INDICATORS OF ECONOMIC ACTIVITY: A REVIEW

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ABSTRACT

This paper reviews the performance of a selection of indicators that are in common use in analysing the business cycle. The analysis proceeds in two stages, looking first at relationships between major expenditure aggregates and GDP, and then looking at the extent to which partial indicators contain useful leading information about particular expenditure aggregates. Results on the first issue show a tendency for housing activity to lead the cycle, while construction and consumption expenditure probably lag. However, these relationships are not very reliable, in the sense that timing can vary significantly from cycle to cycle. On the second issue, the usefulness of a number of partial indicators is confirmed. The most significant in providing leading information are probably local government building approvals and the ANZ job vacancies series.

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INDICATORS OF ECONOMIC ACTIVITY: A REVIEW

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1. INTRODUCTION

An important problem in monitoring and forecasting the real economy is the lag in availability of relevant data. For example, the national accounts, which in principle summarise much of the information of importance on the macro-economy, are generally published with lags of three to four months (measured from the mid-point of the quarter to which they refer); moreover, these series are inaccurately measured and often subject to substantial revision, effectively lengthening the information lags even further.

One response to such information problems is the leading index approach. This aims essentially at constructing a composite index of available partial indicators which has, in some statistical sense, optimal properties in leading the cycle. Two such indexes are currently published in Australia.[1] In practice, however, most economic commentators follow the more pragmatic approach of directly monitoring a wide variety of partial indicators which are thought to contain leading information, or are available with relatively short lags. Implicitly, this information is then combined with rules of thumb and simple statistical techniques to draw conclusions about the economic cycle.

The purpose of this paper is to review the performance of some of the main indicator variables that are typically used in this way. In order to do so, the paper classifies the various indicators into two groups. In the first group are the major expenditure aggregates from the quarterly national accounts, while the second group consists largely of partial indicators which are thought to contain useful information about particular variables from

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[1] The Westpac-Melbourne Institute Index of leading indicators, and the NATSTAT index, published by the State Bank of Victoria. For an exposition of work on the Westpac-Melbourne Institute index, see Boehm and Martin (1987). The properties of these indexes were studied by Trevor and Donald (1986) and EPAC (1985).

group one. Using this classification, the paper addresses two sets of issues: first, the extent to which each of the expenditure aggregates included in group one can be said to lead or lag real GDP; and second, the forecastability of particular expenditure aggregates using information contained in the relevant partial indicators.

2. DATA AND METHODS

The variables included in the study are indicators of real expenditure and activity which are judged to be in frequent use in published analyses of the economic cycle. The variables are listed below in Table 1.

As noted in the introduction, the analysis proceeds in two stages, the first stage looking at relationships between variables from group one in the above table, and the second stage studying the usefulness of the partial indicators in forecasting individual expenditure aggregates. Conceptually, the most appropriate method for dealing with these issues is to use vector autoregressions (VARs) or forecasting equations. That is, we estimate equations of the form

$$y_t = \sum_{j=1}^{m} a_j y_{t-j} + \sum_{j=1}^{m} b_j x_{t-j} + u_t$$

and conclude that x_t leads y_t if the b coefficients are jointly significantly different from zero. It may be noted that these methods are subject to a certain amount of controversy, particularly when the aim is to make inferences about causality. For example, it is well known that such systems of equations are misspecified unless all relevant variables in a causal system are included. Also, results can be very sensitive to design features such as the choice of lag lengths and the length of the sample period.[2]

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[2] For example, Thornton and Batten (1985, p166) state that "individuals could arrive at different, but equally legitimate, conclusions concerning the Granger-causal relationship between time series due solely to differences in their lag-length selection criteria".

Table 1: Summary of Indicators Included in the Study

1. Expenditure Aggregates	2. Partial Indicators
Dwelling investment	Building approvals Housing finance Housing sales
Plant and equipment investment	Capital expenditure survey CAI-Westpac survey
Non-dwelling construction	Construction approvals Capital expenditure survey CAI-Westpac survey
Consumption	Retail trade Car registrations Consumer sentiment index
Change in non-farm stocks	
Exports	
Imports	
GDP	Employment Job vacancies

Note: For further details on sources and definitions, see Appendix.

These problems are less important when the aim is only to draw conclusions about forecasting, since the equations are interpreted only in the more limited sense of showing whether particular variables add information to a given forecasting system. It is nonetheless our experience that the results in this paper are quite sensitive to the design features mentioned above, and we have therefore chosen to supplement the VAR results with simpler techniques based on bivariate VARs, correlation coefficients and visual inspection of the data. This follows a similar approach to that of Bullock,

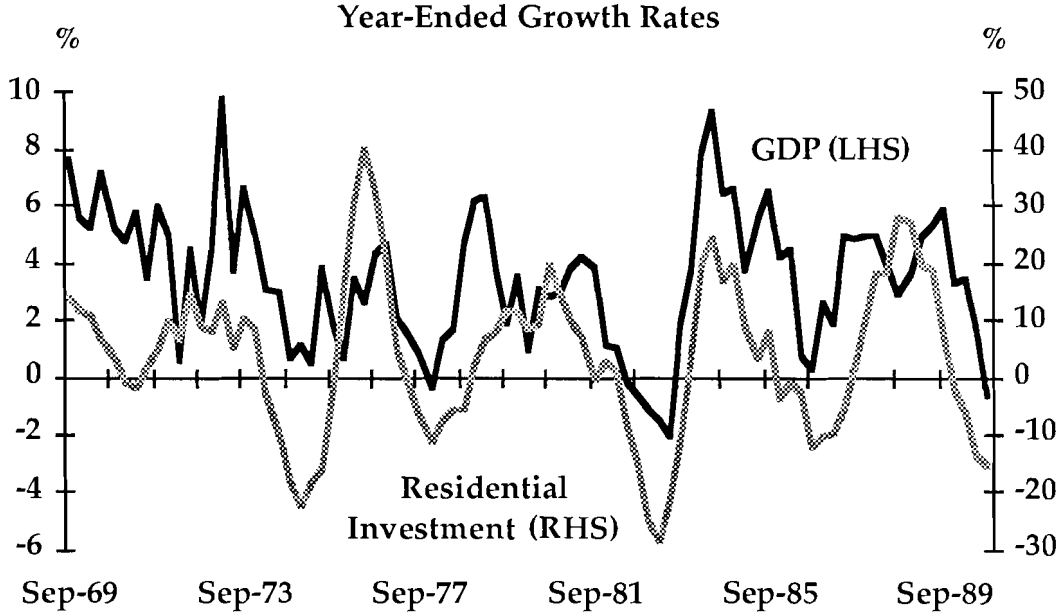
Morris and Stevens (1989) and Stevens and Thorp (1989) in their analyses of financial indicators.[3]

The VARs are estimated with lag lengths of up to four quarters. Generally speaking, the data used are in quarterly log-differenced form, although in some cases it is possible to estimate relationships using monthly data (for example, in estimating the relationship between employment and job vacancies). Further details on data sources are provided in the Appendix.

3. RELATIONSHIPS BETWEEN MAJOR EXPENDITURE AGGREGATES

The expenditure aggregates analysed in this section are dwelling investment, business investment (consisting of plant and equipment and construction), consumption, imports and investment in stocks. Graphs 1 to 6 show the growth rates (in year-ended percentage changes) of each component graphed against the growth rate of real GDP.

