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Towards a New Framework for Modelling Agricultural Land Prices

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(WP 88/05)

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A. INTRODUCTION

The purpose of this working paper is to investigate the way in which the land market has previously been conceptualised and the implications that different types of conceptual frameworks have for the choice of methodological approach taken in modelling land prices.

One apparently successful model of UK land prices was that of Traill (1979) which is based on what is called here 'The Harvey-Traill Framework'. Given the availability of extra data the Traill land price model was re-estimated over an extended period (1952-86) and was found to no longer hold. Explanations are put forward for the failure of the Traill model, including possibly the most serious criticism of the model, that it is based on an inappropriate conceptual framework.

An alternative conceptual framework for the operation of the land market is presented in this paper and is used to identify the best direction to take for future modelling of land prices in the UK. This direction being a Present Value/Demand-Side approach.

B. THE LAND MARKET - THEORY AND ITS IMPLICATIONS FOR STATISTICAL MODELS.

1. THE NEOCLASSICAL FRAMEWORK

Early statistical models of the land market, for example that of Herdt and Cochrane (1966), were based on standard Neoclassical theory with price and area of land sold being determined by the interaction of demand and supply for agricultural land. Potential purchasers of agricultural land enter the land market with different Maximum Bid Prices for agricutural land which, when ordered, results in a downward sloping aggregate demand curve for land. Individual sellers have different Minimum Acceptance Prices for their land which, when ordered, results in an aggregate upward sloping supply curve for land. Equilibrium is achieved at Pe,Ne.(Fig.1a)

Under the Neoclassical framework land prices are modelled by estimating appropriately specified supply and demand curves for land in a simultaneous system.

2a. THE HARVEY-TRAILL FRAMEWORK

Harvey (1974) noted that the 'traditional' methodology is theoretically incorrect. The land market cannot be conceptualised in the same way as ordinary consumption goods or other non-depreciating inputs. Fig.1a is only observed when the land market is **'out-of-equilibrium'**.

Equilibrium in the land market is achieved only when all transactions have taken place such that all Maximum Bid Prices are below Minimum Acceptance Prices. Thus,

"Transactions are merely a means of returning the market to an equilibrium situation." (Traill,1980)

A stable relationship will not exist between the supply of, or demand for land, and the area of land sold -

"...a given price may be associated with either a large number of transactions (out-of-equilibrium) or very few transactions (equilibrium restored)." (Traill,1980)

However, this theoretical interpretation had to be reconciled with the statistical observation from earlier studies (eg.Harvey,1970) of a negative relationship between land prices and the number of transactions; that is, an apparent observation of a downward sloping demand curve.

Traill points out a furthur problem with the Herdt-Cochrane type analysis. There will be an empirical identification problem in estimating the demand and supply functions of land jointly since certain variables effect both the maximum offer and minimum acceptance prices; such factors include the prospective income from farming, expectations of capital gains from the future sale of agricultural land and the perceived 'riskiness' of farming.

In an attempt to overcome the identification problem, and to reconcile the inconsistency between theory and statistical observation, Traill makes two critical assumptions about the operation of the agricultural land market. Firstly, he assumes that the demand curve for land is stable. This assumption can be justified, he says, if the market consists of a large number of potential buyers such that

"...purchases of land in one period does not result in a measurable shift in the demand curve in the next period."

The second assumption is that the aggregate supply curve is vertical and therefore influenced by factors exogenous to agriculture. It is only the supply curve which shifts each period and thereby empirically traces out the demand curve.(Fig.2b)

However, there are problems with both these assumptions.

Firstly, on the demand side, a more complex justification for the assumption of a stable, non-shifting demand curve is needed than there is a large number of potential buyers in the land market. This would not stop, ceteris paribus, a permanent shift in the demand curve back to the equilibrium position along the price-axis after transactions have taken place; that is, no matter how many potential buyers there are there will still be a situation of all Minimum Acceptance Prices being above all Maximum Bid Prices. A better justification for a stable demand curve would be that there are a large number of potential entrants into the bidding process in the land market. Each period a certain amount of individuals enter the bidding process as, for example, financial resources become available to them and, ceteris paribus, the out-of-equilibrium position will be observed each period.

Traill qualifies the assumption of a vertical aggregate supply curve since, for example:-

"farmers contemplating retirement may postpone the decision to do so if they expect a sharp rise in land prices..."

Hence, the seller of land in this case is responsive to the price of land.

2b. THE TRAILL MODEL.

Traills' statistical model, given the assumptions he imposes, consists of a land price equation which, ceteris paribus, is a function of the area of land traded. The demand curve can be estimated econometrically given that various price-quantity traded combinations are observed (for example

P1S1,P2S2,P3S3, Fig.2b) which trace out this demand curve.

Traill also includes in his land price equation farm incomes, expected growth in farm incomes, the rate of interest and the expected capital gains from the purchase of farm land as important influences on the demand for land. Other factors are considered which have previously been used in land price models. For example, technological change is often believed to have an important influence on the expansionary demand for land; however, a proxy for this factor is not included in the final model as the two indices for technological change Traill experiments with are found to have an insignificant effect on land prices.

The final estimating equation for the period 1950-1978 is of the form:-

$$\text{PLAND}(t) = B1 + B2*\text{YSTAR}(t) + B3*\text{CAPGAIN}(t) + B4*\text{AREA}(t) + B5*\text{LANDSOLD}(t) + B6*\text{DUMMY}$$

$$\text{where YSTAR}(t) = \frac{Y^*(t)*(1 + \delta Y^*(t))}{(1 + R^*)}$$

The YSTAR variable is a present-value type variable where:-

$Y^*(t)$ is expected farm income defined as income in period t-1.

$\delta Y^*(t)$ is the expected change in income defined as a fixed weight Fisher lag on actual growth in net farm income.

$R^*(t)$ is the expected rate of interest, which Traill takes as the average AMC loan rate in period t-1.

The capital gains variable is a measure of expectations of future capital gains. For the period up to and including 1973, when land prices are relatively stable, expectations of capital gains are measured as a weighted average of land price changes over the previous three periods. However, after 1973 when there is an explosion in land prices Traill assumes expectations adjust faster and measures capital gains expectations as the change in the price of land of the previous period. The AREA variable is the total area of land sold in the current period.

Traill includes a dummy variable in his land price equation which takes on the value of 1 in 1973 and 0 in all other years to capture the effect of changes in expectations due to the prospective entrance of Great Britain into the EEC.

TRAILL MODEL: ORIGINAL AND EXTENDED PERIOD SIMULATION RESULTS.

The results for the following set of estimated equations are shown in Appendix A, graphs of actual land prices and simulated land prices appear in Appendix B.

From the Traill equation the simulation results A(i) and B(i) are obtained with an apparently excellent fit, as given by the correlation coefficient value of 0.99. It is important to note that this is a dynamic simulation in that land prices appear in the definition of the CAPGAIN variable.

In an attempt to extend the Traill Model, given the extra data available, an initial data problem was encountered. Traill used the net farm income series for his income variable in harvest years. However, since 1979 MAFF has reported net farm income in calender years. In estimating the land price equation over the extended period it was therefore necessary to 'smooth-out' the transition between the two types of series. Fortunately, an overlap period of income in terms of calender years from 1970 was available and it was possible to create a new income series by taking a three year moving-average of harvest and calender income for the entire period.

TRAILL MODEL:NEW INCOME SERIES.

Re-estimating the Traill land price equation over the original data period (1952-1978) with the new income series does not change the apparently good performance of the model in explaining land prices. A correlation coefficent of 0.98 is obtained in comparing actual with the simulated series. (see A(ii) and B(ii)).

TRAILL MODEL:EX-POST FORECAST.

Given that a models performance is sometimes judged on its ability to forecast, using the estimated parameter values from the previous regression a dynamic ex-post forecast of land price values for 1979-1986 was carried out. Comparing the actual land price series with that forecasted clearly shows that Traills' model does not perform well under the forecasting criteria. (see B(iii)).

TRAILL MODEL:EXTENDED PERIOD.

The results obtained from re-estimating the Traill model for the period 1952-1986 are clearly poor.(r^2=0.67). A Chow test of the null hypothesis that the model continues to hold is strongly rejected. (see A(iii) and B(vi)).

