

Warehouse rent predicts aggregate demand **Viewpoint**

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WAREHOUSE RENT, LEADING INDICATOR OF AGGREGATE DEMAND

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SUMMARY The industrial sector captures a significant component of economic activity as it often houses the stock of goods that form part of inventory. Cross-correlations computed show that the indicative net effective rent for most capital cities are in fact leading indicators for some key Australian macro economic demand variables.

INTRODUCTION

An interesting feature of the role of a Research Analyst is to examine how changes in the domestic and global economies affect key indicators such as rents, yields and vacancy in the office, retail and industrial markets. Analysing trends in GDP and employment for example, reveals interesting insights into the key drivers of the sales and leasing markets.

A factor sometimes overlooked is that some property data collected may reveal more about the behavior of the macro economy than vice versa. In particular, industrial markets may signal upcoming changes in demand in the general economy. Industrial warehouses store large amounts of goods and changes in stock levels affect demand. Whilst data collections on stock availability and thus vacancy rates are unavailable, CBRE's extensive collection of net face rental data in grade A warehouses across the major capital cities may act as a leading macro economic indicator for future changes in economic demand.

In economic booms, tenants are likely to experience good current and future profitability, especially when consumer confidence and spending is strong. Tenants often actively seek to increase the stock of goods in their warehouses during periods of strong demand. In such times, landlords may charge higher rents due to

increased demand for warehouse space in order to extract part of the future profitability that will eventually accrue to tenants. During bad economic times, inventories may actually run down and empty spaces in warehouses may arise as tenants refuse to stock excess goods due to cost cutting, particularly when demand pressures are likely to be weak.

In this instance, whatever existing stock that is already there may remain and decisions to expand space may be postponed until economic circumstances improve. Landlords may respond in this situation by dropping or stabilising the net face rent that they charge tenants. They are also likely to increase incentives to attract tenants when vacancies arise resulting in the net effective rent falling.

The aim of this Viewpoint is to determine whether net effective rent is a good forward indicator of future changes in demand variables in the Australian Economy. Although rental data is a cost or input in the production process for producers who lease property, rental data may act as a signal for future profitability of tenants when viewed from the perspective of the landlord. Landlords that charge higher net effective rents for example potentially could be signaling to tenants that their future profitability levels may be higher since general macro economic demand conditions are likely to improve.

One way to test whether the net effective rent is a leading economic indicator is to compute cross correlations between this indicator and key Australian macro economic variables such as real GDP, the national unemployment rate, CPI inflation and the terms

of trade. Cross-correlations are computed by first removing the trend in each of these variables using regression methods discussed below. Once the trend was removed, the cyclical component was analysed for each of these demand variables with net effective rent for each of the main capital cities over the 1981-2009 quarterly time period.

To pre-empt the key findings, our results suggest that grade A warehouse net effective rents is a good leading indicator for most macro economic demand variables for each of the main capital cities. Industrial rental data collected by CBRE therefore could potentially reveal useful future insights into the movement of the general economy. This makes the data valuable as it can be used as a leading indicator to forecast demand variables in economic models.

TIME SERIES DECOMPOSITION METHOD: COMPUTING CROSS-CORRELATIONS

A number of established methods can be used to compute cross-correlations. The most important fact that needs to be conceded at the outset is that economists rarely use raw data and 'built in' excel statistical functions to compute cross correlations. Raw data consists of the trend, cyclical components and measurement errors. If cross correlations were computed but without trend removal, any findings would be spurious or incorrect as typically the trend component does not capture the underlying demand and supply mechanics that form part of market forces.

This is because the trend captures the general direction of an economic variable, where direction could be moving upwards for a long period of time or downwards.

Therefore, removing the trend is vital as this would leave the cyclical component, which broadly captures any underlying market forces in any cross-correlations that exists between the variables. This cyclical component typically involves random upward and downward shifts in data over time. Economic data, such as real GDP, can usually be expressed in

trend terms on a diagram when plotted in its original level form against time. However, it can be expressed in its cyclical component once the trend is removed in some way. The easiest way to do the cyclical plot is convert data in log-linearised growth rates over time, but economists prefer to use other methods as described below.

Further, 'built in' excel statistical functions of cross-correlations do not capture the leads and lags in the data. Standard econometric software packages do however calculate these leads and lags. This information is important as it helps to determine whether one economic variable is a leading or lagging indicator of another.

A leading economic indicator in an upswing is a variable whose growth rates peak earlier than another variable. In a downswing, the leading indicator troughs or bottoms out earlier than another variable. Quite often, the naked eye is used to identify which variable leads or lags depending on the behaviour of the peaks or troughs of the two data sets being examined. Typically, raw data is converted into growth rates and a standard two variable excel chart is used to determine which is the leading indicator.

