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The effect of drought on uncertainty and agricultural investment in Australia

Abstract: *Recognizing that uncertainty plays an important role in decision making, it necessarily follows that the effects of the current devastating drought have significantly influenced the operations of primary producers and strongly impacted upon agricultural investment in Australia. The lack of water is heavily affecting rural exports and employment opportunities, and consequently, primary producers are experiencing financial ruin. Global economic uncertainty combined with the long-running drought is gripping rural communities. Understanding the likely effect of climate change on Australia's agricultural production will enable suitable adaptation strategies and government policies to be implemented for the future sustainability and development of the agricultural industry.*

Key words: *agriculture, Australia, drought, investment, uncertainty.*

Global warming has conferred rising temperatures and a reduced amount of rainfall (Cauchi, 2002, p. 4), which has bestowed important consequences on agricultural production. Drought has increased uncertainty, negatively influencing the level of investment planning and infrastructure. Infrastructure will always be a vital part of the Australian economy due to the demands of a growing population, and this is no different for agricultural infrastructure. Reducing the level of planned investment in agriculture not only affects the future development of agricultural production but also the growth of the agricultural industry and Australia's economic growth.

This paper addresses the consequences of uncertainty on investment and infrastructure for agricultural production in Australia. It is an issue

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that has raised little discussion in the current debate, yet remains at the forefront of concerns for the Australian agricultural industry and primary producers. Minimal research has been done in this area, which is the primary reason for this paper. Orthodox economics fails to handle this concept of uncertainty, as compared to uncertainty in expected utility or options. In contrast, although traditional theory ignores this concept, Post Keynesian economics incorporates the notion of uncertainty as a fundamental aspect, which can then be applied to agricultural production. This paper considers a current issue of drought, which is hindering Australia's agriculture, thus hindering Australia's economic growth. Understanding the likely effect of climate change on Australia's agricultural production will enable suitable adaptation strategies and government policies to be implemented for the future sustainability and development of the agricultural industry.

Uncertainty, investment, and climate change

When decision makers are ill informed about future actions and associated consequences, and thus act out of naïveté with respect to pressuring judgments, the situation of uncertainty unfolds (Setterfield, 1998, p. 168). The problem of uncertainty arises due to the absence of information.[1] "The future is unknown and the past and present provide only limited insights into the future" (Arestis et al., 1999, p. 536). It has been said that "a decision maker creates the future in his or her mind" (Dequech, 1999, p. 422). However, judgment made on imperfect information distorts forthcoming actions, which, ultimately, influences opinions and future behavior. This presence of uncertainty affects investment spending, both at a macro and micro level. Uncertainty and expectations about the future explain why businesses and individuals engage in activities such as investment and saving. According to Busby and Pitts (1995), uncertainty has two principal implications on investment decisions. First, due to the irreversible nature of investments or divestments, awaiting further information is precious. Second, despite having committed one-

[1] Uncertainty is the lack of knowledge of present facts or future possibilities and outcomes. In contrast, risk covers cases in which, although the future possibilities and outcomes are not known, people believe they know the frequency of distribution, the probabilities from which they can draw at random. Cases covered by risk are potentially insurable (deaths, fires, motor accidents), whereas cases of uncertainty are not insurable.

self to investing or divesting, keeping the lines of action open is essential for flexibility until any uncertainty can be resolved.

"In an uncertain world people are not able to make precise calculations on the future" (Arestis and Sawyer, 1993, p. 8). People possess diverging knowledge and views that produce contrasting information on expected outcomes and effects. Analyzing statistical data from previous results and market information provides a guide to the future but is not precise in predicting an outlook. Every day delivers a different set of characteristics and circumstances that are one of a kind, distinct from any other, where it is truly impossible to completely know what the future will hold. Thus, the succession and path of events remains uncertain, in the unique unfolding nature of time (Dunn, 2001, p. 568). Commonly, when unanticipated events occur, individuals without prior experience typically turn to an array of alternate sources seeking information on which to base their decisions and actions against these uncertainties. As new information and knowledge become available, individuals should reassess their plans and thus align their future goals and current decisions. Consequently, the constantly changing nature of uncertainty regarding the future causes fluctuations in investment spending and liquidity preference, which assists in explaining the volatility and fluctuations in market prices for a range of goods and services.

