Incentives, Information & Drought Policy

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Abstract

Australia is subject to widespread droughts, with significant financial implications for agricultural producers, regional, state and national economies. Most economic assessments conclude there is no economic efficiency case for governments to provide drought assistance. However, significant public funds are allocated to farmers during droughts and there is a second-best case to improve drought policy design. In the paper it is argued that the National Drought Policy suffers from adverse selection, moral hazard, incentive compatibility and government commitment problems. The key reason this approach is ineffective is that it is very difficult if not impossible to design an efficient and fair drought policy that relies on ex post revelation of information. An alternative approach is investigated where incentives are designed so that farmers self-select into one of a number of drought policy agreements or contracts. Under this approach, farmers would be offered either a subsidy on risk management actions, such as privately provided rainfall insurance/weather derivatives and self-insurance, thereby forgoing other forms of drought assistance; or assistance to adjust out of the sector. Although there are dead weight losses associated with these forms of assistance, there are likely to be offsetting efficiency gains if adverse selection and moral hazard can be reduced. The government commitment problem also needs to be addressed through better institutional design.

Views expressed in this paper are those of the authors and not necessarily those of the Department. Use of any results from this paper should clearly attribute the work to the author and not the department.

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1. Introduction

Australia is the only continent where the overwhelming influence on climate is a non-annual climatic change, the 'El Nino Southern Oscillation' (ENSO) (Flannery 1994). Severe 'droughts and flooding rain' have been observed from both geological and human records. For example, Lang (in Williams 1967) recorded a drought in the 1830s lasting nearly three years where "the heavens became as brass and the earth as iron". Drought events have had a profound influence on the Australian landscape and also on the size and structure of our primary industries.

ENSO events have a severe financial impact on both individual farm businesses and the economy as a whole; they expose soil to severe degradation and can dry-up rivers and lakes for extended periods. Agricultural producers bear much of the financial damage caused by drought and farmers manage the risk imposed by drought in a variety of ways using both on-farm and off-farm measures. However, over the latter half of the 20th century, governments have become increasingly drawn into providing assistance to farmers adversely affected by drought. In effect, governments now share some drought risk with primary producers. It is questionable, however, whether this assistance has been provided for the right purposes or to the right people. Lack of commitment to pre-existing policies has led to increased lobbying by farmers and has provided incentives for farmers to change their behaviour to attempt to gain extra assistance. It can also be argued that drought assistance has had adverse impacts on the environment and animal welfare.

The aim of this paper is to examine drought policy as an economic problem – to systematically tease out the key features of a more efficient and equitable response that governments could employ in preparing for future droughts.

An important characteristic of droughts in Australia is that they occur on a systemic basis — often over large tracts of land rather than as isolated independent events. It has only been recently, however, that meteorologists have attributed many drought events to systemic climatic processes such as the 'El Nino Southern Oscillation' effect (ENSO) (Botterill and Fisher. 2003) shows that the eleven major droughts since 1864 have affected large tracts of land in Australia (see Table 1.1).

ENSO and other large-scale climatic events are largely borne by farmers but their impacts also show up in the national accounts. The 2002-03 drought, for

example, caused average farm cash incomes in Australia to fall by 42 per cent in the broadacre industries and 72 per cent in the dairy industry (Martin, et al. 2003). In Victoria these sectors experienced reductions in cash income of 43 and 82 per cent respectively. Adams et al. (2003) estimated that the drought caused regional income in the Mallee and Wimmera regions of Victoria to decline by 15.5% and 11.1% respectively, state income (GSP) to decline by 1.6% and national income (GDP) to decline by 1.2%. The drought reduced investment in Victoria by 0.5% (0.7% at the national level); caused employment to decline by 0.4% in Melbourne, 0.6% in Victoria and 0.8% nationally; and export volumes to decline by 4.3% in Victoria and 5% nationally.

Table 1.1 Incidence and severity of drought in Australia

Year	Distribution/Impact
1864-66	All states except Tasmania
1880-86	Southern and eastern states affected
1895-03	Affected most of Australia…sheep numbers halved and 40 percent loss of cattle
1914-15	South Australia, Tasmania, New South Wales 19 million sheep and two million cattle lost
1918-20	Only parts of Western Australia free from drought
1939-45	New South Wales, Victoria, Queensland, some parts of Western Australia…loss of nearly 30 million sheep
1963-68	Widespread drought. 40 percent drop in wheat harvest, 20 million sheep lost
1972-73	Mainly eastern Australia
1982-83	The most intense and widespread on record. Total loss estimated in excess of $3,000 million. Eastern and southern Australia affected.
1991-95	Average production of rural Australia fell by 10 per cent. $590m drought relief provided by the Commonwealth.
2002-03	Eastern and southern Australia

Source: Botterill and Fisher (2003), pp.40-43.

1.1. Current drought policy

In 1992 drought policy was fundamentally altered with the agreement of the National Drought Policy (NDP). The definition of drought changed from a "natural disaster" to a normal part of the farm operating environment to be managed like other business risks. However, it was considered there could be 'exceptional' droughts for which farmers could not be expected to prepare or

manage and that Government assistance would be required during "Exceptional Circumstances" (EC).

Under the NDP, areas are EC-declared for two years by the Australian Government following applications from State Governments (collaborating with interested parties) and assessments by the independent National Rural Advisory Council. An EC event is defined as being 'rare and severe', resulting in a one in 20-25 year downturn in income amongst a significant number of farmers in an area over a period of greater than 12 months (Stoneham, et al. 2004).

Farmers in EC-declared areas are eligible to apply for welfare assistance (equivalent to 'Newstart' welfare available to all Australians except farm assets are excluded from eligibility tests) and/or business assistance. Business assistance is offered in the form of interest rate subsidies (50%) on new and existing loans up to a maximum of $100,000 in any 12-month period, with a cumulative maximum of $300,000 over the previous 5 years (subsidies are given as cash – no obligation to use for interest payments).

In addition to assistance during droughts, farmers also receive assistance to prepare for drought, primarily through the Australian Government's *Agriculture -Advancing Australia* (AAA) program that includes: FarmBis to promote new skills (State: Commonwealth funded); Rural Financial Counselling services to assist farmers assess their situations and consider their future (State:Commonwealth funded); FarmHelp to assist non-viable farmers leave agriculture (Commonwealth funded); Research on climate variability; and Farm Management Deposits to promote self-management of financial risks (funded via foregone taxation). Spending by the Australian Government alone on AAA is estimated at around $1 billion since 1997.

It is widely recognised that NDP had a number of practical short-comings which became evident during 2002-03 drought. Despite the objective of 'self-reliance and asistance only in rare and severe EC events', governments were pressured to provide assistance earlier than EC policy prescribed. For example, NSW introduced transport subsidies in mid-2002 and Victoria introduced Farm Business Support Grants in October 2002 (Stoneham, et al. 2004). These measures were in response to intense media interest and pressure from farm groups and the broader community. Similarly, the Commonwealth responded to this pressure by introducing measures (*prima facie* EC and 'interim' income support) before events were officially 'rare and severe' (see www.affa.gov.au - rural policy and innovation).

The resulting confusion amongst farmers, due to different types of assistance, and a general recognition that EC policy could be improved, led to a review instigated by the Australian Government (Woods 2004). New initiatives to enhance preparedness (combined with reduced emphasis on business assistance) are being developed through State/Territory/Commonwealth Ministerial forums. However, the key issue - governments acting outside NDP due to political pressure - is not beng directly addressed. Rather, it is hoped that developing less cumbersome EC-declaration processes, so that assistance flows more swiftly, will remove the 'need' for goverments to step in before rare and severe events are declared.

The push to strengthen the message that drought preparedness is a farmer's responsibility follows evidence from a review of *AAA* (DAFF 2004) that a significant proportion of farmers still do not prepare adequately for drought. The review notes (stating on pages 7 and 8) the following:

- "Of significant concern is the one third of farmers that perceive drought could have a significant impact on the viability of their farm but have done nothing about it".
- "Of greatest concern is that more than 75 per cent of farmers in this group are not planning to implement a drought management response in the next 12 months".
- "Overall, 63 per cent of farmers were found to have specific strategies to deal with a serious drought. Most of these strategies were production oriented, including stock piling of feed, decreasing stocking rates, improving irrigation practices or using water more efficiently, building additional water storage facilities, undertaking prudent financial management and using Farm Management Deposits (FMDs)".

In the 2002-03 drought, assistance was provided to Victorian farmers in the form of cash grants (called Farm Business Support Grants – FBSG). These grants were for up to $20,000 per farm to assist individuals who met eligibility criteria (Stoneham, et al. 2004). This assistance was provided because EC assistance was perceived, by interest groups, to be provided "too slowly". Even though cash grants are widely perceived to offer a more neutral form of assistance than interest and other input subsidies, there remain significant targeting and incentive issues with this form of assistance. DPI commissioned the Australian Bureau of Agricultural and Resource Economics (ABARE) to conduct a survey of the characteristics of farmers who received Farm Business Support Grants. The

results of this survey are summarised in Table 1.2, from which the following observations can be made:

Assistance was provided to farmers who did not prepare for drought - The survey results indicate that recipients of FBSGs had much lower levels of Farm Management Deposits (667%) than non-recipients. Those that received a grant appear to have higher numbers of stock and retained stock during the drought. As shown in Table 1.2, the 'opening livestock value' of recipients of the FBSGs was on average 4 per cent higher than non-recipients but their 'closing value' was 30 per cent higher. Non-recipients of support tended to sell stock 'early' and 'saved' money that may then have made them ineligible for the grant because they were assessed as 'not in need'.

