DO FINANCIAL AGGREGATES LEAD ACTIVITY?: A PRELIMINARY ANALYSIS

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ABSTRACT

It is frequently argued that an increase in the rate of growth of money or credit will lead to an increase in economic activity. This paper addresses this issue by looking at the lead/lag relationship between a range of financial aggregates and several measures of economic activity for Australia over the past decade.

The paper concludes, on the basis of a range of tests, that monetary and credit aggregates tend to lag, or at best move contemporaneously with, economic activity. There is very little evidence that changes in the trend of money and credit portend future changes in economic activity.

TABLE OF CONTENTS

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1. Introduction

Changes in the rate of growth of financial aggregates, frequently raise questions about the relationship between financial aggregates and measures of nominal economic activity. Do increases in the growth of financial aggregates portend future rises in economic activity? Or are the aggregates simply reflecting current or past movements in activity? Is the relationship between money and activity different from that between credit and activity?

This study offers some preliminary evidence on these issues by examining the lead/lag relationship between financial aggregates and measures of real and nominal activity in Australia. Firstly, simple graphical comparisons are used to illustrate lead/lag relationships at turning points. The relationships are then examined using correlation coefficients between current and lagged values of the relevant variables. These tests are generalised further using vector autoregression (VAR) analysis.

The results are not definitive, but on balance they show that financial aggregates tend to move with, but do not lead, activity on both a quarterly and an annual basis. Some of the test results suggest that particular financial aggregates lag activity.

Section 2 briefly describes the links that might be expected between money, credit and activity. Section 3 surveys some of the relevant empirical literature on the question. Empirical results using Australian data are presented in section 4, and section 5 sets out the main conclusions.

2. Relationships between Money, Credit and Activity

There is a school of thought (e.g. Laidler, 1985) that argues that monetary aggregates are linked with spending through a real balance effect. Individuals or companies are assumed to have a desired stock of real money balances, which is typically thought to depend on income and the opportunity cost of holding money rather than some other asset. If the actual level of real balances falls below the desired level, people will curtail spending and sell other assets to rebuild their balances. If balances are too high, people will seek to reduce them, adjusting their portfolios by purchasing other assets and by final spending on goods and services.

Within this framework, in which the nominal stock of money is supply-determined but the real stock is demand-determined, an "exogenous" increase in the stock of money would be expected to lead to an increase in expenditure on goods and services.

An alternative framework treats the supply of money as adjusting passively to the demand for money. In this case, money could move contemporaneously with, or possibly even lag economic activity through the income effects on the demand for money. A leading relationship would not necessarily be expected.

The relationship between credit aggregates and economic activity is looked at from a slightly different perspective to the link between money and activity. The decision to borrow is a decision to spend today more than today's income, against the capacity to repay of tomorrow's expected income. For consumers, the borrowing decision is closely related to movements in income, to assessments of whether those movements are transitory or permanent, and to the level of interest rates. For business, borrowing for working capital purposes will be a similar decision. When considering borrowing for investment purposes, businesses' decisions will be influenced by present and expected future profitability, the relative cost of equity versus debt capital, the tax treatment of funding costs, and the level of interest rates.

Whether credit should be expected to lead or lag activity is unclear. Whether the change in activity is perceived to be temporary or permanent is an important issue. It is possible that an initial upturn or downturn in income may not be treated as permanent. If an initial decrease in income is regarded as temporary, consumers may increase borrowings to maintain consumption until income returns to its expected permanent level. On the other hand, if the fall in income is perceived as permanent, consumers may reduce their borrowings in line with lower expected future income. On this basis, credit may rise initially, then fall later, lagging the movement in income.

In addition to these considerations, a change in the conditions on which credit is extended could affect the demand for credit, particularly for investment purposes, and through that, spending. Here, credit could be a leading, or at least coincident, indicator.

The availability of credit can also be affected by regulation of the credit market. An interest rate ceiling, for example, can effectively impose quantity rationing on bank advances. In such a situation, changes in income may not cause changes in the level of bank advances. Deregulation, such as has occurred in Australian markets in the past decade, may change the relationship between credit and economic activity.

In summary, economic theory does not unambiguously predict whether financial aggregates should lead or lag economic activity. This relationship might also depend on the nature of policy, changing if the implementation of policy changed. For example, an observed leading relationship from financial aggregates to economic activity may break down if authorities attempt to use this regularity to influence activity.[1] Relationships might also break down with structural changes, such as recent financial deregulation.

Of course, "credit" and "money", seen above as separate indicators, are in reality the bulk of the two sides of the financial system's balance sheet, and so should be integrated into one model.

This study does not attempt such an ambitious project. It does not attempt to grapple with the structure; rather, it simply seeks to show the empirical regularities characterising money, credit and nominal activity.

3. Overseas Experience

The question of the relationship between money and income was brought into prominence by Friedman and Schwartz (1963), in their voluminous study of the monetary history of the United States. Friedman and Schwartz argued that the empirical evidence in the U.S., especially the turning points in money and output over the period from 1867 to 1960, suggested a strong, stable relationship between money and nominal income, with the causality running from money to income.

