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by

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Abstract

The Native Vegetation Conservation Act was introduced on January 1st 1998 to protect native grassland and woodland in New South Wales. The Act has limited clearing of native vegetation and development to crops and pasture, has protected biodiversity, and may have enhanced soil and water conservation. But an analysis of variations in the prices paid for farm land in Moree Plains Shire, with the complementary hedonic and bargaining methods, shows how buyers, sellers, and the market as a whole, value the characteristics of the land. It shows that the Act has led to substantial losses in land values for the farmers. The Act has imposed higher costs on those who had kept most vegetation, and on those who most need to retain their options to clear and develop. Stewardship payments will alleviate the financial situation for some and property plans will provide long-term security for both farmer and vegetation. But the magnitudes of the losses suggest that introduction of individual policies like these must be preceded by a review of the whole strategy of vegetation protection in New South Wales. We must first decide how much to protect and how to allocate the losses in an equitable manner.

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1. Introduction

Government objectives for the management of a nation's natural resources normally include increases in environmental protection, increases in the standard of living, and improvements in social equity. But policies to provide gains on one objective often lead to losses on another, and gains to the whole community are often accompanied by losses to particular groups within the community.

The Native Vegetation Conservation Act NSW was introduced on 1st January 1998 to reflect the growing community concern for the future of native vegetation. The Act was designed to prevent inappropriate clearing, to manage the remaining native vegetation sustainably, to prevent further economic loss, to streamline the administration of native vegetation management, and to encourage landholder and community involvement in vegetation management (NSW Department of Land and Water Conservation, 1998). State Environmental Planning Policy 46 (SEPP 46) had been introduced in August 1995 with the same objectives and the same restrictions, to begin the process of policy formulation.

The gains for the wider community are, however, accompanied by losses to the farming community. The Native Vegetation Conservation Act removes farmers' rights to clear or develop native woodland or native grassland, except for certain minor exemptions such as cutting seven trees per hectare for farm purposes. The Act then permits development on application by the farmer and consent from the Department of Land and Water Conservation (DLWC). The balance between protection and clearing was to be determined by the Regional Vegetation Management Committees that were established under the Act. These committees were to prepare regional vegetation management plans, which must identify the social and economic aspects of native vegetation management, and consider the economic viability of land uses (NSW Department of Land and Water Conservation, 1997).

The requirement to retain native vegetation on farms can impose several kinds of cost on the landholder, including the loss of income because use of land with native vegetation is restricted to grazing, and the associated loss of land value. They also include the continuing costs of maintaining on-farm conservation reserves, and all the different kinds of transactions costs that accompany applications to the DLWC for consent to develop land with native vegetation. The Act is, of course, just one of a wide variety of possible policy instruments for protecting biodiversity. There may be cheaper, more effective, more equitable options rather than this regulatory approach. But the costs of the Act must be identified to help formulate better strategies and options.

Eight years have passed since original SEPP 46 was introduced and so all these costs will have become apparent. A formal assessment of how the Act has affected the distribution of costs is therefore timely, and an intensive case study covering the whole area of a regional vegetation management committee is a useful way to do this.

The objectives of the paper may therefore be summarised as follows:

• to assess the loss in farm land value due to the Act,

• to examine the distribution of these losses, and

• to inform the formation of policy on vegetation protection in New South Wales.

The price that farmers actually pay for land is a measure of their expectations from it and reflects the values from the all the characteristics of the land - - as seen by the farmer. The price will therefore "capture" the short-term income earning capacity of the land, and long-term benefits from reductions in land degradation due to the retention of trees and other vegetation. Further, prices are actual measures of worth because they are actually paid in the market and land is the main capital asset of the farmer. The analysis is therefore based on prices paid for farm land in Moree Plains Shire NSW. This area has been characterised by the active clearing of native vegetation up to the introduction of the Act, the diversity of its agriculture, and the changes in its agricultural enterprises from year to year.

Section 2 reviews literature on the relationships between regulations, land values, and the measurement of the loss in land value. Sections 3 and 4 cover the methods to analyse the formation of land prices, namely the hedonic approach and the bargaining approach. The data are described in Section 5, and the analysis is summarised in Section 6. The results presented in Section 7, and the Section 8 comprises the discussion and conclusions.

2 Native vegetation, land values and opportunity costs

2.1 Land values and constraints on land use

Economic theory suggests that regulations to constrain farmer behaviour tend to reduce farm income and so reduce land values. These losses in land value are opportunity costs, and the circumstances in which they occur have been widely discussed. For example, Spalatro and Provcencher (2001), Knaap (1985) and Vaillancourt and Monty (1985) all argue that regulations to constrain farm development generally reduce the market value of the land. Henneberry and Barrows (1990) reach the same conclusion but add the rider that regulation on one farm may sometimes confer external benefits on another and so raise the value of its land.

Peterson (1974) identifies three effects of a regulation that constrains the actions of landowners - - a fiscal effect (lower land values which lower tax collections), a development effect (reductions in income from constraints on use) and an amenity effect (changes in unpriced benefits from the preservation of environmental amenities). Spalatro and Provencher (2001) argued that very few empirical studies have distinguished the development effect from the amenity effect and then estimated both for zoning of lakefront amenities in Wisconsin.

Nickerson and Lynch (2001) examined the influence of regulations, in the United States of America, to retain land in farming. Lower prices per hectare were paid for larger parcels, parcels further from employment centres, and forested land. Lower prices were also paid where regulations constrain use of the land. But the effect of the constraint was not statistically significant perhaps because buyers did not expect the regulation to be binding in the future.

2.2 Land values and native vegetation

Empirical studies on the formation of prices for farm land in NSW also indicate that land values are reduced when the quantity of vegetation increases, and define the circumstances when this can happen. They also support the underlying belief that environmental quality differences are capitalised into land values. Walpole, Lockwood and Miles (1998) analysed sales of 124 farms across southern NSW and northeast Victoria. The effect of retention of native vegetation on land values was complex, but is well summarised by Walpole (2000). Increases in the area of native vegetation reduced land values when more than 50 per cent of the property was native vegetation. But increases in the area had little effect on land value when less than 50 per cent of the property was native vegetation.

The dieback of eucalypts was associated with increases in the value of farmland on grazing properties on the Northern Tablelands in the 1970s and 1980s (Sinden, Jones, and Fleming 1983). At this time, some 16 per cent of each property was still covered in healthy native woodland. Land value increased as the quantity of healthy woodland increased until it covered some 20 to 25 per cent of the property. After this percentage, increases in native vegetation were associated with reductions in land value.

In his role as a land valuer, Spackman (2000) compared recent individual sales of cleared-and-cultivated properties with uncleared-and-livestock properties in the Liverpool Plains. A hectare of cultivated land typically sold for $600 more than a hectare of land with native grasses that had to be retained under the Native Vegetation Conservation Act. Marano (1991) provides empirical evidence that regulations to protect native vegetation in South Australia have systematically reduced land values, and Fensham and Sattler (2002) report the same effect in Queensland.