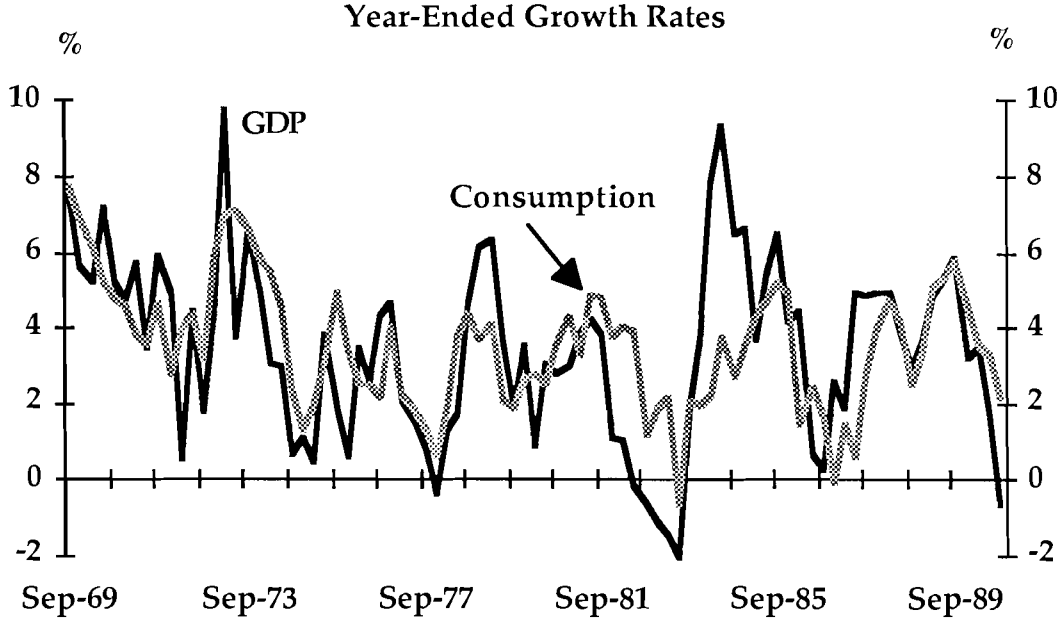
Graph 1: GDP and Residential Investment
Year-Ended Growth Rates



[3] Early studies by Beck, Bush and Hayes (1973) and by Bush and Cohen (1968) looked at an exhaustive list of indicators using various statistical techniques.

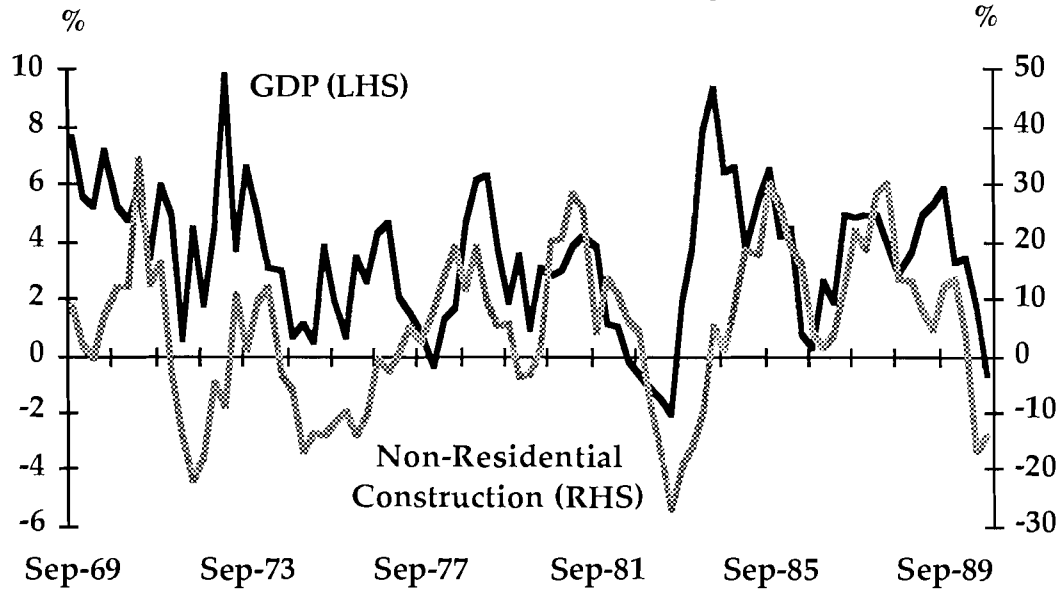
Graph 2: GDP and Consumption

Year-Ended Growth Rates



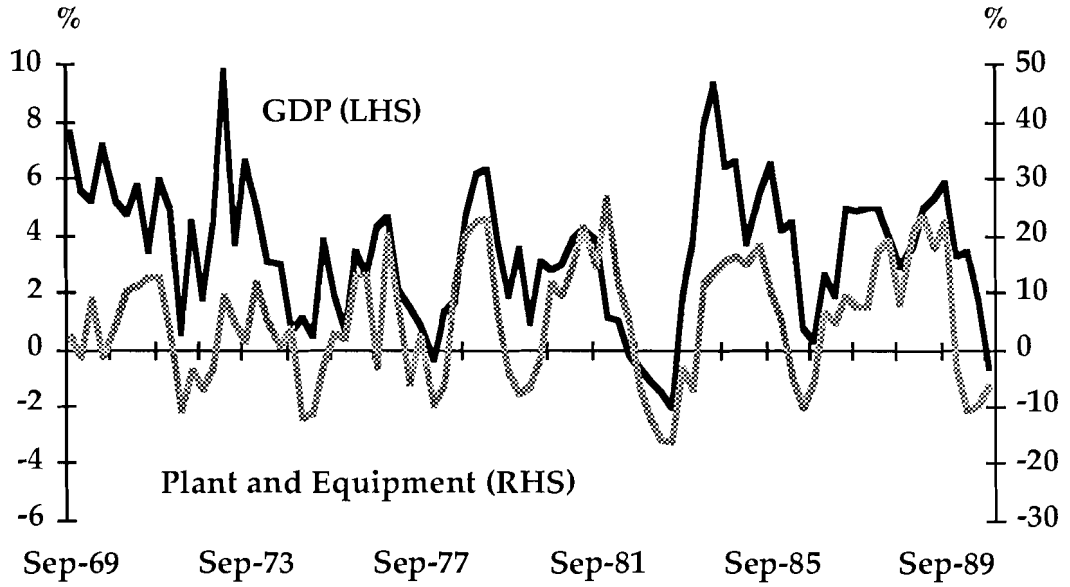
Graph 3: GDP and Non-Residential Construction

Year-Ended Growth Rates



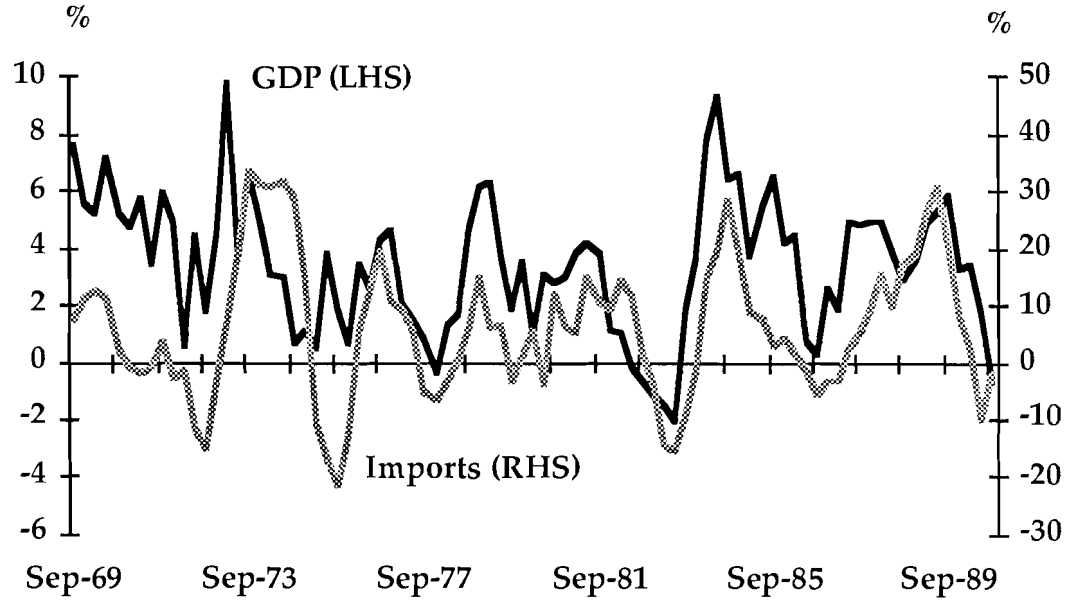
Graph 4: GDP and Plant and Equipment Investment