Confronted by a constantly changing world, the past merely provides a restricted understanding into earlier experiences and is, by no means, a guide to future events. However, when faced with uncertainty and the basic lack of knowledge and information surrounding forthcoming events, "similar decisions may be made over time in unchanging circumstances" (Arestis and Sawyer, 1993, p. 8). Thus, past decisions, which have proved reasonably successful, are often used as a rule of thumb but can never be taken for granted. Commonly, individuals modify their behavior depending on the degree of uncertainty that exists, and this addresses the issues as to how people behave in the presence of uncertainty. The higher the level of uncertainty, the less likely risk-averse individuals are to act, thus postponing decisions until a more certain outcome can be achieved. Conversely, where uncertainty is perceived to be low by individuals, decisions will be made and actions carried out in relative confidence. Hence, the mere existence of uncertainty indicates that decisions are postponed to a later date, when a more certain environment prevails and, therefore, a more certain outcome is available or additional costly information is obtained to reduce the uncertainty. However, a decision not to act today is a decision that confers costs and benefits. There may be a gain achieved by waiting in an uncertain environment. By not investing,

an expected profit stream is foregone, which enables one to make more perceived profitable choices in the future. It has been generally acknowledged that increased uncertainty leads to lower investment rates, which suggests that there is an irreversibility effect under which greater uncertainty raises the value of option to delay a commitment to investment. This effect appears to dominate any positive effect on investment arising from the fact that greater uncertainty under certain circumstances increases the marginal profitability of capital. Factors such as social practices may effectively reduce or increase uncertainty because uncertainty is never concrete.

Once uncertainty is recognized as a deep attribute of real-world economies, the traditional concept of equilibrium is undermined, and the simplistic propositions of laissez-faire are no longer relevant. This is because uncertainty about the future results in economic crisis and instability (O'Hara, 1999, p. 129). The uncertain future involves creative economic activity, in the sense that the future can be permanently changed by individuals, firms, or governments in a way not envisioned by the creators of change (Davidson, 1996, p. 482). In a world of rational expectations, the future is a statistical image of the past, whereas in a world of uncertainty, the current outcome cannot provide information about the future accurately (Davidson, 1994, p. 72). Keynes (1936) argues that investment depends on "animal spirits": spontaneous urge for action rather than inaction. In Keynes's words, entrepreneurs invest because investment is their "way of life" (ibid., p. 150). Entrepreneurial expectations depend largely on culture, civic values, economic conditions, and confidence. Thus, investment is autonomous and independent of savings and the rate of interest (Shapiro, 1977, p. 544).

High levels of employment required steady, rapid, and high growth rates of investment. Due to the inherent unstable character of investment, the role of the state was to implement discretionary economic policies, which ensured that there was adequate aggregate demand to sustain an acceptable level of growth and employment. Demand management by the state could maintain the appropriate levels of aggregate demand, investment, and employment, counteracting the instability due to unregulated and uncoordinated decisions of individuals. This might involve government increasing its expenditure on final goods and investment goods from the private sector, or reducing taxes or the monetary authority influencing interest rates. Crises are the result of uncertainty, which leads to disproportions and mismatches between production and consumption, a tendency of the market system without coordination.

The existence of uncertainty and the imperfect knowledge about the future is indisputable, and it will always be an inevitable and influential element in the agricultural sector, with the potential to benefit or hinder not only the country but also individuals, families, businesses, and communities. When faced with a volatile environment where uncertainty exists, decisions made from information that is incomplete and less than perfect may lead to personal troubles and financial ruin. As the future is not predetermined, individuals must use their tacit knowledge in addition to information made available. Once dubbed "the lucky country," Australia is experiencing unpredictable forces of nature with one of the worst droughts on record and large areas devastated by bush fires. The majority of these problems are unforeseen and outside the control of individuals. This is the situation affecting the rural communities, where drought-stricken farmers face uncertainty regarding the survival of their livelihood. Primary producers in Australia and around the world are confronting a range of challenging issues in agriculture, where the performance of agriculture at all levels is being affected by increased uncertainty and reduced levels of investment, which imposes upon technology, demand and supply, domestic policies, international trade, and environmental conditions. These concerns create a range of challenges for farmers, governments, and other participants in the agricultural sector. Recent drought conditions have diminished forecasting confidence in the agricultural sector in a way that will have important repercussions for investment decisions and, hence, the state of the agricultural sector as a whole.