Assistance was provided to farmers with higher net asset values - Recipients of cash grants had, on average, 50% more land than non-recipients and 24% higher total capital value of farm.

Assistance was provided to "risk-taking" farmers - Recipients of drought assistance tended to be less cautious or not 'risk-averse' types. Their characteristics included: *lower equity* (recipients 7.4% lower equity than non-recipients); *lower liquid assets* - recipients had 217% lower total liquid farm assets, fewer public shares (200%) and lower bank savings (63%) than non-recipients; and *higher farm debt* - recipients had 33% higher farm debt prior to the drought than non-recipients.

Table 1.2 Analysis of Victorian Farm Business Support Grants

PARAMETER	RECIPIENTS		NON-RECIPIENTS		ALL	
	Estimated Mean	**RSE**	**Estimated Mean**	**RSE**	**Estimated Mean**	**RSE**
Population	3,025	.	18,929	.	21,953	.
Sample Size	52	.	262	.	314	.
Physical						
Area (ha)	746	14	498	4	532	4
Financial						
Total capital, closing ($)	1,851,895	10	1,496,125	4	1,545,144	4
Land capital ($)	1,392,587	9	1,180,195	5	1,209,459	4
Opening value of livestock	185,689	6	178,789	4	179,739	3
Closing value of livestock	159,749	6	123,326	6	128,344	5
Liquid assets ($)						
Total farm liquid assets	42,550	21	135,174	26	121,295	25
Opening FMDs	2,357	70	18,438	18	16,028	18
Closing FMDs	2,090	50	21,012	15	18,176	15
Shares public company	21,963	18	65,804	53	59,234	50
Bank savings	12,122	36	19,661	19	18,532	18
Debt ($)						
Total farm debt opening	279,675	17	157,569	8	174,944	7
Total farm debt closing	344,535	13	166,987	8	192,251	7
Land debt opening	149,906	19	94,103	12	102,043	10
Equity, closing (%)	81.4		88.8			

Source: ABARE unpublished data.
Note: RSEs are a measure of an estimate's sampling error as expressed as a percentage.

1.2. Role of government

It is widely recognised that farmers, like other private firms or individuals, are not able to carry the financial impact of all contingencies. Generally, risk averse firms look for a risk neutral partner (such as insurance firms and other financial institutions) to share these risks. These large organisations can carry risk in a less costly way than small firms. Conventional economic wisdom suggests that markets, such as commodity markets, capital markets and insurance markets, can be relied on to efficiently allocate resources, if there is a complete and efficient set of these markets. While government may choose to intervene in the economy to influence the distribution of wealth across members of society, intervention for economic efficiency reasons is only warranted where:

a) markets are inefficient or missing (the necessary but not sufficient condition); and

b) benefits of intervention exceed costs.

1.2.1. Inefficient/missing markets

Markets operate efficiently under a specific set of conditions including when there is perfect information, low transaction costs and well-defined and enforceable property rights. For tradeable goods these conditions generally hold, leading economists to argue that a full set of efficient commodity markets will exist. Similar reasoning can be applied to assess whether capital, labour and risk markets are efficient.

In the past, most economic analysis of drought has concluded that the pre-conditions for efficient markets are not substantially violated, suggesting no case for government to intervene on economic efficiency grounds (Freebairn. 1983). Furthermore, past policy analysis has suggested that producers can insure against drought by purchasing insurance. In this world, producers will perfectly insure against drought if there is no government intervention. However, there are two factors that limit the scope for risk markets to be employed to manage drought:

Systemic risk - Systemic drought events (ENSO induced) will mean premiums for drought insurance will be high. Bardsley et al. (1984) explain that private insurance companies will not be interested in offering insurance contracts when there are limited risk pooling opportunities. Insurance works best where individual risk events are independent from each other (eg. if one house burns down this does not mean all houses burn down). Where all farms go into

drought at the same time (because of ENSO) insurance may not be offered because premiums will be too high. On the other hand, if droughts were independent random events on different farms, it could be argued that efficient insurance markets should emerge and there would be no first-best case for government intervention.

Crowding-out - Governments have a history of providing assistance in times of drought which makes commercial risk management products relatively less attractive. In effect, governments bear some drought risk without cost to farmers.

Newbery and Stiglitz argue that systemic risk and consequent incomplete markets for drought risk may constitute market failure because insurance markets are missing (Newbery and Stiglitz. 1981). Where relevant risk markets are missing, farmers use commodity markets to perform both an allocative and risk diversification functions. This imposes costs on the economy because commodity markets do not efficiently price risk. Whether because of systemic risk or crowding-out by government, drought risk markets are limited and premiums will tend to be high. This suggests that the first condition for government intervention - (that markets are missing or inefficient) can be observed.

1.2.2. Benefits and cost of intervention

The case for or against government intervention then rests on whether the benefits of intervention outweigh the costs, that is whether government can offer drought insurance at a lower price than private providers. This is unlikely for two reasons:

Ability to spread risk - Just as insurance firms have discovered systemic drought risk leads to high premiums and low demand for insurance, Newbery and Stiglitz (1981) note that this also precludes government from doing any better. Unless it can be argued that government has greater ability to spread risk than private companies, there are no underlying reasons to suggest government could lower the price of drought risk. International insurance companies are large, have scope to underwrite risks, and hold diversified portfolios unrelated to Australian drought (Quiggin. 1986). It is difficult to believe they have less ability to spread risk than government

Skills - Insurance is not generally the business of government and governments do not have better information systems, actuarial skills etc. (needed to efficiently

price risk) than the private sector. Government is unlikely, therefore, to be capable of effective intervention in risk markets.

Despite the weak case for intervention, farmers are often successful in lobbying governments to provide financial assistance. The reasons for this are important but poorly understood. Wahlquist (see Botterill and Fisher 2003) cites notions about the romance of the bush, the battle against adversity, farmers as victims of circumstance, national interest etc. as reasons why governments are inclined to provide assistance in times of drought. Empirical survey analysis commissioned by the Queensland State Government (Wilson et al 2004) on attitudes to drought assistance found community members were more likely than farmers to support a case for taxpayer assistance to farm businesses in times of drought.

The economic efficiency arguments for government intervention in drought risk management are weak. While welfare is an important consideration it is difficult to argue that drought causes welfare problems that deserve special forms of assistance over and above those generally available. There is a case, however, to review drought policy because primary producers are able to successfully lobby governments to provide assistance in times of drought. The way this assistance is provided can be shown to be poorly targeted; reduce economic performance generally in the economy; and provide disincentives for self-reliance. In the remainder of this paper we examine the economic concepts needed to understand drought from a policy design perspective, review alternative drought policy mechanisms, propose an alternative approach and discuss the institutional design problem.

2. Economic ideas relevant to drought policy

There are a number of economic concepts that provide a framework for analysing drought policy. These are briefly reviewed in the following sections as a basis on which to assess the current and alternative approaches to drought policy. See Stoneham et al. (2004) for more in depth discussion of how these concepts relate to drought policy.

2.1. Risk

Like the rest of the population, farmers have different attitudes to risk. Some are very cautious when it comes to farm management and investment decisions whereas others will be more inclined to risk taking. Risk-averse producers will only accept a risky alternative if they are paid a *risk premium* above the expected value of the proposition (Mas-Colell, et al. 1995). To a risk-neutral producer, risk is irrelevant, what matters is the expected value of the gamble. This means risk-neutral producers do not require a risk premium to accept a gamble.

Risk-sharing occurs when two parties spread risk between themselves. In drought, risk can be (theoretically) shared between farmers and another party, such as an insurance company. Invoking the *law of large numbers*, if the insurer has a portfolio of diversified risks that are uncorrelated, then the insurer's risk in holding this portfolio is zero because of *risk-pooling* (Goodwin and Smith. 1995). When these conditions exist, firms or individuals can share the risk burden with these large organisations at a lower price than self-insurance. In Australia, at least, droughts often occur as a result of systemic influences, such as ENSO, making risk-pooling more difficult/costly.

Government can also share risk with producers through a social insurance approach where premium rates are not charged but where risk is shared. Natural disasters, such as wide-spread flood and fire tend to attract government support. Yet another approach is to pay each drought-affected producer an amount according to some measure that is correlated with the severity of drought.

2.2. Asymmetric Information

Where government does become involved in providing assistance some explicit or implicit agreement forms the basis of risk sharing between individuals and government. Economic frameworks have been developed to investigate the way

parties interact and how contracts and agreements are negotiated. This is referred to as *principal-agent* theory (Laffont and Martimort. 2002): the principal (eg. the insurance firm) wants to make some arrangement with an agent (eg. a firm) that defines the way risk is shared and priced. It is also possible to use this framework to think about how government (the principal) might formulate an agreement with farmers to define how drought risk is managed. Government will have specific goals including economic efficiency, equity and fiscal considerations. The question is what kind of incentives will achieve the principal's goals and how should these incentives be offered?

The major impediment to the development of efficient and fair agreements between these different parties is that the principal does not have access to all the information it needs to satisfy its objectives. This is referred to as the *asymmetric information* problem. Information asymmetry complicates drought policy design by introducing the problems of *adverse selection* and *moral hazard*.

If government knew the private information of each producer (such as their true financial situation) it could target drought payments perfectly to the desired groups and adverse selection would not be a problem. This is the adverse selection problem — this is when individuals have incentives to misrepresent the group they belong to (their "type" or their private information) in order to gain rents. The rents are referred to as *information rents*. The greater the information rents the greater is the incentive for individuals to misrepresent their type.

If the government could observe every action of the producer then the government could take steps to prevent producers engaging in moral hazard. This is a problem with most contractual arrangements because the principal is not able to *monitor* the actions of the agent and cannot reward (penalise) individuals who do (do not) complete the actions contracted. Moral hazard is likely to be particularly important where agents operate in remote, unsupervised situations (farms may fit this category).

