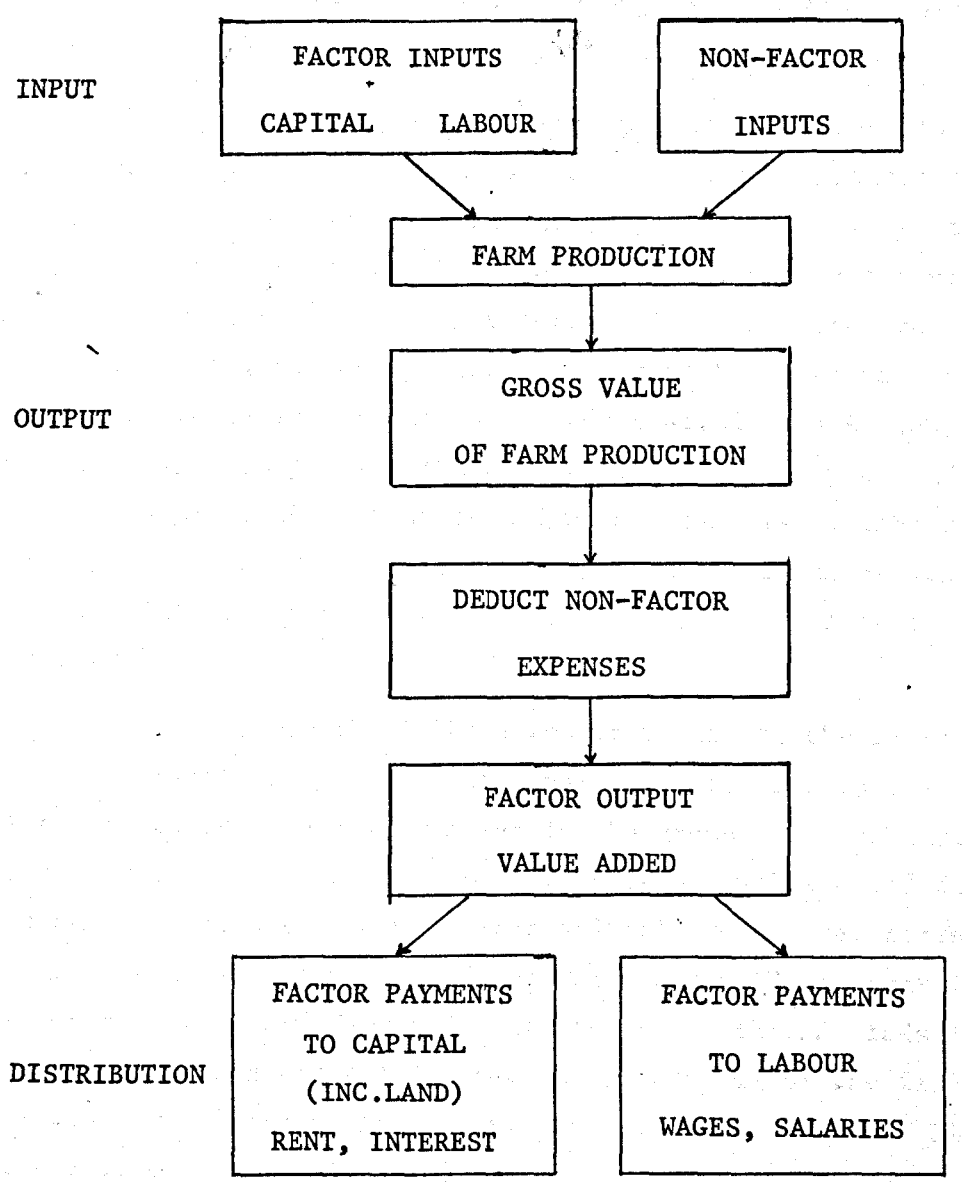
[1] Throughout this study land is included in capital.

FIGURE 2.1

The Simple Model of Inputs, Outputs and Distribution in the Farm Sector



inputs are the labour and capital which are employed in the rural sector. The resultant output can be measured as total sales by the rural sector and termed "Gross Value of Farm Production"[1]. This amount constitutes the proceeds available to provide a return to all inputs.

The most readily identifiable payment to inputs is that paid to non-factor inputs which is cash expenditure on production costs other than payments made for labour or capital (wages, rent and interest). Deducting these non-factor expenses from the gross value of farm production leaves the return to factors (hereafter termed "factor output", but could also be referred to as value added, and is termed gross farm product or factor cost, in the A.N.A.). Factor output is that output attributable to the factor inputs and is therefore the appropriate output term for the analysis of labour and capital productivity. Further, this item represents the amount available for distribution to capital (rent and interest) and to labour (wages and salaries)[2].

