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# THE CHANGING STOCK CYCLE IN AUSTRALIA<sup>1</sup>

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## INTRODUCTION

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Traditionally, fluctuations in firms' stocks have played a key role in shaping the business cycle in industrialised economies. While changes in stocks – that is, inventory investment – account for only a very small part of the level of Gross Domestic Product (GDP) they play an important part in explaining changes in the level of GDP. In Australia, over the past thirty years, quarterly changes in inventory investment have, on average, accounted for around half of the quarterly change in GDP. Over the past decade, however, the nature of the stock cycle appears to have changed; it has become less pronounced and accounts for a smaller part of the business cycle. This article examines the changing nature of the stock cycle in Australia. It begins by exploring the way in which stocks react to expected and unexpected changes in demand. It then looks at how these relationships have changed through time. Finally, it discusses the implications of these changes for the behaviour of the business cycle.

## THE STOCK CYCLE

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Economists have long viewed stocks as a buffer against changes in sales. If firms wish to keep production constant in the face of variable sales, temporary rises or falls in sales will be met entirely out of stocks. In this extreme case, changes in demand do not generate a business cycle as they are completely offset by inventory investment. This is the case whether fluctuations in demand are anticipated or unanticipated. In a less extreme case, however, where the level of stocks is of concern to the firm, the implications are somewhat different.

When a decline in sales is expected, a firm that has a desired stocks to sales ratio is likely to want to reduce its level of stocks. Production may fall, not only because demand is lower but also because the firm wishes to reduce its inventories. In contrast, an unexpected fall in sales is likely to cause an initial increase in stocks, given that production decisions are generally made before demand is known. In time, however, production will be cut back even more sharply than the initial fall in sales, in order to eliminate the unanticipated build-up in stocks and to achieve a lower level of stocks in line with lower sales. In this way, the stock cycle might

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1. This article is based on a paper by D. Flood and P. Lowe, 'Inventories and the Business Cycle', Reserve Bank of Australia Research Discussion Paper No. 9306.

actually amplify the business cycle when unexpected changes in demand occur.

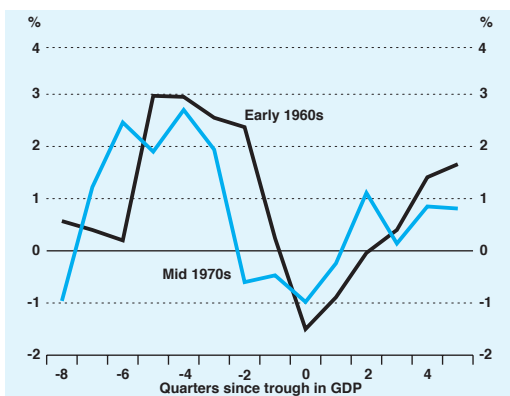
Although it is difficult in practice to distinguish between unexpected and expected fluctuations in demand, the behaviour just described is apparent in Australian business cycles. Graph 1 shows inventory investment as a percentage of domestic final demand during the business cycles in the early 1960s and mid 1970s.<sup>2</sup> The reference point '0' on the bottom axis represents the trough in GDP. It is clear that inventory investment followed quite a marked cyclical pattern. A sharp

increase in inventory accumulation occurred as demand slowed, delaying the impact of changes in demand on production. In subsequent quarters, production was cut sharply in an effort to reduce the unwanted build-up in stocks. This can be seen in the large decline in inventory investment and the reversal of the rising trend in the stocks to sales ratio in the middle stages of the cycle to sales ratio in the middle stages of the cycle (see Graph 2)<sup>3</sup>.

Although the impact on stocks of unexpected falls in demand was clear during these earlier episodes, the behaviour of stocks