Risk specifically affects the design of contracts or agreements through it's link with the potential for moral hazard behaviour. If individuals are risk-neutral, government has greater scope to achieve allocative efficiency because it can exploit indifference to risk. It can reward individuals who undertake risk minimisation actions and penalise those who do not. A more realistic case is to assume that individuals are risk-averse. In this case risk-sharing procedures can

be employed to lower (but not completely eliminate) risk to the individual to ensure that they undertake risk minimisation actions. Recall from 2.1, this entails the payment of risk a premium to the individual to bear some risk.

With all agreements and contracts, there are problems with how well the principal is able to confirm whether or not individuals are engaging in adverse selection or moral hazard. Truthful *information revelation* refers to the revelation of an agent's private information. Observing the actions or choices of agents can reveal private information. An agent's actions reveals private information because agents act in such a way presumably for some private benefit — therefore any action conveys information on which action the agent considers the most privately valuable.

Moral hazard can be partially dealt with through *monitoring and enforcement* if the principal is able to do so at relatively low cost. Monitoring refers to the principal observing the actions of an agent. This could be based on explicit measures specified in the contract, such as output or inputs, but will always be difficult where actions are not readily observable and if there are no *verifiable* measures of producers' actions. Verifiability is whether or not an action can be proven to an objective third party (eg, a court of law).

When the principal finds verifiable evidence that the agent is in breach of contract, the principal can choose to *enforce* penalties against the producer or not. The decision to proceed with enforcement depends on whether *transaction costs* of enforcement are prohibitive. Transaction costs are the costs (eg administrative or legal) of undertaking actions such as enforcing contracts through law courts. In some cases these costs can outweigh the expected benefits of enforcement actions.

Clearly it is not possible for government to have perfect knowledge and monitoring but it is possible to explicitly take account of adverse selection and moral hazard as part of the policy design process.

2.3. Government Commitment

Commitment is defined as the ability of an individual, firm or government agency to ensure that future actions comply with the terms of an agreement (Salanie. 1997). In the context of drought policy, *government commitment* means government being able to refrain from intervening in the implementation of ad hoc policies in the face of political pressure. Government commitment can affect the outcome of drought policy through *credibility* in both enforcing the policy and in implementing a more efficient drought policy. Botterill provides an

account of how government commitment collapsed during recent drought events (Botterill. 2003).

In economic theory, it is often assumed that governments are benevolent social planners — they will always act to maximise society's welfare. This is not, always a safe assumption because governments can be seen to be rational by choosing policies that maximise their re-election probability; ie, governments are groups of individuals acting in a self-interested way.

Commitment may be difficult to maintain because of political incentives to abandon commitment. When such incentives exist, economists say commitment is *non-credible*. For example, if producers as a whole do not believe the government can make a credible commitment to maintain a particular drought policy, then they will lobby for more advantageous drought policy payments. Without credible commitment to maintain drought policy, producers may act in a seemingly irrational manner by not investing in drought preparation, instead believing that government will be generous when a drought occurs. These behaviours have been observed with the National Drought Policy during the 2002-03 drought (see chapter 1).

2.4. Incentive compatibility

Well-designed policy will take account of all incentives that lead individual producers to make decisions and take actions that are aligned with broader objectives of drought policy, specifically encouraging 'self-reliance' in managing drought risk — hence the term incentive compatibility. Drought policy cannot be considered in isolation but also needs to account for incentives producers face from the tax system (eg for environmental protection), with respect to structural adjustment, and any other areas where governments intervene.

2.4.1. Incentives within the taxation system

A number of studies have shown that the taxation system has perverse incentive effects on the economic behaviour of producers — it is not incentive compatible. Douglas summarises key problems with elements of the taxation system that are relevant to drought (Douglas. 2002). Besides a general bias in the income tax system to provide agricultural producers with concessionary tax treatment, there are many specific concessionary provisions. He highlights perverse incentives for resource degradation in natural increase, averaging, and livestock election provisions (which can discourage de-stocking as a farm management option during drought); in investment incentives for conservation and conveyance of

water; and in investment incentives for the horticulture and viticulture industries. Some provisions encourage more income risk than would be chosen if there were no penalties for off-farm income.

2.4.2. Incentives, environment and animal welfare

Most damage caused to the natural resource base occurs episodically. Extreme events, such as prolonged lack of rainfall followed by torrential rainfall, cause the most degradation of soil and water resources. These risks to the resource base can be accentuated by the stocking and cropping strategies adopted by farmers, which in turn, are influenced by the incentives embodied in government policy.

Drought policy may provide perverse incentives to degrade the natural resource base through rule based eligibility criteria. Sometimes these criteria are liable to be manipulated in order to receive drought assistance and, as well as leading to allocative inefficiencies, the environment and animal welfare could also be adversely affected. Drought policy can also compound the environmental costs of drought if it discourages prudent farm management. For example, the livestock elections and natural increase provisions may provide disincentives to de-stock livestock enterprises during drought, increasing the risk of land degradation. These provisions penalise abnormally high sale of livestock either in the current year (natural increase) or in future years (livestock elections) by increasing tax liabilities. Because of these provisions, livestock producers may choose to retain livestock despite the reduced carrying capacity due to the drought. Decisions made in this environment may also have implications for animal welfare.

3. The Current NDP

In this section we use game theory to explain how the current NDP works. The central goals of the NDP are to promote 'self reliance' among Australian producers in managing drought (O'Meagher, et al. 2000). This is similar to the policy prescription for the 'no market failure' first-best case; essentially, the Commonwealth government believed there was no case for government intervention during drought. However, government assistance was made available to producers in a specific geographic area experiencing from 'exceptional circumstances' (EC). Three main criteria must be satisfied in order for an event to be declared exceptional (AFFA. 2003):

1. a severe decrease in income must be experienced over a prolonged period of time;
2. cannot be planned for as part of a risk management strategy; and
3. must be a rare and discrete event (ie, only occurs on average once every 20 to 25 years).

The process of EC declaration can be described in game theoretical terms as a 'sequential move' game (Tirole. 1988). That is each 'player' moves in turn. There are three sequences in this game. The players that move first are producer and/or community representatives, let us call these players 'lobbies'. They initiate this game by alerting their State or Territory government on the perceived severity of the drought they are experiencing. The State or Territory government is the player who moves next; let us call these players the 'non-Commonwealth' players. The non-Commonwealth players decide whether or not to write a submission in conjunction with lobbies to persuade the Commonwealth government to declare the identified region an EC area. The Commonwealth is the last player in this game. They receive the submission from non-Commonwealth governments and decide whether or not to declare the lobbies' area is experiencing EC.

In any game analysed by the tools of game theory, there are payoffs to each player from participating in this game. That is, there are gains and losses associated with each decision. For lobbies, if EC is declared, producers are able to access EC Relief Payments and interest rate subsidies (AFFA. 2003). For a typical agricultural household, the EC Relief Payments may be nearly $700 per fortnight and may last for up to two years (Centrelink. undated). Even if EC was not declared, producers are able to access 'interim income support' payments

during 2002-03 if the Commonwealth is in the process of considering the non-Commonwealth government's submission for EC declaration (AFFA. 2003). Affected businesses are also entitled to interest rate subsidies (AFFA. 2003). In addition to Commonwealth support, State and Territory governments may provide independent drought assistance schemes (AFFA. 2003).

The payoffs for non-Commonwealth governments may be both political and financial. Political, because lobbies can use their local influence to 'reward' or 'punish' governments at election time by influencing how local people vote by using drought as an issue. Hence, State or Territory governments may be vulnerable to political pressure. The financial payoffs may be the higher payments made if the non-Commonwealth governments acknowledge the existence of a severe drought by preparing a submission for the Commonwealth government to consider. Conversely, if non-Commonwealth governments do not believe the lobbies are experiencing a severe drought, it does not make the additional payments triggered by drought. The payoffs for the Commonwealth government are similar for non-Commonwealth governments except that it may be more vulnerable to political pressure especially if drought is nation-wide.

We summarise the discussion in this section by drawing a game 'tree' that represents graphically the structure of what we shall call the 'EC game'.