REASONS FOR TRAILL MODEL FAILURE?

In all simulations, it is clear that the Traill model fails for the period 1978-86.

One possible reason contributing to the failure of Traills' land price equation lies in the definition of the capital gains variable. Over the original estimation period Traills' model and the modified income model have a co-efficient on the capital gains variable of less than one. This fulfills the stability condition, given that capital gains are defined in terms of lagged land prices. However, when estimated for the extended period the coefficient is greater than one and therefore the system is unstable. This explains why such drammatic swings are observed as the instability inherent in the system begins to take effect.

Traill distinguishes the pre-1974 period when price expectations are assumed to adjust slowly from the 1974-1978 period, when land prices explode and expectations are assumed to adjust faster, by redefining the capital gains variable. Reintroducing the earlier definition for the period 1981 to 1986, when land prices have levelled off and the 'euphoria' of the 1970's dissipated from the formation of land price expectations, would seem to be in keeping with the spirit of the original adjustment, and may resolve the problem within the dynamics of the equation.

TRAILL MODEL:MODIFIED EXPECTATIONS.

By re-estimating Traills' model with the capital gains variable defined as a three year weighted average for the periods 1952-1973 and 1981-1986 (see A(iv) and B(v)) the fit between actual and simulated land values is improved (r^2=0.89). However, a Chow Test still strongly rejects the hypothesis that the Traill model holds for the extended period and the coefficient on the capital gains variable still shows the system to be unstable.

In conducting this exercise it is apparent, given expectations of future capital gains are likely to be an important determinant of the demand for land and therefore of land prices, that any attempt to improve the Traill model would require a more internally consistent expectations formation mechanism - rather than having to switch on and off different measures when the time seems right - and one which fulfills the stability condition.

The Traill model has land prices being determined largely by factors within the agricultural sector; non-agricultural factors are not explicitly included within the model. However, some non-agricultural factors are observed to have had an important effect on the land market in the UK. For example, one recent trend has been the strengthening of a two-tier land market. Smaller holdings with a house near to the urban fringe have commanded high prices - "Booming house prices, particularly in the South-east, added a premium to the residential element of farms in the eyes of many potential buyers..." (Farmland Market:Feb.1988) - whereas the bare land sector, particularly for tracts of land over 25 acres, has seen a continuing depression in land values. An important question when deciding how to model the aggregate agricultural land market, therefore, is to what extent do non-agricultural factors determine land prices?

One interesting study of the US land market by Phipps (1984) uses the concept of Granger Causality in an attempt to determine whether changes in farm-based or non-farm-based returns or both are the source of land prices movements at the aggregate level given that, unlike land in Ricardian theory, agricultural land has a non-zero opportunity cost. A similar analysis has been applied to the UK land market.

PHIPPS ANALYSIS - THEORETICAL STRUCTURE.

If farming is the best use for a tract of land over an infinite planning horizon then the market price of land may be written as the present value of expected future rents generated by land in its farm use.

$$P_t = \Sigma_{i=0}^{\infty} \beta^i R^*_{ft+i}$$

where p=Price of land

β=the discount rate

R^*_{ft+i}=expected farm-based returns

However, since the opportunity cost of agricultural land is non-zero then Phipps claims market farm-land prices are determined by equation A:-

$$A.\ P_t = \Sigma^{\infty}_{i=0} \beta^i \max(R^*_{ft+i}, R^*_{dt+i})$$

where R^*_{dt+i}=expected rent in alternative non-farm use.

Therefore, farm land prices are determined by the interaction of two distinct markets, being farmland for agricultural use and farmland for non-agricultural use. For example, if farm land is expected to have a higher valued non-farm use some time in the future then observed farm-land prices will be greater than present value expected farm-based returns.

In summary, "..observed price movements may be caused by changes in expected farm-based returns (internal factors) or by changes in the opportunity cost of farmland caused by external factors."

Phipps specifies three possible relations between farmland prices and farm-based returns:-

(a) $P_t = \Sigma^{\infty}_{i=0} R^*_{ft+i}$ where $R^*_{ft} \geq R^*_{dt}$ for all t.

(b) $P_t > \Sigma^{\infty}_{i=0} R^*_{ft+i}$ where $R^*_{ft} < R^*_{dt}$ for some t.

(c) $P_t > \Sigma^{\infty}_{i=0} R^*_{ft+i}$ where $R^*_{ft} < R^*_{dt}$ for all t.

The relation (c) is observed when, for example, there are non-pecuniary factors or conversion costs which outweigh the present value of non-farm returns, such that farmland is kept in the agricultural sector despite its higher-value alternative use.

It is possible to define the three relations in terms of farm-based returns only, so that in the following empirical analysis a proxy for non-farm based returns is conveniently not required. The three relations can then be expressed in terms of Granger Causality between a land price time-series and a net farm rent time series, which proxies farm-based returns.

The basic idea behind Grangers' definition of causality, which can be used to test for temporal relationships between time-series, is that:-

"....one time-series y_t 'causes' another time-series x_t if present x can be predicted better by using past values of y than not doing so, other relevant information being used in either case."

(Geweke et al,1983)

Going back to the three relations;

If (a) holds then there will be uni-directional causality from farm-based returns to land prices. If (b) holds, Phipps argues that causality will be observed in both directions. This follows from (a) and from the argument that an increase in the non-farm returns of land immediately increases the price of land (equation A.) and will result in land being taken out of farming over time. This increases the marginal value product of land such that, empirically, land prices should be seen to lead farm-based returns. If (c) holds then land prices are fully determined by the non-farm sector. From (b) we would expect to observe in this case unidirectional causality from land prices to farm returns or independence of the two.

Given this theoretical structure tests have been carried out on the direction of causality between net farm rents and land prices in an attempt to establish whether or not non-agricultural factors are determining land prices. The results of such an analysis could provide a valuable insight into the operation of the UK land market and thereby help identify how this market can best be modelled at an aggregate level.

The methodolgy used in this paper is different to that used by Phipps. To test for Granger Causality Phipps uses the Haugh Statistic which by construction involves an arbitary specification of a variable used to determine degrees of freedom. However, it was found that running tests on the UK data using the Phipps technique the causality direction results were highly sensitive to the choice of this arbitary variable, so instead use has been made of a more recent method to test for Granger Causality devised by Geweke(1983).

The Geweke technique involves estimating two sets of equations of the form:-

1. $y_t = \Sigma^{r}_{s=1} G^{+}_{s} y_{t-s} + \Sigma^{q}_{s=0} F^{*}_{1s} x_{t-s} + \epsilon 1_t$

2. $y_t = \Sigma^{r}_{s=1} H^{+}_{s} y_{t-s} + \Sigma^{q}_{s=-p} F^{*}_{2s} x_{t-s} + \epsilon 2_t$

H_o:no causality from y to x ie. restriction $F^*_{2s}=0$ for all s<0.

The Null Hypothesis is tested using the Wald test statistic.

$$T^{aw}_n = n\ (RSS_{\epsilon 1} - RSS_{\epsilon 2})/RSS_{\epsilon 2} \sim \text{Chi-Sq}(p) \text{ under } H_o$$

Applying the Geweke equations to stationary time series on real land prices and real rents, firstly with land prices as the dependent variable, a search is necessary over the possible shapes of the various polynomial lag structures the different variables can take. The results from the optimal regression which was used to test the Null Hypothesis of No Causality from land prices to rents was strongly rejected thus indicating that non-farm based returns are a source of land price movements according to the Phipps criteria.

From this analysis it may be concluded that the ad hoc Traill-type model is inappropriate in that it only includes farm-based returns.

3. AN ALTERNATIVE CONCEPTUAL FRAMEWORK

A furthur problem with the Traill model is perhaps more fundamental in that it is concerned with the conceptual framework underlying the model. A more appropriate conceptual framework is set out here.

Consider the market for an asset, agricultural land, where the present value of that asset is calculated by an appropriate discounted returns formula. The Present Value of land will be determined by such factors as individuals expectations as to what the future returns to land will be - which is also dependent on, for example, how an individual perceives his own management ability - and expectations of potential future capital gains from expected increases in the price of land. Given a large number of potential purchasers of land, the assumption is made here that a perfectly elastic demand curve for land is an adequate approximation, and that the present value of a unit of land determines the price potential purchasers are willing to pay for that unit.