Three points should be noted in regard to the factor output concept. First, in productivity analysis, factor output is used so that the double counting embodied in the gross value of farm production is eliminated. For example, use of the gross value would double count any outputs produced by one farmer and sold to another farmer for use as an input, for example, grain produced and sold as stock feed. The output of the second farmer is only the value that he adds to the purchased grain or store cattle, not the sale value of the finished product. Likewise, rural output must be net of the value of inputs flowing in from outside the rural sector.

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1 Generally, these terms are identical to those used in the A.N.A. [1].

2 In the farm sector where most enterprises are unincorporated, the owner-operator will obtain a return which includes payments for both his capital and labour contributions.

Second, in the process of production, some capital is "used up" and needs to be replaced. Accordingly, some output is needed to maintain the capital stock and is therefore not available for distribution as factor payments. Thus, depreciation is deducted from the gross value of farm production to obtain factor output.

Third, attributing an amount of gross value of farm production equal to non-factor expenses implies equilibrium conditions in the rural sector. Specifically, optimal levels of use are implied, so that the value of output due to the use of the marginal unit of input equals the cost of the marginal unit of input. Constant returns to scale are also assumed. These assumptions are accepted in this study because the evidence generally supports the assumption that farmers do use resources efficiently, or is insufficient to refute these assumptions[1]. This evidence is reviewed in Appendix 2A.

This basic framework indicates that for productivity analysis, six variables must be estimated. These are:

(i) gross value of farm production,
(ii) non-factor expenses,
(iii) depreciation,
(iv) factor output[2],
(v) labour input, and
(vi) capital input (includes land).

But the nature of farming as an industry makes the estimation of some of these variables difficult. The difficulties arise from two main sources, namely, the interaction of the farm business and the farm

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1 This is not meant to imply that alternate sets of assumptions are invalid, but merely to provide a basis for the initial study of technological change. Subsequent research and evidence may well indicate a more appropriate set of assumptions. For example, Young [21] used a method which considered non-factor expenses as an input of the same nature as labour and capital to estimate technological change.

2 Factor output = (i) - (ii) - (iii).

household, and the production of capital on the farm. These are now considered in turn.

2.2.2 The Problem of Interaction Between the Farm Business and Farm Household

In the late 1960's, a lively discussion on these aspects took place in Australia. The issue revolved around the concept of a low farm income and the main contributors were Davidson [9] and McKay [14]. Three aspects of the controversy are relevant to this study. The first, is the use of farm resources to produce farm outputs which are not sold but consumed on the farm. These include the on-farm consumption of meat, dairy products, and vegetables as appropriate to the type of farm, and the efforts of the farmer. This particular component does not cause serious problems because the A.N.A. [1] estimates of gross value of farm production, include an estimate of this item. However, details of how this item is estimated are not available, nor is the value published separately.

The second problem relates to household expenses which are allocated to the farm business, and which are therefore included in non-factor expenses. The main problems arise in relation to items that may be used for both business and household such as motor vehicles, telephone, and various financial and other service charges. Available statistics, such as the A.N.A. estimates, which are based on taxation and farm survey sources encounter the problem of allocating these expenses between the business and the household. In the case of taxation statistics, they are most likely biased towards an overly large allocation to the business but similar a priori judgement of survey data is more difficult. However, it seems likely that non-factor expenses are over-estimated.

The third problem concerns the housing provided on the farm for the farm operator. The inclusion of the value of the house in farm capital means that the total farm capital is used to produce an

output of housing (usually measured as rent) which accrues to the farm operator. In addition, some maintenance and improvements to the house may be carried out by farm labour, and entail the use of purchased materials which are charged to the farm business. The available statistics on farm output do not include any estimate of housing outputs. In the A.N.A., the imputed value of owner-occupier housing accruing in the rural sector is allocated to a separate industry, termed "ownership of dwellings". However, this is not disaggregated to provide an estimate of that portion due to the rural sector.

2.2.3 The Problem of On-Farm Capital Creation

This aspect is of considerable importance. Put simply, farmers are in business to produce capital goods as well as to produce current goods for sale. The nature of rural production and the type of capital employed tends to make the rural sector rather unique in this regard[1].