In the dynamic world, the agricultural sector faces many new challenges, notably, the challenge of uncertainty and unanticipated events, that is, uncertainties attached to the unfolding of time. Over recent years, global climate change has become one of the most pressing environmental issues and is but one force acting heavily on the decisions of primary producers. Global warming has been around for centuries but has accelerated recently with higher levels of greenhouse gases in the atmosphere. Cauchi (2002) suggests that speculation of climatic change and rising sea levels is a constant worry to Australia and many other countries.

Indeed, it is hard to predict and analyze climate changes in the future, providing an enormous challenge to ameliorating the effects of global warming. Global warming is central to an array of uncertain consequences and unanticipated weather phenomenon. Scientists have warned of the problems of global warming caused by extensive carbon dioxide discharge,

where Australia's level of carbon dioxide discharge per head of population is one of the worst in the world. Chang (2002) purports that considerable progress has been made in evaluating the potential effects of climate change on agriculture, however, significant uncertainties remain with concern focused on farm-level impact. Increasingly, severe droughts have been a predicted outcome. Australia is in the grips of the most severe drought yet continues to ignore demands for reduced carbon dioxide emissions. The predictions are for an increase in annual average temperature of 4–5 degrees Celsius or up to 9 degrees Fahrenheit (Adams et al., 1988, p. 349). Climate change challenges the adaptability of individuals and societies and may require primary producers to invest in extensive irrigation infrastructure or to migrate to land that is adaptable to climate change. It could require modifications in lifestyles and economic activities, and potentially bestow a multitude of opportunities and constraints. In addition to altering crop yields, changes in temperature and precipitation will govern water requirements and water supply.

The traditional approach to estimating the effect of climate change is based on production functions. This approach estimates crop effects by varying one or a few input variables, such as temperature, precipitation, and carbon dioxide levels. The production function approach predicts severe yield reductions as a result of global warming. A Ricardian approach that examines the effect of climate and other variables on land values and farm revenues, estimates by using a narrow definition of crops that the negative effect is between 4 and 6 percent of the value of farm output. However, by using a more inclusive definition that weights warm-weather crops and irrigated agriculture more heavily, global warning may be slightly beneficial to American agriculture (Mendelsohn et al., 1994, p. 769). It appears that the effect of global warming would fall disproportionately on the poor, the tropical, and developing countries where the climate is marginal, water is inadequate, and temperatures are high, making agricultural areas less productive or unsuitable (Mendelsohn and Dinar, 1999, p. 278; Mendelsohn and Nordhaus, 1999, p. 1047).

Australia's agricultural industry and the recent climatic changes

Agricultural production has played an important role in the development of Australia's economy and has always been a staple export for the nation. The evolution of agricultural industries in Australia has been determined by interacting factors such as the development of transport facilities, the opening up of new land, and technical and scientific achieve-

ments. However, Australia's dependence on agriculture has declined markedly as the Australian economy has become increasingly diverse, where the value of production of mining and manufacturing has expanded, and the services sector has grown. Agriculture's contribution to the Australian economy has been reduced from 18 percent of gross domestic product (GDP) in 1952–53 to around 3 percent in 1995–96 (Botterill and Chapman, 2002, p. 1). With a weaker agricultural export environment, the flood of cheaper imports combined with strong climatic variability and economic uncertainty dramatically affected local production. Cheaper imports have resulted in the decline of local agricultural production and, combined with reduced investment, resources have been shifted into more profitable areas in an attempt to yield the maximum benefit. As Kaan (2002) purports, primary producers make decisions in an uncertain environment, where the consequences of such decisions are generally not known. Variability of prices and yield are a key source of uncertainty in agricultural production, where the outcomes may be better or worse than anticipated. Agricultural commodities are an important source of income to Australia, but prices fluctuate in a highly unstable world market. "Up to 80 percent of Australia's agricultural products are destined for the international market place, where prices fluctuate in an increasingly open and competitive economy" (Laughlin and Clark, 2000, p. 4). Global agricultural commodity prices are highly volatile because of fluctuations in supply and demand, a direct result of unanticipated events and future uncertainties. Factors such as climatic conditions, pest controls, labor markets, and trade regulations result in fluctuating prices and yields. The inherent instability in agriculture not only arises from nature but also from society, where actions such as price supports designed to buffer instability often add to uncertainty if such actions cannot be adequately anticipated by producers. Consequently, today's successful agricultural producers are entrepreneurs first and farmers second. Entrepreneurs will know when to enter and exit the market and shift resources into a more profitable industry. The uncertainty of the farming environment emphasizes the need for farmers to employ risk management approaches to dealing with commodity price pressures, other economic pressures, and drought.

