FORECASTING OUTSTANDING ADVANCES OF THE MAJOR TRADING BANKS AND PASTORAL FINANCE COMPANIES

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Short-run predictions of the likely level of rural advances would—if well founded—provide guidance for credit policy changes designed to adjust and redirect the pattern of rural credit. Such policy changes, of course, should be aimed towards maintaining some best pattern of advances, over time and by sectors. The determination of an optimal pattern of advances is not discussed here. Certainly it should (a) hinge on comparisons of the marginal productivity of capital in the various sectors of the economy, (b) take account of internal capital formation possibilities within sectors, (c) allow for balance of payments questions, (d) face up to the artificialities of protection and other institutional rigidities, and (e) as need be, allow for the use of credit policy as a substitute approach to income stabilization problems.

Undoubtedly some sectors of agriculture are in greater need of restructuring than others, and their capital needs thereby made worthy of special attention (or inattantion). As well, the potential contribution to overseas earnings is not the same for all regions or farm products. For both these reasons, some preference ordering of types of agriculture *and production regions* should be made so that available capital can be more rationally allocated. To leave the allocation to market forces ignores imperfections in the capital market.[1] The likely result would be a distribution of credit which perpetuates inefficiencies and prevents the farm sector from playing its full role in earning overseas exchange.

The forecasting procedures outlined in this article should, then, be seen as part of a much broader problem, viz. the rate *and pattern* of capital formation in Australian agriculture. In this broader context, we feel the following questions merit greater consideration:

1. By regions, types of farming and types of capital, how much capital is engaged in agriculture and what is happening to the level of farm investment?
2. What are the sources of capital formation in agriculture?
3. What is the order of magnitude of farm investment required to maintain the existing rate and the "required" rate of increase in rural output? And what impact might prospective technologies have on the demand and need for capital?
4. Given some idea of total capital requirements for the farm sector as a whole and for specific regions and types of agriculture, what are the likely levels which external sources of funds will reach?
5. What is the likely level of internally financed farm investment, and as a corollary, what is happening to savings within agriculture itself?

[1] See Lewis, J. N., "Credit facilities for agriculture", *Qrtly. Rev. Agric. Econ.* 8: 157-64, 1955; and "Agricultural adjustment in a changing institutional setting", *J. Aust. Instit. Agric. Sci.* 27: 214-6, 1961.

6. Is there a gap between the "desired" level of farm investment and the available supply of capital? Can it be filled by institutions such as the Commonwealth Development Bank and the term-lending funds established by the major trading banks in 1962?

Here, our interest is in item 4 above, forecasting the likely level of external funds. Unless such forecasts are available, it would be impossible for the Central Bank to decide on the likely future adequacy of current credit policy as measured against the desired future level of advances. Thus, should a significant discrepancy exist between the predicted and desired level of advances, the Central Bank has the opportunity, before the discrepancy becomes an actuality, of effecting changes in the variables under its control so as to bring the predicted and desired level of advances into line. Ideally, such procedures should be followed in terms of both regional and commodity sectors, as well as at the aggregate level of rural versus non-rural and business versus domestic advances. In other words, only if forecasts are available, can the Central Bank ever hope: (a) to meet problems before they arise; and (b) to make full use of the manipulative possibilities open to it. From a national point of view, only by the merest fluke could a blanket credit policy which failed to distinguish between regional and commodity sectors ever approach the ideal—and unless forecasts are available it would be most difficult to devise and justify any other than a blanket policy which only allowed selectivity and discrimination between advances at the aggregate level of business versus domestic and rural versus non-rural.

Given the above justification, we present procedures for forecasting the level of advances outstanding to the major trading banks[2] by the rural sector as a whole and by its commodity subsectors, and by the non-rural sector. As well, forecasts are outlined for advances by the pastoral finance companies. Between them these two groups of agencies accounted for some 67 per cent of rural indebtedness to major institutional lenders as at June 30, 1962. Because advances data are not available on a regional basis, it has not been possible to present regional forecasts.