The observation of Friedman and Schwartz was tested using reduced-form econometric models in later studies. These models usually involved regressions of current values of money or income on lags of both variables. The models were designed to allow tests of the predictive value of lags of money in explaining current values of income, or vice versa. If the researcher could establish the significance of lags of money in explaining income (even allowing for the information provided by own lags) then there was evidence that money "caused" income.

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1. This criticism of monetary targeting has become known as Goodhart's Law. See Goodhart (1975).

Sims (1972) tested the causal ordering of money and income for the U.S., using measures of money base and M1, and nominal and real GNP, for the period 1947-69. Current values of GNP were regressed on future and lagged values of money and vice versa. Sims' test results showed a leading relationship running from money to GNP (both nominal and real), but not from income to money.

However, these results have been disputed on a number of fronts. Firstly, they have not been supported by evidence from other countries. Similar tests were applied to United Kingdom data over the period 1958-1971 by Williams, Goodhart and Gowland (1976). The U.K. study found evidence for one-way causality running from income to money, and some evidence of causality from money to prices, the opposite of Sims' findings for the U.S. On the basis of this evidence, the authors concluded that a more complicated causal relationship existed, in which both variables were determined simultaneously.

Cuddington (1981) proposed two reasons for these apparently contradictory results. He argued that the data were affected by the asymmetry existing between the large (relatively closed) U.S. economy and the small, open U.K. economy under Bretton-Woods. The difference could also be caused by the U.K. authorities' interest rate management policy. Cuddington found support for both propositions, particularly for the latter.

Secondly, the results were found to be sensitive to the inclusion of other variables. In a later study, Sims (1980b) added a short-term nominal interest rate to money and income, and found no evidence of causality from money to output.

Thirdly, the tests have been shown to be sensitive to the pre-filtering procedures applied to the data (see Feige and Pearce, 1979, and Stock and Watson, 1987). Cooley and LeRoy (1985) have shown that they are not strict tests of causality or exogeneity. They can be useful in testing one variable's value in forecasting another, but this type of "causality" is not equivalent to exogeneity. (This point is discussed in more detail in Section 4 below.)

On the basis of these studies, it would seem that the question of the causal relationship between money and income is still open and that the lead/lag relationship is not yet defined. After surveying the U.S. literature, Blanchard (1987) concludes that there is a strong relationship between money and output and that monetary policy affects output, at least for U.S. data, but that the evidence from the U.K. suggests otherwise. The technical critiques of this type of reduced-form analysis encourage care in the construction and interpretation of tests, especially with regard to the pre-filtering of the data and in drawing inferences about causality.

The relationship between credit aggregates and income has attracted less attention in the literature. Most of the discussion has assumed that financial aggregates lead (and cause) income or output and has concentrated on assessing the relative merits of money and credit as policy variables.

Benjamin Friedman is a prominent proponent of the use of credit as an indicator (and possibly as a target) of monetary policy. Friedman examines the comparative stability of money and credit aggregates with respect to income for U.S. data, using both simple regression and VAR techniques. Using results from this analysis, Friedman (1981) argues that credit is at least as stable in relation to activity as the major money aggregates, and that the inter-relationship between money and credit is important for activity. He concludes that credit aggregates should be used as an indicator in addition to money for the purposes of monetary policy.

Friedman (1982) conducted similar tests for data from Canada, Germany, Japan, and the United Kingdom, and again concluded that, in each country, credit aggregates exhibit stability comparable with that of money aggregates.

Offenbacher and Porter (1983), however, express doubts about the robustness of Friedman's results. They argue that slight changes in Friedman's use of VAR techniques or in the construction of the data used in the analysis, cause substantial changes in the results. From their own analysis, Offenbacher and Porter conclude that the evidence favours the use of money rather than credit aggregates as guides for policy.

Other U.S. studies which discuss the usefulness of credit aggregates differ in their methods and conclusions. Islam (1982) compares monetary and credit aggregates as intermediate targets by looking at income velocities and some simple regressions. Using evidence from the United States, Germany and Japan, he concludes that there is some support for the inclusion of a broad credit aggregate among financial indicators, rather than an exclusive focus on monetary targets.

On the other hand both Davis (1979) and Hafer (1984) find little evidence in favour of using a broad credit measure as an intermediate target. By using simple regression analysis, both authors conclude that credit aggregates add very little additional information about the economy once the monetary aggregates have been taken into account. Davis qualifies this conclusion, however, by noting that where innovation distorts the monetary aggregates, broad credit aggregates may become more useful as financial indicators. Fackler and Silver (1982) also conclude that although history provides no support for targeting a credit aggregate, these aggregates may contribute useful additional information until the innovations which distort the monetary aggregates subside.

These studies have focussed on the question of whether credit is a useful target for monetary policy: most have assumed that credit and money aggregates lead, or at least move contemporaneously with, activity. It is not clear whether credit would be a better target or instrument than money, but most studies support the consideration of credit as an indicator, especially during periods of deregulation and innovation.