The grazing industries, sheep, beef and dairy, account for a large proportion of the Australian rural sector. In these industries, at least in recent years, the major investments are directed to the improvement of pastures and associated facilities such as water supply, fences, stockyards and fodder storages[2]. The nature of these items compels a substantial amount of on-site work which can generally be carried out by the use of normal on-farm resources of capital, particularly plant, and labour, in addition to the purchase of required materials. It is reasonable to assume, even in 1970, that many of these property developments would be carried out without help from

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1 In a forthcoming issue of the Economic Record the author raises some of these points [17]. This section draws on that material.

2 These items may collectively be termed "improvements".

outside the property, and that in the years extending back to 1920 (and beyond) the reliance on on-farm resources for these works would have been greater [8]. In recent years, contractors employing specialised equipment, such as for dam sinking or aerial topdressing, may be more important. However, regardless of the way the work is carried out, there are substantial opportunities for capital expenditures and current expenditures to be confused. This is further detailed in succeeding paragraphs.

One other area of capital production that is important is the building up of livestock numbers. This is an identical operation to that of producing cattle for sale but because the stock produced may be added to the national breeding herd, they are not included in production. The converse arises at times when livestock numbers are being reduced. This will add to sales receipts but it is not strictly production but merely a running down of stocks[1].

This capital production would utilise the capital and labour resources on the farm as well as including a component of purchased materials. But the main point at issue is that the employment of resources in these tasks is production in just the same way as it is production to use those resources for growing wheat or running dairy cows. It is reasonable to assume that if these resources were not employed in capital production they could be employed in production elsewhere in the farm (or economy). The only difference between the use of farm resources to produce current outputs and capital output is that the former is generally sold soon after production, or is easily valued as stocks, while the valuation of the capital output is difficult. This would be the main reason for on-farm produced capital not being included in output.

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1 More detailed discussion of the treatment of changing livestock inventories is contained in Chapter 6.

To focus more clearly on this problem, the following analyses three methods of erecting a fence. First, the farmer erects a post and rail fence which involves no cash expenditure as the posts and rails are cut on the property. In national accounts compilations, there would be no entries, yet there would be an addition to the capital stock on the farm, and the property value would be increased by the value of the fence less any diminution due to the use of some standing timber on the farm. The "value added" by the farmer in erecting the fence would be equivalent to the net change in property value due to this work. Thus, both the national output and farm sector output would be underestimated by this net change in property value.

The second situation is where the farmer purchases the posts and wire, but erects the fence himself. In this case, the value added on the farm will be less than in the first case, and equivalent to the net change in property value due to the fence, less the cost of materials. Both national output and farm output will be understated only by the amount of value added in the farm which is lower than the first case. The value added in producing the fencing materials will have been included in some other sector.

The third case involves a contract being let to supply the materials and erect the fence. Here, there is no value added by the farm sector, but value added accrues to the contracting sector equal to the difference between the contract price and the cost of materials. The value of the materials accrues in the materials producing sectors. Thus, neither national output nor farm output will be understated.

Many farm investments would approximate the second case discussed above while the remainder would be akin to the third case. Few of any significance would approximate the first case in 1970, but relatively more of this type would have occurred in the 1920's and 1930's. Thus some significant understatement of the output attributable

to resources employed in the farm would occur[1]. This will tend to result in worse output/input ratios for the rural sector relative to non-rural sectors where most investments approximate the case three type. A similar situation will arise when comparing this type of rural sector with rural sectors which are mainly based on cropping where the main investments are in machinery and so would more closely approximate case three.

This problem has been considered at some length because it is important. Just how important is considered in Part III, but there is other evidence pointing to its importance. The study of Victorian agriculture over the 1870 to 1910 period by McLean [15] suggests this. Over the 1870 to 1900 period, there was a low rate of technological change, and high investment in improvements to land. Between 1900 and 1910, investment in improvements was lower and technological change higher than pre-1900. His study did not include on-farm produced capital in output, nor did he adjust inputs by that amount used in capital production. Thus if relatively more resources were used for capital production up to 1900, this would dampen the rate of increase of the production of current goods. In periods when relatively less capital production takes place, the reverse would tend to occur. This factor may account for some of the difference in the rate of technological change before and after 1900[2].

2.2.4 The Problem of Allocating Expenditure for Capital and Current Purposes

This problem was alluded to in discussing the capital producing operations of farms. It arises in what was earlier described as case

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1 This suggests that the bias would have decreased with the passage of time. However, new developments such as improved pastures, broadens the scope for such on-farm capital production.