2.3 A general relationship to identify opportunity costs

These analyses, theory and empirical observation, all suggest that the relationship between land value and native vegetation tends to follow the trends of Figure 1. Land value increases as the percentage of native vegetation on a property increases from PC_0 up to some point PC_m. In this phase, the benefits of the extra woodland (as shelter for stock or conservation of the soil and water for crops) exceed the costs from loss of productive area. But in the next phase from PC_m to PC_t, increases in the percentage of native vegetation reduce land values. Now the costs from lost productive area exceed the increases in amenity benefits. Clearly, two kinds of effects underlie these trends, namely the "amenity" effects of shelter and conservation, and the "development" effect of immediate income and land value income. The amenity effects dominate up to PC_m and the development effects dominate thereafter.

The percentage of vegetation at the point of inflection (PC_m), the slopes (from PC_0 to PC_m, and PC_m to PC_t), and the values of V_0 and V_m will vary from enterprise to enterprise and region to region. Nevertheless, this specification allows for native vegetation to enhance the value of a property (up to PC_m) where it covers a small portion of a crop farm or a larger proportion of a grazing property. The specification also provides a framework to measure opportunity costs and identify the losses in land value due to the Act.

2.4 The measurement of opportunity cost

The Native Vegetation Conservation Act regulates the farmer's behaviour by restricting development, to crops or pasture, of land with native vegetation. The immediate opportunity cost is the income that is lost from the most productive alternative use of the land where this constraint is imposed. This loss of income will be directly associated with a loss of land value. The concept of opportunity cost is simple and direct, but it is less simple to apply and measure. The complexities concern the identification of the base case for the comparison, the distinction between cost to the farmer and cost to the community, and the need to ensure that empirical analyses do not overstate the costs.

The base case of any assessment of the Act should be the situation without the Act, and so current land values with the Act should be compared to values for the same property before the Act. Such a time series of values is rarely available, but a useful alternative is to compare current land values of different properties with different amounts of vegetation. The value of a property with little vegetation now is analogous to the value of a property with much more vegetation before the Act, when the owner could clear the vegetation if he so wished. This of course is very different from comparing (a) the present value under a regional vegetation plan, against (b) the value before the plan but after the Act is introduced. The former may be a good estimate of current land value, but the latter is not an appropriate base.

The opportunity cost (OC) to the community may differ from that to the farmer. If the land could be cleared and used profitably, the restrictions of the Act will lead to an opportunity cost to the community whether or not the farmer actually clears. In simple terms, for a given farm:

OC to community = LV without Act, as if all could be cleared – LV with Act (1)

Refer to Figure 1, and a farm with PC_f native vegetation:

$$\text{OC to the community} = V_m - V_f \quad (2)$$

As long as the land could be cleared and developed profitably, the community loses land value whether or not the farmer clears or has any intention to clear. But the opportunity cost to the farmer is based the value of land with the amount of vegetation that he would have actually retained. Refer to the same farm where farmer would clear down to PC_d:

OC to landholder = LV without Act, but with the vegetation he would keep – LV with the Act (3)

$$= V_d - V_f \quad (4)$$

The opportunity cost to the community may therefore be higher than that to the farmer.

Consider now the farmer’s situation in more detail. We must distinguish between the following two kinds of cost. (a) The opportunity cost to the farmer of a private decision to retain vegetation. (b) The opportunity cost to the farmer of the community decision to impose restrictions on clearing. Case (a) arises from the farmer’s comparison of all the benefits of retention to him against the costs to him. If the decision were economically rational and he retains vegetation, the sum of all the benefits exceeds the opportunity costs to him. He will likely bear an opportunity cost when he sells his land, even though there was no loss in real income to him up to that time. Case (b) arises directly from the clearing controls and the farmer’s intention to clear and develop and is the relevant case to analyse.

The framework of Figure 1 and these concepts of opportunity cost guide the analysis. In the empirical calculations that follow, the opportunity costs and land values are net of any costs to bring land into production. The calculations of losses in land value infer the rights to clear vegetation as before the Act. The opportunity costs will refer to the farmer’s losses. To capture the various influences on the farmer, the probability of wanting to retain native vegetation, the size of the area concerned, and the potential uses of the land are all included as variables in the analysis. Sensitivity analyses will be undertaken of the effect of the amount of clearing on the loss of land value.

3 The hedonic approach

3.1 The theoretical model

Hedonic models of land values rest on the belief that the sale price represents the equilibrium price for the particular bundle of characteristics of the particular parcel of land (Maler 1977). The hedonic approach to valuing these characteristics, from the market price, has two distinct stages. First. sale prices are regressed on characteristics to which both buyer and seller can respond to give the "hedonic equation". Second, marginal implicit prices of the characteristic are estimated for each property from this hedonic equation, and are used to estimate willingness to pay functions. The distinction between the two stages is usually attributed to Rosen (1974) who developed the theoretical models.

The approach is now well established. For example, Nickerson and Lynch (2001) used the method to value the costs of constraints that retain land in agriculture in Maryland. King and Sinden (1988) applied it to assess the contribution of soil conservation to land value in New South Wales, and Spalatro and Provencher (2001) used it to value amenity benefits from zoning regulations on lakefronts in Wisconsin.

In an agricultural or environmental context, the hedonic equation describes the price of land as a function of the productive, amenity, and environmental characteristics that both seller and buyer respond to in the market place (Freeman 1979). If P is the price of the land and K_i the characteristics:

$$P= f(K_i) \qquad (5)$$

The partial derivatives of P with respect to the K_i's are the implicit marginal prices of the characteristics $P_i(K)$.

In the second stage, the marginal prices of a characteristic for each property are calculated from the quantity of the characteristic actually present. These marginal prices are the increase in the price paid to obtain one more unit of a desirable characteristic. They become the dependent variables from which demand (6) and supply (7) functions are estimated for the characteristic.

$$P_i(K) = f(K_i, B) \qquad (6)$$

$$P_i(K) = f(K_i, S) \qquad (7)$$

where B and S are vectors of buyer and seller characteristics respectively. These vectors enable the identification of demand and supply.

If the buyers are identical, and so have identical utility functions, management skills, and incomes, the B vector drops out of equation (6), and equation (5) identifies the bid function of the buyer. The second stage equation (6) then identifies an inverse demand function for the characteristic. If sellers are identical and so face the same input prices, employ the same technology, and have the same management skills, the S vector drops out of equation (7). Equation (5) then becomes a sellers offer function, and observations on $P_i(K)$ and the K_i identify an inverse supply function for the characteristic. If buyers are identical and sellers are identical, the good would appear in the market as a single bundle of characteristics - - a case clearly not present in the land market.