Year-Ended Growth Rates

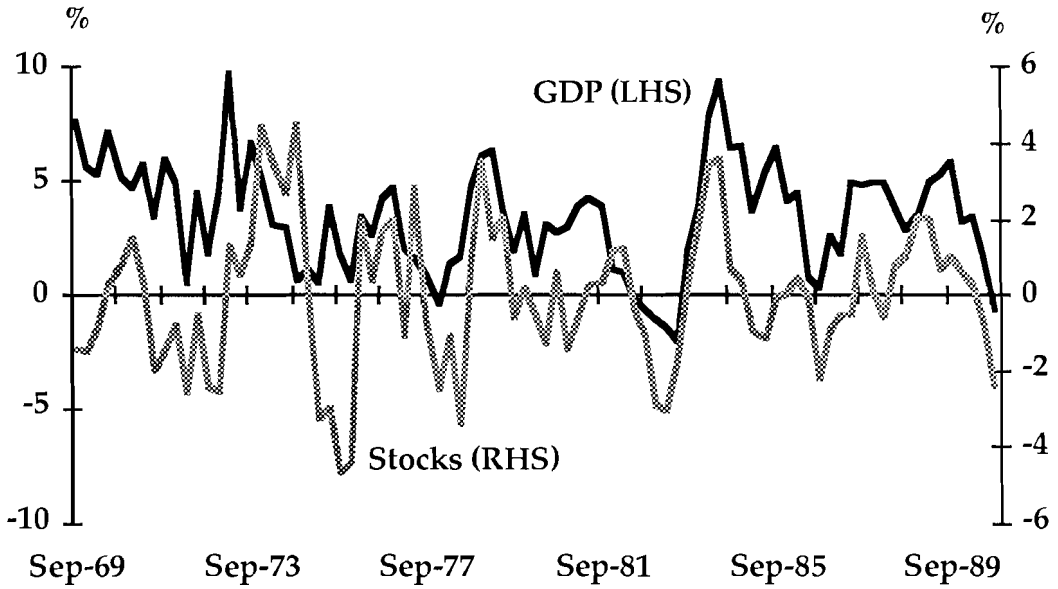


Graph 5: GDP and Imports

Year-Ended Growth Rates



Graph 6: Change in Stocks and Growth in GDP
Contribution to Year-Ended Growth



A useful preliminary way of detecting leads or lags between series is to compare the timing of major turning points. In Table 2, twelve turning points in year-ended GDP growth have been identified and where possible, corresponding turning points in the other variables are listed. This preliminary classification, and visual inspection of the graphs, suggest a number of tentative conclusions about timing. First, there is an apparent tendency for dwelling investment to lead the cycle in GDP; turning points in dwelling investment led those in GDP on five occasions, and by up to four quarters. A leading relationship could be rationalised on the basis that housing is probably the sector which reacts most quickly to changes in financial conditions. This would be consistent with the conclusion of Bullock, Morris and Stevens (1989) that interest rates tend to lead the real economy. It might also be argued that housing activity is sensitive to changes in expectations and therefore plays some causal role in generating cycles in activity. Certainly, the amplitude of housing fluctuations is large compared with those of other spending components.

Consumption (Graph 2) typically follows a much smoother time path than either GDP or any of the other spending aggregates under consideration, presumably reflecting the importance of consumption-smoothing behaviour by households. It also appears that consumption has lagged major changes in income in recent years. A good example of this occurred in the 1982/83

recession when, on a year-ended basis, consumption fell at only one point despite a protracted decline in income. Because consumption represents about two-thirds of total spending, this kind of behaviour has an important stabilising effect, and suggests that consumption spending is unlikely to be an important factor in generating cyclical turning points.

Table 2: Major Expenditure Aggregates: Comparison of Turning Points

GDP	Res.	BFI	PE	NRC	Con.	Imp.	Stocks
1972(1)	-4	0	0	+1	-1	+2	
1973(1)	0	+3	+3	+4	0	+2	+6
1975(1)	-1	-1	-1	-1	-1	+2	+2
1976(4)	-2	0	0		0	-1	
1977(4)	0	0	0		0	0	+2
1979(1)	+2	-1	0	-1	-2	-1	+3
1980(1)	0	-1	-1	-1	-2	-2	+1
1981(2)	-3	0	+2	-1	0	0	+2
1983(2)	-1	0	0	0	0	0	-1
1984(2)	0	+4	+4	+5	+5	+1	0
1986(3)	0	-1	-1	+1	+1	0	0
1989(3)	-4	-5	-2	-5	0	-1	-2

Note: The table shows the relative timing of turning points in the year-ended changes in variables shown, relative to that of GDP. A minus indicates a turning point which preceded that of GDP. The abbreviations are residential investment, business fixed investment, plant and equipment, non-residential construction, consumption, imports, and non-farm stocks, respectively.

On the basis of the graphs and Table 2, other expenditure components appear to have been either coincident with or lagging real GDP. For example, recent turning points in imports have roughly coincided with those in GDP, following an earlier tendency to lag. Growth in stocks has traditionally been regarded as lagging the cycle, reflecting delayed responses by firms to unanticipated changes in output. One such example occurred with the slowing of growth in 1973/74, which was followed first by a stock build-up and subsequently by a major decline. More recently, however, the contemporaneous correlation between stocks and output

appears to have become much closer, perhaps reflecting increased adjustment speeds and improved stock-control methods.

Estimates of the VAR system reported in Tables 3 and 4 unfortunately fail to confirm any robust conclusions about leading and lagging relationships among this group of variables. The tables show estimates when the system contains lags up to two quarters, and four quarters, respectively. Both sets of results imply that there are no significant predictors of GDP growth, including lagged GDP itself. Moreover, there are no variables which lag (or are predicted by) GDP growth, with the surprising exception of residential investment in one of the two cases. There are a small number of significant leading or lagging interrelationships detected among the other variables, but these are generally not robust to changes in the number of lags included in the estimation. For example, housing and business investment are significantly related in both models, but in opposite directions. It seems likely that these negative results are due at least partly to a lack of power in the tests, rather than to a genuine absence of underlying relationships; estimates of more restricted systems described below do suggest that some leading and lagging relationships involving GDP growth can be identified.

Table 3: VAR System with Two Lags

	Res.	NRC	PE	Con.	Imp.	Stocks	GDP
Res.	14.9*	1.0	2.1	0.1	1.8	0.9	0.2
NRC	1.0	1.7	2.7	2.2	0.7	1.0	1.3
PE	4.0*	1.3	3.9*	0.2	2.0	2.9	0.1
Con.	1.1	0.2	0.4	1.5	1.1	0.1	2.1
Imp.	4.2*	1.2	1.9	2.5	0.0	0.5	0.5
Stocks	2.3	0.0	0.1	1.9	2.2	4.6*	0.1
GDP	2.3	0.3	0.2	1.0	1.7	1.3	2.5

Table 4: VAR System with Four Lags

	Res.	NRC	PE	Con.	Imp.	Stocks	GDP
Res.	5.8*	1.5	2.9*	0.7	1.1	1.1	4.3*
NRC	0.9	1.4	2.2	0.7	0.7	0.7	0.6
PE	2.0	1.5	2.3	0.7	0.7	0.8	0.5
Con.	1.3	0.1	0.8	1.2	2.0	0.6	1.0
Imp.	1.9	1.9	2.0	1.2	0.1	1.1	0.9
Stocks	0.5	1.0	0.9	1.6	1.5	6.3*	1.0
GDP	1.2	0.2	0.6	1.2	0.4	0.5	1.4

Note: The tables show F-statistics for the null hypothesis that lag coefficients of the right-hand variables are jointly zero. The estimation period is 1969(3) to 1989(2). Asterisks denote significance at the 5 per cent level. All variables are measured in quarterly log-differences.