4. Empirical analysis for Australia

The empirical work for Australian aggregates reported here is directed toward the question of how money and credit are related to measures of nominal economic activity, such as private demand and non-farm GDP. Specifically, whether a clear lead/lag relationship between money, credit and the indicators of nominal activity can be defined. The general tenor of the results is that monetary and credit aggregates move with, or may lag, movements in activity, and hence are more likely to be driven by nominal activity than to drive it.

a. Graphical Comparisons

A simple graphical analysis is a useful preliminary to the econometric analysis of the relationship between financial aggregates and activity. Of particular interest is whether monetary and credit aggregates have been a good guide to the direction of growth in spending, and particularly whether they have helped to predict turning points in spending. Figure 1 shows annual growth rates of credit[2], broad money and nominal private final expenditure

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2. Credit is defined as lending by financial intermediaries plus bank bills outstanding. See "Measures of Financing", Reserve Bank of Australia Bulletin, October 1987, for further details.

(PFE). (The broader financial aggregates have been least affected by deregulation.) The vertical lines indicate major turning points in spending.

There is some discretion involved in locating a turning point. The episode labelled "4", for example, might be disputed since the actual peak growth in spending was a year earlier. But the decisive change in the trend took place in December 1981, and it is that point which has been labelled as a turning point.

There are seven major turning points:

- in episode 1 (March 1978), growth in broad money picked up at the same time as growth in spending. Growth in credit picked up after a lag of two quarters;

- in episode 2 (March 1979), broad money lagged by one quarter, and credit by two quarters;

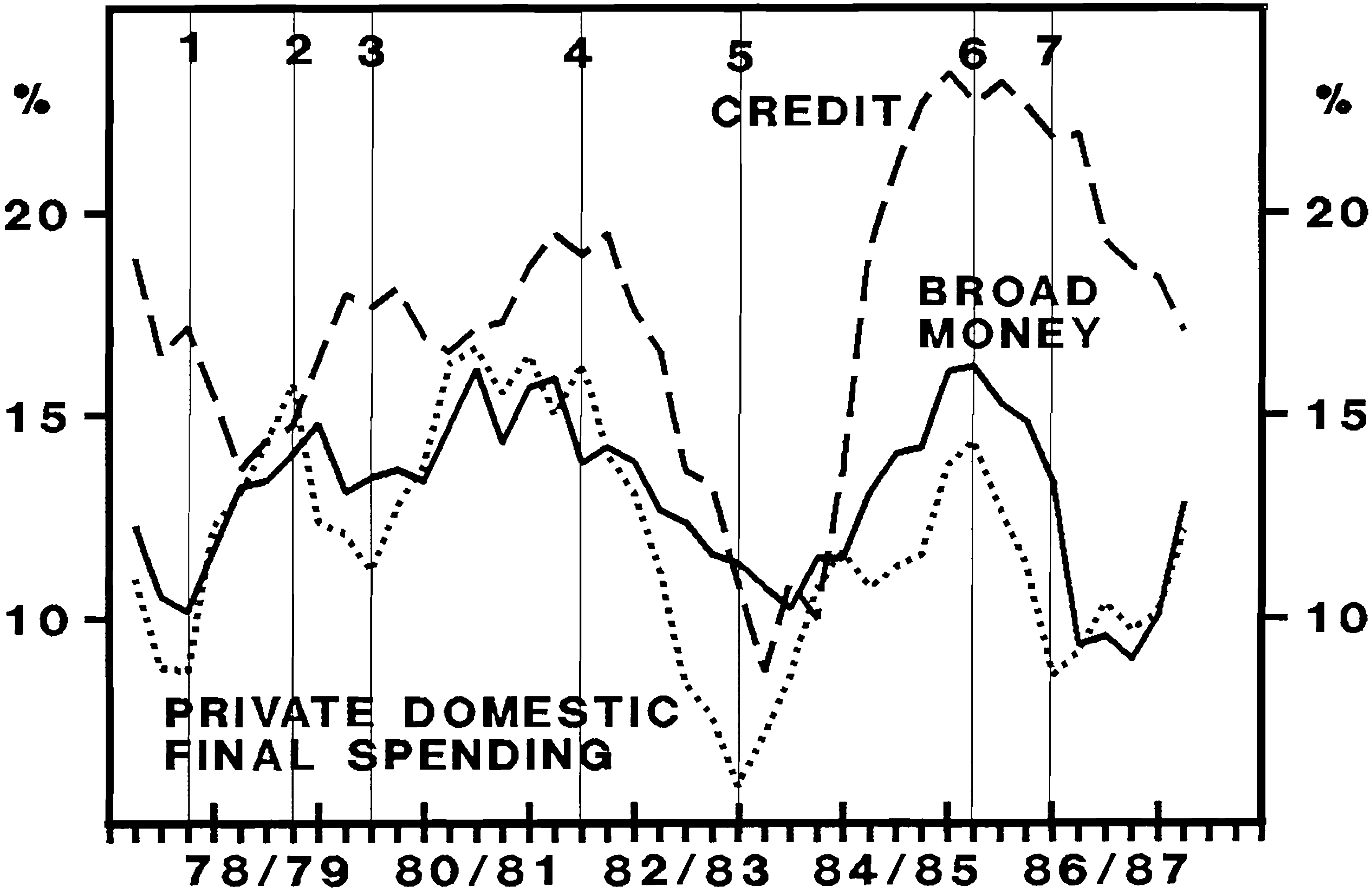
- in episode 3, (December 1979), broad money led by one quarter. Credit growth turned up slightly at the same time as spending, but then moved oppositely to spending over the next two quarters. This is best scored as "no result";