In consideration of Australia's agricultural sector, the greatest problem and uncertainty for the Australian primary producer is nature, where much of Australia is arid or semi-arid country and rainfall is very unreliable and irregular. Australia is the driest inhabited continent on earth, and extreme climatic variability is a feature of Australian farming due to the size and location. As such, drought of some magnitude is a common

occurrence. The country is subject to a high degree of climatic variability, and for graziers, these fluctuations between dry and wet years are difficult to deal with in a management sense, as they are virtually impossible to forecast, and thus farmers operate in a very uncertain environment. The ability and skill of farmers to manage bad seasons have improved remarkably over the years, but these seasons can still create stress on families, finances, and the business of farming. Making good decisions in the face of a bleak outlook can be difficult, and if delayed, can lead to serious consequences. Balancing the long-term view with the immediate needs of a dry season is complex, as are the environmental, production, and financial challenges. Since 2002, Australia has been experiencing widespread drought, with 70 percent of the country encountering serious to severe rainfall deficiencies for the period April to October (Botterill, 2002, p. 61). Droughts and floods have occurred more frequently in recent years, as highlighted in Table 1.

The Bureau of Meteorology (Department of Primary Industries, 2002) proposes that over the longer term, Australian farmers can expect about three good years, four average years, and three bad years out of ten. As a result, farming in Australia goes through cycles of expansion, overexpansion, recession, and regrowth. At present, an unanticipated event affecting agriculture is the onset of drought, which descended upon Australia in 2002 and continued into 2003 to be one of the driest periods in almost a century. Reports ("Drought and the Opportunity for Change," 2003, p. 14) suggest that the drought is the culmination of six years of below-average rains. Its effects are widespread, devastating thousands of hectares of land for primary producers across all states, heavily reducing the numbers of stock, and destroying crops and pastures, where topsoil is being blown away and is creating a cloud of dust for locals. It has cut export earnings, forced rice mills to close, and again raised questions about the long-term viability of water-intensive crops, such as cotton and rice, on the driest inhabited continent. There is path dependency associated with farmers' decision making, and the uncertainty associated with the drought has had permanent effects because of irreversibilities associated with resource allocation. A mitigating factor against the unrelenting drought is the higher world prices received for stock and crops by farmers who have been able to retain part of their herds and produce. However, the slightly higher prices received are nowhere near enough to offset the devastating effects of the widespread drought.

The current drought and droughts of the past have shown that water shortage and prolonged periods of dryness can lead to environmental

Table 1
The occurrence of major droughts and floods in Australia

Major droughts		Major floods	
1864–1866	All states except Tasmania	1916	Queensland, Clermont
1880–1886	Southern and Eastern states	1926	Southwestern Australia
1895–1902	All states	1929	Northern Tasmania
1914–1915	All states	1934	Melbourne
1937–1945	All states	1940	The Great Roper River flood
1952–1953	Queensland and Northern Territory	1952	Southeastern Australia
1965–1968	Southeastern Australia	1955	Hunter Valley
1972–1973	Eastern Australia	1974	Brisbane
1982–1983	Eastern and Northern Australia and Tasmania	1989	Northern South Australia
1991–1995	All states	1990	Nyngan and Charleville
2002–current	All states	1993	Northeast Victoria
		1996	Daintree River
		1998	Townsville, and coast from Mackay to Ingham

Source: Data collected from McKenzie (1999).