Tables 5 and 6 present results based on bivariate VARs and simple correlation coefficients. It should be stressed that there is no claim that these represent causal systems, since the implied systems are clearly incomplete; they are simply presented as an alternative way of describing the data, showing whether or not each particular variable contains information about GDP, given that other information is ignored. Once again, conclusions depend on the number of lag lengths considered. When the systems are estimated with only two lags, one obtains the results that housing leads GDP, while consumption and business investment (mainly the construction component) lag. This is true of both the VAR and correlation estimates. However, the results are very much weakened when the number of lags is extended to three or four; in most cases the apparent "causation" either disappears or becomes bi-directional.

Table 5: Bivariate VARs

	2 lag model		3 lag model		4 lag model	
	GDP	Res.	GDP	Res.	GDP	Res.
GDP	3.3*	3.2*	2.2	1.9	2.5*	2.3
Residential	0.2	13.3*	2.4	8.7*	2.2	11.5*
	GDP	NRC	GDP	NRC	GDP	NRC
GDP	1.8	1.1	1.7	1.5	1.9	1.3
NRC	2.9	2.0	1.8	1.1	1.6	0.6
	GDP	PE	GDP	PE	GDP	PE
GDP	2.6	0.9	1.9	0.6	1.9	1.4
PE	1.1	1.6	0.7	1.3	0.7	1.5
	GDP	Con.	GDP	Con.	GDP	Con.
GDP	2.2	1.5	1.5	1.7	1.9	1.6
Consumption	4.3*	2.2	2.9*	1.9	2.0	1.5
	GDP	Imp.	GDP	Imp.	GDP	Imp.
GDP	2.3	1.9	1.9	1.4	1.9	1.0
Imports	1.3	1.6	1.3	1.1	0.7	1.5
	GDP	Stocks	GDP	Stocks	GDP	Stocks
GDP	1.9	1.8	1.5	1.6	1.3	0.8
Stocks	0.4	20.5*	3.9*	13.1*	2.0	9.8*

Note: Data periods and notation are the same as in Tables 3 and 4.

Table 6: Correlations with GDP

	Lag in quarters								
	-4	-3	-2	-1	0	1	2	3	4
Residential	-0.13	0.02	0.19*	0.14	0.33*	0.13	0.05	0.26*	-0.13
BFI	-0.27*	0.02	-0.05	0.13	0.31*	0.20*	-0.05	0.11	0.06
NRC	-0.15	0.08	-0.08	0.15	0.05	0.27*	0.07	0.05	0.11
PE	-0.25*	0.06	-0.02	0.07	0.35*	0.11	-0.09	0.12	0.00
Con.	-0.13	0.10	-0.16	0.09	0.22*	0.26*	-0.05	-0.03	0.05
Imports	-0.13	-0.05	-0.12	0.11	0.20*	0.17	0.15	0.12	-0.06

Note: The table shows simple correlation coefficients of each variable against lags of GDP. Thus, for example, a significant negative lag indicates that the variable is correlated with future GDP. Asterisks denote significance at the 5 per cent level.

Drawing together the above results and discussion, it is clear that only the most restricted of the statistical methods support the conclusions taken from visual inspection of the data; these were that housing tends to lead the cycle while consumption, construction, and perhaps imports, lag. The negative results obtained from the larger unrestricted VARs suggest a degree of caution in accepting these visual impressions because the leading and lagging relationships may not be particularly strong or reliable. They also suggest that those relationships are "partial" in nature; for example, housing investment does contain useful information about future GDP, but it is only statistically significant when all other current information variables are ignored. A final conclusion to be drawn is that one should be wary of putting strong interpretations on the results from any individual statistical procedure. Results from the large VAR systems in particular seem highly sensitive to changes in design.

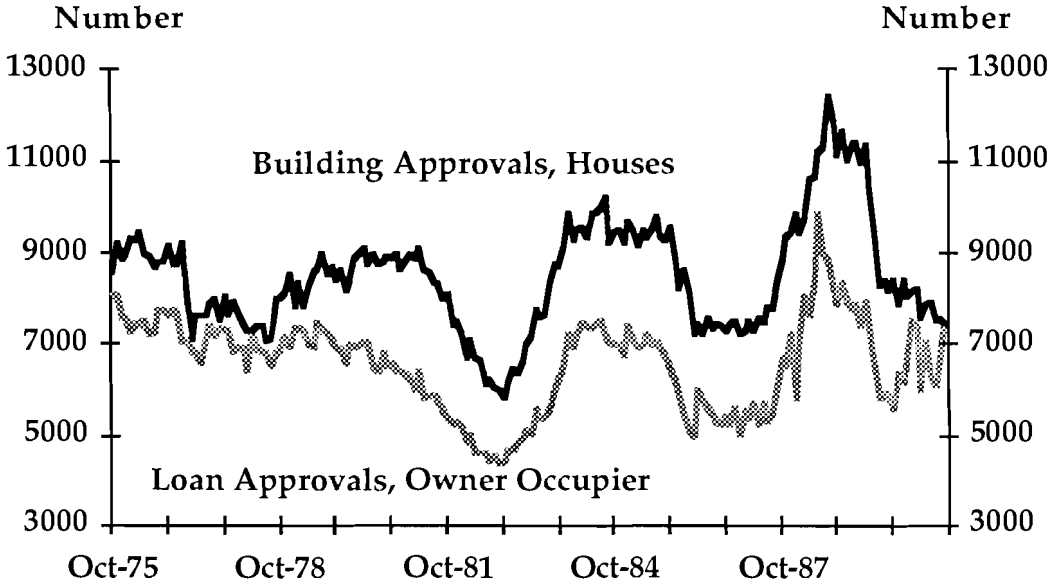
4. PARTIAL INDICATORS

This section looks at the performance of partial indicators in four main areas: housing, investment, consumption and the labour market. The usefulness of these indicators arises potentially from two sources. First, they are often published as monthly series and have considerably shorter publication lags than the national accounts. This provides an important, purely mechanical, reason why such indicators can provide useful information. Secondly, it is possible that they lead the broader spending and production aggregates in terms of underlying timing, and it is this possibility that is examined in the empirical tests reported below.

(a) Housing

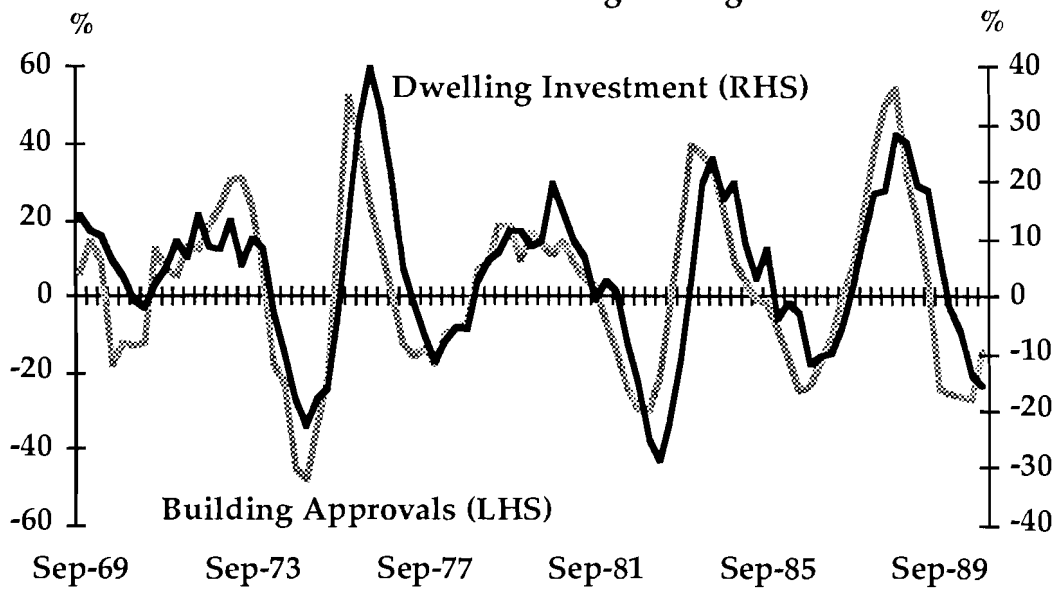
The formalities involved in the process of constructing dwellings provide a well-defined set of potential leading indicators for investment in the housing sector. Securing a housing loan commitment by owner-occupiers is one of the first identifiable links in the chain. Subsequently, a building approval is needed from the relevant local authority before work can commence. Data on new loan approvals and building approvals are published by the ABS with a lag of one to two months, with the building approvals data generally being the earlier of the two to be published. The national accounts measure of dwelling investment is the value of work done, which can diverge from building approvals for essentially two reasons: first, a small proportion of approved dwellings are not commenced, and secondly, roughly half the value of work done is on alterations and additions, which are not covered in the approvals data. These points aside, one would expect building approvals to lead work done, due simply to the average time required for completion. These relationships are illustrated in Graphs 7 and 8.