- episode 4 (December 1981) appears at first to show broad money leading activity. But this could be disputed, since the downturn in December 1981 could be the lagged effect of the short-lived fall in spending occurring in the previous quarter. The rise in broad money growth in March 1982 supports the latter view. This is scored "no result". The major downturn in credit clearly lagged by a quarter;

- episode 5 (June 1983) saw spending turn up one quarter before credit, and two quarters before broad money;

- in episode 6 (September 1985), broad money would best be judged as coinciding with spending. A case could be made for credit showing a lead, but this is tenuous. In December 1985, the figure for growth in credit would have been a poor guide to the direction of growth in spending. This is scored as a lag for credit; and

CREDIT, BROAD MONEY AND SPENDING
12 MONTHS-ENDED PERCENTAGE CHANGE



- in the last episode (June 1986), broad money growth turned a quarter later than growth in spending. Simultaneously, credit growth steadied, but then continued to fall. Based on this graph, credit was a poor indicator of spending over 1986-87.

Table 1 shows a "scoreboard" from the above episodes. Broad money was coincident twice. It led once, and lagged three times, with another episode which could go either way. Credit was almost always a lagging indicator.

Table 1: Turning Points

	Broad Money			Credit		
	lead	coincident	lag	lead	coincident	lag
1 (Mar. 1978)		X				X
2 (Mar. 1979)			X			X
3 (Dec. 1979)	X			?	?	?
4 (Dec. 1981)	?	?	?			X
5 (Jun. 1983)			X			X
6 (Sep. 1985)		X				X
7 (Jun. 1986)			X			X

Figure 1 gives some feel for how the two of the major financial aggregates relate to a measure of activity. But there are other measures of activity and many other aggregates. It would be tedious to present all possible combinations graphically, and there are dangers of subjective interpretation of graphs.

The following sections report more formal statistical tests of lead/lag relationships for a number of aggregates and measures of activity.

The financial aggregates considered are:

- M3 and broad money, the two monetary aggregates which receive most attention;

- borrowings by non-bank financial institutions, the major non-M3 component of broad money;

- lending by all financial intermediaries; and

- credit.

The indicators of activity are nominal non-farm GDP (GDPNF) and nominal private final expenditure (PFE). Measures of real GDPNF and PFE and their price deflators are also included in the VAR analysis.

b. Correlation Results

Simple bivariate correlation coefficients were estimated between quarterly log changes and annual rates of growth of aggregates and measures of nominal activity. Growth rates of financial aggregates were adjusted, where appropriate, for transfers when NBFIs became banks and for other breaks in the data series. (Data sources and construction details are outlined on pages 23 and 24 of the paper.)

The results of estimating correlations between 12 months-ended rates of growth and quarterly log-changes are summarised in Tables 2 and 3 respectively. An *(**) appears where coefficients are significantly different from zero at the five per cent (one per cent) level. A dash (-) appears where the estimated coefficient was not significantly different from zero.

The main point of interest in these sample coefficients is whether lagged values of one variable are significantly correlated with current values of another. A significant sample correlation coefficient is taken as an indication that the lagged variable leads the current variable. In the tables, either of the following results would be of interest:

- asterisks only along the first row of each section, which would indicate that lags of the activity variable are correlated with the current value of the financial variable;

- asterisks only down the first column of each section, which would indicate that lags of the financial variable are correlated with the current value of the activity variables.

The results in Table 2 show that lagged values of annual growth in non-farm GDP and PFE tend to be significantly correlated with current values of all financial aggregates (except perhaps M3). By contrast, few lags of the annual growth in financial aggregates are significantly correlated with current values of GDPNF and PFE, and these are restricted to the monetary, rather than credit, aggregates.

TABLE 2: BIVARIATE CORRELATIONS

	Annual ΔGDPNF	ΔGDPNF(-1)	ΔGDPNF(-2)	ΔGDPNF(-3)	Annual ΔPFE	ΔPFE(-1)	ΔPFE(-2)	ΔPFE(-3)
Annual ΔBM	**	**	**	*	**	**	**	**
ΔBM(-1)	*				**			
ΔBM(-2)	-				*			
ΔBM(-3)	-				-			
Annual ΔM3	**	*	-	-	*	-	-	-
ΔM3(-1)	**				-			
ΔM3(-2)	-				-			
ΔM3(-3)	-				-			
Annual ΔNBFI	*	**	**	-	**	**	**	-
ΔNBFI(-1)	-				**			
ΔNBFI(-2)	-				*			
ΔNBFI(-3)	-							
Annual ΔAFIC	-	*	*	*	-	*	**	*
ΔAFIC(-1)	-				-			
ΔAFIC(-2)	-				-			
ΔAFIC(-3)	-				-			
Annual ΔAFIL	-	*	**	*	**	**	**	**
ΔAFIL(-1)	-				-			
ΔAFIL(-2)	-				-			
ΔAFIL(-3)	-				-			

* indicates positive correlation significantly different from zero at the 5 per cent level.