2 In his article McLean did not include the data series so that calculations to validate this point were not possible. The forthcoming Economic Record exchange does not conclusively resolve this point either [16, 17].

two where farmers purchase materials for capital work, and use on-farm labour and capital to complete the capital project. Expenditure data should allocate these purchased materials to capital expenditure. However, expenditure data such as that contained in the A.N.A., whether based on taxation sources or farm survey sources, encounters the difficulty of separating current and capital expenditures. Taxation data is likely to contain larger biases than survey data because in many cases, the taxpayer is advantaged if these material costs can be claimed as current costs able to be written off in the year in which they are incurred, rather than as capital expenditure depreciable over a number of years[1]. Because of this allocation problem, A.N.A. capital expenditure estimates are likely to be underestimated and current expenditure overestimated.

The available published data is not sufficiently detailed to enable an estimate of this misallocation to be made. However the problem should be recognised along with the implications that first, capital investment will be underestimated if A.N.A. capital expenditure estimates are relied on entirely; and second, that factor output will be underestimated if the full amount of non-factor expenses is deducted from the gross value of farm production. But because this is an allocation problem rather than an omission from the measurement of inputs and outputs, the implications are not so serious.

2.2.5 The Expanded Framework

Consideration of the issues discussed in the previous sections results in an expanded model of inputs, output and distribution for the farm sector. This is shown in Figure 2.2. The diagram aims to indicate all of the outputs that are derived from the use of capital

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1 This is distinct from those items which are essentially of a capital nature but allowed to be fully written off in one year under Sections 75 and 76 of the Income Tax Assessment Act. In the A.N.A. estimates, these items are considered capital expenditure [1].

and labour resources on the farm, and from non-factor expenses. On the left hand side, on-farm produced capital is shown, but it should be noted that this amount does not include all investment. Expenditure classified as capital is not included in this diagram but the arrow from non-factor inputs to capital production recognises the problem of allocating expenditure between capital and current uses (see Section 2.2.4). On the right hand side, the various components associated with the farm household are shown. Overall, the diagram indicates the larger range of, and greater outputs attributable to the inputs used on the farm.

Deduction of non-factor expenses leaves the balance (factor output) to be distributed as factor payments to labour and capital. These payments will now include a share of the capital produced on the farm, the value of house rent, the value of goods produced on the farm and the value of household expenses charged to the farm business, in addition to normal payments of rent and interest to capital and wages and salaries to labour.

This framework suggests two general approaches to measuring inputs and outputs in a consistent way. The first begins with the measurement of inputs in some defined way such as all inputs used for all purposes in the rural sector[1]. The analysis then seeks to identify all of the outputs attributable to those inputs. This approximates the full system shown in Figure 2.2. The second approach begins with a definition of output and then seeks to ascertain those inputs used to produce those outputs. Generally the Rural Industries Bulletin estimate of output which includes only current rural outputs is used. Thus, considerable adjustment to measured inputs is required, yet information on which to base these adjustments is not substantial.