Forecast Variables

Three forecasting procedures might be distinguished. First, there are naive methods, a simple example being forecasts made on the assumption that the variable to be forecast will be the same in the next period as in the current period. Such procedures are direct predictions in the sense that they take no account of outside variables. Their disadvantage is that generally there is no logical basis a priori for choosing one particular rule of thumb instead of another out of the myriads that might be used. Second, reduced-form equations from a structural model involving many variables might be used for prediction. Typically, however, while such models are useful for examining the potential effect of alternative policies, for prediction purposes they contain too many unlagged independent variables. If, in forecasting, we are prepared to assume levels of the unlagged independent variables,

[2] As classified in the Reserve Bank's *Statistical Bulletin*, the major trading banks are the Commonwealth, Wales, A.N.Z., E.S. & A., C.B.A., C.B.S., National, and Adelaide.

we might just as well guess a value for the variable to be forecast without any preliminary hocus-pocus.

The third, and logically most attractive procedure, is to forecast the variable we are interested in on the basis of the known current values of those other variables which we believe influence that variable, also using the next-period values of any influential variables whose next-period size we already know. This approach, used here, does not require any assumptions about the next-period values of the predictors. Prediction equations based on this approach, of course, are equivalent to reduced-form equations derived from some virtually fully-lagged structural model and, as such, are hybrid equations having no structural significance. Based on this third approach, the variables used in our basic prediction equations for the various categories of advances are listed below, the equations themselves being of the form:

$$\hat{Y} = a + \Sigma\, b_i Z_i .$$

A. *Outstanding advances of the major trading banks:*

I To *all rural producers* as a function of: interest rate, GNP, all-rural parity ratio, and time;

II To *wool growers* as a function of: interest rate, GNP, wool parity ratio, dummy seasonal, and time;

III To *wheat growers* as a function of: interest rate, GNP, all-rural parity ratio, and time;

IV To *dairy and pig farmers* as a function of: interest rate, GNP, monetary policy dummy, dairy parity ratio, and time;

V To *miscellaneous rural producers* as a function of: interest rate, GNP, all-rural parity ratio, and time;

VI To the *non-rural sector* as a function of: interest rate, GNP, LGS ratio, and time.

B. *Outstanding advances of the pastoral finance companies:*

VII To *wool growers* as a function of: interest rate, GNP, wool parity ratio, seasonal dummy, and time.

Three variables common to each equation are the interest rate, gross national product (in constant prices) which serves as an optimism indicator bearing on next-period lending, and time. Parity ratios (prices received over prices paid) are used to reflect the impact of changes in profitability on the demand for credit. Because wheat producers include a large proportion of mixed farmers, the all-rural parity ratio is used in equation III rather than the wheat parity ratio. A dummy variable for credit squeeze effects appears as a predictor for dairy advances because the impact of monetary restraint appears to have been important in the dairy sector.[3] A dummy seasonal variable appears in both the equations for bank and pastoral company advances to woolgrowers because of the obvious seasonal pattern in these advances. In fact, the same set of predictors are used for both these sources of woolgrower credit. Likewise, identical sets of variables are used to predict total rural and miscellaneous rural advances from the major trading banks. The only new variable involved in the forecasting equation for non-rural bank advances is the LGS ratio.

[3] See Jarrett, F. G., "Agricultural credit—the pastoral finance companies". In Hirst, R. R. and Wallace, R. H. (eds.), *Studies in the Australian Capital Market*, Cheshire, Melbourne, 1964 (in press).

Of the nine predictor variables used in equations I to VII, all except four are measured at time t-1 for predictions at time t. Of the four exceptions, two—the time trend and seasonal dummy—have future values that are known with certainty. The other two unlagged variables —interest rate and the credit-squeeze dummy—while not known publicly one period ahead, are assumed to be known with some certainty six months ahead by the Central Bank (which should be making the predictions). Overall therefore, the forecasting equations meet the logical requirement of involving predictors which do not themselves have to be guessed.

Data

As listed in Table 1, the basic data series encompassed 26 sets of six-monthly observations spanning the period from June 1949 to December 1961. Later observations were used for test forecasts outside the sample period.