Figure 3.1 The EC Game

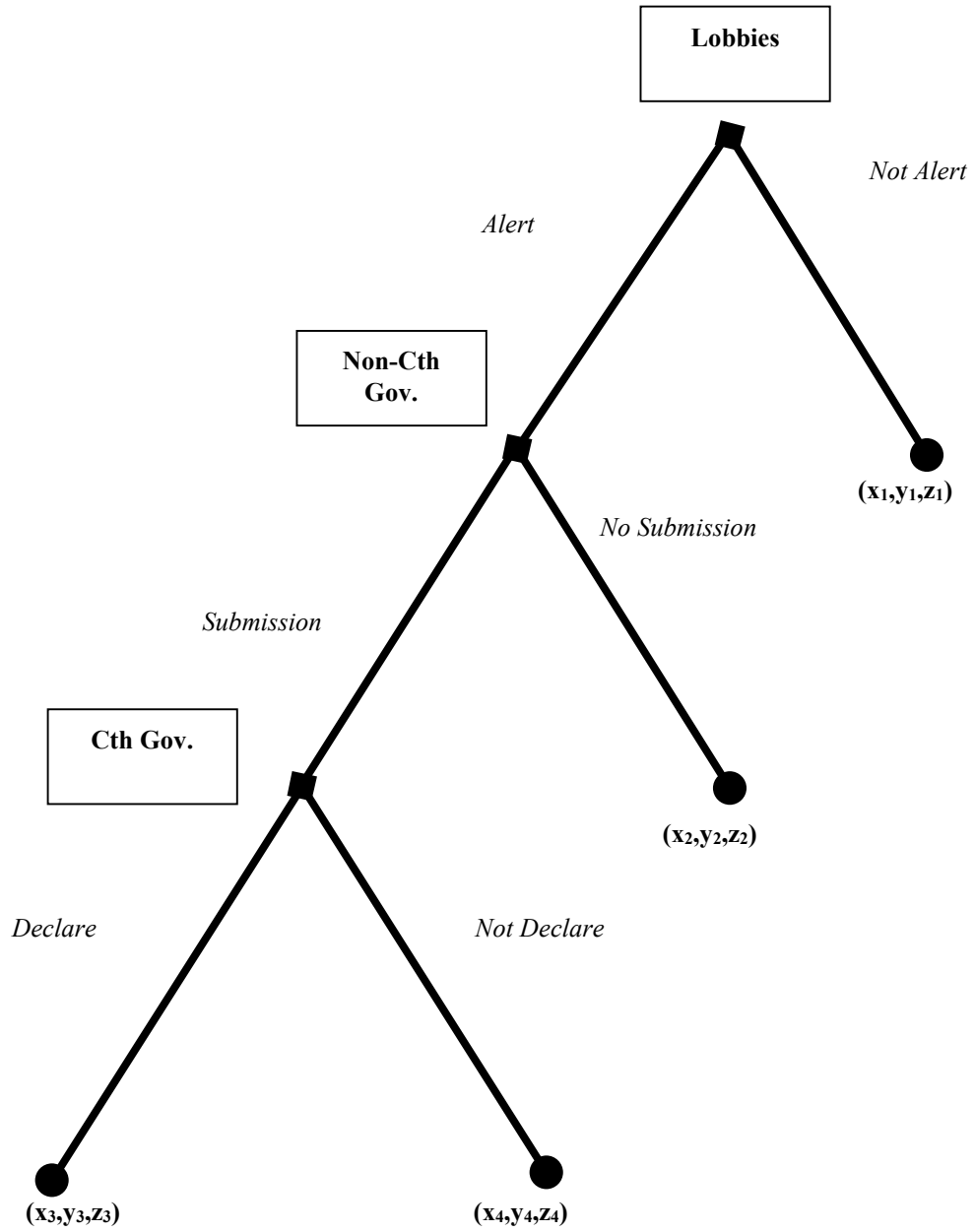


Figure 3.1 is the game tree of the EC game. The name of each player is in the boxes. They correspond to a 'decision node' for each player which is represented by the diamond-shaped node. A decision node is where the player is faced with a choice; the choices are given in italics next to the 'branches' emanating from each decision node. These branches either lead to the next player's decision node (eg, from lobbies to non-Commonwealth governments) or to 'terminal nodes' which is the circular node. When the game reaches a terminal node, the game ends and each player receives their payoffs. The value of payoffs are given by the brackets; the x value represents lobbies' payoffs, the

y value is non-Commonwealth payoffs and z represents Commonwealth payoffs. The subscripts are assigned to each payoff to assist in identifying in which decisions have been played. For example, a subscript 4 means lobbies have played 'alert', non-Commonwealth have played 'submission' and Commonwealth have played 'not declare'. The reason why we have not assigned actual numerical value is because this will allow us to consider different situations of this game when payoffs have been modified.

Let us consider the present situation as described above. That is lobbies prefer the following payoffs (in descending preference) x_3, x_4, x_2 and x_1. What this preference ordering tells us is that lobbies unambiguously prefer the non-Commonwealth government to write a submission for EC declaration and the Commonwealth government to declare EC. Given this ordering of payoffs we can predict that lobbies will always play 'alert' and never play 'not alert'. The non-Commonwealth government's preference ordering of its payoffs in descending order is assumed to be: y_1, y_4, y_3 and y_2. That is, the non-Commonwealth government prefers it if lobbies play 'not alert' in the first place but if this does not occur, prefers the Commonwealth government to declare rather than not declare. The non-Commonwealth government will not play 'no submission' because, given our previous discussion, the lobbies punish them by campaigning against them in the next election. Therefore, the non-Commonwealth government will always play 'submission' because of a fear of rural voters' backlash. The Commonwealth government's preference ordering in descending order is: z_1, z_2, z_3 and z_4. That is, the Commonwealth prefers if lobbies kept quiet, but if this does not happen than it prefers the non-Commonwealth government refuses to help the lobbies pressure the Commonwealth to declare EC. But if the lobbies play 'alert' and the non-Commonwealth government plays 'submission' than the Commonwealth always plays 'declare' to avoid being punished at the next election by the lobbies. The outcome of this game is then for lobbies start the game by playing 'alert', the non-Commonwealth playing 'submission' and the Commonwealth by playing 'declare'. The payoffs from this outcome is (x_3, y_3, z_3); in game theory this is called a *Nash equilibrium* because this is the outcome of rational and intelligent players doing the best they can given their understanding of what the other rational and intelligent players do (Myerson. 1991).

Notice that this Nash equilibrium may not be efficient because both the non-Commonwealth and Commonwealth governments are better off if the lobbies do not play 'alert'. This is because y_1 is greater than y_3 and z_1 is greater than z_3.

Conversely, the lobbies are no where better off than at the Nash equilibrium. This result relies on the assumption that the lobbies can punish both tiers of government.

Also note that punishment by the lobbies is not a discrete action by the lobbies but is instead implicit in the actions of the non-Commonwealth and Commonwealth players. This means punishment by the lobbies is contingent on the actions of the other players. In this way, we have simplified the game. Have we simplified the game to the point where we may be ignoring the lobbies incentives to punish? In our EC game, an implicit assumption is that lobbies are able to credibly commit to punishment if either the non-Commonwealth plays 'no submission' or the Commonwealth plays 'not declare'. Given our description of the actual EC process, this implicit assumption is not unreasonable. To see why, the payments received from EC declaration are greater than if EC was not declared, even if interim income support are made available (which they are). However, the gain from EC declaration are higher than the other outcomes. Therefore, the lobbies have an incentive to punish if the other players do not play the Nash equilibrium actions.

This game theoretical analysis is very simplistic and ignores many factors such as the role of the media in transmitting and applying political pressure and the model does not explain why some regions were not successful in applying for EC. However, it makes transparent the strategic interactions between the players. Our simple game theory model highlights the flaw of the current EC system: there is an institutional bias towards EC declaration. The current EC process actually provides perverse incentives for lobbies to apply political pressure because it is able to achieve its highest payoff to do so. Recall that lobbies are able to access 'prima facie' interim income support if the Commonwealth is in the process of considering the non-Commonwealth submission for EC declaration. This means there is an incentive for the lobbies to play 'alert' even when they might not be experiencing an EC event because the prima facie payments are not dependent on EC declaration but on non-Commonwealth playing 'submission' (Centrelink. 2003; Stoneham, et al. 2004). Lobbies are better off from lobbying than not; the EC process actually provides incentives for lobbies to punish governments. This makes credible government commitment impossible to achieve because each tier of government knows it will be punished if it 'deviates' from the Nash equilibrium outcome.

We have shown that the current EC system can be modelled by using game theory. The analysis suggests that the EC process incorporated an institutional bias towards EC declaration if we assume producer and community groups are sufficiently influential at both the State/Territory and Federal level. Government commitment cannot be credible in the 'EC game' because the threat of punishment is too much of a disincentive for governments to deny the lobbying efforts of producer and community groups.

3.1. The Lack of Government Commitment in Implementing NDP

As we mentioned before, the Australian Commonwealth government could not credibly commit to maintaining the original structural adjustment objectives of the NDP (Botterill. 2003). In Figure 3.1 we used game theory to show how political pressure from local interest groups can influence drought policy at both the State/Territory and Federal level. We can also use game theory to explain how the Commonwealth government was pressured into making the NDP less about structural adjustment and more about providing an income 'safety net' (ie, insurance). However, because of the dynamic nature of the commitment problem and the interaction of producers' incentives with the tax system, we do not develop a game theory model here. Instead we will restrict our discussion to the concepts developed in Chapter 2 to explain how government commitment could not be made credible.

Why did producers' interest groups apply political pressure to governments during times of drought for more generous government assistance? It would be easy to claim that producers used political pressure to improve their financial position but this ignores the farm level problem of managing drought as a risk. Drought can be managed like other risks to a certain extent. However, one important risk-management tool is not available to producers: drought insurance. In Section 2.1, we argued that drought insurance could not be provided by private insurance companies because of the uninsurability of drought. See Stoneham et al. (2004) and Goodwin and Smith (1995) for reasons why the private sector does not supply drought insurance. Without drought insurance, producers bear the full risks of a drought event. One could argue that this would provide sufficient incentives to invest in drought minimisation strategies (Freebairn. 1983). However, this ignores the perverse incentives to *not* invest in drought minimisation strategies imposed by the tax system and the lack of credible government commitment.

In Chapter 2 we have noted how specific provisions in the Australian tax system restrict the ability of agricultural producers to diversify their risk by diversifying their income sources into non-agriculture. This prevents producers from smoothing their income during times of drought by using non-agriculture income to maintain their current living standards. With the onset of a drought event, producers who do not have access to non-agriculture income sources are exposed to the associated fall in agriculture income with little or no opportunity to smooth their incomes. Furthermore, tax provisions such as natural increase inhibit farm management decisions during drought by increasing the tax liabilities from de-stocking.