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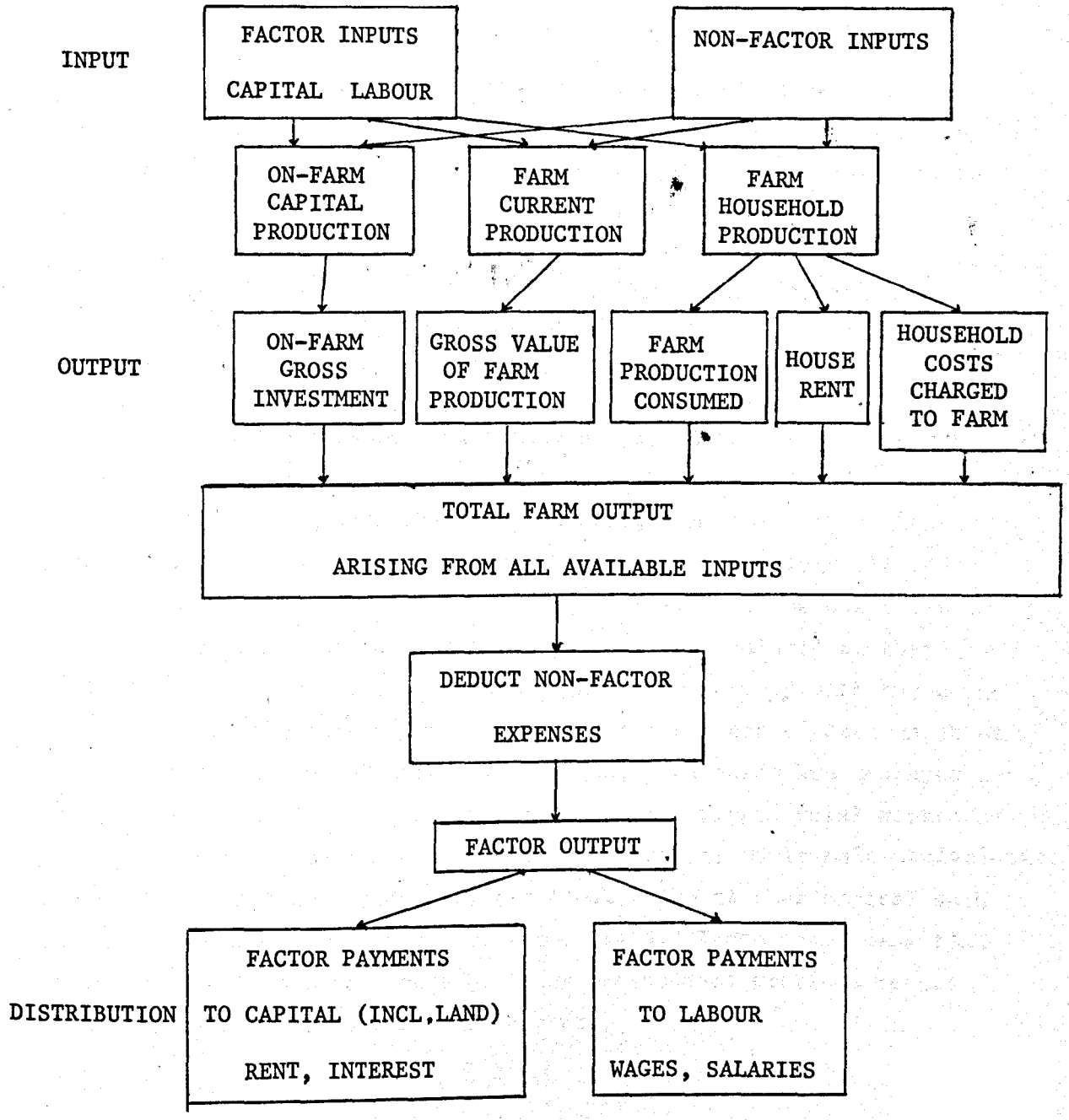
1 It is possible to adopt a more restrictive definition of inputs which would then entail establishing the outputs due to that more restricted definition of inputs.

FIGURE 2.2

The Expanded Model of Inputs, Outputs and Distribution in the Farm Sector



Therefore this method will probably result in unreliable estimates of the inputs used in current production. For this reason, estimates based on this approach are accorded secondary priority, and further discussion is deferred to Chapter 9.

The main method used in this study is based on establishing the level of all inputs used by the rural sector and then estimating all outputs derived therefrom. Section 2.2.6 discusses how estimates of the main data components are derived on this basis.

2.2.6 The Basis for Consistent Estimates of Rural Sector Inputs and Outputs

(i) Inputs

Inputs are measured relatively simply within this framework and are unadjusted but for the use of farm resources outside the rural sector. It is recognised that many farmers, sometimes using their plant, undertake work off the farm. This would probably still be within the rural sector on other farms. But it would be desirable to allow for any work outside the rural sector, particularly as there would be a tendency for the amount of this work to vary with the economic health of the farm sector. However, the absence of data on these aspects precludes any adjustment. Non-factor expenses are measured as actual cash expenditure; labour input as the employed rural workforce expressed in terms of a common denominator such as adult male equivalents; and capital input as the depreciated stock value of that capital such as the walk-in, walk-out value of farm assets. These input measures minimise adjustments to inputs but many measurement problems remain which are reviewed in subsequent chapters.

(ii) Outputs

Output should include all items attributed to inputs as shown in Figure 2.2. Alternatively there must be sound reasons for omitting any items. The items are considered one by one.

(a) Production of current farm outputs, and farm outputs consumed on the farm. These two components are bracketed together because the Rural Industries Bulletin estimates include both components. This aspect of output creates few problems because of the adequacy of the published estimates, so both of these components are included.

