SECTION 3

Socioeconomic Impacts of Climatic Variability

3.1. Introduction

As outlined in Section 1 of this case study, climatic variability is a fundamental fact of life of Australian agriculture. It and its impacts have already been the subject of reviews from several other points of view (*see*, e.g., Williams, 1946; Rutherford, 1950; Everest and Moule, 1952; Anon., 1966; Campbell, 1966; Anon., 1967; Anon., 1968; Lovett, 1973; McQuigg, 1975; Chapman, 1976; Butler and Doesell, 1979; Heathcote and Thom, 1979; Young and Wilson, 1979; Heathcote, 1983). However, the observation of Campbell (1958, p. 3) that "one cannot but be impressed by the extremely limited progress which we, as a people, have made .... in coming to terms with the most insidious and pervasive characteristic of our climate – its variability" is still cogent. The objective in this section is to undertake a broad review that spans agriculture from farm to the macro-economy and spans climate generally rather than one that addresses only drought – the focus of Section 4.

However, within this broad charter, the present review is selective in scope and is confined to economic (as opposed to the important ecological, environmental, meteorological, physiological and sociological) aspects. First, a framework is developed to provide a structure in which past studies might be considered. This features behavioral motivations and probability distributions of financial performance, physical performance and prices. Second, investigations of the impacts of climatic variability on domestic agriculture are reviewed against this framework. These studies are categorized first by level (farm, industry, region and sector) and, within levels, variously by region, industry or type of impact.

3.2. A Framework for Reviewing the Impacts of Climatic Variability on Agriculture

The complexity of the relationships between climatic variations and the people in, and dependent on, the agricultural sector can be tackled by a simplified

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disaggregation of the major effects. A starting point is the basic behavioral assumption about what motivates the key economic agents in farming – the farmers who make the economic decisions. This objective can be stated as: farmers' satisfaction depends, *inter alia*, on the probability distribution of financial performance. There is mounting evidence (Francisco and Anderson, 1972; Just, 1974; Anderson *et al.*, 1977; Bond and Wonder, 1980) that farmers' attitudes are typically ones of aversion to risk so that features of the probability distribution other than the expected value (e.g., variance, semivariance, lower range, skewness, etc.) are also relevant to decision making. An important personal characteristic that influences attitudes to risk is the wealth or asset base of the farmer. This changes over time, partly as a result of climatic fortune.

The second general relationship is a mix of behavioral and environmental effects that enter the probability distribution of financial performance. This distribution depends on allocative decisions, the probability distribution of yields, the probability distribution of prices, institutions, and government interventions. The probability distributions noted may not, in fact, be independent, e.g., drought-reduced cuts of wool may be associated with reduced strength and quality (see Chislett, 1973) and price. Interventions by government other than through prices may be passive (e.g., the progressive income taxation structure) or active (e.g., various forms of assistance for relief from natural disasters such as drought, flood and tempest).

The third general relationship summarizes the main direct effects of climate at the farm level in that the probability distribution of yields depends on both climate and allocative decisions.

The influence of climate on yields is obvious, even if not precisely understood. The following generalization for the growing of plants in Australia is based on the discussion of Fitzpatrick and Nix (1970). Solar radiation is rarely an important restraining factor. The thermal regime sets the major seasonal growth patterns and constrains growth in most of the country during winter, and the dominating climatic factor in growth is the moisture regime. This is determined by evaporation and precipitation (mainly as rainfall) which is typically meager, strongly seasonal and inevitably variable. The validity of these generalizations is supported by the empirical work of Easter (1975), who related several measures of pastoral production to rainfall and/or to estimated soil moisture levels over different periods.

Many of the allocative decisions of farmers are influenced by climate and are, in turn, often intended to mitigate the effects of climatic variation – consider, e.g., drought feeding of livestock (Hill, 1973), irrigation scheduling, trapping soil moisture by fallowing, choosing between wheat and barley, etc. Moreover, there is typically a strong interaction between controlled decision variables and uncontrolled climatic factors in production, e.g., between rainfall and other climatic factors, and crop variety (Anderson, 1974), stocking rate (Chisholm, 1965; Byrne, 1968; McArthur and Dillon, 1971) or fertilizer (Anderson, 1973; Watson and Anderson, 1977).

The fourth and final general relationship is concerned with what are normally thought of as economic considerations, but which surely also have a climatic component. The probability distribution of prices depends on consumer