On the supply side it is again assumed that the amount of land coming onto the land market in each period is independent of current price and therefore determined by a perfectly inelastic supply curve. The position of this supply curve is assumed dependent on such exogenous factors as death or the retirement of landowners which, ceteris paribus, results in a relatively constant proportion of the total area of land held (S*) being offered up for sale on the land market in each period (Fig.3a)

Contrary to the caveat imposed on the inelastic supply assumption under the Harvey-Traill framework - landowners, for example, should be expected to postpone their decision to retire if they expect land prices to increase in the near future - it is contended here that, given perfect capital markets, landowners should be indifferent as to whether they retire and sell their land today or tommorrow; the expected increase in the price of land should be capitalised into the price of land they receive today. Thus, if it is assumed that the same information is available to all market participants, a totally inelastic supply for land should be an adequate assumption.

Given this conceptual framework for the land market it appears that land prices can be modelled purely from the demand side: however, an explanation must also be found in the context of this model for the statistical observation in the literature of a downward sloping demand curve.

Since the Second World War there has been a downward trend in the area of land sold and the total area of land under crops and grass in England and Wales. However, there has also been a downward trend in the area of land sold as a percentage of total area. Thus, if the percentage of area of land traded per annum is plotted against the price of land, which has experienced a trend increase, then a downward sloping 'demand curve' is obtained; of course such an observation should not be taken to mean that the price of land and the percentage of land traded are related. Indeed a bivariate test of Granger Causality, again using the Geweke Technique, was carried out with causality in both directions being strongly rejected, thus implying that supply of land is independent of price. If the downward trend in area of land sold as a percentage of land traded is assumed to be an indication that S* has been decreasing over time then given the above framework a downward sloping 'demand curve' is also obtained.(**Fig.3b**)

Time series analysis was carried out on the percentage of land traded variable and it was discovered, having first differenced the variable to remove the downward trend, that the resulting series was essentially a white noise error process. Thus it would seem reasonable to assume that the percentage area traded fluctuates randomly from period-to-period around a trending S*. (**Fig.3c**)

The above framework is also consistent with Harveys notion that transactions in the land market are an 'out-of-equilibrium' phenomena. After transactions have taken place the supply curve can be conceived to shift back to the price-axis until the next period when the retirement etc. of land owners again moves the supply curve to an 'out-of-equilibrium' position.

Given the alternative conceptual framework for the operation of the land market put forward in this paper it would appear that land prices can be modelled purely from the demand side. It would also suggest that further analyses of land prices will necessarily involve investigating the way in which the present value of land is determined, and a justification for the observed decline in the percentage of land traded variable, S*, which is independent of land prices must also be found.

C. CONCLUSION/SUMMARY.

An understanding of the operation of the UK land market and the determination of land prices is important from a policy perspective and for an understanding of resource allocation and structural adjustments within the agricultural sector. Also, given that land is the predominant asset held in the agricultural sector, a knowledge of land prices is important since movements of land prices will affect the debt/equity ratio of land-owning farmers which may have important consequences for the financial viability of these farmers.

The starting point of this analysis of land price determination has been an evaluation of the land price model put forward by Bruce Traill. This analysis has been of use in identifying the various problems encountered when modelling the land market.

Possible reasons have been put forward for the failure of Traills' model when it was found not to perform well over an extended estimation period.

Firstly, Traills definition of the capital gains variable was identified as a problem, particularly since the coefficient on this variable for the extended period showed the system to be unstable.

A second possible reason analysed was that Traills' ad hoc model was concerned largely with explaining land prices from within the agricultural sector. Use was made of the concept of Granger Causality to test whether or not non-farm-based returns should also be included in modelling the UK land market. The evidence indicates that they should.

More important in terms of indicating the way in which future studies of agricultural land prices in the UK should be carried out, given there are a number of alternative directions, has been the criticism of the Harvey-Traill conceptual framework which underlies the Traill land-price model.

It is possible to broadly define the possible alterntives for modelling land prices.

(i) Ad hoccery could be continued with. This could involve attempting to modify and improve Traills' model by improving, for example, the measurement of the expectations of capital gains and including what may appear to be important non-agricultural factors.

(ii) An example of a recent simultaneous equation framework approch is the study by Van Dijk et al (1986) of land prices in two regions of the Netherlands. Their belief is that land prices should be modelled by taking into account demand and supply factors and that market prices do have an effect on the supply of land. They also include non-farm factors, for example an index of house prices, in their model. However, this type of approch would not be justified in terms of the conceptual framework for the land market put forward in this paper.

(iii) A more formal approach to modelling land prices could be undertaken. For example, it is possible to estimate dual functions of the production function in an attempt to derive a series on the marginal value product of land which can then be used to calculate the Present Value of returns from farming. Present Value calculations are likely to be of importance in models where land is considered only as a factor of production or in models that place emphasis on land as an asset held as part of a portfolio.

It is possible to use flexible functional forms to estimate the marginal value product of land; McKay et al (1982) postulate a translog form for the variable profit function which can be used to calculate shadow prices for fixed inputs, such as land, which are then used in equations derived from the profit function to estimate marginal physical products and therefore the marginal value product of land can be obtained.

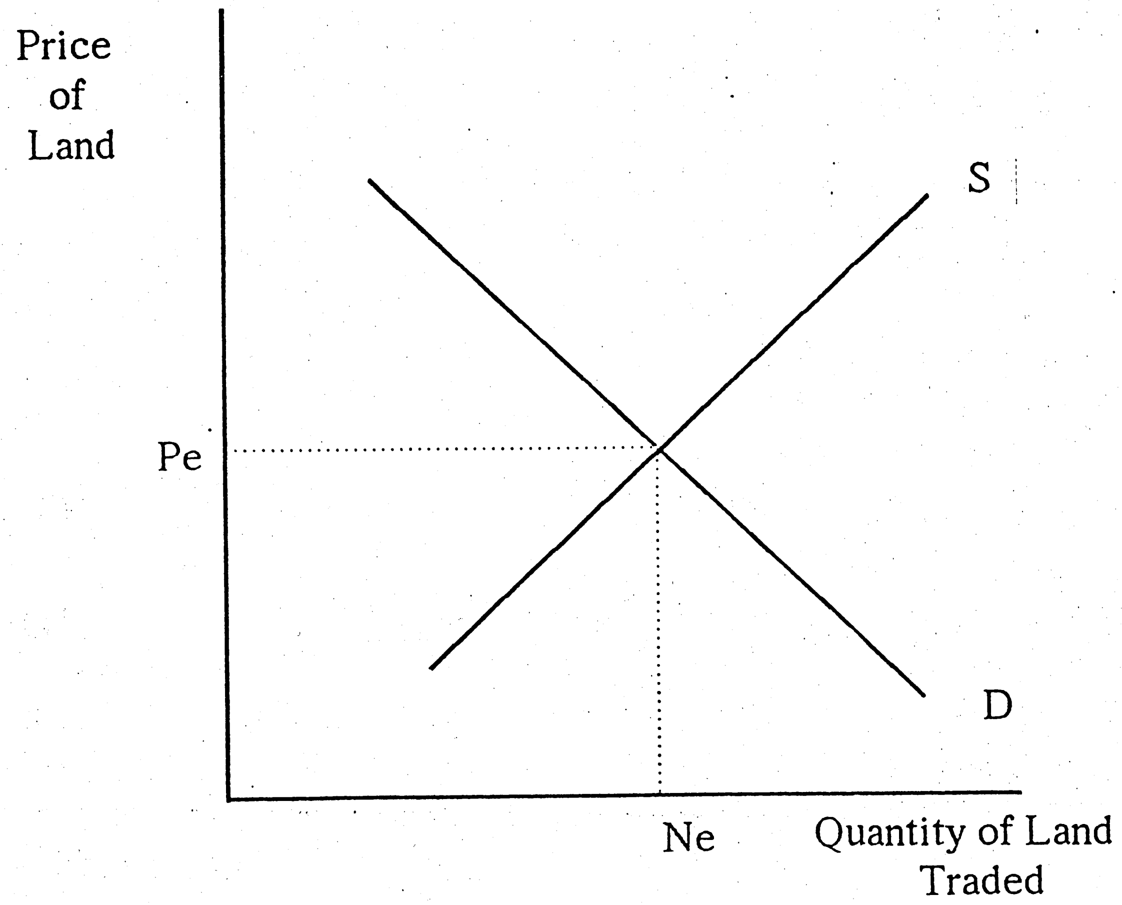
However, one problem in applying this sort of analysis to land is that the area of land, which would be included in the profit function as the amount of this factor applied to the estimated production process has been relatively constant over the years. Therefore, there may be insufficient variability in the data to be able to estimate the marginal value product of land.