There remain several theoretical and empirical issues in the application of the method. Ribaudo and Shortle (2001) suggest the most important issue is whether the land market is competitive and in equilibrium. The approach assumes that each household is in equilibrium with respect to the vector of characteristic prices and that the vector is the one that just clears the market. If the market is thin or adjusts slowly, the estimated marginal implicit prices do not accurately measure household willingness to pay. Further, participants in the market must be able to observe the levels of the particular characteristic, to adjust their bid and offer prices to those levels, and then interact in a competitive manner (Willis and Foster 1983).

3.2 Application of the model

The procedure to estimate the hedonic equation (5) depends upon the data available on the area affected by regulations to protect native vegetation. The only information may be whether the individual parcel is affected or not. In this case, a variable DUMA is defined as 1 = affected or 0 otherwise (Nickerson and Lynch 2001). The empirical form of equation (5) becomes:

$$LVALUE_j = a + bK_{ij} + cDUMA_j + e_j \qquad (8)$$

where LVALUE is now the market price, K_{ij} is a vector of characteristics i of the farm j, e is the error term, and a, b and c (and d below) are parameters to be estimated.

All farmland in New South Wales is affected by the Native Vegetation Conservation Act, but different parcels have different amounts of native vegetation left. When the percentage of native vegetation can be measured directly for each parcel (PCNV), the empirical form becomes:

$$LVALUE_j = a + bK_{ij} + cPCNV_j + e_j \qquad (9)$$

This equation can be labelled "Model 1: the basic hedonic model". It "captures" the trends of Figure 1 through the inclusion of variables LVALUE and PCNV, and so will be applied.

Equations (8) and (9) assume that all observations refer to sales within the same time period, so only the cross-sectional variations in characteristics of the farm (K), including the percentage of native vegetation (PCNV), need to be included. If the observations covered to a period of time (t), the longitudinal variations in other explanatory variables must be included as well. These other market variables could be commodity prices, exchange rates, loan rates, and cyclical economic factors that affect both buyers and sellers. Where M is a vector of such market factors that affect both buyer and seller, and with n of them:

$$LVALUE_{jt} = a + bK_{ij} + cPCNV_j + dM_{njt} + e_j \quad (10)$$

Models (8), (9), and (10) assume that the underlying processes of price formation are the same for all parcels of land, irrespective of how much is native vegetation and so affected by the Act.

The error term e_j may include the effect of unobserved characteristics of the land, the buyer, seller, or the market. These unobserved characteristics may be related to the decisions to buy or sell the land and so lead to a sample selection problem. The obvious a priori expectation is that land with more native vegetation is less likely to be purchased and so less likely to enter the sampling frame. The variable PCNV is included already and allows for allows an ex post comparison of percentages of native vegetation in the sample and the Shire as a whole. The second obvious expectation is that buyers are more likely to enter a market that is regulated by the Act if they are willing to conserve native vegetation in the way that is prescribed by the Act. This characteristic of buyers was observed and data were collected for it, but it is excluded from the hedonic equation that includes characteristics to which both buyer and seller can react.

If the influence of market structure changes across the sample, if the process of price formation differs across the sample or between buyers and sellers, and if market factors affect buyer and seller differently, then the bargaining approach may be used instead of the hedonic approach (King and Sinden 1994). In this formulation, a variable (DUTY) is included for the buyers' willingness to conserve native vegetation as prescribed by the Act.

4 The bargaining approach

4.1 The theoretical basis

In reality, market prices are a response to buyer characteristics, seller characteristics and to the interaction of buyer and seller in the market - - as well as a response to the characteristics of the land. The hedonic approach necessarily ignores the former set of data and concentrates on the latter characteristics of the land. The bargaining approach seeks to model this broader scenario, with some advantages and some disadvantages, and some differences in the information that becomes available for policy formation.

Walras (1900) was an early contributor to the discussion of tatonnement processes - - the search for equilibrium and the adjustment from an initial position to a pseudo-equilibrium. One branch of the bargaining and adjustment literature addresses strategic bargaining between agents representing groups of individuals (Nash 1950 and Wolinsky 1987). Another branch concerns bargaining in markets where buyers and sellers bargain over both price and quantity. This literature, and its application to the valuation of characteristics of the land, was reviewed by King and Sinden (1994).

Wolinsky (1987) presented a model of search and market matching. Buyers and sellers search for each other, and then bargain over the difference in their bids, or continue their searches. When they fail to find a match, both parties continue their search as long as the gain from the search exceeds the gain from continued bargaining. Search, bargaining, and "matching" of buyers and sellers are central to exchange and price formation in farm land markets so Wolinsky's model is now applied to the problem.

The market to be modelled is one in which farmers with land for sale search for buyers by posting an offer price, buyers search for a property, and bargaining then occurs toward some kind of equilibrium. This process is costly and the cost is a function of the number of properties for sale, number of potential buyers for each, and search intensity.

The seller determines his offer price (SOFF) in terms of the characteristics of the land and other personal factors (S). He makes the first proposal and offers his property for sale at an advertised price of SOFF. The buyer determines the price he will bid (BBID) in terms of the same characteristics of the land, and his own personal situation (B). He makes this bid known to the seller. Then buyer and seller bargain over the difference in their prices (HAGL) in the "presence" of market variables (M), and a land value or market price (LVALUE) forms.

The relationships among these concepts may be summarised as follows:

$$SOFF > BBID$$

$$HAGL = SOFF - BBID$$

$$LVALUE = f(SOFF, HAGL, M_i)$$

$$SOFF >= MPRICE$$

$$BBID <= MPRICE$$

The advantage of this approach, over the hedonic procedures is the ability to differentiate valuations of characteristics by both buyer and seller and to differentiate behaviour of buyer and seller. Further, the role of market factors can be introduced more appropriately when they apply to either seller or buyer. The disadvantage, of course, is the need for primary data on BBID and SOFF, and on the characteristics of buyer and seller. These extra data were explicitly collected in the present study to allow for this kind of analysis to improve the information available for policy.

4.2 Application of the concepts

Market behaviour can readily be analysed with these concepts, and the simultaneous and sequential adjustment models are two ways to do this.

Model 2: The simultaneous adjustment model

The seller determines, and advertises, an offer price (SOFF) based on (a) his estimates of what the buyer will bid and what the final price might be, (b) the characteristics of the land and (c) his seller characteristics. The buyer determines his bid price (BBID) as a reaction to (a) the sellers advertised price and his perception of the final land price, (b) the characteristics of the land and (c) his own buyer characteristics. The final price is then the result of bargaining from the sellers' offer, and is influenced by the existence of market factors (M_i) such as forced sales and market conditions. This behaviour may be modelled as follows.

$$\text{SOFF} = f(K_i, S) \qquad (11)$$

$$\text{BBID} = f(K_i, B) \qquad (12)$$

$$\text{LVALUE} = f(\text{SOFF}, \text{HAGL}, M) \qquad (13)$$

The model is estimated as a system of simultaneous equations.