(b) On-farm produced capital. This is an important component which cannot be omitted. Published data primarily relates to off-farm produced investments or materials and does not include the contribution to capital formation of on-farm production. Further there is the problem of misallocation of expenditure between capital and current uses. Thus, somewhat roundabout procedures are used to estimate on-farm produced capital.

First, the "walk-in, walk-out" value of the national farm is calculated for each year from a variety of sources, the main ones being land valuation data, plant and machinery stocks, and number of livestock. Second, the year to year change in this stock, plus depreciation is determined which represents gross investment. Third, gross investment will be made up of items produced off the farm and purchased by the farm sector as capital expenditure, and on-farm production of capital. By deducting the A.N.A. estimates of gross fixed capital expenditure from gross investment, an estimate of on-farm capital production is obtained. This on-farm component parallels the gross value of farm production.

The above procedure will fail to provide accurate estimates of the two sources of capital because of the problems of allocating expenditure between the capital and current components[1]. But this is not of major concern in productivity analysis because factor output is required,

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1 Specifically, some of the so-called on-farm capital production will be the value of materials purchased as current inputs. Thus, this source of capital will be overestimated, yet there will be a corresponding underestimation of value added via production of current outputs.

which means that non-factor expenses must be deducted from the gross value of farm production. Thus, by considering output as the total addition to capital plus the production of current goods, and deducting both capital and current expenditures, an estimate of factor output is obtained which includes on-farm production of both current and capital outputs. It is only the separation of the two outputs that will be the subject of errors due to misallocation of expenditure[1]. The overall accuracy of the estimates is still dependent on the farm capital stock estimates which are variable in quality and will be discussed in Chapters 5, 6, 7 and 9.

(c) House rent is also an important item of output in quantitative terms. Such a component would be present on almost all farms. The amount is difficult to assess objectively, but would be a relatively constant amount over time and would not fluctuate in response to economic conditions as in the case of on-farm capital production. Although some consideration is given to this problem in the context of the value of farm improvements (Chapter 5) this component of output is not included in this study. This is because it is assumed to be a constant factor, the absence of which will not significantly bias the estimates of technological change.

(d) Household expenditure charged to the farm is another component on which quantitative data is unavailable, but is known to occur. Hopefully, this item is small relative to total expenditure and, like house rent, is a relatively stable component of expenditure. On this basis, this aspect is also omitted from consideration.

The approach to the measurement of inputs and outputs is relatively simple, that is, identify all inputs used in the rural sector,

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1 This assumes that available data on expenditure is more accurate in total than in the capital and current categories. This appears reasonable given the earlier discussion of reasons for this misallocation (Section 2.2.4).

then identify all of the outputs obtained from the use of those inputs. However, the following review of major studies which compiled statistics for the rural sector indicates that there is no satisfactory set of rural input-output data for productivity analysis. This study attempts to provide estimates consistent with the principles established in this section. However, as already indicated, data inadequacies will prevent the full achievement of that objective. The main contribution lies in the handling of on-farm produced capital. The importance of this component is considerable and will be quantitatively established in Part III.

2.3 A Review of the Main Previous Studies

Four studies by Butlin [7], Gutman [12], Wilson [19] and Young [20] are singled out for examination against the background of the framework established in Section 2.2. These studies have been selected because they compile data series over various time periods for most or all of the components required for this study. Other studies which consider lesser time periods or only some data components are considered in subsequent chapters[1].

Butlin [7] estimated a number of components over the 1861 to 1938-39 period. For the present study, the 1920-21 to 1938-39 period is relevant. He was primarily concerned with estimates of domestic product, investment and foreign borrowing which are considered in a national accounts framework. Thus, his study provides little useful information on labour used in the rural sector. Of most use are the estimates of output and non-factor expenses for the rural sector which incorporate some refinements to the Value of Production Bulletin estimates.

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1 A notable omission from those considered here is the so-called Monash Study [11]. This contains useful tabulations and discussion of mostly official statistics for the post-war period up to the early 1960's. This study is excluded from this brief review because of the relatively short period covered by the data presented, and because the data were compiled for essentially a different purpose.

Most reservations relate to Butlin's estimates of capital formation in the rural sector. First, in his study, public investment is not disaggregated by sector so that portion pertaining to the rural sector cannot be identified. Second, private investment appears to be substantially underestimated. Boehm [6] pointed out deficiencies arising from the exclusion of land clearing, and the establishing of orchards and vineyards. Third, Butlin only included purchased inputs used in capital formation, and excluded the value added by the use of on-farm labour and capital. As a result, Butlin underestimates output by excluding capital outputs[1], and underestimates the real level of investment. The underestimate of investment is mainly in improvements to land, so that Butlin's estimates of the machinery and livestock components are more useful.