An example of this approach is the work of another Dutch economist, Luijt (1987), who has employed the translog function to estimate marginal value products of land for the Netherlands.

(iv) An alternative direction to take in modelling land prices is to follow recent American literature where analyses of land prices are based on a 'Capital Asset Pricing' approach.

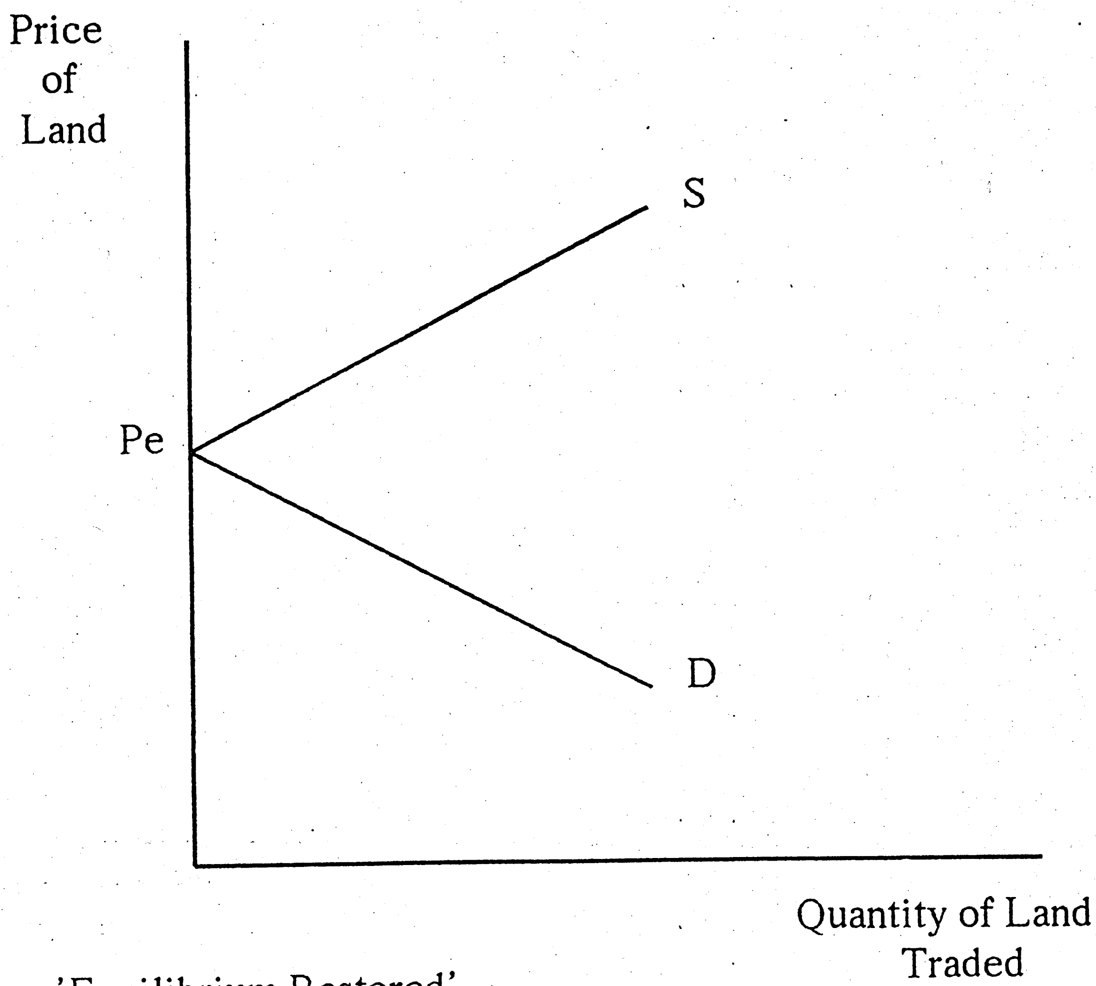
Land is by far the predominant asset held within the agricultural sector and it may be that decisions to hold land are based on a portfolio allocation process with individuals investing (or disinvesting) in land in an attempt to maximise returns or minimise risk ,or a combination of both, from their portfolio. An example of this approach is study a by Feldstein (1980). He provides a formal model of portfolio choice derived from utility maximisation to show how, during inflationary periods, the price of land increases relative to the value of other real assets due to tax laws specific to the US. This more recent Capital Asset Pricing/Present Value type of approach is more consistent with the conceptual framework for the land market developed in this paper and would therefore seem to be the best approach to adopt for future analyses of agricultural land prices in the UK.

Fig .1a NEOCLASSICAL FRAMEWORK



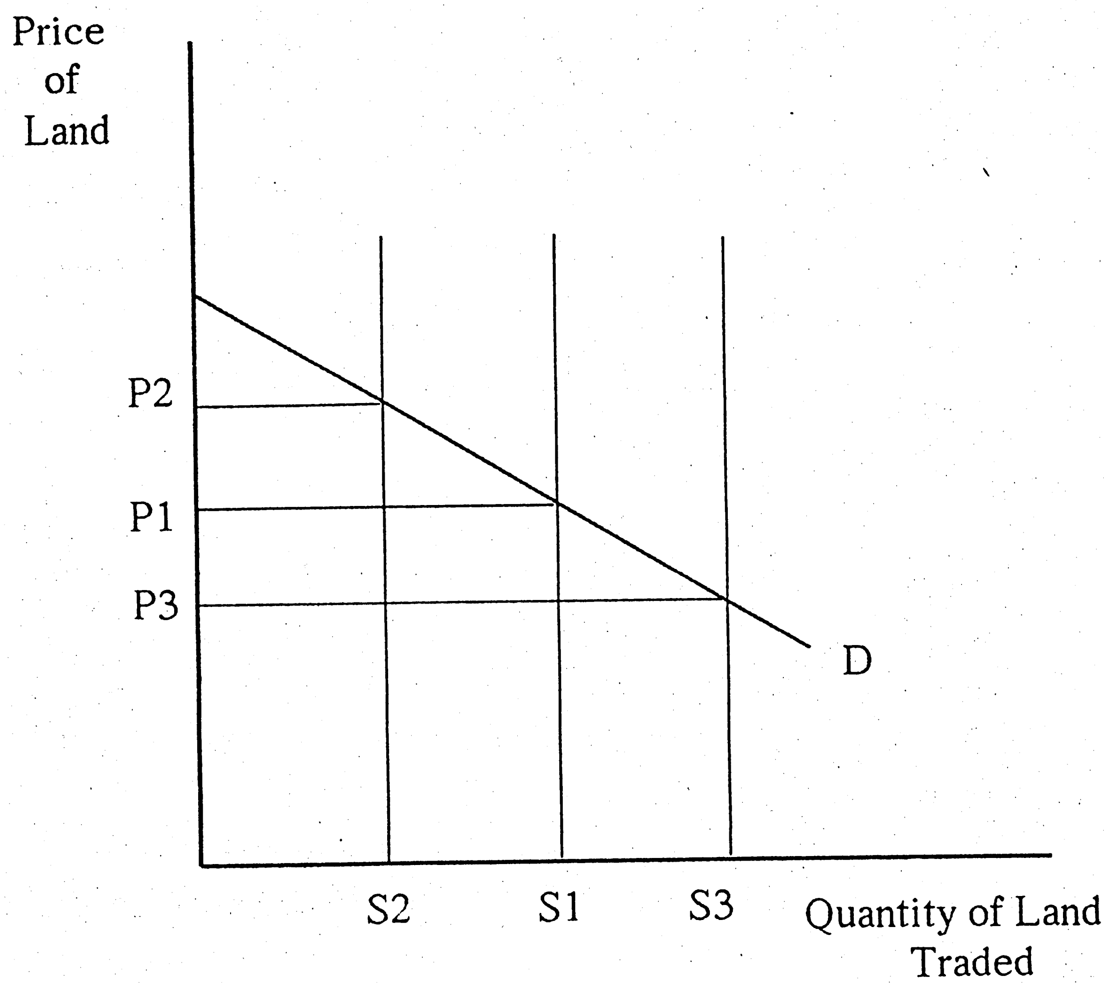
(Harvey-Traill 'out-of-equilibrium')