Graph 7: Finance and Building Approvals



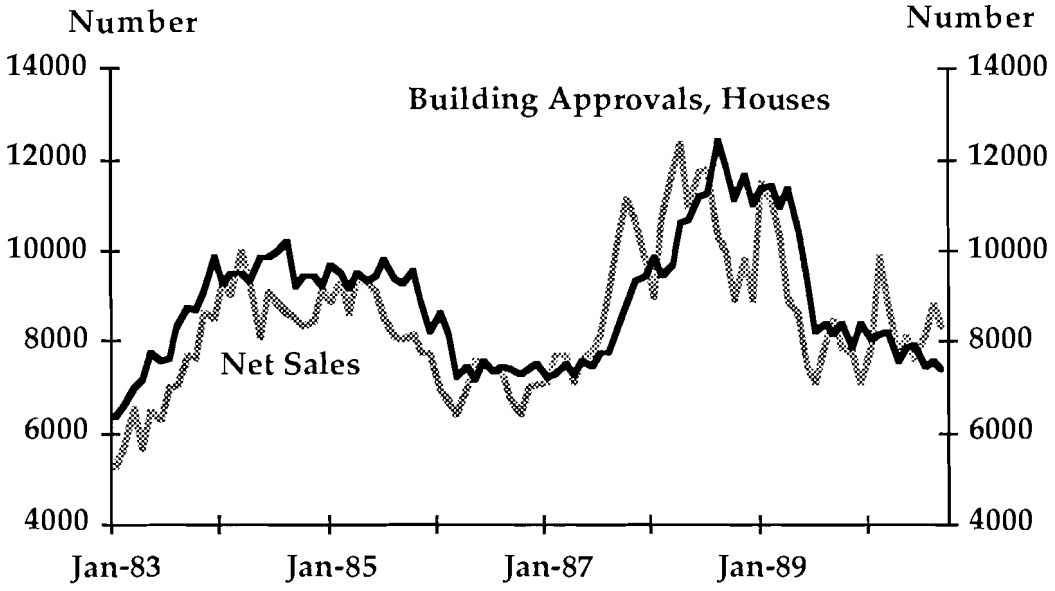
Graph 8: Building Approvals and Dwelling Investment

Year-Ended Percentage Change



A further indicator of house building approvals is provided by the Housing Industry Association's survey of volume builders. The HIA defines net sales of new houses as the number of deposits taken by volume builders for the drawing up of plans, less cancellations. As Graph 9 indicates, the historical net sales series appears to have a leading relationship to building approvals; however, it should be noted that it is a fairly volatile series and it is also prone to frequent revisions, both of which diminish its value as a forward indicator.

Graph 9: HIA Net Sales and Building Approvals



The estimated forecasting equations reported in Tables 7 and 8 provide strong support for the observations made above. In bivariate systems (Models 1 and 2 in Table 7) both building approvals and housing finance have statistically significant power to forecast dwelling investment when the other variable is excluded. The relationship appears strongest in the case of building approvals, which forecasts investment with an R-squared of 0.59. The most significant lags appear to be the first and second, suggesting an average lead time of three to six months for this indicator. Interestingly, the contemporaneous value of building approvals adds little to the explanatory power of the equation, raising the R-squared only from 0.59 to 0.62. When the system as a whole is estimated (Model 3), the result is obtained that only the building approvals series enters as a significant

predictor of dwelling investment; housing finance does not add significantly to the information in the building approvals series.

Table 7: VAR Models for Dwelling Investment

Model 1	Dwelling Investment	Approvals	
Dwelling Investment	0.6	18.6*	
Approvals	1.5	7.5*	
Model 2	Dwelling Investment	Finance	
Dwelling Investment	1.7	6.2*	
Finance	1.8	1.7	
Model 3	Dwelling Investment	Approvals	Finance
Dwelling Investment	3.3*	7.8*	1.3
Approvals	0.8	1.6	0.5
Finance	0.6	1.0	0.6

Note: All equations are estimated over the period 1969(4) to 1989(2), (79 observations) with three lags. The table shows F-statistics for the test of the null hypothesis that the lag coefficients on a variable are jointly zero. Asterisks denote significance at the 5 per cent level.

The above quarterly regressions were implemented by aggregating the relevant monthly numbers to obtain quarterly totals for the two partial indicators which were then used in predicting the quarterly national accounting aggregate. Because this procedure throws away some information from the monthly series, it is of interest to look further at the inter-relationships between the monthly indicators. This also allows sufficient observations to bring in the HIA series, which is only available from 1983. The results for a three-variable VAR using monthly data on sales, finance and approvals are summarised in Table 8. The net sales series is found to contain statistically significant leading information on both finance and building approvals, with the profile of coefficients suggesting that lags of up to about four months are significant. Unfortunately, the short data series prevents direct testing of the link from sales to the national

accounts aggregate of work done, but the results seem to provide robust support for two conclusions: that building approvals form a reliable leading indicator of work done, and that net sales lead approvals. Housing finance is also a leading indicator of work done but cannot statistically be shown to add to the information contained in the other two variables.

Table 8: VAR Model for Monthly Housing Indicators

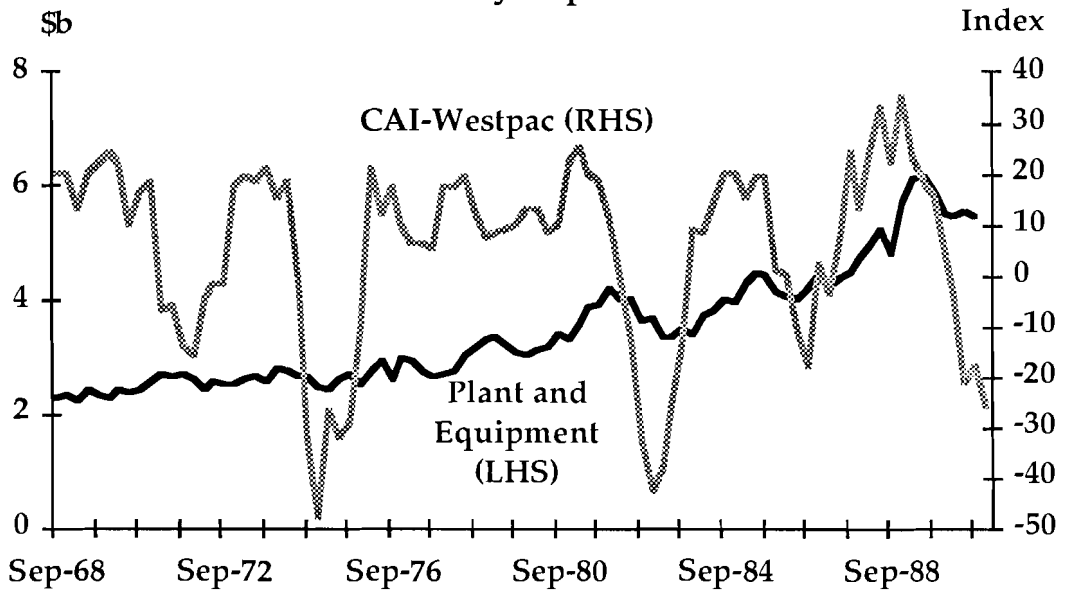
	HIA	Finance	Approvals
HIA Net Sales	1.2	1.1	0.4
Finance	3.8*	5.1*	1.2
Approvals	2.6*	0.8	6.7*

Note: The system is estimated using monthly data over the period 1983(8) to 1986(6), (71 observations), with six lags. Otherwise, notation conforms to that in previous tables.