** indicates positive correlation significantly different from zero at the 1 per cent level.

\- indicates correlation insignificantly different from zero.

TABLE 3: BIVARIATE CORRELATIONS

	Quarterly ΔGDPNF	ΔGDPNF(-1)	ΔGDPNF(-2)	ΔGDPNF(-3)	Quarterly ΔPFE	ΔPFE(-1)	ΔPFE(-2)	ΔPFE(-3)
Quarterly ΔBM	**	-	*	-	*	**	-	**
ΔBM(-1)	-				-			
ΔBM(-2)	-				-			
ΔBM(-3)	-				-			
Quarterly ΔM3	-	-	-	-	-	-	-	-
ΔM3(-1)	-				-			
ΔM3(-2)	-				-			
ΔM3(-3)	-				-			
Quarterly ΔNBFI	-	-	**	-	-	**	*	**
ΔNBFI(-1)	-				-			
ΔNBFI(-2)	*				-			
ΔNBFI(-3)	-				-			
Quarterly ΔAFIC	-	-	*	-	-	-	*	*
ΔAFIC(-1)	-				-			
ΔAFIC(-2)	-				-			
ΔAFIC(-3)	-				-			
Quarterly ΔAFIL	-	-	*	-	-	-	*	**
ΔAFIL(-1)	-				-			
ΔAFIL(-2)	*				-			
ΔAFIL(-3)	-				-			

* indicates positive correlation significantly different from zero at 5 per cent level.

** indicates positive correlation significantly different from zero at 1 per cent level.

\- indicates correlation insignificantly different from zero.

Current period growth in the three borrowings aggregates is significantly correlated with current period growth in both activity variables. Credit is not contemporaneously correlated with either activity variable.

On balance, this evidence weighs in favour of the view that the financial aggregates move with, or lag, activity variables. The case for a lagged response is strongest for credit.

Table 3 shows equivalent correlations between quarterly changes. The overall level of correlation is weaker than the annual growth data, but such significance as there is tends to come from lags of activity moving with current changes in financial aggregates. Only broad money is contemporaneously correlated with the activity variables. Again, M3 appears to have the weakest relationship with the activity variables.

On the whole, the quarterly results also support the view that the financial aggregates move with, or lag, changes in nominal activity, and not the reverse.

The strength of such results based on simple bivariate correlations is nonetheless limited. A more general approach is to test whether a number of lags of financial variables <u>jointly</u> help to explain the current value of the activity variables and <u>vice versa</u>.

c. <u>VAR Methodology</u>

The results obtained from correlation analysis can be more thoroughly assessed using vector autoregression (VAR) techniques. VAR models are useful for testing one variable's power for predicting another variable at a very general level. Granger-causality tests can be used to clarify lead/lag relationships between variables.

A VAR model attempts to explain movements in a vector Y_t of n endogenous variables. It is assumed that Y_t is generated by the mth order vector-autoregression:

$$Y_t = D_t + \sum_{j=1}^{m} \beta_j Y_{t-j} + \varepsilon_t$$

where D_t is a (nxl) vector representing the deterministic component of Y_t (D_t is usually a polynomial in time: for the models reported here, D_t is a simple constant term, i.e., a polynomial of order zero), $ß_j$ are (nxn) matrices of coefficients and ε_t is a (nxl) vector of multivariate white noise residuals.

VAR models are very general: unlike conventional regression equations, no restrictions are applied to the $ß_j$ matrix. Consequently, the VAR model consists of n linear equations, with each of the n endogenous variables appearing as the dependent variable in one equation, and (m) lags of all n variables, plus the deterministic component, appearing on the right-hand side of every equation. Under the orthgonality conditions $E(\varepsilon_t)=0$ and $E(Y_{t-j}\ \varepsilon_t)=0$, each equation can be estimated separately by ordinary least squares.

Once estimated, the models can be used to test whether one variable in the vector is useful in forecasting another variable from the vector. Variable Y_{1t} is useful in forecasting variable Y_{2t} if lags of Y_{1t} in the equation for Y_{2t} signficantly reduce the forecast error variance. In other words, if lags of Y_{1t} are jointly significant in an equation for Y_{2t} which also includes lags of Y_{2t} as explanatory variables, then Y_{1t} is said to "Granger-cause"[3] Y_{2t}.

Put in the terms of the present exercise, if including lags of money or credit in the equation improves the prediction of spending over and above the contributions of lags of spending itself, then money or credit would be said to "cause" spending. Granger-causality can be tested using a standard F-test for the joint significance of lags of each variable.