Fig.2a HARVEY-TRAILL FRAMEWORK



'Equilibrium Restored'

Fig.2b



AN ALTERNATIVE FRAMEWORK

Fig.3a

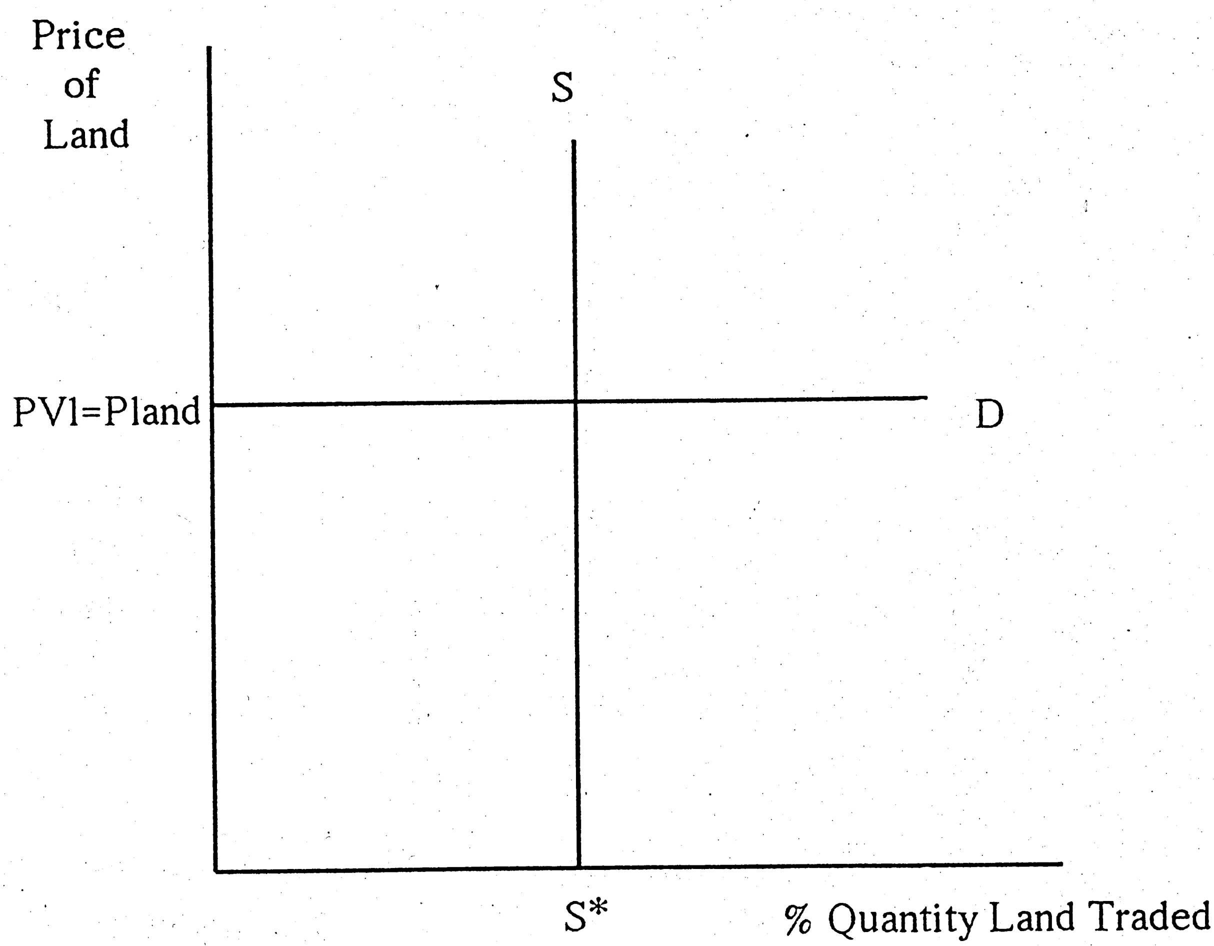


Fig.3b

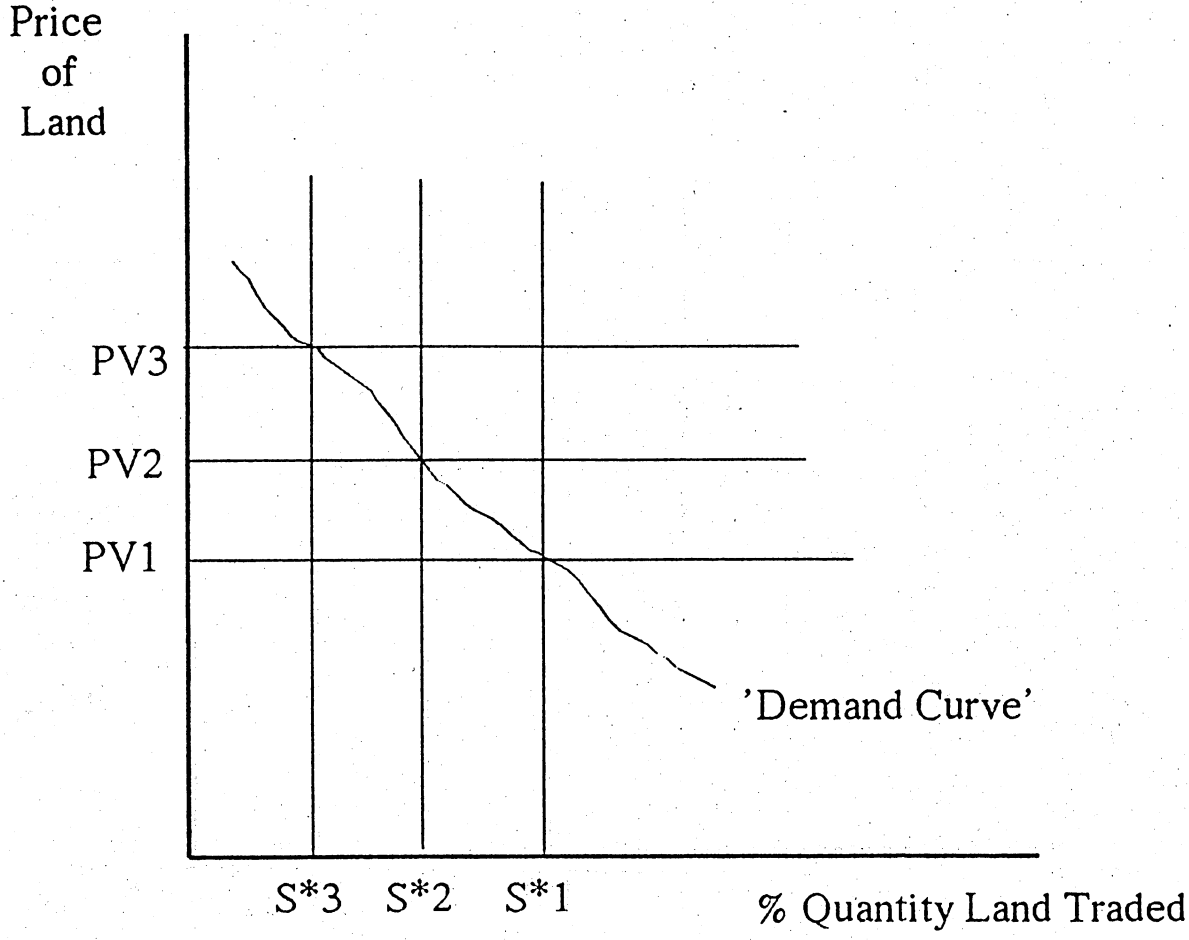
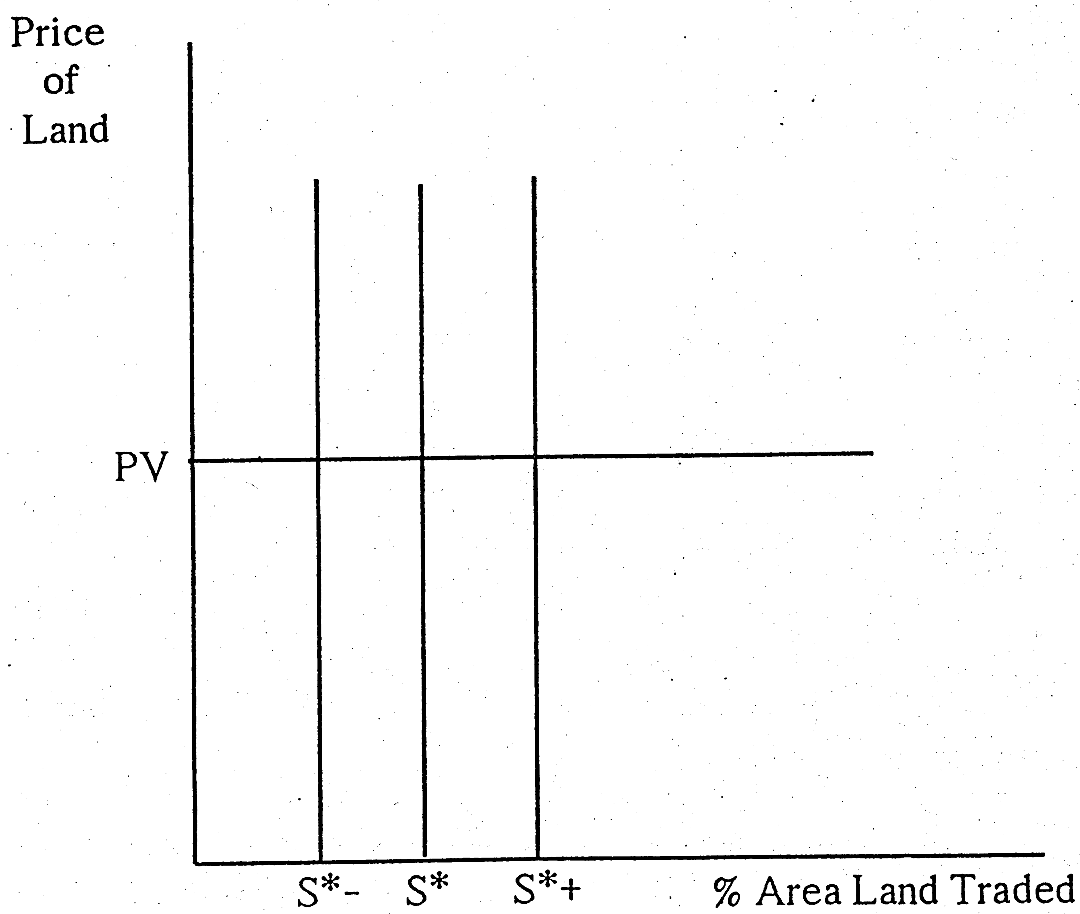