damage, as farmers struggle to maintain their livelihoods. For many, the rains will bring an end to what has been a devastating season, but to say that the rains will bring relief, rejuvenate the soil, and all will be forgotten is naïve. For some, when the rain falls, it is simply too late. Farmers have already removed their resources from the land, as they were unable to cope with the uncertainty of weather and income, and thus looked for greener pastures. Resources have been shifted into more profitable areas such as housing development, and the risk of uncertainty materialized by the restructuring of agricultural production. Accordingly, the drought increases the presence of economic uncertainty and thus increases the risk associated with future investment in agricultural production. With a dramatic drop in production and no incoming dollar, many producers have no choice but to liquidate all agricultural resources and invest their capital elsewhere. Farmers are resilient and hard working, essential to Australia's economy, but with adverse conditions, economic uncertainty, and reduced investment in the industry, many have no choice but to leave behind their livelihood and seek employment or drift onto welfare payments, materializing the risk associated with the unpredictability of farming. Essentially, the recent drought conditions have diminished forecasting confidence, ensuing a decline in agricultural investment.

The effects of the recent drought on investment and agricultural production

A drought carries substantial costs for city and rural areas alike and affects everyone in some way. Power pole fires can be caused by the build-up of dust on wooden poles during a drought, which is then dampened by light rain, resulting in a short circuit with sparks. Bush fires play another role in the drought process, as the drier an area becomes, the more vulnerable it is to fire. With little or no rain and high temperatures, the bush dries out, and disastrous fires occur, as in Canberra in early 2003 and the Ash Wednesday bush fires in 1983. Furthermore, houses begin to crack and move in drought conditions as the soil is deprived of moisture, causing added financial problems to families. Dust storms, water restrictions, broken water mains, sinking building foundations, polluted water supplies, and inflated commodity prices are a few of the many consequences bestowed on individuals and families in times of drought. Few people and industries benefit from a drought, and the financial effects on the Australian rural community are hard felt, in addition to the effect on the country's economy and the balance of payments. Where farmer's incomes are substantially reduced, this often means that

small businesses, which depend on local spending, are drawn into the problem of drought uncertainty and will, consequently, sometimes fail as a result.

The onset of the drought has seen economic conditions in Australia's rural sector deteriorate sharply over the course of 2002 and 2003. The volume of farm production has fallen to levels comparable to the devastating 1994–95 drought. The drought has depressed agricultural production and farm income. This coming financial year, farmer's incomes are expected to fall to levels seen around ten years ago. The effect of the drought is exacerbated by falling prices for some commodities combined with the rising farm costs of increased expenditure on livestock feeding, higher interest rates, and increased borrowing levels. The drought has a major effect on the Australian economy: in October 2002 the Australian Bureau of Agricultural and Resource Economics (ABARE) announced that the drought would reduce economic growth in 2002–3 by 0.7 percent, around $4.14 billion (Botterill and Chapman, 2002, p. 1).

As a result of the drought, the emergence of war, and other unforeseen circumstances, farming production is strongly predicted to diminish in 2002–3, directly affecting a decline in exports and a reduction of economic growth in Australia. Dairy production has fallen, and further significant downturns are anticipated. The shortage of cheese produced has created a strong demand for imported cheese from New Zealand. Grain farmers in Victoria are also expecting significant deterioration with winter crops. In December 2002, the ABARE drastically revised figures revealing a 70 percent fall in harvest levels. With the lower crops of wheat, barley, and canola, it is expected that Australia might need to import larger quantities of grain in the near future. According to Buttler, "wheat production in Victoria is forecast to be down by 68 percent on the previous season," which will have a significant effect on the Australian economy and detrimentally affect those harvesting crops (2002, p. 16). "National canola production is set to be down 61 percent and cotton down 65 percent" (Hopkins, 2002, p. 2). It will be the worst year for Victorian grain farmers since the 1982–83 drought. For the farm sector as a whole, the volume of production in 2002–3 declined by 23 percent. The 2002–3 cropping season was one of the worst on record, with production falling to 17.8 million tonnes, or around 60 percent lower than in the previous year. Grain harvest was the lowest since the drought in 1982–83, when production fell to 13.9 million tonnes. Wheat production declined to 9.4 million tonnes in 2002–3, down from 24.3 tonnes in the previous year. Barley production fell to 3.3 million tonnes, from 8.3 million tonnes in 2001–2 (ABARE, 2002).