Economists typically use this 'graph' method' as a preliminary first step of determining whether or not one variable leads or lags another. Sometimes however, the presence of too many peaks and troughs in the growth rates of the two variables being examined makes naked eye assessments difficult.

Quantitative methods are needed to determine the nature of the cross-correlations. Variables that move in the same direction are positively correlated and those that move in the opposite direction are negatively correlated. The closer the correlation is to 1, the more strongly the variables are positively correlated. A strong degree of negative correlation implies computed cross correlation very close to -1.

Generally, correlations are computed for various leads and lags. These leads and lags are denoted

in the notation $\text{Corr}(Y_t, X_{t+i})$ where:

Corr = correlation, 'i' are time periods; $i = -4, -3, -2, -1, 0, 1, 2, 3$ and 4 .

Thus, the subscript 'i' denotes the various leads and lags. Variables 'Y' and 'X' are the two variables of interest where the trend in the data is removed. Lags are denoted by $i = 4, i = 3, i = 2$ and $i = 1$ If $i = 3$, then $\text{Corr}(Y_t, X_{t-3})$ measures the amount by which variable 'Y' lags variable 'X' by three time periods. As quarterly data is used in this analysis, 'Y' lags variable 'X' by three quarters in this case.

Leads are denoted by $i = -4, i = -3, i = -2$ and $i = -1$ since for example, $\text{Corr}(Y_t, X_{t+i})$ for $i = -4$ gives $\text{Corr}(Y_t, X_{t+4})$, implying that variable 'Y' leads variable 'X' by four quarters. When $i = 0$, $\text{Corr}(Y_t, X_t)$ measures the amount of correlation in the current period 't' called the contemporaneous correlation. Thus, the analysis computes nine cross-correlation values, four each for the leads and lags and one for the contemporaneous value.

The actual formula for the cross-correlation at time period t is:

$\text{Corr}(Y_t, X_t) = \text{Cov}(Y_t, X_t) / (\text{stdev}(X_t)(\text{stdev}(Y_t)))$ where: 'Cov' measures the covariability between variables 'Y' and 'X' at time period t, and 'stdev' measures the standard deviation.

Deciding whether variable 'Y' leads, lags or is contemporaneously (positively or negatively) correlated with variable 'X' involves a two step process. The first step involves determining the absolute value of the nine computed cross-correlations. In the second step, the sign of the actual value at this located point from the first step determines if the variables are positively or negatively correlated. An actual example can clarify this statement. Diverting from the main point briefly, recall from high school algebra that if 'a' is any real number, its absolute value $|a| = a$ if $a > 0$ and $|a| = -a$ if $a < 0$. Thus $|-7| = 7$ and $|7| = 7$.

Now suppose for example, $\text{Corr}(Y_t, X_{t-4}) = 0.06$, $\text{Corr}(Y_t, X_{t-3}) = -0.13$, $\text{Corr}(Y_t, X_{t-2}) = 0.25$, $\text{Corr}(Y_t, X_{t-1}) = -0.36$, $\text{Corr}(Y_t, X_t) = -0.01$,

$\text{Corr}(Y_t, X_{t+1}) = 0.37$, $\text{Corr}(Y_t, X_{t+2}) = -0.38$, $\text{Corr}(Y_t, X_{t+3}) = -0.13$, and $\text{Corr}(Y_t, X_{t+4}) = -0.21$.

The largest absolute value occurs when $\text{Corr}(Y_t, X_{t+2}) = 0.38$. Therefore, variable 'Y' leads variable X by two quarters. In the second step, since the actual [and not absolute value] at this located point is -0.38 , the variables are negatively correlated. In the example above, we have assumed variables 'Y' and 'X' have had their trend variables removed.

In our analysis below, we specify how the trend is removed. A number of standard macro economic techniques exist to undertake this such as filtering to remove the trend.

This viewpoint uses an approach popular in the late 1970's and early 1980's called time series decomposition. This approach assumes that the trend component in any variable can be captured by the past lags in an economic variable. The cyclical component, is captured by the residuals. Both the trend and residuals are highlighted in standard regression models for example:

$$(1) B_t = a_0 + a_1 B_{t-1} + a_2 B_{t-2} + z_t$$

$$(2) C_t = d_0 + d_1 C_{t-1} + d_2 C_{t-2} + v_t$$

where B and C are the two variables of interest. Trend is captured by the respective lagged values of B and C at time periods 't-1' and 't-2' in equations (1) and (2). The random disturbance or error terms 'z' and 'v' capture the residuals or cyclical components. Equations (1) and (2) are estimated using maximum likelihood estimation and the residuals are used as the basis to compute the cross correlations: computations are done for net effective rent against the terms of trade, GDP, unemployment rate, and CPI Inflation variables.