Given the preceding discussion drought policy on the natural resource base, one may wonder why producers do not use their considerable political influence to change the tax act. The reason may be quite simple: large, profitable producers benefit from the current Australian tax system. These producers are likely to attempt to block any attempt to reform the Australian tax act that removes provisions that benefits them (eg, averaging). In contrast, small, less profitable producers are unlikely to have the resources to organise a lobby group for tax reform. As Douglas and Davenport shows, many of the primary production related provisions benefit large, profitable producers (Douglas. 1995; Douglas and Davenport. 1995). However, some reform may be possible, such as the removal of off-farm income limits and the natural increase provisions.

The lack of credible government commitment encourages producers to view governments as 'insurers of last resort'. It may be more accurate to say producers view governments as 'insurers of first resort' given the lack of insurance options there are. Lack of credible government commitment allows producers to shift the risk of drought to governments. This is because producers have a reasonable expectation that government will provide government assistance if they apply political pressure. Because of this expectation, there is little or no incentive to invest in costly drought minimisation strategies. The implication of the lack of government commitment encourages moral hazard because producers know they can gain *perfect insurance* from the government. Government provides perfect insurance through EC relief payments without the producer paying any insurance premiums. Even if private insurance for drought was available, the provision of perfect insurance by the government is a more attractive option than the partial insurance provided by private insurers; therefore, even if drought insurance was

theoretically viable without subsidies, producers may not buy drought insurance from private insurers.

The combined perverse incentives of the Australian tax system and lack of credible government commitment may contribute to political pressure in a circular fashion. Because of the disincentives against drought preparation and self-insurance given by the tax system and non-credible governments, the producers' need for an external agent to share the risk of drought is very high. However, there are no private insurance companies that are willing to share drought risk with drought producers at a 'reasonable' price. Given the lack of insurance options, producers turn to government to share the risk. Because there is no market for producers to signal their desire to buy insurance from the government, producers apply political pressure to extract the insurance they need and more. Given the strong political influence of producers, they are able to extract perfect insurance from the government. This process resumes in the next drought because producers again suffer from their lack of preparation (because of perverse incentives). If drought policy and the tax system will not fundamentally overhauled, it is likely the same problems will occur again as they have in previous droughts.

3.2. Incentive Effects of Eligibility Tests

The current EC Relief Payments and *prima facie* EC income support are administered to eligible producers. Eligible producers are determined through the use of income and asset tests as well as geographic location. These tests are used to 'target' drought assistance payments to eligible producers; ie, income and asset tests and geographic location are used to solve the adverse selection problem. However, these eligibility tests may create perverse incentives for drought-affected producers to attempt to satisfy tests by reducing effort and therefore income, deferring asset purchases and using political pressure to gain EC declaration.

Income tests provide perverse incentives to produce less output to gain government assistance. This perverse incentive can be viewed as moral hazard because some producers would put more time and effort into production in the absence of income tests. Income tests distort production decisions only if a producer would gain from government assistance. Therefore, the lower the amount of government assistance, the fewer number of producers will reduce their production. Conversely, the higher the level of government assistance, the higher the number of producers would benefit from reducing production in order to meet income tests.

Similarly, asset tests may distort producers' investment decisions by providing producers an incentive to defer investment in order to satisfy the asset test. Asset tests may also encourage producers to dispose of assets that may contribute to current and future income. As for income tests, the higher the asset tests, the more producers will benefit from reducing their assets.

For both income and assets tests, what is included in the test is important. For example, non-farm assets are only included in the assets test for the *prima facie* income support. This may overstate the eligibility of producers because, in this case, some producers may be able to survive the drought by selling some farm assets. Also, in this example, this asset test provides perverse incentives for producers not to diversify their income sources away from agriculture.

As we have mentioned before, EC declaration is for a specific geographic area. However, the boundaries of these areas may be arbitrary and provides an opportunity to apply political pressure. For example, some producers may lie outside of an EC declared area but may be suffering some negative impacts. These producers may apply political pressure by asking (reasonably) why they were excluded. This has happened in the last two droughts, see Botterrill (2003) on how political pressure was applied on this 'line on the map' controversey.

Table 3.1 summarises our discussion of the NDP in this chapter using the concepts developed in Chapter 2.

Table 3.1 National Drought Policy

Assessment criteria	National Drought Policy (also known as Exceptional Circumstances policy)
Description	Assistance provided for "exceptional circumstances" including special welfare payments and business assistance. Areas are EC-declared for two years by the Australian Government following applications from State Governments (collaborating with interested parties) and assessments by the independent National Rural Advisory Council.
Adverse selection	**Poor** • The current policy relies on *ex post* assessment of private information (to assess "need") by a third party. This is done using information on the each farmers' financial circumstances. The term "need" is subjective. It may be difficult to fully elicit or evaluate "need", leading to adverse selection. • Geographic location, as determined under the EC criteria, is not a good indicator of whether any individual producer is actually affected by drought. Some producers within the EC boundary will not be affected by drought while some producers outside of the boundary will be drought affected; ie, the 'line on the maps' controversy (Botterill 2003).
Moral hazard	**Poor** • The EC eligibility criteria create incentives for producers to take actions that improve their eligibility for drought assistance. This provides disincentives for farmers to become self-reliant, by not adequately preparing for drought. • The EC eligibility criteria create perverse incentives for drought-affected producers to use political pressure to gain assistance within and outside the policy. • Farm viability tests tend to reward poor managers and penalise those that save and otherwise prepare for drought. • Different treatment of asset classes (eg. off-farm assets are treated differently than on-farm assets for eligibility for special welfare payments) distorts decisions that farmers make about investment in each type before and during droughts.
Government Commitment	**Poor** • Successive Commonwealth & State Governments have been unable to credibly commit to the 1992 National Drought Policy. The onset of drought has triggered political pressure from producers' lobbies and the community for more generous assistance. In 2002-03, the Commonwealth Government introduced *prima facie* EC income support (Botterill 2003) as well as *interim* income support, and State Governments continued or re-introduced direct business payments.
Incentive compatibility	**Poor** • *General* - Incentive problems associated with the tax system, and other forms of assistance by governments has undermined the effectiveness of the National Drought Policy. • *Specific* - Provisions in the Australian tax system encourage investment in agriculture, and discourage agricultural producers from diversifying their risk by diversifying their income sources into non-agricultural investments. For example eligibility for Farm Management Deposits is restricted to producers with less than $50,000 in taxable off-farm income. This may prevent producers from smoothing their income to the extent needed during times of drought by using non-agricultural income to maintain living standards. This is contrary to the self-reliance principle of National Drought Policy. • Drought policy should aim to provide appropriate incentives to prepare for drought, care for the environment and animal welfare.

4. Drought assistance contracts

Although insurance products offer some interesting possibilities for risk management, these products do not fill the policy vacuum (see Stoneham et al. (2004) for discussion). Farmers will continue to lobby for assistance, and governments will respond, damaging the feasibility of, and incentives for, commercial risk management products. A broader drought policy context would include improved policy mechanism design to manage government commitment, structural adjustment and welfare considerations associated with drought. In this chapter we draw on ideas developed in the field of information economics (specifically contract theory) in an attempt to design an improved drought policy mechanism. This policy specifies the way farmers interact with government and the private sector to manage drought risk. Salient features of modern risk management contracts, developed principally to deal with the problems of adverse selection, moral hazard and incentive compatibility, are woven into this approach to drought policy.

4.1. Drought assistance contracts and adverse selection

The survey of recipients of drought assistance (see Table 1.2) illustrated that it is very difficult to target assistance to those in need. The first task of an efficient drought policy is to overcome this problem. Analysis of the NDP in Chapter 3 illustrated that it is not possible to deal with adverse selection using regional declarations and eligibility criteria applied during the drought. With *ex post* eligibility assessments, individuals have clear incentives not to reveal private information that would make them ineligible for assistance.

The first problem for an efficient drought policy is to identify the different "types" of producers and assign them to efficient classes of agreements or contracts - one agreement will not suit all. Sen argues that targeting must take into account the incentive and informational aspects of the problem by linking assistance to a measure that is correlated with the need of applicants (Sen. 1995). Those in need will then 'self-select' by participating in such programs. Besley and Coate apply this idea of self-selection showing how a work requirement to receive social assistance reduces adverse selection problems (Besley and Coate. 1995) - those who are in need are more likely to complete work requirements than those who are not.

There are significant advantages, therefore, to be gained if government can know whether individual farmers consider that they are ***viable*** (those that have long-run prospects as primary producers) or ***non-viable*** (those likely to exit from farming). As noted above, the information needed to make this assessment is held privately by farmers who are unwilling to reveal this information to others. One approach to the adverse selection and moral hazard problems inherent in drought policy is to construct a set of incentives that induce farmers to reveal or signal relevant information rather than have an external agent make this assessment. Once farmer "type" is known different farmers can be offered drought assistance that is appropriate and relevant to each individual's circumstances.

The insurance industry does this by offering a menu of contracts together with carefully constructed incentives so that individuals use their private information to *self-select* into the right (or efficient) contract. Translating this idea to drought policy would see the government offering farmers a menu of contracts each with a different bundle of benefits and eligibility requirements. A producer self-selects by choosing the contract that provides them with the highest net benefits where each contract would involve actions that are not costless. By offering a menu of contracts and incentives that facilitate self-selection, the government saves on administrative costs by not collecting farm-level data while improving the quality of information needed to target specific groups (Sen. 1995). Instead, producers voluntarily reveal this information by their choice of contracts. They reveal their type out of self-interest, thus dealing with the problem of adverse selection.

4.2. Drought assistance contracts and moral hazard

When producers are risk-averse, a straightforward way of mitigating moral hazard is through risk sharing. That is, the principal does not perfectly insure farmers against the risk in question. Instead, the principal limits the amount of benefits paid in an effort to force the insured to bear some of the risk. The purpose of this strategy is to align the incentives faced by the agent (the farmer) with the incentives of the principal so that the farmer takes measures to reduce the impact of the risk in question – thus minimising moral hazard.