"Causality" has a strictly defined, technical meaning when used in relation to VAR models. It does not necessarily have to imply causality in the usual sense. Nevertheless, if lags of variable Y_{1t} are significant explanators of

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3. So-named after C.W.J. Granger, see Granger (1969).

current values of Y_{2t}, given the information already supplied by own-lags, then we can infer that Y_1 leads movements in Y_2.[4]

d. VAR Results

The VAR models were estimated using annual growth rates and quarterly log-changes in real and nominal GDPNF and PFE, the relevant price deflators, each of the five financial aggregates and yields on 90-day bank-accepted bills. Four different models were estimated for each financial aggregate: two models were estimated including the nominal activity variables and the interest rate, and another two with real activity variables and price deflators separately, together with the interest rate. Lag-lengths were chosen so that in most cases the last lags were jointly significantly different fron zero, and the errors free from serial correlation, within the constraint of degrees of freedom[5]. The test for correct lag-length is an F-test for the joint significance of the last lag of every explanatory variable in each equation in the system. This test was applied to each model in steps, beginning with a lag of order four and working downwards. The relatively small sample size (40 observations for the annual series), and the large number of estimated coefficients restricted lag length to lags of order three or four at most. Some models were estimated with second order lags, and no model had a lag order higher than four.

It was noted in Section 3 that some researchers' results were sensitive to the inclusion of interest rates in models of money and activity. The early

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4. Some studies (including Friedman, 1981) use the innovation accounting techniques suggested in Sims (1980a) to analyse the timing and extent of causal relationships between macroeconomic variables. These techniques have not been employed in this analysis. One short-coming of such tests is that it is necessary to assume a causal ordering in the vector of endogenous variables before the techniques can be applied. The weakness of these techniques are discussed in Cooley and LeRoy (1985) and Trevor and Donald (1986). In regard to the Granger-causality tests applied in this analysis, Cooley and LeRoy argue that the Granger test cannot be interpreted as a test of predeterminedness or strict exogeneity. Strict exogeneity implies Granger-causality, but the converse is not true. Although not useful for proving causal orderings, it can be correctly applied in uncovering characteristics of the data to be explained by theory. On the basis of the limitations of the test, care needs to be taken in interpreting the results.

5. Some of the equations estimated using annual growth data appear to have significantly correlated errors. These equations are marked with a + on Tables 4 and 5. These correlation problems could not be overcome by extending the model lag length within the degrees of freedom constraint. The majority of equations, however, were free from serial correlation at the 5 per cent level of significance.

studies by Sims (1972) and Williams, Goodhart and Gowland (1976), for example, did not include interest rates, and it has been noted that Sims (1980b) found substantial changes in the relationships when interest rates were included. No separate bivariate VAR tests of money and activity have been conducted for this study. Models which include interest rates provide, in our view, a more powerful test of the lead/lag relationship in question. Models which exclude variables which are relevant to the joint behaviour of money and activity may produce spurious results.[6] These variables were selected as giving a good coverage of the conventional financial aggregates and as consistent with the bulk of overseas studies.

A complete set of results of Granger-causality tests is reported in Tables 4-7. Tables 4 and 5 report results for annual growth, and Tables 6 and 7 refer to quarterly changes. An *(**) indicates that coefficients on lags of the relevant explanatory variable are jointly significantly different from zero at the five (one) per cent level. A dash (-) appears where the estimated coefficients are not significantly different from zero.

The off-diagonal elements of these matrices are the most interesting, since those symbols indicate the Granger-causal relationships. Significant coefficients along the diagonal simply show that the dependent variable is explained by its own lags.

The relevant results from VAR analysis of annual growth in financial aggregates and activity are summarised below:

Annual Growth:

Variable	Granger-caused by
. broad money:	Both real and nominal PFE
. M3:	-
. NBFI borrowings:	Both real and nominal GDPNF
	Both real and nominal PFE
. AFI credit:	Real GDPNF
	Both real and nominal PFE
. AFI lending:	Real GDPNF
	Both real and nominal PFE

6. It has been pointed out that for an open economy, the exchange rate may be a key factor in the relationship of the financial system to economic activity. Strictly speaking, the most general of statistical tests would include the exchange rate as well as interest rates and financial aggregates. This is to be investigated in future work.

TABLE 4: GRANGER-CAUSALITY

Annual growth rates

Model 1

Dependent Variable	Explanatory Variables: BM	Real GDPNF	P	R
BM	**	-	-	-
Real GDPNF	-	-	-	-
P	-	-	**	-
R	-	-	-	*
	M3	**Real GDPNF**	**P**	**R**
M3	**	-	-	-
Real GDPNF	-	-	-	-
P+	-	-	**	-
R	-	-	-	**
	NBFI	**Real GDPNF**	**P**	**R**
NBFI	**	**	-	-
Real GDPNF	-	-	-	-
P+	-	-	**	-
R	-	-	-	*
	AFIC	**Real GDPNF**	**P**	**R**
AFIC	*	*	-	-
Real GDPNF	-	*	-	-
P	-	-	**	-
R	-	-	-	-
	AFIL	**Real GDPNF**	**P**	**R**
AFIL	**	**	-	-
Real GDPNF	-	-	-	-
P+	-	-	**	-
R	-	-	-	**