During the past year of severe drought, 130 rail freight positions were lost in Victoria due to the huge decline in grain production (Masanauskas and Buttler, 2002, p. 15). Further pressure was placed on the rural economy when almost 70,000 farming and forestry jobs were lost (Colebatch, 2003, p. 5). The effect of the drought has restricted farming activities, whereby farmers have difficulty in maintaining employees until the drought breaks. With the financial effect of the drought expected to linger for several months, jobs will not necessarily return with the falling of the rains. Depleted resources and gravely reduced income and capital may see farmers carry on with only their family resources until a more positive outlook emerges, and certainty is more foreseeable.

According to the Foreign Investment Review Board annual reports, the level of foreign investment into the agriculture, forestry, and fishing sector in Australia has seen dramatic fluctuations over recent years. Table 2 shows that investment has markedly declined from an extremely high $0.998 billion in 1998–99 to a much smaller $135.46 million in 2001–2. Accordingly, the number of proposals to invest in the sector has followed a similar trend. With the drought taking over in 2003–4, the declining trend looks set to continue, with no incentive or profits to attract or encourage overseas interest.

We have been unable to find data regarding domestic investment in agriculture in Australia during the drought.

Policy implications

The restructuring of agricultural production confers many consequences for the future. Where graziers invest their resources elsewhere due to the presence of economic uncertainty, the level of infrastructure available has been reduced. Thus, where farmers are at the mercy of the weather and are trying to replenish the land to get back to their original position before the drought, there is a definite lack of infrastructure in which to operate. Simplistically, the drought has stalled investment into the agriculture sector, and if the attractiveness of agricultural investment has gone, the whole future of rural communities is at risk. Unless producers have sufficient agricultural infrastructure and rural services, such as adequate extension services and efficient transport for getting their produce to markets, then farming will fail. Therefore, it is fundamental that we encourage the exchange of information globally, to assist in developing common strategies, and to consolidate, analyze, and diagnose information for sound decision making. However, the agricultural sector must obtain investment in which to meet these objectives.

Table 2
Foreign investment in Australia's agriculture, forestry, and fishing sector

	2002–2001	2001–2000	2000–1999	1999–1998	1998–1997	1997–1996	1996–1995
Proposed amount of investment (millions)	$136.68	$290.26	$614.32	$0.998	$314.83	$291.03	$268.76
Number of proposals	5	10	18	26	31	23	23

Source: Data collected from Foreign Investment Review Board Annual Reports (various issues from 2001/2002–1995/1996).

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Individuals may be encouraged to invest their capital and resources by being provided with ownership, finance, and the means to market their produce at fair prices. Farmers need better access to rural finance and better marketing services, in addition to education, training, and technical assistance to assist them to be open to the new and profitable innovations that will be especially necessary in the transition to sustainable agriculture. This would include a role both for direct government intervention and for private-sector initiatives. Deficiencies in infrastructure impede development in Australia's regional areas, where much-needed investment could enhance the development of these areas by including the provision of infrastructure such as energy, transport, telecommunications, water supplies, and facilities that deliver educational, health, and financial services.

We can argue, however, that continuing problems with drought and the fluctuating climate conditions emphasize the need for policies that manage Australia's water supplies in a sustainable way. Current initiatives are simply not adequate and, thus, strategies to improve water management are critical. Water loss from irrigation systems is still at unacceptable levels and is, furthermore, no guarantee of drought-proofing. More realistic pricing of such a valuable commodity is needed, while there is also considerable scope for improved efficiencies in water use and recycling in the urban context, which would require government funding and education programs for the community. Additional capital investment will be required by both federal and state governments to improve the efficiency of water management. As Engineers Australia stated, "there is a lack of investment by governments in recycling water. Currently, less than 10% of water generated in Australia's cities and towns is being reused. Government can address this problem by implementing programs to increase water reuse in domestic and industrial environments" (2003, p. 1). The government's approach to water reform fails to consider the need to encourage investment in to the irrigation industry. Rather than providing direct investment to reform water use across the board, current initiatives leave investment directly up to the private sector, hence, the farmers themselves, who are ill able to afford such investment in water efficiency and improvements, due to significantly reduced incomes and cash flow difficulties. Further, attracting investment from the private sector to fund such water efficiency improvements is negligible, as there are no incentives or profits to attract investors. Accordingly "there comes a time when the cost of water and uncertainty over property rights will impact on the investment climate" (ibid.).