The full insurance level depends on whether the aim of drought assistance is to insure the business cost of drought (and, therefore, to transfer subsidies to producers from taxpayers), or to assist producers in smoothing their consumption levels during drought. If drought assistance is used to transfer business assistance, then the full insurance level will be different between

producers because of difference in enterprise type, severity of the drought, condition of the natural resource base, etc. As a result, determining the full insurance level may be administratively costly because of the need to collect cost, price, production and agronomic data. Some of this information will be private information and so will require the use of a menu of contracts approach to truthfully elicit it in a lower cost way. However, while the use of incentive contracts to provide inducements for producers to truthfully reveal private information may be a second-best approach compared with using surveys or eligibility criteria to target business assistance, it may require the use of a large number of contracts to accurately elicit private information.

If the aim of drought policy is to assist producers in smoothing their consumption level, determining the full insurance benefit level may be less complex. This is because consumption patterns are generally similar between producers. Instead of fully guaranteeing to protect producers' consumption, the government can instead guarantee producers a subsistence level of consumption. This provides producers with an incentive to self-insure against drought to ensure consumption does not fall during drought. However, subsistence may not be politically feasible.

Eliminating moral hazard when producers are risk-neutral depends on the extent of liability producers have for managing drought risk. It is likely that producers will not bear the full risk of drought because of lobbying arguments already presented. Even though risk-neutral producers are impartial to risk, this does not mean they are not better off from exerting political pressure to gain more drought assistance. Given this, the relevant question is how to eliminate moral hazard when the producer bears limited drought liability.

According to the economic literature, a *limited liability rent* could be paid to eliminate moral hazard when risk-neutral producers face limited drought risk (Laffont and Martimort. 2002). This is because the producer has less incentive to self-insure through costly investments because of limited liability. Applied to drought policy, this suggests that the government could pay a limited liability rent to create an incentive for producers to self-insure.

One further implication of economic literature on information, incentives and behaviour is that there are significant efficiency implications associated with the sequence in which adverse selection and moral hazard are addressed (Laffont and Martimort. 2002). In other words, it may be possible to significantly improve the efficiency of drought policy by addressing moral hazard prior to

adverse selection or visa versa. The relevant question is: can the government structure contracts so that moral hazard is solved before adverse selection? If it is possible, then it is also possible to design second-best efficient contracts.

4.3. A Producer's Choice of Contracts

In this section, we use decision trees to analyse how farmer's choose an incentive contract given a menu of incentive contracts. We will assume that producers are rational and intelligent when making economic decisions. For the moment we will consider that the government can credibly commit to the menu of contracts drought policy and that the tax system does not incorporate any distortionary taxes (except for a progressive income tax schedule). We make these assumptions for simplicity and to focus on the producer's choice of contracts. Later in this section, we will relax these assumptions to ask how the menu of contracts approach needs to be modified to minimise non-credible government commitment and a distortionary tax system. We also assume for simplicity that there are only two types of producers.

We will consider the following menu of contracts:

1. Allow the opening of Risk Management Deposits (RMDs). RMDs are a similar concept to the existing Farm Management Deposits (FMDs) but with a different set of incentives specifically designed to ensure that farmers' contract choice matches their "type". These incentives could be tax benefits or some form of subsidy. In this example, we assume RMDs confer a tax benefit per dollar of pre-tax income deposited. RMDs also do not have restrictions on deposit size and off-farm income (unlike FMDs).
2. Social security payments over six months.

4.3.1. Menu of Contracts with Credible Government Commitment and Non-distortionary Tax System

Figure 4.1 is a decision tree for the case of credible government commitment and a non-distortionary tax system. The analysis starts at the top of the decision tree at the node labelled 'Farmer's choice'. At this node, the producer has a choice of either contract 1 or contract 2. Let us examine the contract 1 branch first. If the producer chooses contract 1, the next decision (at the 'Contract 1 (RMD)' node) is to determine how much cash to invest in an RMD. We assume for simplicity that the producer can invest a 'high' amount of $x or a 'low' amount of $y and assume x and y are positive numbers; algebraically, this means $x>y>0$. Of course, the producer in reality has a continuous choice of deposit

amounts rather than the binary choice we have assumed. This assumption was made to make the decision tree as simple as possible while highlighting the importance of the producer's decision in this policy proposal.

After the producer has made the investment decision, the next decision occurs during drought in the 'Drought' space (indicated by the dotted semi-circle). During drought, a producer can choose to withdraw all or none of their RMD deposit; again we have assumed that the choice is a binary one for simplicity. Note that the producer is under no obligation to withdraw any cash from his/her RMD; this will depend on the individual circumstances of each producer. Recall that the RMDs encourage deposits during high taxable income years and withdrawals during low taxable income years. Not all producers will suffer low taxable income years during drought especially if they de-stock; these producers may choose to deposit *more* during drought. The point is that RMDs give producers flexibility to manage their farm response during drought according to individual circumstances.

Once the producer has decided to withdraw or not, the next decision is to choose whether or not to lobby. By lobbying, a producer can receive more government funds than he/she otherwise would. We assume lobbying is costless but this is probably unrealistic. However, with credible government commitment, governments would not reward lobbying efforts so payoffs are unaltered.

Payoffs are given at the bottom of the decision tree. The payoff from withdrawing is multiplied by whatever the initial deposit amount was (ie, either x or y), where t is the tax benefit from withdrawing funds during a low-income year. In other words, the producer receives a gross payoff equal to the principal of his/her investment *plus* the tax benefit of withdrawal, but the *net* payoff is the tax benefit of the withdrawal. Note, t is negative if the producer withdraw funds during a higher-income year than when the funds were deposited. However, this would only occur if the producer was irrational and since this contradicts our original assumption of producers' behaviour, t can never be negative given rationality. The payoff from not withdrawing is $0 since the payoff is dependent on how much is withdrawn.

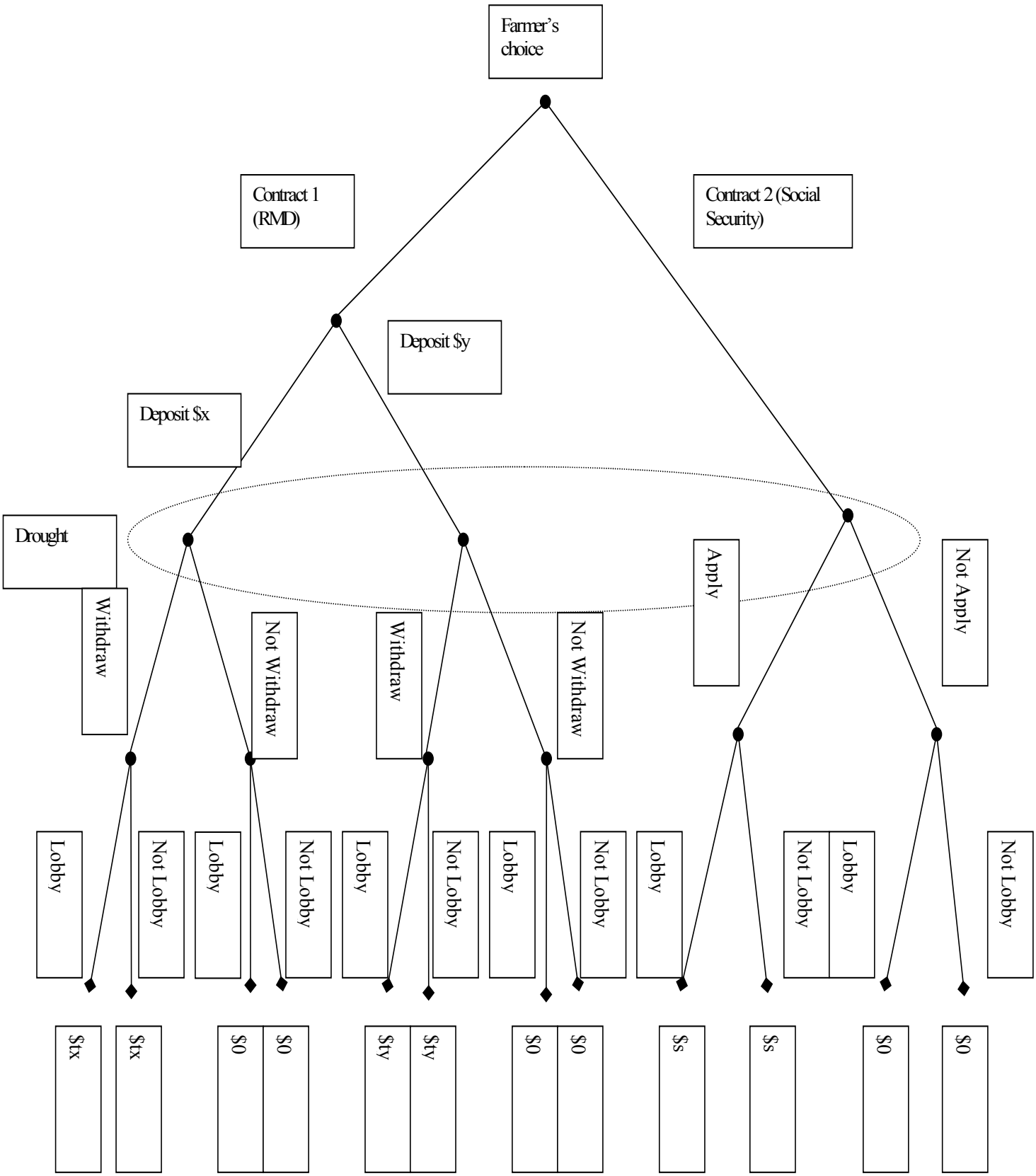
Now we describe the contract 2 branch of the decision tree in Figure 4.1. A producer who signs on to contract 2 only has to decide whether or not to apply for social security at the 'Drought' space. The producer can also choose to lobby but since there is no benefit from lobbying, the lobbying decision is irrelevant to the producer's payoffs. The payoff from choosing to apply for social security

benefits is $s (assume $s is a positive number) but otherwise the producer receives $0.