Data on advances were taken from the Reserve Bank's *Statistical Bulletin,* except for pastoral company advances which are only listed for 1956 onwards. For 1949 to 1956, December pastoral company advances were interpolated from June estimates provided by Coombs[4] using a seasonality correction factor of 1·032 based on the December/June ratio for the five years beyond 1956.

Wool, wheat and all-rural parity ratios were obtained from the B.A.E. series published in the *Quarterly Review of Agricultural Economics.* Half-yearly parity figures were estimated by averaging the quarterly B.A.E. series.

Gross national product at constant (1948) prices was obtained by deflating the gross national income series in the *Quarterly Estimates of National Income and Expenditure* by the consumer price index (all groups, six capital cities) published in the *Quarterly Summary of Australian Statistics.* For the interest rate series, we used the "other trading banks" overdraft rate published in the September 1960 *Statistical Supplement* of the Reserve Bank's *Statistical Bulletin.* The bank liquidity measure was calculated as the ratio of liquid assets and government securities to total deposits of the cheque-paying banks as listed in the private finance section of the *Quarterly Summary of Australian Statistics.*

Of the dummy variables, the seasonal was taken as 1 in the December half year and as 0 otherwise. The credit squeeze dummy—based on qualitative statements in Reserve Bank *Annual Reports*—was taken as 1 in periods of credit stringency and 0 otherwise. The linear time-trend series was taken as 1 in June 1949 and increased by 1 for each succeeding data period.

Estimation

The forecasting equations were estimated by least-squares regression. Comparisons showed use of the raw data to be preferrable to using logarithmic data. Although the Durbin-Watson statistic, d, may not be used to test the extent of auto-correlation since the regression equations include among the independent variables the lagged value of the dependent variable, the autocorrelation coefficient ρ was estimated roughly

[4] Coombs, H. C., "Rural credit development in Australia", *Aust. J. Agric. Econ.* 3 (1): 57-66, 1959.

TABLE 1
Data Series[a]