Model 3: The sequential adjustment model

The sequential model postulates a sequence of three discrete behaviours that lead to a sale. The seller sets his advertised offer price (SOFF) as a function of the property characteristics and his own personal characteristics. Then the buyer determines a bid (BBID) as a function of the same property characteristics and his personal characteristics. Finally both parties get together to bargain to a final market price.

$$\text{SOFF} = f(K_i , S) \qquad (14)$$

$$\text{BBID} = f(K_i, B) \qquad (15)$$

$$LVALUE = f(SOFF, HAGL, M) \quad (16)$$

A sequence of three separate equations is estimated.

5 Data collection

The data are now described and their descriptive statistics are summarised in Table 1**.**

5.1 Choice of study area

Farm land in Moree Plains Shire is characterised by extensive clearing of native vegetation (up until recently), the diversity of agriculture, and the environmental sensitivity of some of the remaining areas of native vegetation. The farm land market is very active and 370 parcels of land over 100 hectares in size were exchanged between August 1995 and December 2000. Of this total, some 180 were exchanges of land between different farm families and the remainder were exchanges involving business companies with headquarters in a state capital, transfers within a family, and purchases of closed roads.

This study focuses on the 180 farm families who had bought land from other farm families and the first 51 of these buyers, with whom appointments could be made, were interviewed. The sample of 51 family farms was widely spread throughout the Shire, comprised some 8.2 per cent of all farmers in the Shire, and livestock and crop production were well represented. The sample may therefore be representative of enterprise types, profitability and management skills. All the buyers in this sample lived on their properties, and their farms were their main source of income. They were scattered widely across the Shire and are considered representative of family owned and operated farms in Moree Plains Shire.

5.2 Farm characteristics

The price paid for land (LVALUE) was expressed per hectare. Data had been obtained from the Valuer-General on all exchanges of land of 100 ha or larger in the Shire since January 1991. Since that time, prices had been rising steadily at eight per cent per year, so the prices paid were inflated at this annual rate to the common date of December 2000.

Gross margin, and return to capital invested in the land, are both standard economic measures of annual farm income. Gross margin per hectare (GMNORM) is defined as:

GMNORM = Gross money revenue – variable money costs (17)

The percentage return to the capital invested in the land (RLNORM) is defined as:

RLNORM = (Gross margin – fixed costs - depreciation – owners salary)/(Price paid for land) expressed as a percentage (18)

The owner's salary is set at its opportunity cost, that is the foregone salary in the owner's highest-paying employment elsewhere. This value was set at a conservative $80 000 per year before tax, as an estimate of the potential earnings in alternative employment such as the public service or business.

Both measures of profit were assessed for a "normal" year, using long-term average yields as they applied to each farm, current costs and conservative prices as at December 2000. The results are presented in terms of the normal year because they represent the long-term, sustainable, situation.

The area of the purchased land was expressed in hectares (AREA). The distance from the nearest large town, Moree, Narrabri, or Goondiwindi, was a measure of the residential amenity of the purchase (DTOWN in kilometres). Seven of the properties had licences to irrigate from an adjacent river or creek (IRRIG =1 if there is a licence, and 0 otherwise). Sixty-three per cent of the farms had livable houses (HOUS=1) and thirty seven per cent had no livable house (HOUS=0).

5.3 Vegetation characteristics

Following standard definitions, native woodland was defined as vegetation where the tree canopy covered more than 20 per cent, but less than 100 per cent, of the ground. Native forest was defined as vegetation where the tree canopies touch and cover all of the ground. The farmers estimated the percentages of their purchase under native forest, native woodland, native grassland which had not been cultivated in the last 10 years, native grassland that had been cultivated in the last ten years, and land in cultivation - - all at the time of purchase. These percentages provided useful descriptions of the farms as the percentage of the farm in native grassland (PCNG) and the percentage in native forests and woodland (PCNW). The sum of these two is the total percentage of the farm area in native vegetation (PCNV), and this is the horizontal axis of Figure 1.

The expected sign on PCNV is of some interest. The simplest case is perhaps the buyer who is a profit-maximising crop farmer. He will discount the price of land with native vegetation because the option to clear has been removed. He will also discount it because he expects high transactions costs with DLWC if he applies for consent to clear and develop. Furthermore, he will also discount for the same kind of transactions costs, even when he does not wish to develop, if rare and endangered species are found on the land. But he will discount the price even further. When he purchases the land, he gives up the chance to learn more about these important transactions costs and so requires compensation in the form of a lower price for this lost opportunity (Zhao and Cling 2001). We can use the term "precautionary behaviour" for these kinds of response, and so expect that native vegetation would be an regarded as an undesirable characteristic of the land. Increases in PCNV will be associated with losses in land value and a negative sign on PCNV would be expected - - ceteris paribus. The short-term loss of income, because development is limited because of the Act, is already part of GMNORM.

5.4 Buyer and seller characteristics

Data were collected from buyers on age (BAGE in years), and distance of purchase from existing homestead (DHOME in kilometres). An enterprise variable (LIVE) was coded as 1 if he carried livestock and 0 otherwise. Twelve of the 51 were purchases of whole discrete properties, and the rest were additions to existing properties (PART = 1 if a whole and 0 if an add-on).

The level of awareness of the activities of the Moree Regional Vegetation Committee was a good indication of the buyer's objective knowledge of the Act, other relevant legislation and local vegetation issues. The variable AWARE was coded subjectively from 5 = very aware to 1 = very unaware, from the purchaser’s knowledge of the aims and members of committee, and his attendance at the committee’s events.

To further account for selectivity bias, the variable DUTY is included in the bargaining approach to represent the likelihood that the buyer will conserve the native vegetation. The variable is calculated from the results of a logit analysis where the dependent variable Z is coded as 1 = the buyer does not wish to clear, and 0 = he does wish to clear. The logit model was estimated as:

$$Z_j = a + f(W_j) + u_j \quad (19)$$

where W is a vector of environmental and buyer characteristics and u_i is the unobserved characteristics. The characteristics W were the return on the capital invested in the land (RLNORM), percent of native woods and forests (PCWF), percentage of native grass land (PCNG), and awareness of implementation of the Act (AWARE). The parameters of this of equation are estimated and the unstandardised values for $DUTY_j$ are calculated from them.

Sellers were not interviewed, but the following information was obtained about them from buyers: the age of seller (SAGE in years), whether he was still in farming (STILL =1 if so, and 0 if not), and whether there was a relative to pass the property on to (PASS =1 if so and 0 otherwise).