This menu of contracts approach can solve adverse selection and moral hazard but it depends on the values of x and s; y is irrelevant as we shall see. Consider two type of producers, a 'rich' producer who can deposit x>y>0 in RMDs and a 'poor' producer who cannot invest any funds into RMDs (ie, x=y=0). Adverse selection is solved if the payoff from investing in RMDs is greater than the payoff from social security payments; ie, tx>ty>s. If this is the case, rich producers will choose contract 1 whereas poor producers will choose contract 2; hence, adverse selection is solved. This is called a *separating equilibrium* in game theory (Tirole. 1988). If payments from social security exceed tx, than even rich producers will choose contract 2 and no one will choose contract 1; this is called a *pooling equilibrium* (Tirole. 1988). There may exist some values of x and s where there is a hybrid of separating and pooling equilibria where some rich producers choose contract 2 (Potters and Van Winden. 1990). As a result, truthful revelation of the menu of contracts policy is possible depending on the values of x and s.

Is it possible for this menu of contracts to reduce the incentives of moral hazard? In the decision tree, moral hazard is when the rich producers choose to invest y rather than x under contract 1. This is because the rich producer can invest more and therefore bear more drought risk. But the producer gains most when he/she invests x because the tax benefit is increasing in the deposit size. Therefore, the producer will always gain the most by investing x rather than y and will always choose to invest x and never chooses to invest y; y is irrelevant because a rich producer will always choose to invest x. As a result, moral hazard is eliminated because the producer has an incentive to invest as much as possible under contract 1.

Figure 4.1 Producer's Contract Choice with Credible Government Commitment and Non-distortionary Tax System



4.3.2. Menu of Contracts with Non-credible Government Commitment

We have shown that a menu of contracts can be designed to provide incentives for producers to truthfully reveal their private information and for producers to not engage in moral hazard. However, this result hinges on our assumption of government credibility. In this section we will explore the implications of non-credible government commitment on the design of a second-best menu of contracts.

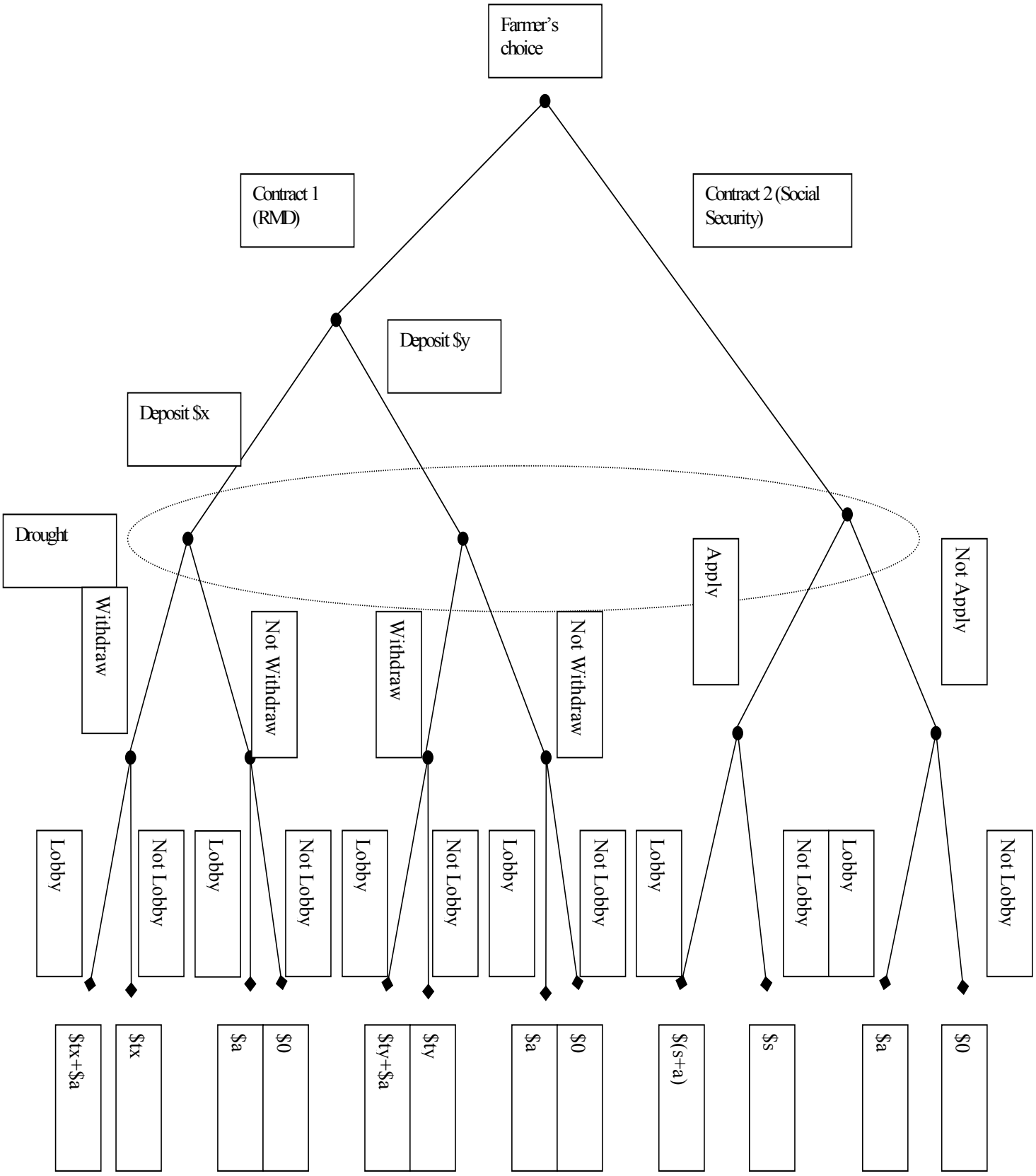
Figure 4.2 is similar to Figure 4.1 except that the payoffs from lobbying are now different. If a producer lobbies, they will receive a positive amount of $a in addition to their payoffs given their contract and decisions made at each decision node. Lobbying is assumed to result in a certain payoff of $a which is unrealistic since the amount a government may pay is dependent on the budget situation, sensitivity to lobbying, etc. We make this assumption for convenience. Regardless of the realism of the payoffs from lobbying, the point is that if there is no credible government commitment, then the producer has an incentive to lobby regardless of the choice of contract. Notice that the choice of contracts does not change, just the decision to lobby. This is because the producers still have an incentive to reveal their type and to refrain from engaging in moral hazard, but they are unambiguously better off from lobbying regardless of the choice of contract.

Payoffs from lobbying may change if they differ given contract type. We do not show this here but only sketch the reasoning. For example, the government may engage in ratcheting behaviour by using the information gained from the choice of contracts to refuse to give funds to producers who choose contract 1 but give $a to producers who choose contract 2. If producers expect the government to behave this way, this may encourage adverse selection by encouraging rich producers to choose contract 2 if $s+a>tx$. As a result, contract choice can be distorted if the government rewards lobbying one type of producers over another type.

In summary, non-credible government commitment is likely to impose greater budgetary costs and may lead to a higher tax burden for the rest of society. In the worse case, lack of credible commitment may result in adverse selection and moral hazard, which not only accentuates the budgetary cost but also harms the

long-term future of the industry. This implies that credible government commitment is required to maximise the benefits of drought policy reform.

Figure 4.2 Producer's Choice of Contract with Non-credible Government Commitment



4.3.3. Menu of Contracts and a Distortionary Tax System

What happens if an introduction of menu of contracts approach does not coincide with comprehensive tax reform of primary producer provisions? We will discuss this qualitatively since the tax system could be reformed a number of different ways.

An unreformed tax system is likely to bias producers towards contract 2. Only the most profitable producers are likely to accept contract 1. This is because the current tax system has similar benefits to RMDs without requiring the producer to bear any drought risk. Adoption rate of RMDs is likely to remain unchanged with the introduction of menu of contracts approach.

The implication of the above discussion suggests that an introduction of a menu of contracts approach requires comprehensive tax reform to maximise the benefits of drought policy reform. Without tax reform, adverse selection and moral hazard will still be a problem. This may mean no drought policy reform may be less costly than drought policy reform with no tax reform.

4.3.4. Sequencing

Another important element in the design of these contracts concerns the problem of sequencing. As noted by Laffont and Martimort, there are significant efficiency implications associated with the sequence of adverse selection and moral hazard (Laffont and Martimort. 2002). If moral hazard precedes adverse selection, the moral hazard stage involves the producer choosing the type of production strategy and the amount of management effort to exert and this (imperfectly) determines how viable the enterprise is. The adverse selection stage is where the producer decides which policy to accept. Assuming the producer is rational and intelligent, he/she will understand the implications of choosing contract 1 or 2. That is, he/she will know that choosing contract 1 reveals viability and ability to manage through drought. Conversely, choosing contract 2 reveals that the producer is a marginal or non-viable producer, unable to survive drought without assistance.