Year	Half-year (b)	Major trading bank advances to: All rural	Wool growers	Wheat growers	Dairy farmers	Other rural	Non-rural	Pastoral company advances	Interest rate	GNP	All-rural parity	Wool parity	Seasonal dummy	Credit squeeze dummy	Dairy parity	LGS ratio	Time
		£m	£m	£m	£m	£m	£m	£m	%	£m						%	
1948	II									1998	108	119			101	23.0	
1949	I	109.4	41.2	14.1	27.4	26.7	319.4	21.0	4.50	1748	104	112	0	1	102	21.6	1
	II	108.5	37.6	14.4	29.3	27.2	341.9	34.0	4.50	2205	105	123	1	1	101	24.0	2
1950	I	117.8	40.1	16.0	31.5	30.2	368.8	33.0	4.50	1906	118	154	0	1	99	22.6	3
	II	118.9	39.0	14.0	34.3	31.6	438.6	53.0	4.50	2614	136	243	1	1	95	21.4	4
1951	I	125.1	41.4	14.4	35.4	33.9	460.3	51.0	4.50	2184	145	268	0	1	91	21.7	5
	II	131.2	45.0	13.8	36.3	36.1	578.8	51.0	4.50	2336	102	117	1	1	96	18.2	6
1952	I	143.9	51.5	14.9	37.9	39.6	609.6	49.0	4.50	1975	98	95	0	0	103	18.0	7
	II	145.1	55.5	15.5	36.6	37.5	544.1	49.0	4.50	2257	97	110	1	0	106	26.1	8
1953	I	148.3	54.3	14.8	38.8	40.4	521.8	47.0	4.75	2000	101	116	0	0	107	32.1	9
	II	165.6	60.2	17.6	44.8	43.0	563.6	57.0	4.75	2371	102	115	1	0	106	26.7	10
1954	I	192.3	73.3	20.2	50.1	48.7	600.2	55.0	4.75	2124	96	107	0	1	106	26.5	11
	II	210.6	87.7	21.6	52.0	49.3	653.4	68.0	4.75	2507	92	99	1	1	103	20.5	12
1955	I	220.9	93.8	22.7	51.5	52.9	706.5	66.0	4.75	2246	91	94	0	1	102	22.6	13
	II	212.4	94.1	22.2	48.5	47.6	681.0	77.0	4.75	2632	86	77	1	1	98	19.2	14
1956	I	213.0	96.0	20.2	46.9	49.9	684.2	74.3	4.75	2358	91	83	0	1	97	22.3	15
	II	199.0	89.8	18.8	44.5	45.9	666.6	87.4	4.75	2673	92	96	1	1	90	21.0	16
1957	I	200.0	90.7	16.2	45.7	47.4	682.4	80.1	5.50	2418	88	101	0	1	91	23.5	17
	II	200.4	93.6	14.5	45.3	47.0	664.9	89.2	5.50	2685	85	85	1	0	91	21.4	18
1958	I	231.0	112.7	18.2	48.7	51.4	731.2	92.9	5.50	2407	79	67	0	0	91	23.4	19
	II	231.5	116.9	19.3	45.8	49.5	692.8	97.8	5:50	2820	77	57	1	0	94	21.5	20
1959	I	229.6	115.1	18.2	44.9	51.4	703.7	91.3	5.50	2578	80	62	0	0	93	26.2	21
	II	222.7	110.2	17.7	42.8	52.0	717.3	96.2	5.50	3024	82	71	1	1	91	23.6	22
1960	I	236.8	113.7	19.8	45.6	57.7	817.0	101.9	5.50	2750	81	65	0	1	90	22.6	23
	II	228.3	110.7	20.1	42.4	55.1	836.3	117.1	5.50	3136	80	56	1	1	89	18.1	24
1961	I	225.3	110.4	18.0	41.7	55.2	813.8	106.4	5.50	2704	80	62	0	1	89	17.8	25
	II	217.3	105.9	16.6	39.6	55.2	767.0	106.0	6.00	3050	75	62	1	0	86	26.0	26
1962	I	239.6	113.7	21.3	43.8	60.8	826.3	104.0	6.00	2843	74	62	0	0	87	29.0	27
	II	235.6	109.7	21.0	43.0	62.0	814.2	107.1	6.00	3294	75	61	1	0	87	25.4	28
1963	I	247.4	114.0	23.2	45.8	64.5	870.1	106.9	5.50				0	0			29

(a) The segregated data for 1961, 1962 and 1963 are only relevant for predictive testing.
(b) I denotes the half year from Jan. to June or observations as at June 30. II denotes the half year from July to Dec. or observations as at Dec. 31.

via the approximate relation $d = 2(1 - \rho)$ and then more precisely by iteration around this rough estimate to obtain a ρ value which minimized the residual sum of squares for transformed prediction equations of the form:

$$\hat{Y}_t = \rho Y_{t-1} + a\,(1 - \rho) + \sum_i b_i\,(Z_{it} - \rho Z_{i,\,t-1}).$$

Empirical Estimates

Estimates of both the untransformed and transformed prediction equations are given in Table 2. As shown in Table 3, which lists various statistics pertinent to the prediction equations, use of the auto-regressive transformation resulted in an improvement in the multiple correlation coefficient and reduced the variance of the estimated residuals. Of course, no structural economic interpretation should be attached to the individual coefficients listed in Table 2. They are only pertinent for prediction and cannot be used to derive elasticities. Graphs of actual observations compared with predicted values from the transformed equations are shown in Figures 1 and 2.

As well as the coefficient of determination, R^2, and the coefficient of variation of forecast, V, two approaches due to Theil[5] were used to analyse the accuracy of forecasts made via the predicting equations. The first of these is based on the success or otherwise of predicting turning points in the series. The second is a coefficient of inequality which measures the discrepancy between actual and predicted values.