5.4 Market characteristics

Data on the sellers offer (SOFF in dollars per hectare), the buyers bid (BBID in dollars per hectare, whether the seller was forced to sell (FORC = if so, and 0 otherwise), and the number of potential buyer (NOBY), were all obtained from the buyer. A measure of the market activity would be desirable to begin to assess the competitiveness of the market. The number of sales in the Shire in the six moths prior to the sale (NOSA) is a partial indicator of this market characteristic, and a partial proxy for the levels of crop prices and yields. Higher values for NOSA indicate a more competitive market, and of course indicate that buyers have more funds available to buy. Data on NOSA were obtained from the information provided by the Valuer-General's Department.

6 Analysis

6.1 The models to be estimated

The three models of market behaviour may now be specified.

Model 1: The basic hedonic model was specified as ;

LVALUE = f(GMNORM, AREA, PCNV, IRRIG, DTOWN, HOUS) (20)

Both buyers and sellers can respond to all these variables in the process of price formation.

The buyers were all from the Shire, or from a few kilometres outside. They all had experienced at least one recent year with good yields and good prices, so they all had funds available to make the purchases but a large variation in funds was unlikely. Sellers are established on their farms and so are varied in the enterprises that they actually pursue. But buyers face an identical range of possible enterprises, an identical set of available technologies and have equal access to technological information. They were all committed to staying in the area and on their farms, whereas 40 per cent of the sellers moved away after the sale. Most of the buyers (76 per cent) were purchasing additions to existing properties - - another indication that buyers were relatively similar in their competitive characteristics.

There was a strong common perception amongst buyers of the problems of native vegetation and the problems of land with native vegetation. There was a common belief that applications for consent to develop would be refused or drastically reduced. These perceptions were characterised by a common lack of information about whether vegetation included rare or threatened species, and uncertainty about what would happen if it did. Given these circumstances, the buyers seem sufficiently similar to argue that the observations of P_i (K) and K_i in the second stage of the hedonic approach (equation 28) will identify a demand functions for characteristics.

Model 2: The simultaneous adjustment model comprises the three following equations to be solved as a system.

SOFF = f(GMNORM, AREA, PCNV, IRRIG, DTOWN, HOUS, SAGE, STILL, PASS) (21)

BBID = f(GMNORM, AREA, PCNV, IRRIG, DTOWN, HOUS, BAGE, PART, DUTY, DHOME, LIVE) (22)

LVALUE = f(SOFF, HAGL, FORC, NOSA, NOBY) (23)

The seller determines, and advertises, an offer price terms of his estimates of what the buyer will bid and what the final price might be. The buyer determines his bid price as a reaction to the sellers advertised price and his perception of the final land price. This set of simultaneous equations will be estimated as a case of Seemingly Unrelated Regressions, also known as Zellner estimation, through three stage least squares.

Model 3: The sequential adjustment model may be specified as follows.

SOFF = f(GMNORM, AREA, PCNV, IRRIG, DTOWN, HOUS, SAGE, STILL, PASS) (24)

BBID = f(GMNORM, AREA, PCNV, IRRIG, DTOWN, HOUS, BAGE, PART, DUTY, DHOME, LIVE) (25)

LVALUE = f(SOFF, HAGL, FORC, NOSA, NOBY) (26)

The seller determines and advertises his offer price. Then the buyer determines his bid price. Then the buyer and seller get together, in some way, and determine the final price through bargaining. Each equation will be estimated as a separate ordinary least squares model.

6.2 Statistical properties of the basic hedonic model

The basic hedonic model was estimated by ordinary least squares and is presented as equation (27) in Table 2. The functional form of the model follows theoretical and intuitive reasoning. Observation of the data on LVALUE and PCNV suggested that (a) the relationship between them would follow the downward curvilinear trend from PC_m to PC_t, in the framework of Figure 1, and (b) land values would tend toward a minimum over a relatively large range of per cent native vegetation at a high level of PCNV. The data for percent of native vegetation were expressed in natural logarithms to allow for this trends. The data on AREA were also expressed in natural logarithms to reflect the financing and management problems of larger properties. All other variables were arithmetic. A good indication of correct specification is a high adjusted R squared value. The adjusted R^2 of 0.6765 is high for data which captures both biological and management variation, so the equation appears to be correctly specified.

The data are from a cross section of farms at a given time, so there should be no auto-correlation and the residuals should be independent of each other. Nevertheless the Durbin-Watson statistic was calculated to test for possible auto-correlation. The statistic is 1.78, which is sufficiently near 2.0 to indicate no auto-correlation. The Brigalow soils in the outwash province of the east of the Moree Plains Shire are often described as more fertile than those in the west. The possibility of a systematic east-west variation in the effect of soils on yields and on land values was therefore tested by re-ordering the 51 farms by easting and using the Durbin-Watson statistic to test for auto-correlation. There appeared to be no auto-correlation and so no systematic east-west soil effect.

Heteroscedasticity can be detected by applying tests to examine the residuals. Judge et al (1980) discuss the forms of heteroscedasticity and the tests for it, and note that a major difficulty is the need to know which form is present. The dispersion of land values is likely to depend on several variables, and these variables cannot be expected to move in the same direction. In this case, the Breusch-Pagan Test is useful. Greene (1997) argues that the three Glesjer Tests are more powerful in the specific context of regression models. They test the dispersion of residuals with respect to the independent, explanatory variables and the constants.

The Glesjer tests, and the Breusch–Pagan-Godfrey test based on coefficients of determination, were therefore applied to the hedonic model (equation 27). Following the Glesjer tests, the null hypothesis of homoscedasticity was not rejected. Following the Breusch-Pagan-Godfrey tests, this null hypothesis was not rejected either. We conclude that heteroscedasticity exerts no measurable effects on the basic hedonic equation.

The independent or explanatory variables must not be correlated. The highest correlation between the independent explanatory variables was 0.621 between AREA and HOUS. The next highest correlation is 0.378 between AREA and DTOWN. The variables GMNORM and PCNV will not be directly related. Gross margins across whole properties, for a given PCNV, will still vary by enterprise choice, the proportions of each enterprise per farm, individual grower costs and prices. The correlation coefficient between them is -0.045.

Griffiths et al (1993, p 453) offer the following rule of thumb A correlation between two explanatory variables "greater than 0.80 to 0.90 indicates a…potentially harmful collinear relationship". On this basis, the correlation of 0.621 correlation is not harmful. Klein (1962), supported by Huang (1970), had offered a further rule of thumb. Collinearity is "tolerable" if the correlation coefficient is less than the coefficient of multiple determination (R). The coefficient of multiple determination in equation (27) is 0.8458 so the independent variables are clearly not correlated to an extent that will bias the coefficients of the model.

7 Results

7.1 Influence of the conservation of native vegetation on land values

The protection of native vegetation through the Act affects land values directly by reducing both short-term profitability (GMNORM) and long-term development options (as measured by PCNV). The first stage hedonic equation is conventionally used to assess the effects in the market of marginal changes in characteristics such as these. The results (equation 27 in Table 2) show that;

• reductions in gross margin decrease land value (because of the positive sign on GMNORM) and,

• increases in percentage of native vegetation also reduce land values (because of the negative sign on PCNV).