Gutman [12] made a substantial contribution to available data in his study of productivity in the rural sector, for the period 1920-21 to 1947-48. Most reservations again relate to the handling of capital and a number of points can be made. First, he does not include changes in livestock inventories in his output estimates. Instead, he adjusts livestock numbers by stock slaughterings in an attempt to take account of changes in the 'production' and capital components of livestock. As explained in Chapter 6, inclusion of livestock inventory changes in output is a preferable method of adjustment. Second, only the irrigation component of public capital expenditure is included in the capital stock. All other public investment components such as transport and communication development which contribute to increasing productivity are ignored. Third, and most important, Gutman is inconsistent in his measurement of inputs and outputs. He estimates total capital investment in improvements to land by analysis of land valuation data. This results in a more accurate estimate of the capital stock in

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1 It should be noted that Butlin includes changes in livestock inventories in the gross value of farm production.

the rural sector than relying on expenditure estimates alone[1], and implicitly includes on-farm produced capital in the capital stock. Further, Gutman does not adjust inputs for that proportion used in producing capital, although he recognises the problem in relation to labour input [12, p.290]. Thus, he is following the model proposed in the previous section, which adds on-farm capital production to output. He does not do this and so a form of double counting of inputs results.

The double counting alluded to in the previous paragraph can be illustrated as follows. In year t the farmer uses his labour for both capital and current production, but all labour is considered to be used in current production and is written off to year t's current output. In year t+1, the estimated capital stock includes the value of on-farm capital production carried out in year t, and this value is made up in part by labour used in year t to produce those items. The capital stock in year t+1 is then an input generating current output in year t+1, and so on for subsequent years. As a result, the labour input used in year t for capital production is charged against output twice, once as labour input in year t, and once in years t+1 and t_0 as part of the capital stock. This can be avoided by adding the value of on-farm produced capital to output, or by deducting from inputs, that amount used for capital purposes as explained in Section 2.2.

Overall, Gutman's study is a useful starting point for the compilation of data series for productivity analysis. However, the main points raised above, and a number of minor points mentioned in subsequent chapters indicates that it is worthwhile reviewing and revising the whole of Gutman's data rather than merely building on where he finished.

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1 This is argued in Chapter 5 of this study.

Wilson's study [19] essentially built on Gutman's work and extended the series to 1966-67. He followed Gutman very closely and so the main points mentioned above in relation to Gutman also apply to Wilson. The exception is that Wilson included as part of capital, the unimproved value of land and excluded the estimated public investment in irrigation. In this way, separate estimates for components of public capital such as irrigation were avoided, because the value to farmers of this public infrastructure would be reflected in the value of unimproved land. However, the problems of satisfactorily deflating land values were inadequately appreciated by Wilson[1]. As a result the unimproved land series expressed in constant prices, behaved in an unacceptable manner.

In summary, Wilson's work, while it contains a useful extension of Gutman's data series, also needs reviewing and revising.

Young's study [20] of productivity spans the years 1948-49 to 1967-68 and introduces a number of refinements to the data series. His approach begins with the definition of output in terms of production of current goods, and then seeks to define and measure inputs that have contributed to this output. But, he only goes some of the way towards this. For example, only labour inputs are adjusted for off-farm work and for capital work, yet, he ignores the use of capital inputs in development work and any off-farm uses, and takes no account of any non-factor expenses that are used in on-farm production of capital. For these reasons, he has overestimated the capital and non-factor expenses used in producing current goods. But on the other hand, his estimated capital input is likely to be underestimated because he has not included any on-farm capital production in his capital series.

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1 These are reviewed and discussed in detail in Chapter 5 of this study.

Overall, the study of Young involves some inconsistency in the measurement of inputs and outputs. But the main deficiency is seen to lie in substantial underestimation of the capital stock.

All of the four studies just reviewed, contain substantial data deficiencies in terms of productivity analysis. But all have made significant contributions in detailing and evaluating available data and identifying problems. From this foundation a review and revision of all aspects of available data from 1920-21 to the present appears warranted. This is contained in the remaining chapters of this Part.