Theil's turning-point measures are ψ_1 and ψ_2. ψ_1 is the ratio of the number of predicted turning points to the number of actual non-turning points. Thus it measures the extent to which turning points are forecast but fail to eventuate in the actual series. ψ_2 measures the failure to predict turning points and is the ratio of the number of predicted non-turning points to the number of actual turning points. The smaller the ψ's, the more successful the forecasting of turning points. Values of ψ_1 and ψ_2 for all of the estimated equations are given in Table 3. In general, these ψ values are pleasingly low and, comparing values for the transformed and untransformed equations, generally indicate that the transformation was worthwhile.

The coefficient of inequality, U, for predictions of the variable Y_i is given by

$$U_i = [\textstyle\sum_t (\hat{Y}_{it} - Y_{it})^2]^{\frac{1}{2}} \,/\, [\,(\sum_t \hat{Y}_{it}{}^2)^{\frac{1}{2}} + (\sum_t Y_{it}{}^2)^{\frac{1}{2}}]$$

where $\hat{Y}_{it}$ and Y_{it} are predicted and actual values respectively. Values of U for both the untransformed and transformed prediction equations are shown in Table 3. U may range from 0 for perfect forecasting up to 1 for perfectly imperfect forecasting so that the lower the value of U the better. Perusal of the U values of Table 3 indicates very successful forecasting over the data period and again the use of the autoregressive transformation is shown to be worthwhile.

Overall, assessing equations I to VII in terms of the forecast reliability measures — R^2, V, ψ_1, ψ_2, and U — listed in Table 3, it appears that the transformed equations provide a quite successful forecasting

[5] Theil, H., *Economic Forecasts and Policy,* North-Holland, Amsterdam, 2nd ed., 1961, pp. 28-33.

TABLE 2

Estimated Forecasting-Equation Coefficients[(a)]

Outstanding advances being forecast	Equation[(b)]	Constant	Interest rate (t)	GNP (t−1)	All-rural parity ratio (t−1)	Wool parity ratio (t−1)	Seasonal dummy (t)	Credit squeeze dummy (t)	Dairy parity ratio (t−1)	LGS ratio (t−1)	Time (t)
MTB to all rural	IA	409.578**	−56.686**	0.00007	−0.509*						8.058**
	IB	229.648**	−44.096**	0.00641	−0.396						7.138**
MTB to wool growers	IIA	173.464**	−18.969**	−0.02836		−0.018	−11.815				5.800**
	IIB	77.639**	−16.753*	−0.01256		−0.024	−5.746				5.048**
MTB to wheat growers	IIIA	59.370**	−8.498**	−0.00025	−0.068*						0.597**
	IIIB	19.232**	−4.497**	0.00038	−0.041						0.344
MTB to dairy farmers	IVA	24.547	−10.624**	0.00127				−0.036	0.505**		1.395**
	IVB	6.028	−2.965	0.00200				0.839	0.092		−0.629
MTB to miscellaneous rural	VA	86.298**	−13.458	0.00162**	−0.027						1.843**
	VB	10.751**	−5.599**	0.00453**	−0.015						1.052**
MTB to non-rural sector	VIA	1261.964**	−193.741**	0.01184						−3.584	28.754**
	VIB	355.131**	−95.063*	0.00984						−2.936	20.200**
Pastoral finance companies	VIIA	−27.974	−1.841	0.02980**		−0.011	15.537**				2.223**
	VIIB	−16.806	−1.690	0.02782**		−0.023	14.820**				2.152**

(a) * Denotes significance at the 10 per cent. level; ** denotes significance at the 5 per cent. level.
(b) Equation A is the untransformed equation, equation B the transformed equation. For the transformed equations, the listed coefficients are those of the transformed variables $(Z_{i,t} - \rho Z_{i,t-1})$ or $(Z_{i,t-1} - \rho Z_{i,t-2})$, as appropriate, except for the constant term which equals $a(1-\rho)$.