The Act reduces GMNORM and increases PCNV, so protection of native vegetation is associated directly with a lower land value.

Consider now the influence of the percentage of native vegetation by itself. Increases in the percentage of native vegetation on a property reduce market price in both Stage 1 and Stage 2 hedonic models of Table 2. Clearly the proportion of native vegetation is related to land value, and land with less native vegetation brings a higher price. The market as a whole therefore reduces land values as the amount of native vegetation rises. But the buyers and sellers appear to assess the influence of native vegetation differently. In both the bargaining models (Tables 3 and 4), only the buyer's bid is affected by the percentage of native vegetation on a property. Buyers discount their bid according to the percentage of native vegetation on the property but apparently sellers do not discount their offer price in this way.

The second stage inverse demand function (equation 28) is used to assess welfare changes and the effects of non-marginal changes in a characteristic (Irwin 2002). The negative sign on PCNV in equation (28) shows that, native vegetation is an undesirable characteristic so demand is not the usual willingness to pay for extra units. Rather it is the willingness to pay to avoid an extra unit of an undesirable characteristic - - the conventional defensive-expenditure concept of demand. The demand curve is the willingness to pay, as an increase in the price, for land with one unit less native vegetation, at each of a range of levels of PCNV - - ceteris paribus. The inverse demand function (equation 28) shows that:

• at low levels of native vegetation, the willingness to pay is relatively high because one more unit of native vegetation brings with it relatively high extra transactions costs and proportionately more restrictions when little or none is owned already.

• at high levels, the willingness to pay to avoid one more unit is lower, because one more unit, added to the "large" amount already held brings relatively few extra problems.

These trends suggest that buyers are averse to the problems of taking on any native vegetation at all, over the whole range of percentage native vegetation left on the farms.

Land values, incorporating the complementary effects of GMNORM and PCNV, were calculated from the hedonic model of equation (27). The average land value at the average proportion of native vegetation is listed first.

Percentage native vegetation	Land value $ per ha	Reduction in land value Per cent
41	793	0
35	814	2.6
25	848	7.0
15	883	11.4
5	920	16.0
1	939	18.4

With the Act, a farm with 41 per cent still in native vegetation has a land value of $793 per hectare. With the Act, a farm with only 5 per cent native vegetation has a land value of $920 per hectare. But without the Act, a farm with 41 per cent could be cleared to leave five per cent of its native vegetation and so have the value of $920. The Act therefore imposes the loss of $127 per hectare, or 16.0 per cent of land value, on the farmer who would leave five per cent of his native vegetation. These data confirm the trends of Figure 1. As more and more vegetation is cleared from the starting point of PC_f, the land value steadily rises toward PC_m with increasing marginal returns to clearing as in the figure. Apparently, PC_m is very close to PC_0 for Moree Plains Shire.

The area of agricultural holdings in the Shire in 1996/97 was 1.558 m hectares (Australian Bureau of Statistics, various). So the Shire-wide loss in land value, as estimated from the sample loss per hectare, is $198m ($127 per ha*1.558m).

These losses in land value are the opportunity costs to the farmer. They are distributed unevenly - - and in a sense unfairly. First, farmers who have kept more native vegetation are more disadvantaged because their opportunity cost will be higher. For example, these results show that a farmer with only 35 per cent left in native vegetation and who wants to clear all but five per cent loses "only" 13.0 per cent (the foregone percentage change from 814 to 920) under the Act. His land value would be 13.0 per cent higher without the Act. But the farmer who has kept 41 per cent will lose 16 per cent of his land value. Second, farmers who have more native vegetation will tend to have lower incomes. They may need to clear more native vegetation to maintain their income but they will lose more under the Act. A farmer who needs to clear down to 5 per cent will lose 16 per cent. But one who needs to clear from 41 down to only 15 per cent will lose only 13.5 per cent. The Act therefore imposes higher costs on those who have kept most vegetation, and on the poorer farmers who most need to clear or at least retain their options to clear and develop.

7.2 Characteristics that consistently affect market price

The following results appear consistently in the hedonic market model (equation 27) and/or both the bargaining models.

• Percentage of native vegetation (PCNV) is significant and negative - - so increases in the proportion of native vegetation are associated with decreases in the market price of land, ceteris paribus.

• Gross margin (GMNORM) was significant and positive - - so increases in gross margin are associated with increases in market price.

• Area (AREA) was significant and negative - - so increases in area are associated with decreases in market price due to the problems of financing and managing larger properties.

• The possession of an irrigation licence (IRRIG), surprisingly, did not influence price in any of the models. Only 14 per cent of the properties had irrigation licences.

• The existence of a livable house (HOUS) did not influence price in any of the models either. Seventy-six per cent of the purchases were additions to existing properties and so a house was unnecessary.

• The coefficient on duty of care (DUTY) is negative and significant wherever it occurs (Tables 2, 3, and 4). The sign suggests that decreases in the likelihood that the buyer will protect the native vegetation are associated with increases in price paid - - perhaps crop farmers are less likely to protect and more likely to pay higher prices. Equally livestock farmers may be more likely to protect native vegetation (and so have higher values for DUTY) and be more likely to pay lower prices. The negative sign on LIVE in Table 4 supports this conclusion.

7.3 Differential valuation of characteristics

Differences in significance and size of given coefficients, between buyer and seller, (Tables 3 and 4) suggest that buyers and sellers value characteristics differently.

• The coefficients for PCNV are significant and negative for buyers and insignificant but also negative for sellers. Buyers are clearly assigning lower values to properties with larger percentages of native vegetation whereas sellers are not discounting the values at all (or may be only just discounting them).

• The coefficients for GMNORM are significant and positive for both buyer and seller in each of the bargaining models. But the coefficients are 14.3 per cent higher for sellers in Model 2 and 6.6 per cent higher for Model 3. Sellers therefore appear to value production more highly than sellers. At the time of purchase, buyers may have less knowledge of GMNORM than sellers and may have different attitudes to future incomes than sellers.

• The coefficients for AREA are negative and significant in each of the bargaining models. But the coefficient for sellers is 8.8 per cent higher for Model 2 (simultaneous adjustment) and 17.8 per cent higher for Model 3 (sequential adjustment). Apparently, sellers discount area more heavily than buyers. At the time of purchase, sellers may be more aware of the problems of managing larger areas than the buyers.

• Distance to town is negative and significant for sellers but insignificant for buyers. Apparently sellers discount price for increases in distance from town but buyers do not.

The differences in valuation of characteristics could result from the asymmetry of information between buyers and sellers (Scitovsky 1990). Consider the statistically significant property characteristics in Tables 3 and 4. The characteristics whose effects are best known to the seller are GMNORM, AREA and DIST. Sellers weight these characteristics more heavily than buyers. Indeed, DIST is significant only for sellers, and the sellers may be the only ones to fully know the effects of distance of the farm from the nearest large town. The characteristic whose effects are of more concern to the buyer is PCNV, and least information on this of all the characteristics would appear to be available to buyers. Indeed, for buyers, considerable uncertainty surrounds the ability to develop land with native vegetation so they discount land value for this characteristic even though sellers do not.