RESULTS

After undertaking the process described above, the overall results suggests that rent is a leading positive indicator ranging between one to four quarters for the GDP, inflation and terms of trade variables for most states; with correlations ranging

from 0.19 to 0.37 over the quarters from March 1981 to September 2009. Further, real net effective rent is potentially a better leading indicator of aggregate demand using the national unemployment rate as a measure than real GDP. For example, the national unemployment rate is a leading negative indicator for real net effective rent, ranging between one to three quarters across most states, with correlations between -0.27 to -0.38.

Examining each of these variables in turn, stronger economic growth implies stronger demand and income, and thus, the greater the ability of tenants to pay higher rents desired by landlords. Findings in Table 1 show that real GDP is mildly correlated with rents; correlation is relatively stronger in Melbourne (0.23), Sydney (0.21) and Adelaide (0.20) than in Brisbane (0.14) and Perth (0.12). A much stronger positive relationship was not obtained because it is likely that some components of GDP, such as investment, may be too volatile and thus obscure any positive relationship between the indicators.

Net effective rent leads GDP in Sydney, and Melbourne by one to two quarters but lags by one to three quarters in the rest of the other states examined in the paper.

This suggests that movements in real net effective rent in Melbourne and Sydney maybe a leading indicator of the possible presence of an upcoming Australian recession.

For example, when the economy registered two consecutive quarters of negative real GDP growth and fell into recession in September 1990, real net effective rent had already started to fall in Sydney from \$146/sq m in December 1989 to \$140/sq m on September 1990. Real net effective rent proceeded to keep on falling until it reached its bottom at \$105/sq m in December 1994, continuing to fall well after the economic recovery that followed the downturn.

Moreover, findings indicate that the unemployment rate is negatively related to net effective rent. When

the economy is sluggish, lower GDP growth and higher unemployment occurs.

Tenant profitability falls and thus, landlords may potentially lower net effective rents to alleviate financial stress. In good times, the opposite is true and higher net effective rents are associated with lower rates of unemployment. In either case, only the data can reveal whether the national unemployment rate leads or lags rent in booms or recessions since economic theory does not usually provide any guidance on which is the leading or lagging indicator. Theory and intuition can only reveal whether variables are positively or negatively related.

Correlations suggest that net effective rent leads the national unemployment rate by one to three quarters in Sydney, Melbourne and Adelaide. In Perth, net effective rent is contemporaneously correlated with unemployment. Stronger negative correlation was recorded over the quarters from March 1981 to September 2009 for Melbourne and Adelaide (-0.38) than Sydney (-0.29), Perth (-0.27) and Brisbane (-0.14).

Both real GDP and unemployment variables are quantity variables. Since rent encapsulates pricing information, the overall results suggest that it is also a very useful signal for future price changes in the general economy. Since rent is an input, cost incurred by tenants, an increase in rents can be potentially passed onto consumers by increasing the sales price charged to them to recover these input charges.

The results suggest that rents and national CPI inflation are positively correlated for all states, with rent leading inflation for Sydney, Brisbane and Adelaide by one to three quarters. Industrial grade A warehouse rent in Brisbane in particular, is a leading indicator of CPI inflation. Rent lags national CPI inflation in Perth and Melbourne, suggesting that landlords are more likely to take into account movements in capital city CPI measures in their rental pricing decisions than in the other states.

Interestingly, the fact that rent is leading and positively correlated to national CPI inflation in Sydney (0.33), Adelaide (0.30) and Brisbane (0.25) may suggest the rental behaviour may provide an insight to the conduct of future monetary policy. Rising inflation is a key determinant in whether the RBA takes action to raise the interest rate.

As rising industrial warehouse rent in these three states precedes the increase in national CPI inflation, industrial rent changes may signal that future inflation increase is likely and thus, monetary policy tightening in response to this may also be on the way. Finally, the terms of trade summarises the ratio

of export to import prices. A rise in the terms of trade implies export prices are rising more than import prices, suggesting that domestic Australian producers are receiving greater income and profitability. Thus, tenants who export are likely to be asked to pay higher rent than those that do not. For most states, rent is positively correlated to the terms trade and is a leading indicator.