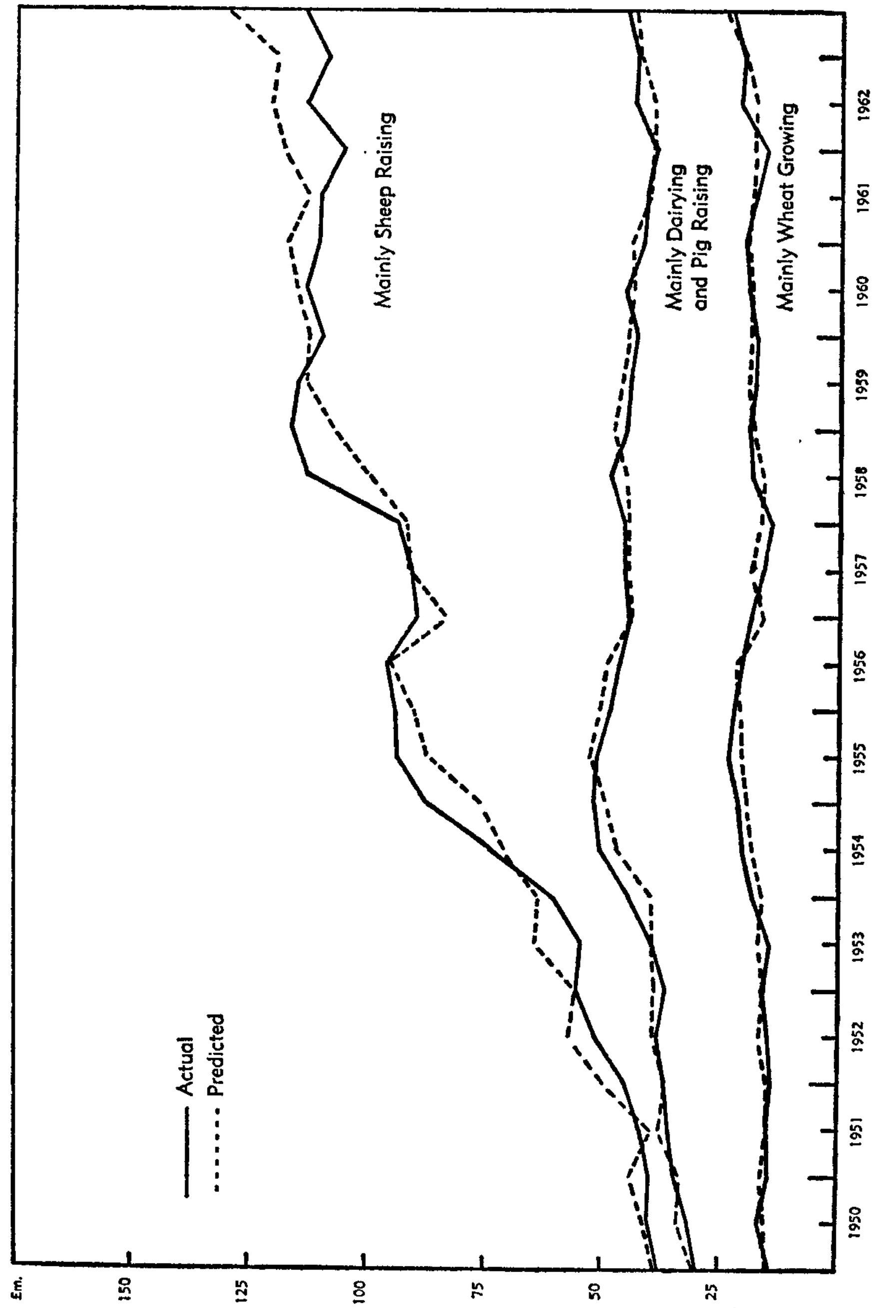

Fig. 1

Outstanding advances of major trading banks to types of farming.

device within the data period; and so long as the structure of the credit market remained fairly unchanged, should serve well for forecasts beyond the sample period. The least successful forecasting equation is that for wheat growing advances, equation III. The relative lack of predictability for wheat grower advances, combined with further results from some conjoint but unpublished structural analysis, seems to indicate that the wheat advances series is suspect. Probably it includes many advances that should be classed as mainly for wool or fat lamb production.