Model 2

Dependent Variable	Explanatory Variables: BM	Nom GDPNF	R
BM	**	-	-
Nom GDPNF	-	-	-
R	-	-	*
	M3	**Nom GDPNF**	**R**
M3	**	-	-
Nom GDPNF	-	*	-
R	-	-	**
	NBFI	**Nom GDPNF**	**R**
NBFI	**	*	-
Nom GDPNF	-	**	-
R	-	-	**
	AFIC	**Nom GDPNF**	**R**
AFIC	**	-	-
Nom GDPNF	-	-	-
R	-	-	*
	AFIL	**Nom GDPNF**	**R**
AFIL	**	-	-
Nom GDPNF	-	*	-
R	*	-	**

TABLE 5: GRANGER-CAUSALITY

Annual growth rates

Model 3

Dependent Variable	Explanatory Variables			
	BM	Real PFE	P	R
BM	**	*	-	-
Real PFE	-	**	-	-
P	-	-	**	-
R	-	-	-	*
	M3	Real PFE	P	R
M3	**	-	-	-
Real PFE	-	**	-	-
P	-	-	**	-
R	-	-	-	**
	NBFI	Real PFE	P	R
NBFI+	-	*	-	-
Real PFE	-	**	-	-
P	**	-	**	-
R	-	-	-	**
	AFIC	Real PFE	P	R
AFIC	**	**	**	-
Real PFE	-	**	*	-
P	*	-	**	-
R	-	-	-	**
	AFIL	Real PFE	P	R
AFIL+	**	**	*	-
Real PFE	-	**	-	-
P	*	-	*	-
R	-	-	-	**

Model 4

Dependent Variable	Explanatory Variables		
	BM	Nom PFE	R
BM	**	*	-
Nom PFE	-	**	-
R	-	-	*
	M3	Nom PFE	R
M3	**	-	-
Nom PFE	-	**	-
R	-	-	**
	NBFI	Nom PFE	R
NBFI+	-	**	-
Nom PFE	-	**	-
R	-	-	**
	AFIC	Nom PFE	R
AFIC	**	*	-
Nom PFE	-	**	-
R	*	-	**
	AFIL	Nom PFE	R
AFIL+	**	*	-
Nom PFE	-	**	-
R	*	-	**

TABLE 6: GRANGER-CAUSALITY

Quarterly growth rates

Model 1

Dependent Variable	Explanatory Variables			
	BM	Real GDPNF	P	R
BM	-	-	-	-
Real GDPNF	-	-	-	-
P	-	-	*	-
R	**	-	-	**
	M3	Real GDPNF	P	R
M3	-	-	-	-
Real GDPNF	-	-	-	-
P	-	-	-	-
R	-	-	-	**
	NBFI	Real GDPNF	P	R
NBFI	-	**	-	-
Real GDPNF	*	-	-	-
P	-	-	-	-
R	-	-	-	**
	AFIC	Real GDPNF	P	R
AFIC	*	**	-	-
Real GDPNF	-	-	*	-
P	-	-	*	-
R	-	-	-	**
	AFIL	Real GDPNF	P	R
AFIL	*	*	-	-
Real GDPNF	*	-	*	-
P	-	-	*	-
R	-	-	-	**

Model 2

Dependent Variable	Explanatory Variables		
	BM	Nom GDPNF	R
BM	-	-	-
Nom GDPNF	-	-	-
R	*	-	**
	M3	Nom GDPNF	R
M3	-	-	-
Nom GDPNF	-	-	-
R	-	-	**
	NBFI	Nom GDPNF	R
NBFI	-	*	-
Nom GDPNF	-	-	-
R	-	-	**
	AFIC	Nom GDPNF	R
AFIC	**	*	-
Nom GDPNF	-	-	-
R	-	-	**
	AFIL	Nom GDPNF	R
AFIL	*	-	-
Nom GDPNF	-	-	-
R	-	-	**

TABLE 7: GRANGER-CAUSALITY

Quarterly growth rates

Model 3

Dependent Variable	Explanatory Variables: BM	Real PFE	P	R
BM	–	–	–	–
Real PFE	–	–	–	–
P	–	–	–	–
R	–	–	–	**
	M3	**Real PFE**	**P**	**R**
M3	–	–	–	–
Real PFE	–	–	–	–
P	–	–	–	–
R	–	–	–	**
	NBFI	**Real PFE**	**P**	**R**
NBFI	–	–	–	–
Real PFE	–	–	–	–
P	*	–	–	–
R	–	–	–	**
	AFIC	**Real PFE**	**P**	**R**
AFIC	**	**	**	*
Real PFE	–	–	–	–
P	–	–	–	–
R	*	–	–	**
	AFIL	**Real PFE**	**P**	**R**
AFIL	–	–	*	–
Real PFE	–	–	–	–
P	–	–	–	–
R	–	–	–	**

