

Chapter 1: Introduction

1.1 Background and Motivation

Agriculture in South Africa has a central role to play in building a strong economy and in the process, reducing inequalities by increasing incomes and employment opportunities for the poor (Hanekom, 1998). The sector contributes directly and indirectly to the total economy. It accounts for 5.2 % of the GDP, employs 13 % of the economically active population and generates about two billion US dollars from exports annually (AAS, 2001). The sector indirectly contributes to the growth of the economy through income and employment multipliers (Van Zyl, 1988; McDonald *et al.*, 1997; Townsend, 1997; Hassan, *et al.*, 2001)

It is generally recognized that climate change has an impact on agriculture (IPCC, 1990). Many efforts have been made to estimate the economic impact of climate change on agriculture (Adams, 1989; Rosenzweig, 1989; Mendelson *et al.*, 1994; Kaiser *et al.*, 1993). However, most of these studies focused on the United States and other developed countries.

Due to the global nature of climate change, concerns of the impact of climate change on agriculture in developing countries have been increasing (IPCC, 1996). As a consequence some attempts have been made to estimate the impact of climate change on agriculture in developing countries (Winter *et al.*, 1996; Dinar *et al.*, 1998; Kumar and Parikh, 1998; Mendelson *et al.*, 2000).

Sugarcane production is an important activity in the South African agriculture (Hassan *et al.*, 2001). Based on the actual sales and selling prices in 2000/2001, it is estimated that the South African Sugar industry contributed R 1.9 billion to the country's foreign exchange earnings. Employment within the sugar industry is approximately 85000 jobs, direct and indirect employment is estimated at 350000 people & there are approximately one million people dependent on the sugar industry (SASA, 2001). Given these contributions, any factor affecting the industry has an impact on its contribution to the total GDP of agriculture and hence to the overall economy.

Like other agricultural sectors, sugarcane farming is expected to be significantly influenced by climate Change. Studies have been conducted to analyze the impact of climate change on maize production (Schulze *et al.*, 1993; Du Toit, 2001), the farming sector of the Western cape (Erasmus *et al.*, 2000) and sugarcane farming (Kiker, 2002 and Kiker *et al.*, 2002) in South Africa. All of these studies adopted the production function approach, which does not include farmers' adaptations. So far there has not been any study to address the economic impact of climate change on sugarcane farming and farm level adaptations that sugar farmers make to mitigate the potential impact of climate change. Accordingly, little is known about the impact of climate change on sugar farming. This presents a serious limitation on policy formulation and decision making in terms of adaptation and mitigation strategies. This study makes an attempt to analyze and measure the economic impact of climate change on sugarcane farming in South Africa contributing to bridging the mentioned gap in literature.

1.2 Objectives of the Study

The main objective of this study is to measure the economic impact of climate change on South African agriculture using sugar-producing regions as a case study. Under this overall objective the following specific objectives are set for this study.

- a) Develop and apply an empirical model to assess the impact of climate change on sugar farming in South Africa.
- b) Use the developed model to assess and compare the seasonal and regional distribution of the impacts of climate change on agriculture across the sugarcane producing regions.
- c) Inform policy and decision-making in the sugar industry on appropriate adaptation and mitigation strategies.
- d) Identify gaps for further research.

1.3 Approach and Methods

To achieve the above listed objectives the study will adopt the Ricardian approach to examining farmers' performance across climatic zones and measuring the contribution of environmental variables such as climate factors to farm income. The Ricardian approach uses a regression of land values or net revenue on a set of environmental inputs to measure the marginal contribution of such inputs to farm income.

Farmers are likely to respond to changing climate and other environmental factors by varying among other things, the crop mix, planting and harvesting dates, irrigation scheduling and application of fertilisers and pesticides. By doing so, farmers mitigate the potential negative effects of climate change. The mitigation and adaptations farmers make to reduce the negative effects of climate change involve economic costs, which materialise in the form of reductions in net revenues or farm asset values. The Ricardian approach measures these economic costs (reductions in net revenue or farm value), which are caused by environmental variables.

1.4 Organisation of the Study

The study is organized in six chapters. Chapter two provides an overview of the South African agriculture, its contribution to the national economy and the position of sugarcane farming. Chapter three reviews relevant literature and models of measuring the climate sensitivity of agriculture in general and in South Africa. The approaches and methods applied in the analysis are presented in chapter four. Chapter five presents and discusses the results of the analysis. Conclusions and implications for policy formulation and mitigation strategies are distilled and gaps for future research are identified in chapter six.