Perth is an exception. Western Australia is a large mining state that imports a lot of its capital goods; these need to be kept in industrial space before being transported to the resources fields. As mining companies are likely to pay a large amount to get

Table 1: Correlations in grade A warehouse rent with key macroeconomic variables

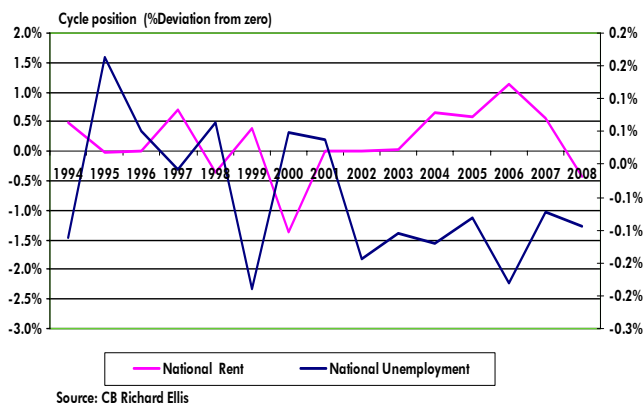
Real Net Effective Rent in (capital city X)	GDP	National Unemployment rate	National CPI inflation	Terms of trade
SYDNEY	leads GDP by 2 qtrs (0.21)	leads by 1 qtr (-0.29)	leads by 1 qtr (0.33)	leads by 2 qtrs (0.37)
MELBOURNE	leads by 1 qtr (0.23)	leads by 1 qtr (-0.38)	lags by 4 qtr (0.21)	leads by 1 qtrs (0.25)
BRISBANE	lags by 3 qtrs (0.14)	lags by 1 qtr (-0.14)	leads by 1 qtr (0.25)	lags by 1 qtr (0.33)
ADELAIDE	lags by 1 qtr (0.20)	leads by 3 qtrs (-0.38)	leads by 3 qtrs (0.30)	leads by 1 qtr (0.19)
PERTH	lags by 1 qtr (0.12)	contemporaneous (-0.27)	lags by 3 qtrs (0.14)	leads by 4 qtrs (-0.18)
NATIONAL	lags by 1 qtr (0.23)	leads by 1 qtr (-0.20)	contemporaneous (-0.23)	leads by 2 qtrs (0.18)

its big items imported, tenants of industrial warehouses that process these goods may receive greater profits from their mining clients for processing these goods.

Landlords may take advantage of this by charging higher rental values to tenants with mining clients. Further, since Perth is geographically isolated, storing goods may be relatively more expensive than in the eastern states where industrial markets are more geographically closer and more competitive in terms of providing greater shed size and more flexible lease prices.

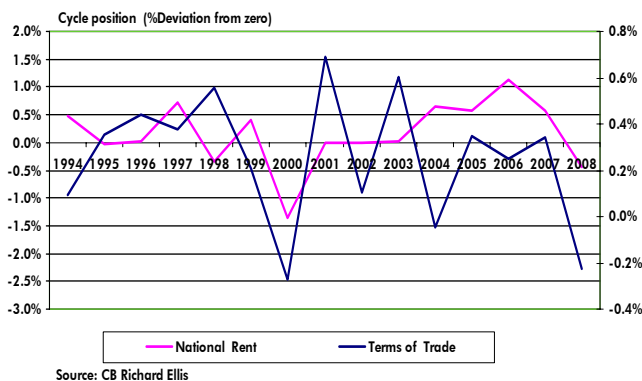
In addition to the capital city series, a national rent series was created using industrial supply to weight the five rental series and then combine them together to form the national series. Cross-correlations were computed between this variable and the four demand variables and results are presented in Table 1. The national rent series is a leading indicator of the national unemployment rate by one quarter and negatively correlated (-0.20). This finding supports the earlier results for each of the capital city series (see Figure 1).

Figure 1: National Industrial Warehouse Grade A cyclical rent leads the national unemployment rate



Likewise, national rent is a leading positive indicator of the terms of trade (Figure 2). It is however, a lagging indicator of real GDP.

Figure 2: National Industrial Warehouse Grade A cyclical rent leads the terms of trade



Interestingly, the national series is contemporaneously related to CPI inflation, thus providing prima facie evidence that it may be a good predictor of monetary policy intention. However, inflation and rent are negatively related, contradicting the results of the earlier findings for some of the capital city results. This suggests that aggregating data masks important distributional effects of rent on inflation. Therefore, users of industrial rental data in economic models are advised that aggregation should be conducted with some caution.

CONCLUSIONS

This viewpoint found that real net effective rent in most states for industrial warehouse grade A is a leading indicator for demand variables. In particular, changes in rent precede changes in the national unemployment rate and CPI inflation. This suggests that leasing information in the industrial sector provides potential information for the state of aggregate demand and inflation in Australia's macro economy.

In Sydney's case, rent was a leading indicator for all four demand variables in the analysis. Specifically, rent was a leading indicator of national CPI inflation, suggesting that positive movements in rent may act as a potential indicator of the future conduct of monetary policy.

This study therefore recommends that greater attention should be paid towards collecting a broader set of statistics in the Australian industrial sector as it may reveal further important insights into the Australian economy.

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