TABLE 3

Forecasting-Equation Statistics

Equation	ρ	R^2	V	ψ_1	ψ_2	U
I A		.91	.077	7/13	3/9	.034
I B	.3	.94	.068	6/11	4/9	.029
II A		.93	.101	5/12	4/11	.048
II B	.4	.97	.083	4/12	3/11	.036
III A		.65	.101	4/15	1/12	.046
III B	.5	.71	.094	5/14	3/12	.043
IV A		.66	.105	6/11	4/9	.045
IV B	.9	.90	.053	4/11	2/9	.024
V A		.94	.054	2/11	3/12	.024
V B	.8	.96	.041	2/13	1/12	.019
VI A		.93	.066	2/12	1/11	.028
VI B	.6	.94	.059	2/11	1/11	.025
VII A		.97	.065	4/18	2/16	.033
VII B	.25	.97	.064	4/18	3/17	.030

The only real test of a forecasting device, however, is how well it predicts beyond the data period. We have made three such tests, the first being of advances as at June 30, 1962, based on the estimated prediction equations of Table 2. The second and third tests were for advances as at December 31, 1962, and June 30, 1963, and were made by recomputing the prediction equations using up-to-date data series. In other words, these second and third tests were made exactly in the way, say, that the Central Bank should predict. Results of these tests, along with forecasts based on the naive prediction model that Y_{t+1} will equal Y_t, are presented in Table 4 where the forecast values are shown as a percentage of the values that actually occurred.

Perusal of the forecast comparisons given in Table 4 shows the transformed equations were the most reliable predictors in June 1962 and June 1963, while the naive model was the best in December 1962. The good performance of the naive model in December 1962, is due to the fact that there was little change in the relevant environment during the preceding six months. When things are fairly quiet, a naive model based on no change must do well. But when changes are taking place in the relevant environment, better predictions result from the more sophisticated forecasting models because their logical basis is such as to take account of environmental changes. Moreover, reliable forecasts are most important when changes are under way because it is then that the greatest uncertainty prevails. For these reasons, we believe that the data of Table 3 and 4 indicate that it would be well worthwhile for the Central Bank to use computer-age forecasting procedures in