Price
of
Land
PV3
PV2
PV1
'Demand Curve'
S*3
S*2
S*1
% Quantity Land Traded

Fig.3c



APPENDIX A

(i) Traill Land Price Equation (1950-78)

$$PLAND_t = \underset{(1.39)}{60.04} + \underset{(13.74)}{11.13}\ YSTAR + \underset{(5.16)}{0.83}CAPGAIN_t^*$$

$$- \underset{(-3.84)}{0.19}\ Area_t + \underset{(2.13)}{89.25}\ DUMMY$$

$r^2 = .99$ $\quad$ $d = 1.91$

(ii) Traill Land Price Equation-Adjusted Income (1952-78)

$$PLAND_t = \underset{(-0.77)}{-82.35} + \underset{(13.05)}{14.26}\ YSTAR_t + \underset{(4.19)}{0.700}CAPGAIN_t^*$$

$$- \underset{(-2.55)}{0.68}\ Area_t + \underset{(2.30)}{230.29}\ DUMMY$$

$r^2 = 0.98$

(iii) Traill Land Price Equation-Extended (1952-86)

$$PLAND_t = \underset{(-2.79)}{-701.99} + \underset{(11.11)}{23.01}\ YSTAR_t + \underset{(3.56)}{1.23}CAPGAIN_t^*$$

$$+ \underset{(0.52)}{0.366}\ Area_t - \underset{(-0.007)}{1.96}\ DUMMY$$

$r^2 = 0.67$

(iv) Traill Land Price Equation-Adjusted Capital Gains (1952-86)

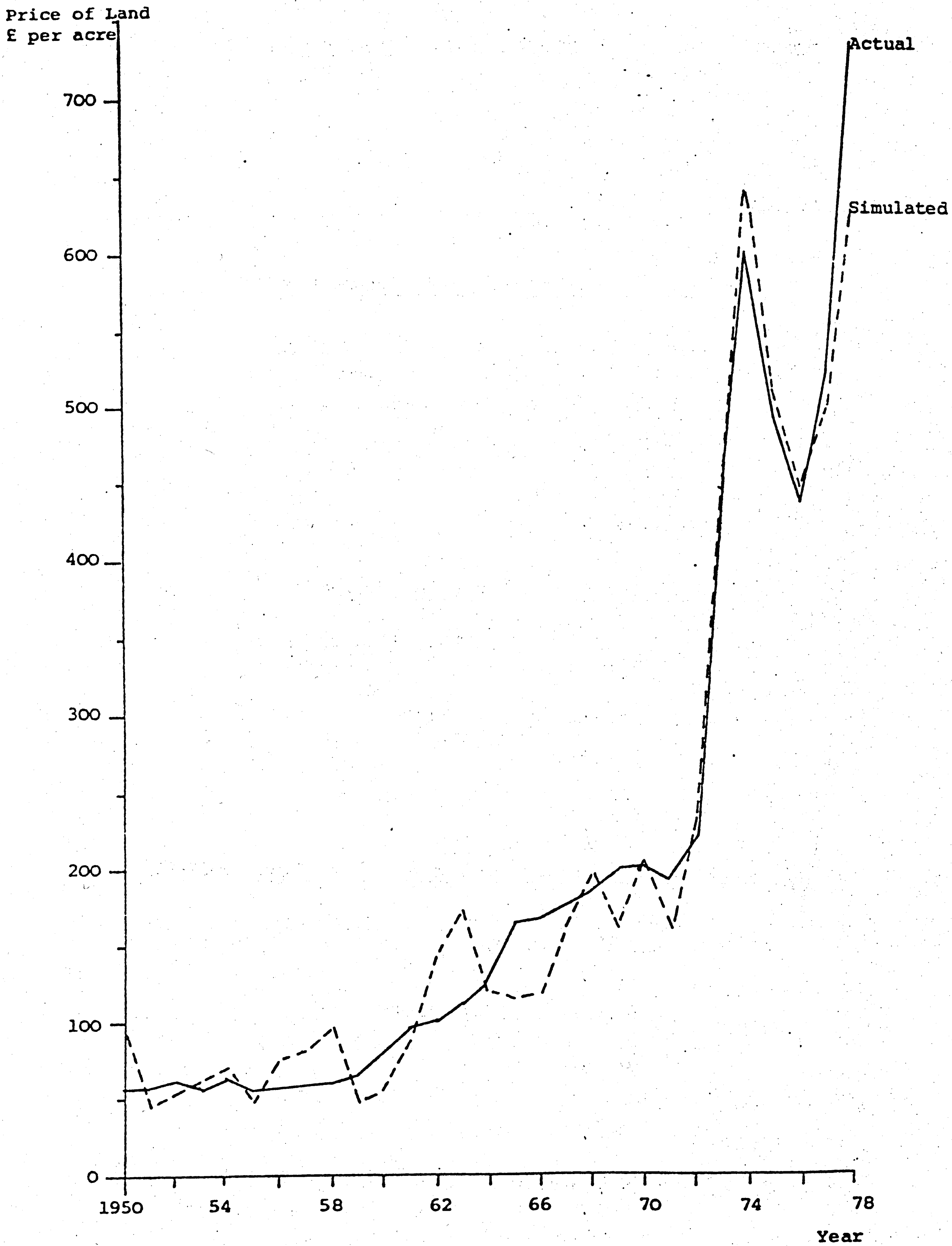
$$PLAND_t = \underset{(-2.72)}{-673.33} + \underset{(10.69)}{22.37}\ YSTAR_t + \underset{(3.74)}{1.36}CAPGAIN_t^*$$