8 Discussion and conclusions

8.1 The role of information and uncertainty

The hedonic approach to valuation is based on certainty but the participants in the market act under degrees of uncertainty particularly as to the effects of the Act.

Indeed, there is widespread concern as to whether applications to develop will be refused or seriously reduced. Twenty per cent of the sample had recently applied for consent from the DLWC to clear. All these applications had been rejected outright or significantly reduced, so that landholders now hold the consistent subjective belief that applications would have little success.

The hedonic prices are based on buyer's subjective probability of such events rather than an objective probability of their actual likelihood. The inability of buyers to transform available information to probabilities may bias the hedonic estimates of value. The bias may also arise from the poor quality or insufficient quantity of information. Lichtenstein et al (1978), Fischoff (1975), and Tversky and Kahneman (1973) offer formal treatments of these issues. They all suggest that subjective probabilities are highly sensitive to the quality and quantity of available information. Kask and Maani (1992) derive rules to interpret hedonic estimates of values in these situations. Where subjective probability (SP) is below the objective probability (OP), increases in information raise SP toward OP and so hedonic estimates of values are underestimates or lower bounds of the true values. Where SP exceeds OP, increases in information reduce SP and so the estimates of value are upper limits.

Information, on the probability that an application to develop will be accepted, exists in very low quantities within the Shire as everywhere else - - there are insufficient cases so far to offer any kind of rational, objective, systematic pattern. In this case, we expect increases in information to reduce the uncertainties and raise the currently low subjective estimates so the coefficient on PCNV may under-estimate the cost of the Act.

8.2 The effects of variation in the data

The relative importance of changes in the variables on land value can be assessed through their elasticities - - the per cent change in land value for a one percent change in the variable. The elasticities on the significant variables in the hedonic equation (27) are GMNORM 0.205, DTOWN, 0.144, AREA -0,129, and PCNV -0.045. The per cent changes in land value for a one per cent change in several other variables were also calculated.

- A one percent change in the percentage of native vegetation to be retained by the farmer leads to a 0.060 per cent change in land value.

• A one per cent change in wheat gross margin leads to a 0.004 per cent change in land value, and

• A one percent change in cattle gross margin leads to a 0.001 per cent change in land value.

Prices paid for land are therefore more responsive to changes in short-term profitability (GMNORM) than long-term development options (PCNV), and to distance to town (DTOWN) and size (AREA) rather than PCNV. The changes in land value are relatively insensitive to changes in wheat and cattle gross margin, and to the amount of vegetation that the farmers would retain. In fact, all these elasticities are low and show that changes in land value are relatively insensitive to all of these variables. They also show that the estimates are most sensitive to those variables for which considerable data are available, objective, and readily observable (GMNORM, DTOWN, AREA, and PCNV).

The loss in land value, as an opportunity cost to the farmer, appears to be some $127 per hectare or 16 per cent over the whole sample of 51 purchases. This estimate might usefully be extended to the Shire as a whole, so the differences between the sample and the Shire must be identified and the loss adjusted as necessary. Variations in soil type, ownership, or area of cotton, are unlikely to lead to important variations in the magnitudes of the losses. Extensive alluvial deposits have formed uniformly deep soils dominated by grey self mulching clays, across flat plains of uniform slope - - over all but a very small, southeastern part of the Shire. Differences in losses between family farms (which were sampled) and corporate farms (which were not sampled) depend very largely on the choice of agricultural enterprise and the remaining amounts of native vegetation - - and not on the difference in ownership *per se*. Indeed, the three corporate farmers, with whom the results were discussed, all indicated that their losses in land value were similar to these losses for family farms. Twenty-two per cent of the area of the Shire was under cotton (Australian Bureau of Statistics, various) as opposed to 21 per cent of the sample.

But differences in the area of native vegetation are likely to affect the losses, because a higher percentage leads to a higher loss in land value with all types of enterprise. Forty-eight per cent of the Shire is still under native vegetation (NSW Department of Land and Water Conservation 2002) as opposed to 41 per cent in the sample. The Shire-wide loss in land value, with the sample loss per hectare and Shire area of 1.558m hectares, was calculated as $198m. This estimate is therefore conservative because the sample farms with a lower tan average percentage of native vegetation. It is also lower than the loss to the community because it assumes farmers retain five per cent of their native vegetation.

8.3 Development of policies to conserve vegetation

The loss in land value in More Plains Shire appears to be substantial, even with this conservative estimate. The loss is high because the alternative land use of cropping is very productive, large areas of native vegetation remain in the Shire, and the government agency (DLWC) uses a high-cost decision rule to implement the Act (Sinden 2003). Stewardship payments will alleviate the financial situation for some and property plans will provide long-term security for both farmer and vegetation. But the size of the likely loss in land value over the whole State would appear to be so large that such individual policies cannot be funded sufficiently to correct the equity problems that the Act has created. The broad strategies of vegetation conservation must therefore be addressed first. Do we need to retain all native vegetation and what is a desirable allocation of costs?

To enhance vegetation protection, buyers should be aware of any threatened species on a potential purchase, and what degree of threat they are under. Sellers should be required to provide this information, although buyers may end up paying for it in the bargaining process. This use of the land market may provide a useful environmental management system (Sinden and King 1996).

To enhance economic efficiency, information should be symmetric and clearly far more information is needed on the likelihood that development would be approved on land with native vegetation. Due to their precautionary behaviour, buyers are clearly assigning lower values to properties with larger percentages of native vegetation whereas sellers may not be discounting the values at all. Further, the extension efforts by the DLWC and the Moree Regional Vegetation Management Committee appear to have had little impact on the landholders behaviour or knowledge. This is surprising, and suggests that the extension system also needs to be reviewed.