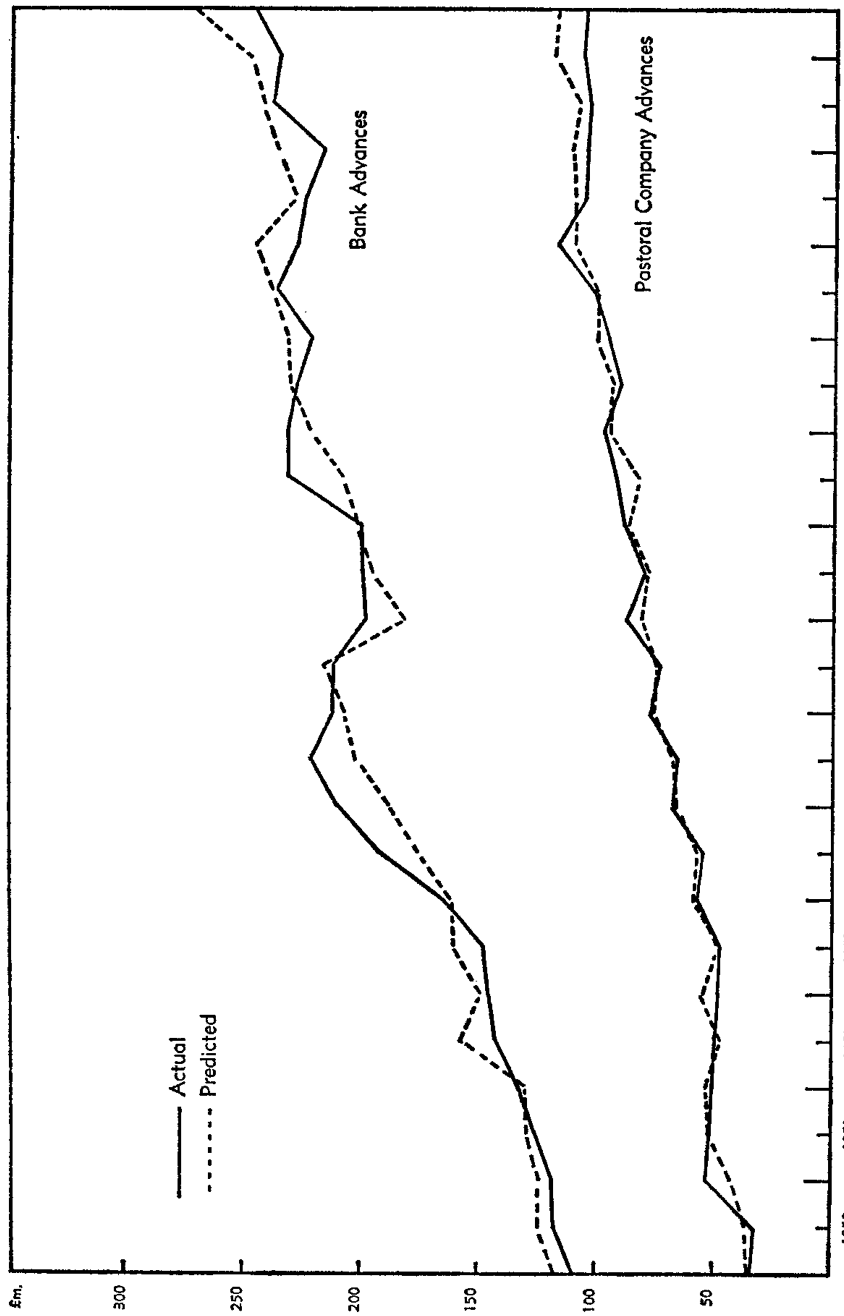

Fig. 2

Outstanding advances of major trading banks to rural sector and of pastoral companies.

TABLE 4

Comparison of Actual and Forecast Levels of Outstanding Advances[(a)]

Class of advances	June, 1962				December, 1962				June, 1963			
	Actual level of advances	Untransformed equation forecast	Transformed equation forecast	Naive forecast	Actual level of advances	Untransformed equation forecast	Transformed equation forecast	Naive forecast	Actual level of advances	Untransformed equation forecast	Transformed equation forecast	Naive forecast
	£m	% of actual			£m	% of actual			£m	% of actual		
Major trading banks to:												
Wool producers	113.7	113.1**	106.6*	93.1	109.7	113.7**	109.8	103.6*	114.0	119.6**	115.4	96.2*
Wheat producers	21.3	87.3*	85.0	77.9**	21.0	90.5**	98.1	101.4*	23.2	100.0*	101.7	90.5**
Dairy producers	43.8	104.5*	91.1	90.4**	43.0	107.9**	99.5*	101.9	45.8	111.8**	94.1*	93.4
Miscellaneous rural	60.8	95.9*	95.2	90.8**	62.0	95.6**	97.1	98.1*	64.5	103.4	100.5*	96.1**
All rural	239.6	104.0	101.7*	90.7**	235.6	107.1**	106.0	101.7*	247.4	113.0**	109.5	95.2*
Non-rural business	826.3	99.1*	94.8	92.8**	814.2	102.4	104.5**	101.5*	870.1	110.5**	103.2*	93.6
Pastoral companies	104.0	106.9**	104.2	101.9*	107.1	113.4**	111.2	97.1*	106.9	114.3**	109.7	100.2*

(a) * denotes the best out of each triplet of predictions; ** denotes the worst out of each triplet of predictions.

its assessments of likely trends in rural advances, especially as larger and more accurate data series are now becoming available. This is not to say that the feelings of experienced trend-watchers and their favourite rules of thumb should be discarded.[6] Rather, as outlined in our introductory remarks, it is to acknowledge the importance of the credit market and the need to be as efficient as possible in its manipulation. With this we are sure Dr. Coombs would agree.

[6] The philosophy of forecasting that we have in mind is as outlined in Part 1 of: Vandome, P., "Econometric forecasting for the United Kingdom", *Bul. Oxford Instit. Econ. Stat.* 25: 239-82, 1963.