Farm debt is high, progressively increasing from $13.7 billion in 1996 to $22.96 billion in May 2003, where at least half of this has been borrowed to purchase land (Boyd, 2003). Farmers own their own land but have few resources to develop any significant enterprises, especially those that may require innovation. Perkins (1998) suggests that in the current low-inflation environment, it is necessary to make profits from the farm itself in order to grow, survive, and reinvest into production. Farmers operate the businesses of land ownership and farm production together. However, these businesses can be separately owned, such as when the farm is leased, share farmed, or operated as a joint venture, which could assist in increasing investment into agriculture. The different businesses have different cost structures, returns, and risk profiles. Land ownership has a high entry cost, with generally low maintenance costs and a low return with high security. A farm business can have a medium entry cost, high maintenance costs, and a high return with low security. These two investments attract investors with different resources and requirements. Corporations or superannuation funds with large investment portfolios may be interested in investing in rural land to balance their investment structures. Primary producers, freed from having to own land, could then invest in larger or more highly developed rural enterprises that would be able to provide the return on investment they require. The exclusive land ownership ethic and monocultural approach to farming are largely responsible for the low yield on investment in land in Australia. Thus, the potential exists to raise the productivity and return on investment on Australian farms.

Federal and state governments have provided drought relief to farmers for decades in Australia. There was recognition of market failure in addition to the politically motivating factors. Until 1989, drought was considered a natural disaster, and this formed the basis for drought relief. Relief was not restricted to income support because there was provision in providing financial assistance for the protection of the resource base, including the preservation of breeding herds. Early drought relief schemes reflected this concern with an emphasis on provision of subsidies for transporting fodder and moving stock to less affected grazing pastures (Botterill and Chapman, 2002, p. 3).

In April 1989, the government announced that drought was no longer covered by the Natural Disaster Relief Arrangements. In 1992, a National Drought Policy was formed with a clear change in drought policy objectives. From now on, drought policy should not undermine the structural adjustment process in agriculture. Emphasis was placed on risk management and the provision of support only to those farms with a

viable future in the sector so as to ensure the advancement of the principles of self-reliance and productivity improvement. The policy implicitly preferred that marginal farm businesses (which are now divorced from farm families) be closed down or taken over or amalgamated with other farm businesses. The free market policies pursued by the Australian government in past decade have resulted in a reduction in the number of small farms and an increase in larger farms (McColl et al., 1997, p. viii).

The new drought policy reflected the adoption of the free market approach of neoliberalism in government policies. The emphasis shifted from offering support to farm families and businesses to long-term profitability and structural adjustment. The disaster responses to drought were substituted with risk management and self-reliance. The 1992 National Drought Policy emphasized profitability, sustainability, competitiveness, and self-reliance, but with one notable addition: drought is a normal feature of farmers' operating environment and, as such, it should be managed like any other risk. The justification for this was that disasters are generally considered to be sudden and unpredictable events. Australia is the driest inhabited continent on earth with extreme climatic variability: climatic variability was seen as "the norm." In addition, recent advances in understanding climatic patterns have increased the predictability of dry seasons. As such, drought should not be considered a disaster. However, a category of exceptional drought was created in recognition that, occasionally, conditions become so severe and prolonged that even the most efficient farms cannot manage. The clause of "extreme drought" and "exceptional circumstances," meanwhile, remains problematic because it is not defined and remains the responsibility of the Commonwealth Minister, making it potentially politically driven.