Model 4

Dependent Variable	Explanatory Variables: BM	Nom PFE	R
BM	–	*	–
Nom PFE	–	–	–
R	–	–	**
	M3	**Nom PFE**	**R**
M3	–	–	–
Nom PFE	–	–	–
R	–	–	**
	NBFI	**Nom PFE**	**R**
NBFI	–	**	–
Nom PFE	–	–	–
R	–	–	**
	AFIC	**Nom PFE**	**R**
AFIC	*	–	–
Nom PFE	–	–	–
R	–	*	**
	AFIL	**Nom PFE**	**R**
AFIL	*	–	–
Nom PFE	–	–	–
R	–	–	**

There was no instance of a financial aggregate "causing" nominal or real GDPNF or PFE. All financial aggregates, except M3, are "caused" by at least one activity variable. In three models, a financial aggregate significantly Granger-causes prices. However, in two of these instances, the financial aggregate is also significantly explained by lags of prices. These results are not easy to interpret, and probably point towards a contemporaneous relationship, which cannot be usefully examined in a VAR model.

The same test conducted with seasonally-adjusted quarterly changes generally support these conclusions, although the overall fit of the models is poorer, and the relationships are weaker. The following table summarises the quarterly results.

<u>Quarterly Growth</u>:

Variable	Granger-caused by
. broad money:	Nominal PFE
. M3:	-
. NBFI borrowings:	Nominal GDPNF Nominal PFE
. AFI credit:	Both real and nominal GDPNF Real PFE
. AFI lending:	-

In two cases (NBFI borrowing and AFI lending) the financial aggregate "caused" real GDPNF at the five per cent level. In both of these cases there is also an opposite significant causality from real GDPNF to the financial aggregate, which implies that an unambiguous lead/lag relationship cannot be defined from these results.

The presence of serial correlation in some of the estimated equations on annual data also suggests caution (see Footnote 5). Nevertheless, the general tenor of the results clearly favours a lead relationship from activity to the financial aggregates (excluding M3).

5. Concluding Comments

This study has attempted to establish whether financial aggregates are leading or lagging indicators of economic activity in Australia. The main findings can be summarised as:

- turning points in nominal private domestic final spending are more often than not followed by turning points in broad financial aggregates.

- in general, lags of nominal activity variables tend to be correlated with current movements in money and credit, and not the reverse;

- on VAR analysis, there is evidence that lags of real and nominal activity variables help explain movements in money and credit aggregates (except M3), but little evidence of the reverse;

The poor results for M3 - it neither "Granger-causes" anything nor is Granger-caused by anything - are surprising at face value. But this does not necessarily mean that there is no relationship between M3 and economic activity - only that whatever relationship there is is fully reflected in the information from lags of M3 itself - lags of activity do not add any further explanation.

On balance, the analysis suggests, then, that money and credit aggregates are probably contemporaneous or lagging indicators of activity. While the structural relationship between financial aggregates, activity and interest rates is no doubt complicated, the implications of this paper are that observed changes in monetary and credit aggregates most likely indicate what is happening and has already happened in the real economy, not what is about to happen.

There is still some value in monitoring such aggregates. Comprehensive information on economic activity typically becomes available on a quarterly basis, in the national accounts, with a lag of two or three months. Information on financial aggregates becomes available monthly, and with a shorter lag. Provided that the lag from activity to money and credit is not too long, information on financial aggregates can be used, along with partial indicators of activity, to assess what is happening to economic activity.

Appendix A: Data Definitions and Sources

GDPNF - gross domestic non-farm product, seasonally adjusted. "Nominal" series in current prices; "real" series in 1979-80 average prices. Source: Australian Bureau of Statistics (ABS) Quarterly Estimates of National Income and Expenditure, June 1987.

PFE - private final expenditure, seasonally adjusted. "Nominal" series in current prices, "real" series in 1979-80 average prices. Source: ABS Quarterly Estimates of National Income and Expenditure, June 1987.

P - implicit price deflators for GDPNF and PFE. Source: ABS Quarterly Estimates of National Income and Expenditure, June 1987.

R - yield on 90-day bank-accepted bills: average of daily market yields reported to RBA for week ended last Wednesday of the month, end-month of quarter. Source: Reserve Bank of Australia (RBA) Bulletin Database.

M3* - M3, end-month of quarter. Source: RBA Bulletin Database.

NBFI* - borrowings from the non-finance private sector by non-bank financial institutions, end-month of quarter. Source: RBA Bulletin Database.

BM* - broad money, end-month of quarter. Source: RBA Bulletin Database.

AFIL* - loans, advances and bills discounted to the non-finance private sector by all financial intermediaries, end-month of quarter. Source: RBA Bulletin Database.

AFIC* - bank bills outstanding plus loans and advances to the non-finance private sector by financial intermediaries whose liabilities are included in broad money, end-month of quarter. Source: RBA Bulletin Database.

*Note: Growth rates in all financial aggregates are adjusted for transfers from NBFIs to new banks, the introduction of cash management trusts and the exclusion of double counting from NBFI borrowings and lending series, where appropriate. Twelve-months-ended growth rates series are not seasonally adjusted. Quarterly log-change series were seasonally adjusted using the SAS X11 procedure.

Twelve months-ended growth rate series run from 1977(3) to 1987(2).

Quarterly log-change series run from 1976(4) to 1987(2).

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