$$+ \underset{(0.50)}{0.34}\ Area_t + \underset{(0.06)}{17.83}\ DUMMY$$

$r^2 = 0.89$

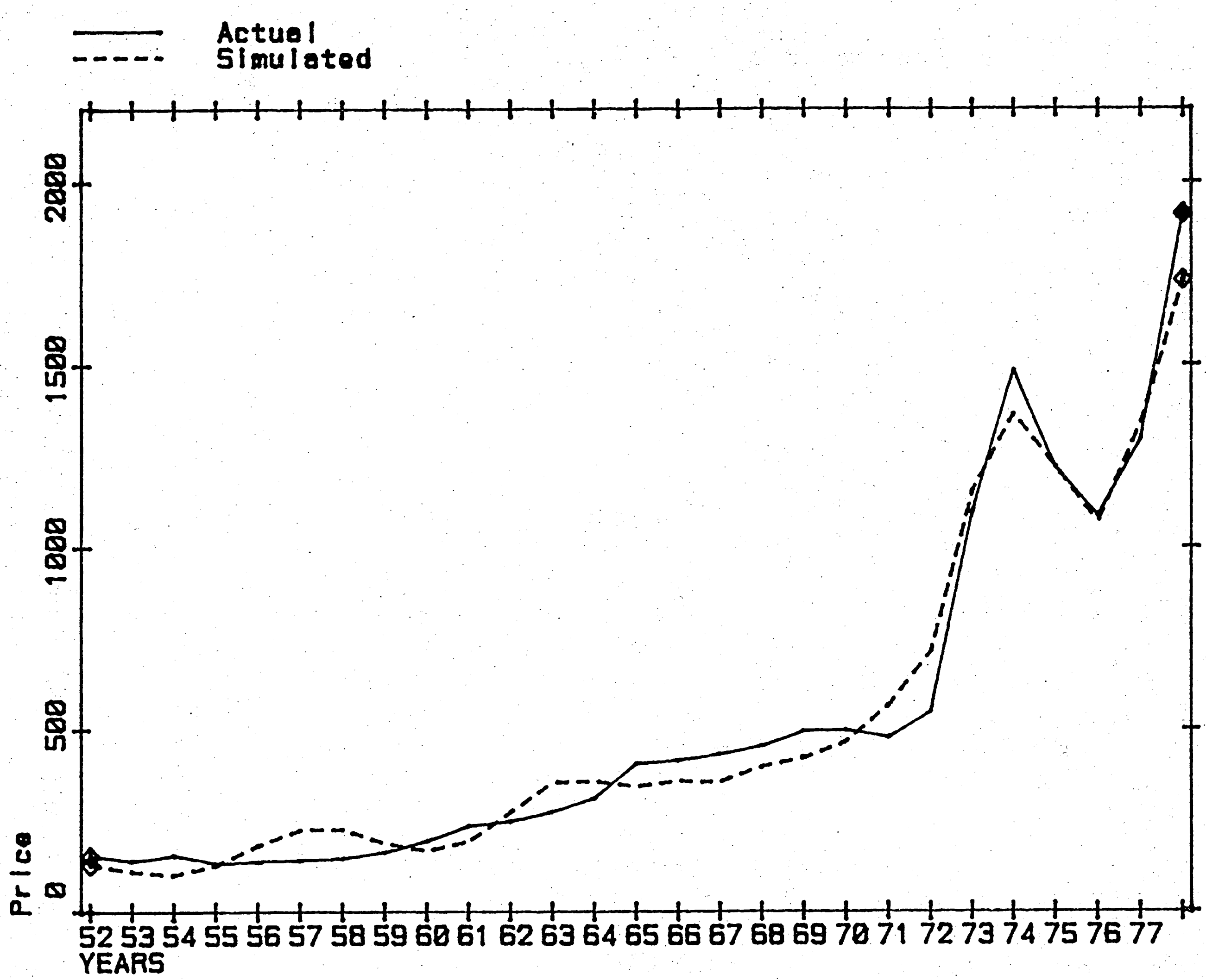
(t-ratios in parenthesis)

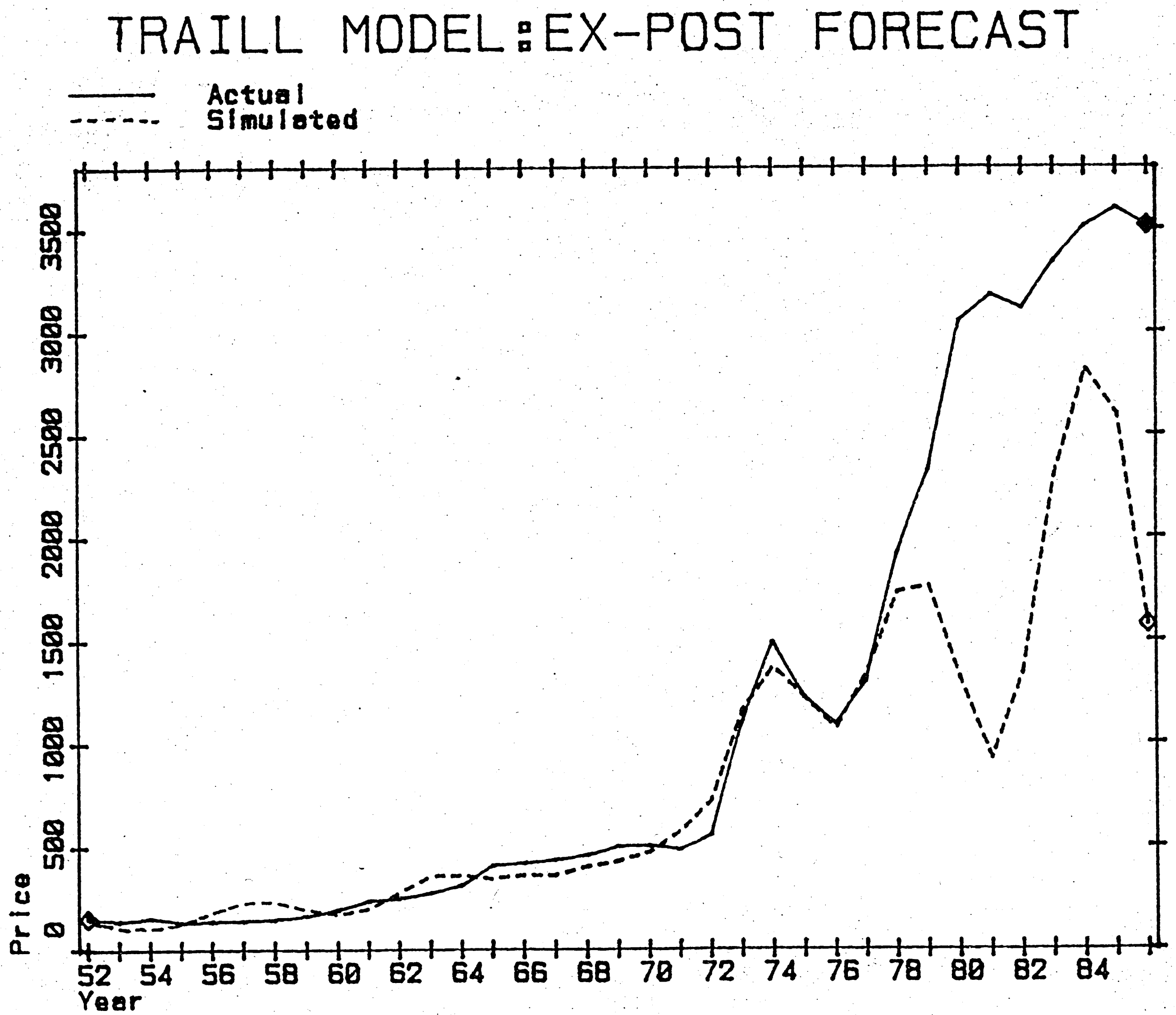
: Actual and Simulated Land Prices: 1950-1977