2.4 Some Further Preliminary Comments

Here, some miscellaneous aspects of the presentation used in succeeding chapters are noted. The subsequent analysis of productivity is undertaken with all series expressed in constant price terms. In some cases the determination of suitable deflators is difficult, but all series are deflated to 1949-50 base period prices. This base period was chosen because it is close to the mid-point of the study period but not an abnormal year subject to influences such as wars, droughts or wool booms. In addition, any errors in deflation that tend to increase with the length of time from the base period, will tend to be minimised by the use of a mid-period base. In general, tables and figures in the text are in constant 1949-50 prices. Price indices and more detailed tabulations in both constant and current prices are included in the Appendices.

Throughout this study no attempt is made to remove any disturbances which give rise to considerable fluctuations in the series, Disturbances may arise from a number of sources such as seasonal conditions, the nature of the basic data, the deflation procedures used to obtain constant price series, and so on. At many points there was a considerable temptation to "smooth" the series but the temptation has been resisted for two main reasons. First, in general, there was insufficient data on which some smoothing procedure could be based.

Thus, smoothing would tend to be some crude procedure such as the use of moving averages. This is a process which adds nothing to the information contained in the series but is more likely to reduce the worth of the series. Second, these series are presented in detail to facilitate further analysis. Any manipulation of the series for analysis is likely to depend on the nature and purpose of that analysis[1]. Thus, only unadjusted data are presented.

The estimates contained in the following chapters should be used carefully as none of the estimates can be regarded as completely accurate. In many cases, a considerable amount of judgement has been exercised which has only limited empirical backing. To a large degree, the compilation of data series does not constitute a problem if some judgement is not needed. Throughout the study, judgement is required and so far as possible the judgements made, and the reasons for them, are explained. Often, there is ample scope for differing opinions and judgements with little evidence to suggest which opinion is correct. This should not detract from the series presented as the basic raw data is included or referenced so that any researcher, whose judgement differs from those contained herein, can easily adjust the series to conform with his judgement and purposes.

A word of caution should be recorded in relation to the series and is based on changes in statistical procedures over the fifty year period. Collection and analytic methods have changed substantially between 1920 and 1970 as have the purposes for which statistics are compiled. Major changes in methods and definitions can usually be traced, although the effect on the estimates may be difficult to determine. However, the more gradual evolution of procedures designed

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1 Analysis of the series including the causes and effects of these fluctuations is an important area for further study. Some aspects of the impact of seasonal conditions on some of the series is already planned as an extension of this study.

to improve collection, analysis and presentation of statistics are less easily identified and the effects on the series themselves indeterminate, but unlikely to be neutral. Further, there are also changes in classification systems such as employment by industry and imports which can create difficulties in compiling a consistent series. Thus, these data series spanning fifty years may appear to be of consistent quality and uniformly compiled but in fact may vary greatly on both counts. Users of the series should bear this in mind.

Finally, the remaining chapters of this Part are concerned with the conventional approach to measuring inputs and outputs. That is, total inputs used in the rural sector are estimated, unadjusted for capital production. Output is measured as current production plus changes in livestock inventories. The adjustments designed to make the estimates of inputs and outputs consistent as developed in this chapter, are carried out in Part III, Chapter 9.

2.5 References

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[4] AUSTRALIAN BUREAU OF STATISTICS, Rural Industries Bulletin, Canberra.

The above reference is used throughout this study but only applies since 1962-63; between 1950-51 and 1961-62, titled Primary Industries, Part I, Rural Industries; between 1936-37

and 1949-50, titled, Production: Part II, Primary Industries and Total Recorded Production, and prior to 1936-37, titled, Production Bulletin.

Prior to the publication of the bulletin, selected statistics are published in a wide range of A.B.S. publications, see A.B.S., Publications of the Australian Bureau of Statistics, Canberra.

[5] AUSTRALIAN BUREAU OF STATISTICS, Value of Production Bulletin, Canberra.

The above reference is used throughout this study but only applies since 1964-65; between 1962-63 and 1963-64, titled Non Rural Industries and Value of Production; between 1950-51 and 1961-62, titled Primary Industries, Part II, Non Rural Industries and Value of Production; between 1936-37 and 1949-50, titled Production: Part II, Primary Industries and Total Recorded Production; and prior to 1936-37 titled Production Bulletin.

Prior to the publication of the Bulletin, selected statistics are published in a wide range of A.B.S. publications, see A.B.S., Publications of the Australian Bureau of Statistics, Canberra.

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