This two-stage problem is solved by use of backwards induction - adverse selection is solved first. We use the decision tree from Figure 4.1 to illustrate sequencing. The producer will choose the contract that will make him/her better off. However, this decision depends on the moral hazard stage: is the producer better off operating a viable or non-viable enterprise? If the producer is viable, choosing contract 1 is best because of benefits from limited liability rent (if risk-neutral) or risk premium (if risk-averse) plus an information rent. A viable

producer will not choose contract 2 because there are no rents. Conversely, if a producer is non-viable he/she will choose contract 2 to receive partial insurance against drought. Contract 1 requires the investment of a producer's surplus cash in an RMD in order to receive any benefits, but by definition, non-viable producers do not generate sufficient surplus cash, so they cannot benefit from contract 1.

Working our way backwards, we now consider the moral hazard stage, in which the producer decides on the value of exerting costly effort to become viable, or not doing so. We do not show this diagrammatically but only outline the argument here. Imagine the producer can choose to manage their farm efficiently or inefficiently. If the farm can be managed efficiently, the producer generates a profit; efficient producers will have an incentive to choose contract 1 over contract 2 if the gains from RMDs are greater than $s. Conversely, if a producer chooses to be inefficient, there is an incentive for these types to choose contract 2. Assume there are no costs from choosing to be efficient or inefficient, producers in general will choose to be efficient if tx>s. Therefore, a menu of contracts approach can provide producers with a dynamic incentive to adopt more efficient practices. This eliminates the incentive for some producers to choose inefficiency. However, this depends on the relative costs of farming practices which in turn depends on many factors such as the quality of the land, education level of the producer, etc.

Some producers may be marginally viable but may not generate enough surplus cash to warrant the use of RMDs; these producers will probably choose contract 2. Some producers may be viable enough to generate substantial surplus cash and so will find it viable to use RMDs; these producers gain from generating profits and gaining rents, they will choose contract 1. In summary, we can predict the following:

- Non-viable producers: cannot make a profit even with contract 2 and will cease production.
- Marginally viable producers: do not generate substantial surplus cash flow and will choose contract 2.
- Viable producers: make a profit at or above commercial rates of return and also generate substantial surplus cash flow. They will choose contract 1.

The moral hazard problem is solved because these drought assistance contracts provide incentives for viable producers to self-insure against future drought risk

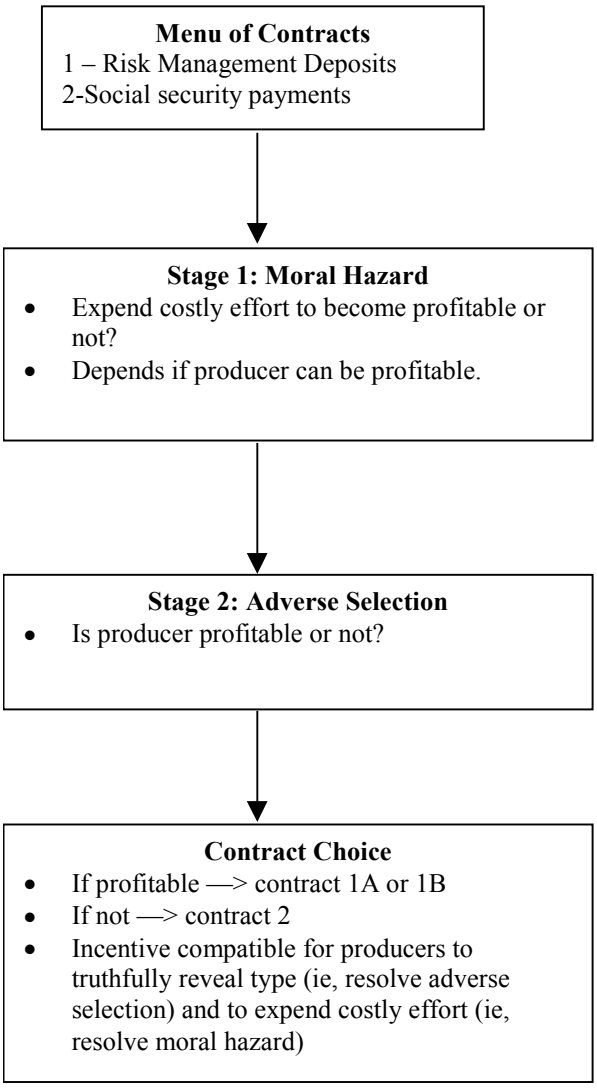
by exerting management effort to maintain viability and to generate the surplus cash to invest in RMDs or to purchase insurance. Furthermore, non-viable producers can choose to exit the industry or stay in the industry and remain non-viable. Figure 4.3 summarises this discussion.

The adverse selection problem is solved because there are incentives for producers to truthfully reveal their types. Viable producers are unambiguously better off with contract 1. Marginally viable producers are unambiguously better off with contract 2. Non-viable producers are clearly better off exiting the industry but may choose to continue producing for lifestyle and other non-economic reasons.

What are the overall efficiency effects of these contracts? Laffont and Martimort (2002) argue that in a game where moral hazard is followed by adverse selection, the result is second-best. This means that there is an improvement in welfare but does not necessarily maximise welfare gain. Rents are still paid by the government but the producers make efficient self-insurance decisions.

In the real world, the menu of contracts has incentives for producers to first solve the moral hazard problem and then the adverse selection one. This is because each type will have the information to know if they can be viable or not by solving the moral hazard problem first. Some will already know and can solve for the adverse selection problem. Either way, there are incentives for producers not to engage in moral hazard or adverse selection as explained above. Therefore, it is possible for a menu of contracts approach to produce a second-best outcome in drought policy. This implies that the allocative efficiency of drought policy may be improved if certain actions are used as a signal to reveal a farmers' "type". In simple terms, this means that we look for some action that a farmer might take, out of self-interest that signals their "type". Purchase of RMDs, or rainfall insurance/weather derivatives are actions that could reveal whether a producer is viable and interested in preparing for contingences, such as drought.

Figure 4.3 Summary of a Producer's Choice of Contract



5. Summary and Conclusions

Drought policy is a complex problem for which there are no simple solutions. In this paper it has been argued that the role of government with respect to drought is problematic. Whilst a complete set of risk markets do not exist, this does not automatically justify government involvement. The main reason for government intervention is on a second-best basis. In other words, if the government does not establish a formal drought policy, there will always be political pressure from producers to provide drought assistance. By formalising drought policy, government can define the 'rules of the game' to reduce the economic costs of drought policy and to improve the distribution of any assistance given. To achieve these objectives it is imperative that Australian governments design drought policy to provide producers with incentives to prepare for drought and to provide governments with incentives to credibly commit to a second-best policy.

Past (and proposed) solutions to drought policy have been (and are), inefficient and inequitable because they do not take explicit account of asymmetric information and the implications for adverse selection, moral hazard, systemic risk, uncertainty, credible government commitment and the perverse incentives of the Australian tax system (Stoneham, et al. 2004). The current NDP arrangements fail on all of these criteria because it has not been designed to deal with the information problems that pervade risk management. The NDP does not employ mechanisms to reveal private information (about farmers' needs, capabilities and preparation for drought) instead it relies on *ex post* assessment and regional classifications of need (Exceptional Circumstances). This approach provides farmers with incentives to lobby government to declare droughts and increase assistance, to change behaviour so that they remain eligible for drought assistance, and to avoid truthful revelation of financial information where this reduces eligibility for assistance. The outcome is that assistance is provided to the wrong people and induces individuals to change behaviour to gain access to assistance.

In this paper we have proposed a drought policy framework that explicitly accounts for the information problems that plague drought policy. This approach has been developed by drawing on the techniques developed in commercial risk markets and embedding these into drought policy. We provided a broad description of drought policy that utilises a menu of incentive contracts

for farmers who consider that they have long-run prospects of being profitable and another for those who consider that they are likely to be unprofitable in the long-run. This approach would involve incentives to encourage farmers to self-select into efficient classes of contract. Well-designed incentives will induce farmers who consider themselves to be profitable in the long-run to self-select into contracts that make them better off. Farmers who select this type of assistance would not be eligible for other forms of assistance. In this case the inducement could be a subsidy on self-insurance through a mechanism we have labelled Risk Management Deposits (RMDs). Farmers who consider they are not viable in the long-run will find this contract relatively unattractive and will self-select into a contract which offers exit or adjustment assistance. Self-selection into relevant contracts effectively reveals "type" allowing assistance to be targeted efficiently and equitably, thus solving the adverse selection problem.

Incentive contracts also deal with moral hazard by providing incentives for profitable producers to save surplus funds using RMDs and by sharing some of the risk of drought. In both cases, the contracts apportion risk between the government and the producer, providing farmers with an incentive to manage drought risk themselves. Furthermore, monitoring and enforcement is not required since producers have an incentive to self-insure some drought risk (this is despite the non-verifiability of moral hazard in the context of drought).

Although further quantitative analysis is required, economic theory suggests that the cost of these inducements should be more than offset by the efficiency gains associated with improved drought policy and could be expected to reduce the fiscal burden of current drought policy. In other words, this approach should result in significant savings to government besides being more efficient and fairer. A pilot of the ideas developed in this paper would be informative to both government and private sector interests.

Although these mechanisms, in principle appear to offer many advantages, they will be ineffective without credible government commitment. Stoneham et al. (2004) provides a discussion of various strategies that could be employed to address the government commitment problem. These are not easy to design or implement but there are a number of alternatives that deserve closer examination. Further analysis will be needed to design these institutions and to understanding community support and lobbying processes.

Reform of the tax system is highlighted as necessary to remove perverse incentives against self-insurance. The environmental impacts of the proposed

drought policy are also positive because of the removal of incentives to overstock and remain on marginal land and generally improved incentives to take longer-term approaches to drought-management.

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