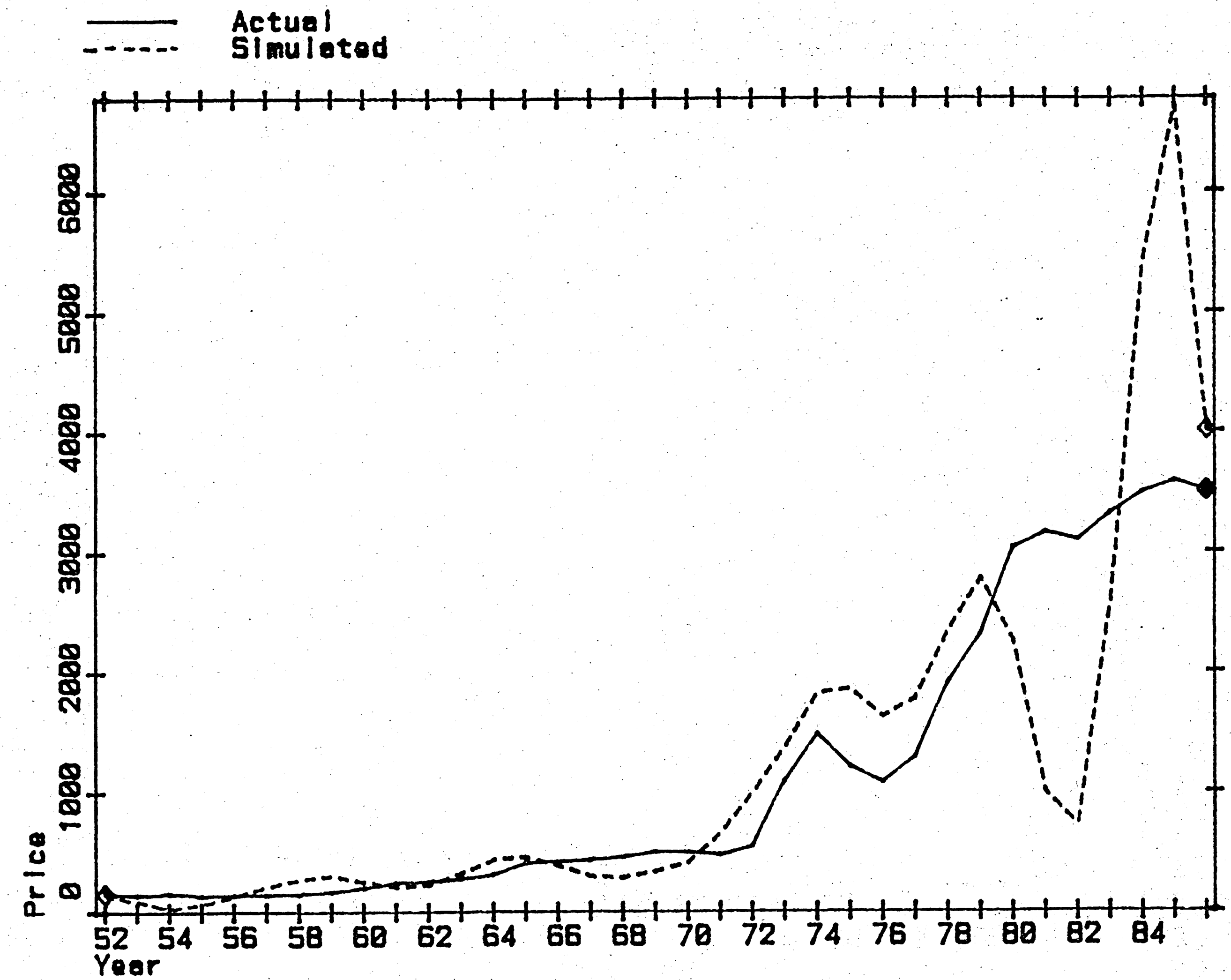
Source: W.B. Traill, Land Values and Rents: The Gains and Losses from Farm Price Support Programmes, D.A.E., Manchester Univ. Bulletin 175(1980).

TRAILL LAND PRICE MODEL

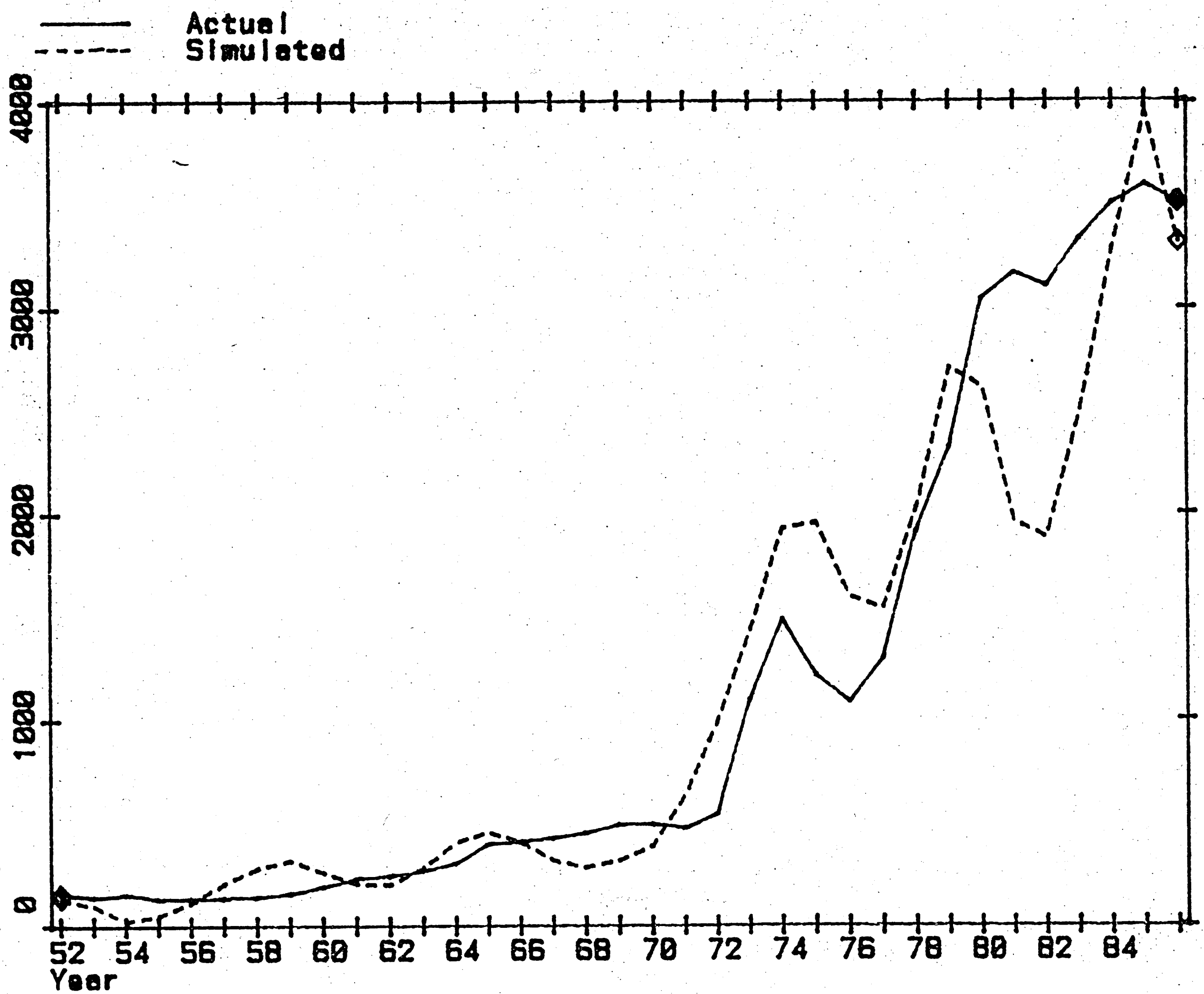



TRAILL MODEL:EX-POST FORECAST
Actual
Simulated
Price
0
500
1000
1500
2000
2500
3000
3500
52
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82
84
Year

TRAILL MODEL:EXTENDED PERIOD



TRAILL MODEL:MODIFIED EXPECTNS



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