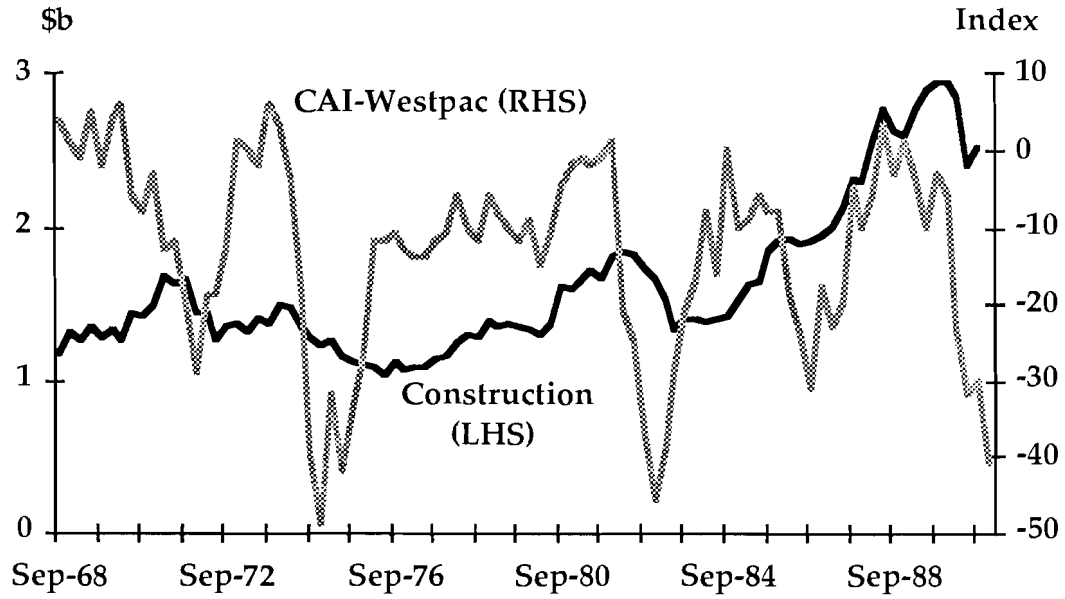
(b) Business Investment

The main partial indicators of business investment are provided by two surveys of investment intentions, the ABS Capital Expenditure survey (CAPEX) and the CAI-Westpac survey of the manufacturing sector: each survey is conducted quarterly. In the ABS survey, respondents are asked to report their investment intentions in value terms, allowing their responses to be aggregated to obtain an estimate of the total. Generally this has been found to result in underestimates of investment, and for forecasting purposes the figures are usually adjusted to compensate for this. The CAI-Westpac survey follows the somewhat simpler procedure of asking businesses whether they expect their investment levels in the coming year to rise, fall or stay the same. An index of investment intentions is then obtained by taking the difference between the proportion of respondents expecting a rise, and the proportion expecting a fall. This difference is referred to as the net balance (see Graphs 10 and 11).

Graph 10: Plant and Equipment Investment and Survey Expectations



Graph 11: Non-Residential Construction and Survey Expectations



Two features of the ABS survey make it difficult to translate the numbers directly into quarterly forecasts. The first is the structure of the reporting cycle, whereby expectations are reported only as half-year and annual totals; this means that in two quarters out of four a direct quarterly forecast can be inferred by deducting the relevant quarterly outcome from the half-year forecast, while in the other two cases only the half-year figure is available. Moreover, these figures are not adjusted for under-reporting bias or seasonal factors. Secondly, the CAPEX expectations are forecasts of CAPEX outcomes, rather than national accounts outcomes, for business investment. This second problem is relatively minor in the case of equipment investment, where the two series are similar, but is quite serious for construction, as will be discussed further below.

In view of the complications referred to above, the forecasting equations to be estimated are set up as follows. First, business investment is divided between its equipment and construction components. For each component, quarterly CAPEX forecasts are constructed for the quarters where direct forecasts are not available, by simply halving the half-year forecasts. Forecasting equations are then set up, using the relevant survey variables to predict investment outcomes. In the case of construction investment, a series on non-residential building approvals is also included. The equations are estimated in non-seasonally-adjusted nominal terms, since that is the form in which the forecasts are expressed; seasonal dummies are included to allow for possible seasonality in the prediction errors. Results for the two sets of forecasting equations are presented in Tables 9 and 10.

Table 9: Plant and Equipment Investment Forecasting Equations

Independent Variable		
CAI/Westpac (Lags 1 to 4)	CAPEX Forecast (Lag 1)	CAPEX Forecast (Lags 1 to 4)
1.13		
1.76		2.80*
	17.36*	

Note: The table shows F-statistics for the null hypothesis that the relevant coefficients are zero. The data period is 1975(2) to 1988(4), (55 observations). The dependent variable in each case is the nominal quarterly growth of plant and equipment investment (national accounts basis, n.s.a.). All equations include four lags of the dependent variable and seasonal dummies.

For plant and equipment investment (Table 9), the results indicate that CAPEX forecasts are significant predictors of investment, but that the CAI-Westpac index does not contain significant additional information. Indeed, if all information other than the first lag on the CAPEX forecast is excluded, the forecasting equation still has an R-squared as high as 0.92 (although it should be noted that much of the explanatory power is contributed by the seasonal dummies). In the case of construction however (Table 10) both the CAPEX and CAI-Westpac forecasts performed poorly. Building approvals do appear significant, with a peak lag coefficient coming at three quarters, suggesting quite long average implementation lags in construction projects. It would appear that the poor performance of the CAPEX construction forecast is due largely to the lack of correlation between the national accounting and CAPEX estimates of actual investment outcomes. In other words, the CAPEX forecasts are useful for predicting CAPEX outcomes, but not national accounting outcomes.[4] This is evident from the last equation reported in Table 10, which shows that when the dependent variable is the CAPEX measure of construction investment, rather than the national accounts measure, the forecasts are highly significant.

[4] The two series differ partly for reasons of coverage, and partly because the CAPEX survey records investment spending, whereas the national accounts series are a measure of the value of work done.

Table 10: Construction Investment Forecasting Equations

Dependent Variable	Independent Variables: CAI/Westpac (Lags 1 to 4)	Construction Approvals (Lags 1 to 4)	CAPEX Forecast (Lag 1)	CAPEX Forecast (Lags 1 to 4)
Construction (National Accounts basis, s.a.)	2.76*			
Construction (National Accounts basis, n.s.a.)	2.90*			
		4.20*		
	0.60	1.61		
				1.83
Construction (CAPEX basis, n.s.a.)			32.86*	
				10.53*

Note: All equations include four lags of the dependent variable. Seasonal dummies are included in all equations except the first. Data are not seasonally adjusted except for the dependent variable in equation 1. The data period is 1975(2) to 1989(2), (55 observations). Asterisks denote significance at the 5 per cent level.