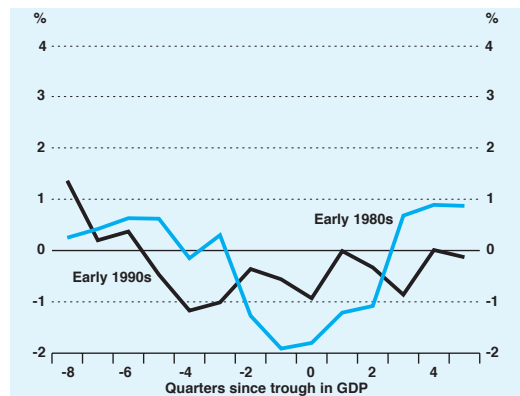
**GRAPH 1**

**STOCK CYCLES: EARLY 1960s & MID 1970s**  
Increase in Stocks, % of Domestic Final Demand



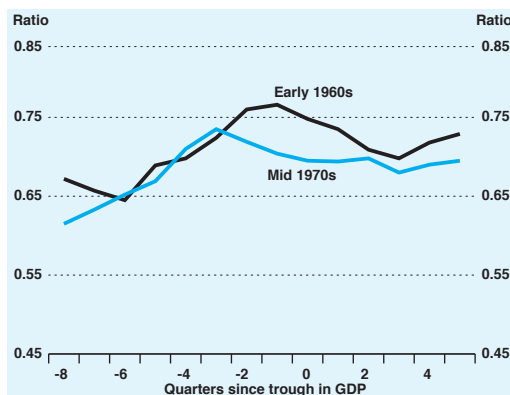
**GRAPH 3**

**STOCK CYCLES: EARLY 1980s & EARLY 1990s**  
Increase in Stocks, % of Domestic Final Demand



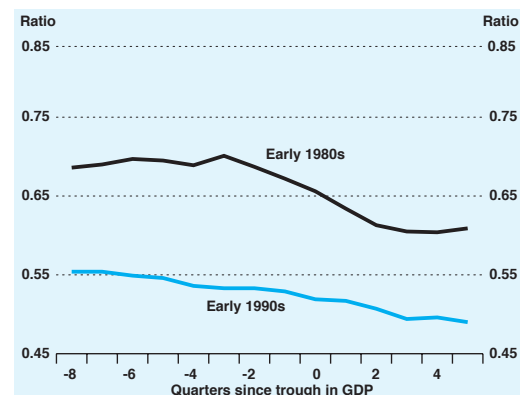
**GRAPH 2**

**STOCKS TO SALES RATIOS: EARLY 1960s & MID 1970s**



**GRAPH 4**

**STOCKS TO SALES RATIOS: EARLY 1980s & EARLY 1990s**



2. Domestic final demand is used as the denominator here since, unlike GDP, it excludes changes in inventories.
3. The denominator of the stocks to sales ratio in Graphs 2 and 4 is the sum of gross non-farm product, endogenous imports and imports of services, less changes in private non-farm stocks. The stocks to sales ratio shown in Graph 5 is the new ABS definition of the ratio, which excludes services from the denominator.

in the two most recent downturns was quite different (Graphs 3 and 4). At no stage were stocks allowed to run up substantially as demand slowed. Instead, inventory investment declined as demand declined, recording a relatively lengthy period of disinvestment before making a modest recovery. Similarly, the stocks to sales ratio declined gradually throughout both periods, without showing the initial unwanted build-up evident in the earlier cases. Firms were somehow able to adjust production in response to slowing demand more quickly than during the 1960s and 1970s.

The impact of these changes in the inventory cycle on GDP growth is demonstrated in Table 1. The first two columns show, respectively, the peak-to-trough movement in GDP during each business cycle and the contribution of non-farm stocks to that movement. The third and fourth columns show corresponding figures for the first year of recovery.

During the first two episodes, the impact of stocks was large relative to the overall change in GDP, both during the downturn and during the first year of recovery. More recently, however, the impact of stocks on the business cycle has been reduced.

Another picture of the changed nature of the inventory cycle can be obtained using data from the ACCI-Westpac Survey of Industrial Trends, which allows some measure of expected and unexpected changes in demand and stocks to be identified. Amongst other

questions, this survey asks manufacturing firms whether they expect new orders, stocks of finished goods and stocks of raw materials to increase, decrease or remain unchanged over the following quarter. The survey also records actual changes over the previous quarter. From the responses it is possible to derive a measure of unexpected changes in orders and stocks by subtracting the net balance of firms expecting an increase in the quarter from the net balance actually experiencing an increase in that quarter.<sup>4</sup>

Table 2 presents the correlations between *unexpected* changes in orders and *unexpected* changes in stocks and between *expected* changes in orders and *expected* changes in stocks. Separate correlations are presented for each half of the sample period.

In the first period, the correlation between unexpected changes in demand and unexpected changes in stocks of finished goods is negative – that is, when demand is unexpectedly low, inventories are unexpectedly high. In the first instance, stocks act as a buffer for production. In the second period, the correlation is much smaller and insignificant. This suggests a change in inventory behaviour; unexpected changes in demand no longer have as pronounced effect on stock levels as they once did. Firms now adjust production more quickly than was the case in earlier decades.