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Table 1 Summary of descriptive statistics

Variable	Description	Mean	Min	Max
LVALUE	Land value, $ per ha	793	374	2033
GMNORM	Gross margin, $ per ha	125	7	459
RLNORM	Per cent return to capital	8.4	-16.9	29.4
AREA	Area in hectares	1393	100	8000
DTOWN	Distance from a major town, kms	62	18	130
IRRIG	Irrigation licence, Yes = 1, No = 0	0.14	0	1
HOUS	Livable house, Yes = 1, No = 0	0.63	0	1
PCNV	Total per cent native vegetation	40.5	0.1	100
PCNG	Per cent native grassland	19.9	0.1	98.7
PCWF	Per cent native woods and forests	21.0	0	100
BAGE	Buyers age, years	43	26	66
DUTY	Likelihood to keep native veg., as an index	0.40	-2.4	2.6
PART	Part (0) or whole (1) farm	0.24	0	1
DHOME	Distance from existing homestead, kms	14	0.1	110
LIVE	Livestock enterprise, Yes =1, No = 0	0.35	0	1
AWARE	Awareness of relevant legislation and local vegetation issues, as an index where 5=very aware, 1=very unaware	2.8	1	5
SAGE	Sellers age, years	53	28	73
STILL	Seller still in farming, Yes =1, No = 0	0.6	0	1
PASS	Can pass farm on, Yes =1 No = 0	0.41	0	1
SOFF	Sellers offer price, $ per ha	833	411	2033
BBID	Buyers bid, $ per ha	726	330	1898
HAGL	Difference in bids which is the subject of bargaining (equals SOFF - BBID), $ per ha	107	0	395
FORC	Forced sale, Yes =1, No = 0	0.33	0	1
NOSA	Number of sales in Shire in last six months	45	9	70
NOBY	Number potential buyers for farm	2	1	6

Table 2 The hedonic approach, with results for both stages

Variables	Stage 1: the hedonic equation (27)		Stage 2: the inverse demand function (28)	
Characteristics of the property				
GMNORM	2.842	(6.9)***	-0.0637	(2.3)**
AREA	-101.91	(2.0)**	7.826	(1.1)
PCNV	-35.548	(1.4)*	-35.433	(6.5)***
IRRIG	4.554	(0.1)		
DTOWN	-1.8479	(1.4)*	-0.116	(0.5)
HOUS	65.243	(0.8)		
Characteristics of the buyer				
BAGE			-0.507	(1.0)
DUTY			-11.799	(2.0)**
PARTW			-18.705	(1.4)*
DHOME			-0.0963	(0.5)
LIVE			5.258	(0.4)
Constant	1330.3		70.815	
R	0.8458		0.7859	
R^2	0.7153		0.6177	
Adj R^2	0.6765		0.5338	

* indicates significant at 1 per cent or better
** indicates significant at 5 per cent or better
*** indicates significant at 10 per cent or better

Table 3 The simultaneous adjustment model (Model 2) #

Variable	**BBID (29)**		**SOFF (30)**		**LVALUE (31)**	
Characteristics of the property						
GMNORM	2.593	(6.9)***	2.963	(6.6)***		
AREA	-92.791	(2.1)**	-101.040	(1.9)**		
PCNV	-45.874	(1.9)**	-31.847	(1.2)		
DTOWN	-1.059	(0.9)	-2.5043	(1.5)*		
IRRIG	20.087	(0.2)	-11.682	(0.1)		
HOUS	16.186	(0.2)	65.658	(0.7)		
Characteristics of the buyer						
BAGE	0.0371	(0.1)				
DUTY	-32.304	(2.0)**				
PARTW	39.743	(1.1)				
DHOME	0.094	(0.2)				
LIVE	-21.726	(0.6)				
Characteristics of the seller						
SAGE			-0.720	(0.5)		
STILL			10.570	(0.3)		
PASS			37.674	(1.0)		
Characteristics of the market						
SOFF					1.0364	(58.0)***
HAGL					-0.569	(6.5)**
FORC					-13.557	(1.2)
NOSA					-0.079	(0.3)
NOBY					-0.389	(0.1)
Constant	1252.0		1369.2		-0.806	
R	0.8590		0.8400		0.9956	
R^2	0.7380		0.7052		0.9913	

The system R^2 is 0.7905

Table 4 The sequential adjustment model (Model 3)

Variable	BBID (32)		SOFF (33)		LVALUE (34)	
Characteristics of property						
GMNORM	2.650	(5.8)***	2.827	(6.1)***		
AREA	-85.324	(1.8)*	-100.56	(1.8)*		
PCNV	-63.109	(2.1)**	-33.901	(1.2)		
DTOWN	0.040	(0.1)	-2.027	(1.4)*		
IRRIG	-17.753	(0.2)	3.724	(0.1)		
HOUS	-36.511	(0.5)	45.093	(0.5)		
Characteristics of buyer						
BAGE	0.800	(0.3)				
DUTY	-83.226	(2.4)**				
PARTW	109.96	(1.5)*				
DHOME	0.181	(0.2)				
LIVE	-91.694	(1.3)*				
Characteristics of seller						
SAGE			0.661	(0.2)		
STILL			46.923	(0.6)		
PASS			28.560	(0.4)		
Characteristics of market						
SOFF					1.029	(59.7)***
HAGL					-0.550	(6.5)***
FORC					-14.441	(1.3)*
NOSA					-0.072	(0.3)
NOBY					-0.767	(0.2)
Constant	1212.0		1308.9		4.342	
R	0.8742		0.8421		0.9956	
R^2	0.7634		0.7092		0.9913	
Adj R^2	0.6967		0.6453		0.9903	

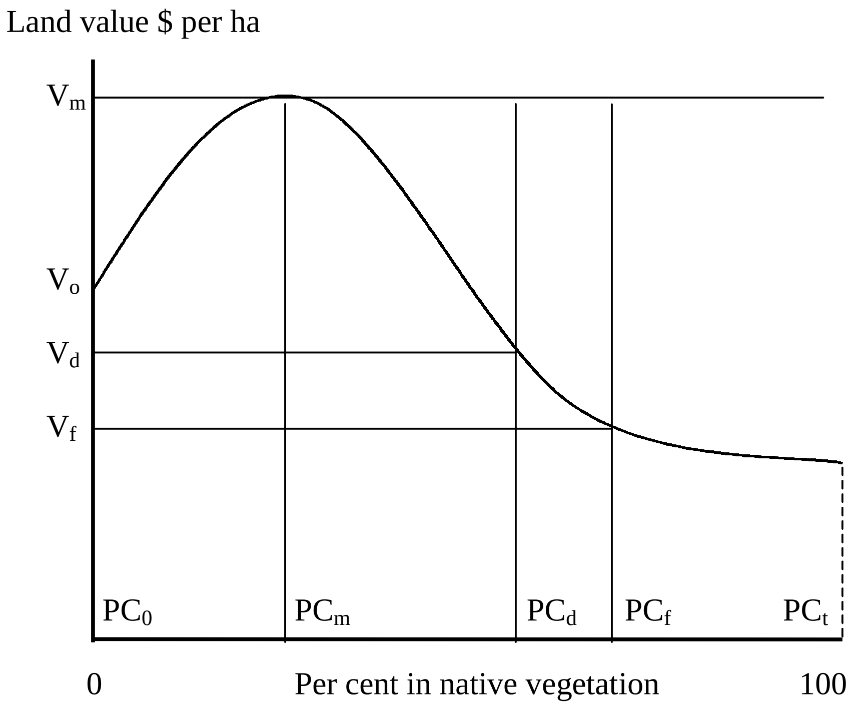

Figure 1 Relationship between land value and per cent of farm still in native vegetation, with the Act