In response to the current severe drought, the federal government's National Drought Policy of 1992 was engaged, which has seen staggering amounts of income assistance paid to drought-stricken farmers for "extreme circumstances," in addition to the subsidies made available to interest rates on loans. The treasury has estimated that the 2002 drought could cost the federal government $153.58 million in "exceptional circumstances" payments (Truss, 2002). In mid-August 2003, more than 20,600 farm families were receiving family income support, and 5,778 farm businesses were obtaining interest rate subsidies on farm business debt. Assistance through the Exceptional Circumstances program totaled around $109.04 million between July 1, 2001, and July 25, 2003 (ABARE, 2002). However, despite huge cash payments made to farmers, there has been no significant investment announcement by government regarding

agricultural infrastructure during the year to reaffirm the confidence of agricultural producers. Local infrastructure around major capital cities has received major funding, yet the agricultural sector, which has formed the backbone of the Australian economy, is left to struggle with depleting resources. The increased level of uncertainty in the economy due to the drought consequently requires government intervention to direct resources back to the sector and develop the abandoned infrastructure, to allow farmers to get back to their original position before the drought. For example, assuming seasonal conditions improve, producers can be expected to attempt to rebuild herds. However, given the biological constraints on how fast the herds can be increased—the period between joining a cow and the resulting heifer calf producing offspring takes around three years—it is likely to take three or four years before the cattle herd can recover to predrought levels. The rate at which numbers recover will also be influenced by such factors as producer expectations about future returns from beef and returns from competing farm enterprises (ABARE, 2002). The cash handouts merely provide for a farmer's food on the table and feed for their core breeding herbs, which, although necessary, is not sufficient to rejuvenate regional infrastructure. The government needs to focus on regional communities and prepare a strategy for the ongoing development of agricultural infrastructure and resources in Australia's agriculture sector. Both efficiency and equity criteria require consistent government intervention, not only in the form of income support but also as a means of stimulating investment and infrastructure. Government investment in agriculture and infrastructure is competitive with other public expenditures, such as education, municipal water supply, and so on, providing both high private and social returns.

As Anderson et al. (1994) submit, the challenges that lie ahead for primary producers are considerable indeed. There will be unprecedented increases in the demand for additional food and fiber production, while the threats to even achieving, let alone sustaining, such levels of output in agriculture loom large. Consequently, primary producers must undertake careful business planning, which must make allowances not only for the longer-term changes that are reasonably predictable but also a comfort margin should be built in for unexpected events.

There are a number of implications likely to arise for Australian primary producers as they contemplate the future during the next decade, according to Lucey and Devlin (1996). First, investment decisions will have to be made with considerable care, particularly if loan repayments extend beyond the end of the decade. Budgets would have to take account

of the lower profitability margins, with limitations on direct payments by governments, particularly for the larger, more commercial farmers. Second, production efficiency will become more important as prices are reduced and the margins between the value of sales and production costs become more critical. Third, scale of production will become more important. Modern technology will facilitate larger scale of production, but the cost of farm expansion, particularly where it involves land purchase, is a major barrier. Accordingly, quotas, licenses, and access to foreign markets will become a more central issue.

If a more sustainable Australia is to be achieved, greater investment and infrastructure are required in Australia's agricultural sector, which may require a change to current farming practices and management strategies. As such, government intervention appears critical. In the case of drought, the government and individuals need to weigh the uncertainties about drought in order to carefully formulate suitable policies for the future development of agricultural production. The current farming conditions have considerably diminished investor's confidence, which has directly resulted in decreased investment to the industry in which so many farmers rely. Without capital available for infrastructure, rebuilding properties to predrought positions is almost impossible. Thus, efforts should focus on rebuilding and expanding agriculture infrastructure, attempting to provide better opportunities for farmers, and potentially attracting previous and new investors to the industry by renewing confidence. Accordingly, government policy forms an essential element to achieve the conquering of a drought and further progress the agricultural industry and make it sustainable in the future.

Conclusion

Australians farm an island continent where production agriculture operates in a highly unreliable climate. The demands of a growing world population suggest that agriculture is a vital part of a country's economy. However, it is receiving little attention with reduced private investment to the industry resulting from the drought, and uncertainty surrounding the future. The necessary empowerment mechanisms and rural infrastructure must be in place if primary producers are to remain competitive in the twenty-first century. Providing much needed investment will assist future success in the risk-laden and uncertain world of agricultural production, determined largely by the ability to anticipate and prepare for the unpredictable future. Failure to support and nurture today's Australian primary producers may reap unfortunate and undesired conse-

quences in the future. If Australia's agricultural sector is to have any chance of survival, it must respond to challenges and exploit opportunities, increase investment to the industry, and provide the required infrastructure.

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