Quicker adjustment is also suggested by the correlations for raw materials stocks. In the earlier period, unexpectedly low demand

**Table 1: Contribution of Stock Movements to Growth in GDP(I)**

Peak – Trough	Peak to Trough		First Year of Recovery	
	Change in GDP	Contribution From Stocks	Change in GDP	Contribution From Stocks
<b>Sept. 60 – Sept. 61</b>	-2.9%	-5.0%	+6.9%	+3.4%
<b>Mar. 74 – Sept. 75</b>	+1.6%	-4.0%	+4.5%	+2.5%
<b>Sept. 81 – June 83</b>	-2.4%	-2.3%	+9.9%	+2.9%
<b>Mar. 90 – Sept. 91</b>	-2.4%	-1.4%	+2.4%	+0.4%

4. The net balance is calculated by subtracting the percentage of firms expecting a decrease from the percentage expecting an increase.

**Table 2: Correlations Between Changes in Orders and Inventories**

Correlation Between:	Sept. 60 – Sept. 76	Dec. 76 – Mar. 92
<b>Unexpected changes in orders and unexpected changes in stocks</b>		
– Finished Goods	-0.57 *	-0.15
– Raw Materials	-0.12	0.23
<b>Expected changes in orders and expected changes in stocks</b>		
– Finished Goods	0.58 *	0.72 *
– Raw Materials	0.78 *	0.80 *

\* Indicates significantly different from zero at the 5 per cent level.

meant that firms found their stocks of raw materials higher than they had expected. More recently, this does not appear to have happened, with firms being more able to quickly adjust their stocks of raw materials in response to unexpected changes in demand.

The lower half of the table focuses on expected changes in demand and stocks. It shows that the correlations between expected changes in new orders and expected changes in both stocks of raw materials and stocks of finished goods are positive: when firms expect demand to increase they also expect their stocks to increase. There is no evidence that firms have a strong desire to smooth production and meet expected changes in demand out of stocks. Instead, when demand is expected to increase, both output and inventories are also expected to increase. This is consistent with firms trying to maintain a stable stocks to sales ratio. While the effects of unexpected demand changes on inventories have become more muted, the response to expected changes has increased.

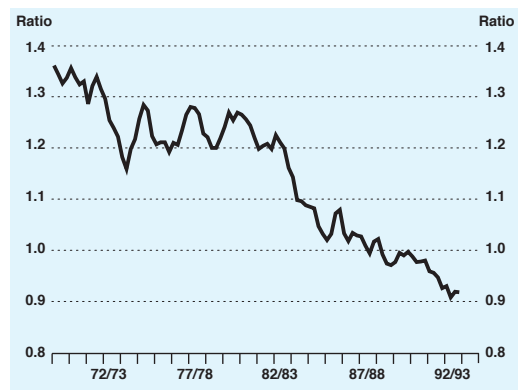
### INVENTORY MANAGEMENT AND THE STOCKS TO SALES RATIO

Inventory behaviour has shifted considerably compared with the 1960s and 1970s. Firms now seek to better align production with demand, and thereby reduce unintended movements in inventories. This

change has coincided with the adoption of ‘just in time’ inventory/production systems and the spread of computer-based technology allowing better monitoring of both stock levels and sales.

The improvement in stock control techniques has facilitated the other major change that can be observed in inventory behaviour in recent times: a lower average level of stocks relative to sales. This development has probably been motivated, at least in part, by the relatively high real interest rates through much of the 1980s. The decline of the stocks to sales ratio is shown in Graph 5.

**GRAPH 5**  
**STOCKS TO SALES RATIO**



This decline is, in itself, sufficient to account for some moderation of the stock cycle. The increase in stocks necessary to maintain a desired stocks to sales ratio, in the face of a given increase in sales, will be smaller the

lower is the target ratio. As mentioned, this development has occurred in conjunction with improved inventory management techniques. This has allowed a quicker production response to changes in demand and hence reduced the need for high levels of buffer stocks. These developments have acted to reduce the impact of inventories on the business cycle.

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## CONCLUSION

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Generally speaking, firms are not concerned primarily with insulating production from fluctuations in demand, but rather aim to alter both inventories and production *in line with changes in demand*. If substantial unanticipated

changes in stock levels occur, this approach tends to lead to an amplification of the business cycle. This appears to have been the case in Australia in the 1960s and 1970s. In more recent times, however, smaller unanticipated changes in inventories have occurred, leading to a more muted stock cycle.

An implication of this change is an altered business cycle. Any downturn in demand will impact on output more quickly since inventories will not act as a buffer to the degree that they once did. The path through the downturn, however, will be smoother to the extent that there are smaller unintended inventories to be run down. Finally, the impetus to growth from stock rebuilding as the economy comes out of the recession is also likely to be weaker. The latter effect has been a factor in the recent sluggish nature of the recovery of the Australian economy.