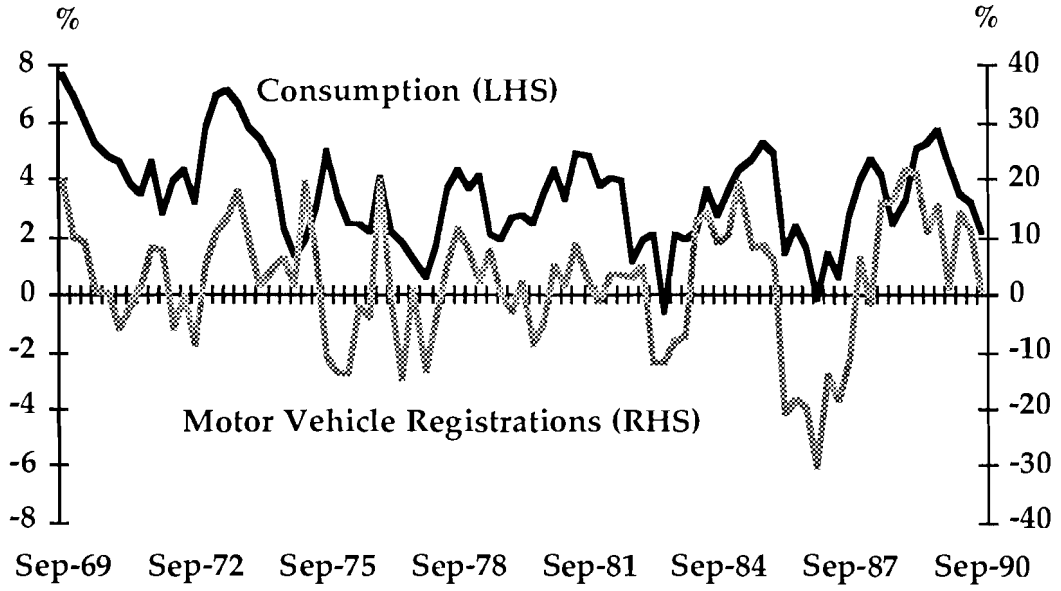
This last qualification aside, the above results suggest that good forward indicators are available for both major components of investment spending. The study has not addressed the accuracy of the longer-range forecasts (out to seven quarters ahead) which are also reported in the CAPEX surveys. However, a recent study by Brennan and Milavec (1988) suggested that these longer-range forecasts are much less accurate, and that their prediction errors could not be accounted for by unexpected developments in other economic variables. Taken in conjunction with the results reported here, this would imply that the main usefulness of the CAPEX forecasts is in short-term forecasting, particularly the next quarter ahead.

(c) Consumption

Three main partial indicators of consumption are in common use; retail trade, motor vehicle registrations and the index of consumer sentiment: all are published monthly. The first two are components of aggregate consumption spending, comprising about 40 per cent and 4 per cent of the total respectively. Being such a large proportion of the total, retail trade data convey important information for the purely mechanical reason that they are available with shorter publication lags than the national accounts (about two months). Unfortunately, however, the interpretation of these figures is hampered by the presence of considerable month-to-month variation, which is especially evident during the past four years. This is mainly a consequence of problems in seasonal adjustment, caused for example by frequent changes to the timing of school holidays, which have had a significant effect on the seasonal pattern of consumer spending. Motor vehicle registrations are considered a useful indicator because of their relatively short publication lags, and because this is probably, together with household durables, one of the principal areas of consumption which is sensitive to policy change (see Graph 12).

Graph 12: Consumption and Motor Vehicle Registrations

Year-Ended Percentage Change



The Melbourne Institute's Index of consumer sentiment reports results of a consumer attitude survey containing five questions on a variety of topics, including the respondent's present and expected financial position, and the suitability of the present time for major household purchases. The index is constructed from balances of favourable over unfavourable responses averaged over the five questions.

Estimates from the forecasting equations using the three indicators are reported in Table 11. These suggest fairly unambiguously that motor vehicle registrations contain significant leading information about aggregate consumption. Estimates of individual lag coefficients show the strongest effect occurring at a lag length of two quarters. Neither retail trade nor the consumer sentiment index is found to add significantly to predictive power. These results should not however be taken as detracting from the usefulness of the retail trade data in the mechanical sense referred to above.

Table 11: VAR Model for Consumption Growth (four lags)

	Con.	RT	CS	MVR
Consumption	2.7*	0.7	0.9	3.2*
Retail Trade	2.8*	0.9	0.1	3.2*
Consumer Sentiment	1.4	0.6	0.7	0.4
Motor Vehicle Registrations	0.9	1.2	2.5	0.7

Note: Notation and data period are as in Table 7.

(d) Labour Market

Monthly labour market indicators of employment and job vacancies are among the most quickly published indicators of the real economy. Publication lags are usually less than two weeks, compared with six to eight week delays for retail sales and the monthly housing indicators. Employment data are obtained from the ABS labour force survey, while monthly job vacancies figures are provided by the ANZ bank from a survey

of job advertisements in major newspapers.[5] Comparisons between employment and GDP, vacancies and employment, and vacancies and GDP, are shown in Graphs 13, 14 and 15 respectively.

Major slowings in employment growth occurred in 1974 and 1982 (Graph 13). In the former case, the slowing clearly preceded a slowing in GDP growth, whereas in 1981, employment moved together with, or slightly behind, output. The difference between the two cases can probably be attributed, at least in part, to the differing behaviour of real wages in the two cycles. In the 1974 episode, major real wage increases occurred much earlier, relative to the cycle in GDP, than was the case in 1981. The milder slowing in employment growth which occurred in the second half of 1986 provides a further perspective on the issue. With real wages remaining fairly constant through the cycle, the slowing in employment growth followed that of real GDP by two or three quarters. The ANZ job vacancies series appears to have acted as a reasonably good forward indicator of trends in employment (Graph 14). Job vacancies led the downturn in employment growth in both 1981 and 1986.

Estimated forecasting equations summarised in Table 12 suggest that the ANZ vacancies series is a significant predictor of both GDP and employment. In the GDP equations the first quarterly lag is highly significant, a result which seems fairly robust to changes in the number of lags included. The employment equation is estimated using monthly data and shows the vacancies coefficients to be jointly significant when up to nine lags are included, with the highest coefficient occurring at a lag of three months.

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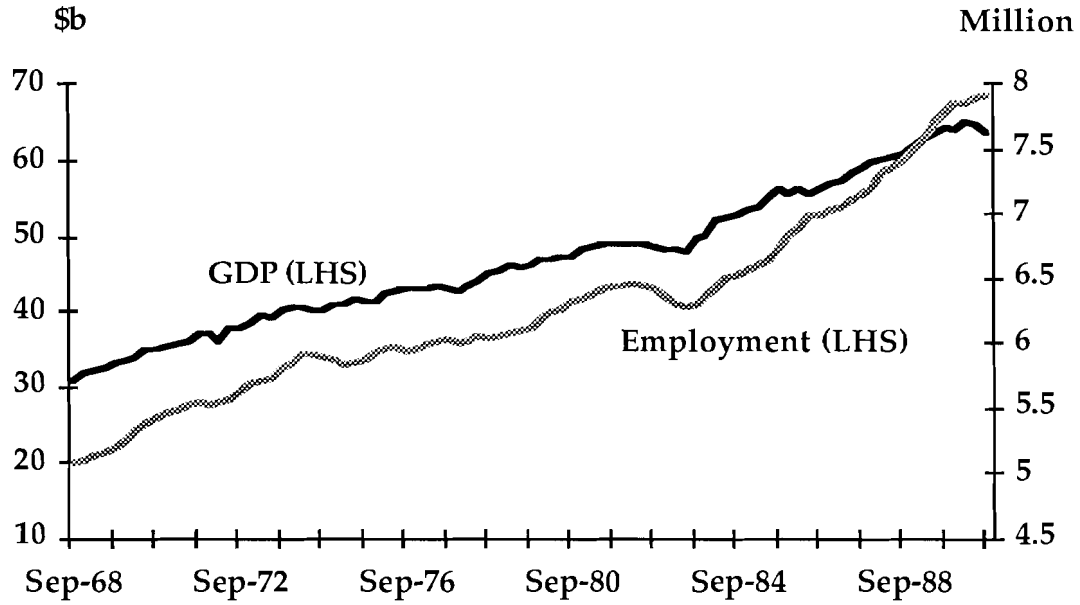
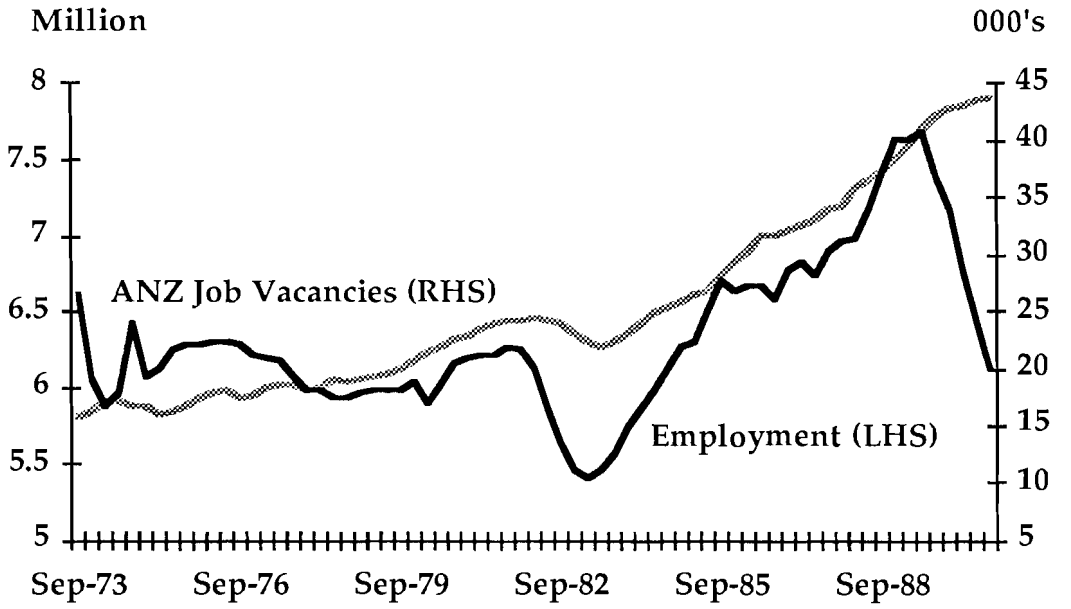
[5] A quarterly survey of job vacancies is also published by the ABS, but is not studied here.

Graph 13: GDP and Employment



Graph 14: ANZ Job Vacancies and Employment



Graph 15: GDP and ANZ Job Vacancies

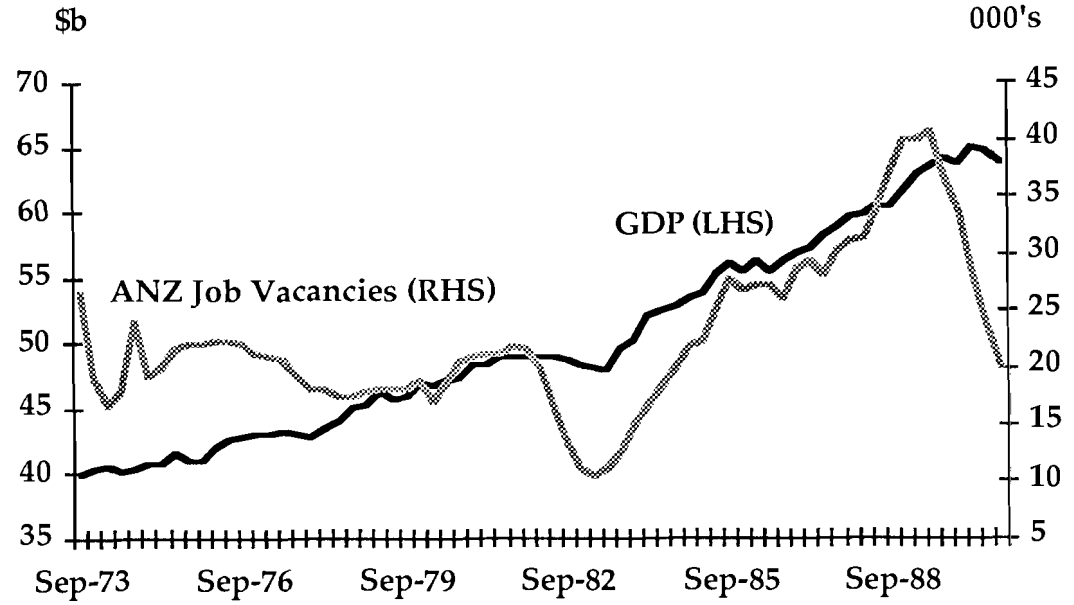


Table 12: GDP and Labour Market Indicators

Dependent Variable	Data Frequency	Number of lags	Independent Variables Vacancies	Employment
GDP	quarterly	4	4.75*	0.53
		3	4.90*	1.28
		2	5.12*	0.03
		2	5.47*	
		1	9.03*	
Employment	monthly	9	2.51*	
		6	2.85*	

Note: All equations are estimates with lagged dependent variables. Data periods are 1974(1) to 1989(2) for quarterly equations, and 1978(9) to 1989(6) for monthly equations. Asterisks denote significance at the 5 per cent level.

5. SUMMARY AND CONCLUSIONS

The paper has reviewed the performance of a selection of indicators judged to be in common use in analysing the business cycle in Australia. The approach taken does not in any sense attempt to construct optimal forecasting rules using these indicators, but has the more limited aim of assessing which indicators contain information that is useful for short-term forecasting. This question was addressed in two stages, looking first at relationships between major expenditure aggregates, and secondly at the information contained in various partial indicators.

On the first issue, results were found to be very sensitive to the way the tests were set up. The most general VAR specifications showed little evidence for any non-contemporaneous relationships between the variables included. More restricted models did however suggest some significant leading and lagging relationships. For example, the housing sector appeared to lead GDP, while consumption, construction activity, and perhaps imports, lagged. These latter results also found some support in less sophisticated methods such as correlation analysis and visual inspection of turning points in the data, but the overall impression left by the evidence is that these relationships are somewhat unreliable, in the sense that the timing can vary from cycle to cycle.

On the second issue, the statistical results were much clearer. Significant forecasting power was found for partial indicators in all of the four areas studied. Of the indicators considered, local government building approvals and the ANZ job vacancies series appeared to be the most significant in providing forward information about income and spending aggregates.

APPENDIX: DATA SOURCES

1. National Accounts

All national accounts data used for estimation purposes are from the National Income and Expenditure (ABS 5206.0) release for June quarter 1989. Graphs, however, use data from the September quarter 1990 release. With the exceptions noted in Tables 9 and 10, the variables are log-differences of the constant price seasonally adjusted quarterly series.

2. Housing

* Housing finance for owner occupation (ABS 5609.0), new dwellings, monthly, s.a., available from October 1975.
* Building approvals (ABS 8731.0), total, monthly, s.a..
* HIA net sales, published by the Housing Industry Association, available monthly from January 1983.

3. Investment

* CAI-Westpac survey, conducted jointly by the Confederation of Australian Industry and Westpac, published quarterly. The survey gives net balances of respondents expecting an increase in investment spending in the coming quarter, with separate questions relating to plant and equipment investment and investment in buildings and structures.
* Capital expenditure survey (ABS 5626.0).
* Non-residential building approvals (current price values, monthly, n.s.a.) are taken from the ABS Building Approvals release (ABS 8731.0).

4. Consumption

* Retail Trade (ABS 8501.0), quarterly constant price, s.a. series.
* Motor Vehicle Registrations (ABS 9301.0), number of motor cars and station wagons registered, monthly, s.a..
* Consumer sentiment index, published by the Melbourne Institute of Applied Economic and Social Research, n.s.a..

5. Labour Market

* Labour force (ABS 6202.0), number employed, monthly, s.a..
* ANZ job vacancies series is a survey of the number of job advertisements appearing in major newspapers, published monthly by the ANZ bank.

All series are used in log-differenced form apart from the CAI-Westpac net balances, which are differenced in levels. Monthly series are aggregated into quarterly totals when used in quarterly regressions. A print-out of data used is available from the authors on request.

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