Business Investment: A Case Study of the Bubble in Japan and Australia:＊1

David Parker
The Treasury
Commonwealth of Australia

Abstract

The recent economic cycle in Japan and Australia display a number of common features. This paper analyses the determinants of business investment in Japan and Australia, including the effect of the Bubble. The major determinants of investment are found to be capacity utilisation and competitiveness. In addition, the Bubble is shown to have had an influence on investment, given that models estimated without bubble variables, or on a pre-Bubble sample, display sytematic under and over prediction during the Bubble and subsequent downturn. The transmission of the Bubble to investment appears to involves a number of channels, including through collateral effects in financial markets and on business confidence. It also appears that the Bubble experience changed the behaviour of firms. The models imply that a relatively extended period of weakness or slow growth in business investment can be expected in Japan, consistent with common expectations. It may be that the outlook for investment could actually be weaker than suggested by the models because they are unlikley to fully capture the change in behaviour associated with the Bubble. This could be a common feature of any model that displays structural instability through the Bubble period or which excludes bubble variables.

＊1 This article was originally prepared for the "Third Seminar on Fiscal and Monetary Policy," which was held from September to December,1994 by the Institute of Fiscal and Monetary Policy, Ministry of Finance, Japan.

Thanks are due to Tomotaka Kojima, Masamichi Kono and Meguru Shinoda, officers of the Ministry of Finance; Akitoshi Takatsuki of the Sakura Bank, Professor Mitsuaki Okabe of Keio University and Kenji Shigyoh of the EPA for helpful discussions. Kenji Shigyoh also provide some of the data used in the analysis.

I. Introduction

The Japanese economy has recently experienced one of the most severe economic downturns in modern times. The recession was both relatively long and deep, with significant falls in industrial production, increasing unemployment and falling inflation. The trough of the recession has recently been officially dated at October 1993. The recovery since then has been modest with only a slight upward trend in consumer spending and industrial production. Moreover, notwithstanding the general recovery, business investment and the labour market have not yet improved significantly. The general expectation is that the recovery in activity, and investment in particular, will continue to be slow by past standards. To a significant degree, the recession is seen as an inevitable result of the "Bubble economy" period between 1986 and 1990, and the macroeconomic policy responses to the Bubble. The Bubble period saw an extended period of economic growth, with high and rising asset prices and with very high levels of business investment. A significant part of that investment, both in office buildings and manufacturing capacity, now lies idle.

The recent economic cycle in Japan bears a number of striking similarities with that in several Western economies. In the case of Australia, only the country name and dates in the above description need to be changed to provide an accurate summary, together with the fact that the recovery in the Australian economy, which began in mid-1991, was slow for an extended period. Indeed, business investment continued to fall for an unusually long period into the general recovery in activity. Unemployment reached a post-Great Depression high some one and a half years after the recovery began and remained stubbornly high for a further year. More recently, however, economic growth in Australia has accelerated significantly, as business investment has begun to recover and unemployment has fallen.

In both the Japanese and Australian cycles, business investment played a crucial role in making the recessions "different" from previous episodes. This paper examines the role of business investment in economic cycles in Japan and Australia and includes quantitative analysis of the determinants of investment and the effect of the Bubble. This analysis forms the basis for some necessarily limited conclusions about the outlook for investment and consequential policy implications.

The parallels between the Australian experience and that presently unfolding in Japan are informative because of the similarity of the apparent causes of the cycle and the fact that the Australian cycle is a number of years ahead of the Japanese. However, some caution is required in pursuing this approach. The two economies are sufficiently different in terms of size, resource endowments, regulatory structure and (possibly) behavioural aspects to make overly close comparisons potentially misleading. In particular, while both countries are undergoing a process of structural change, the forces driving that change are different, and the issue of 'hollowing out' in the manufacturing sector is not presently relevant in Australia. Conversely, the world economic environment is now relatively more favourable than at a comparable stage of the Australian cycle.

The structure of this paper is as follows. The next section reviews the role of investment in economic cycles in Japan and Australia, with an emphasis on the most recent downturn. Section 3 presents a brief survey of the theoretical and empirical literature on the determinants of investment. Section 4 includes analysis of an equation for the determinants of investment in Japan and Australia and compares these with the results of some previous studies [1]. The data used in the study includes that available up to the second quarter 1994. Section 5 draws conclusions.

The main conclusions are that the Bubble was important in both countries. At least within the confines of the models estimated in this paper, it appears that the Bubble period involved a change in investment behaviour such that it would have been difficult to forecast the extent of the rise in business investment and the subsequent fall after the Bubble, even if a forecaster had prior knowledge of developments in land prices during and after the Bubble. The implications of the results of the models for the outlook for investment are also discussed briefly, with the conclusion that it is difficult to foresee a rapid rise in investment in Japan in the near future. Moreover, there is a possibility that models of investment may over predict the recovery, to the extent that they do not include or do not adequately capture the effects the bursting of the Bubble or the changed behaviour resulting from the Bubble experience.

II. Investment and Economic Cycles in Japan and Australia

At the outset, it is important to note one difference in terminology between Australian and Japanese statistics. In English translations of Japanese statistics, the term "plant **and** equipment investment" refers to private sector investment in machinery, equipment and non-residential construction. In contrast, in Australia and a number of other countries, "plant and equipment investment" is used to refer only to private sector machinery and equipmentinvestment. To avoid possible confusion, this paper will use the term "business investment" when referring to private sector investment on machinery, equipment and non-residential construction. Japanese readers should, therefore, read "business investment" as "plant and equipment investment" while other readers should not.

1) The language barrier has prevented a more thorough review of Japanese writing on this issue within the time available. Apologies are, therefore, due to neglected authors.

Chart 1 illustrates the share of business investment in GDP, measured in real terms, since the early 1960s for Japan, Australia and the US. Two features of this chart are notable. Firstly, Japanese business investment has, over the period as a whole, accounted for an increasing proportion of GDP, ie. investment growth has on average been faster than GDP growth. Investment grew rapidly as a share of GDP in the period from the mid-1960s to 1970, when the Japanese economy entered a recession. The subsequent cycle in the investment share until the latter part of the 1970s appears to reflect the various external shocks of the early 1970s and the domestic policy responses to those shocks[2)]. From the latter part of the 1970s until the end of the Bubble period in 1991, the investment share increased at an accelerating rate, with the exception of a relatively slight pause following the Second Oil Shock and the early 1980s international recession. In both Japan and Australia, business investment fell significantly in the most recent recession, to a historic low in the case of Australia.

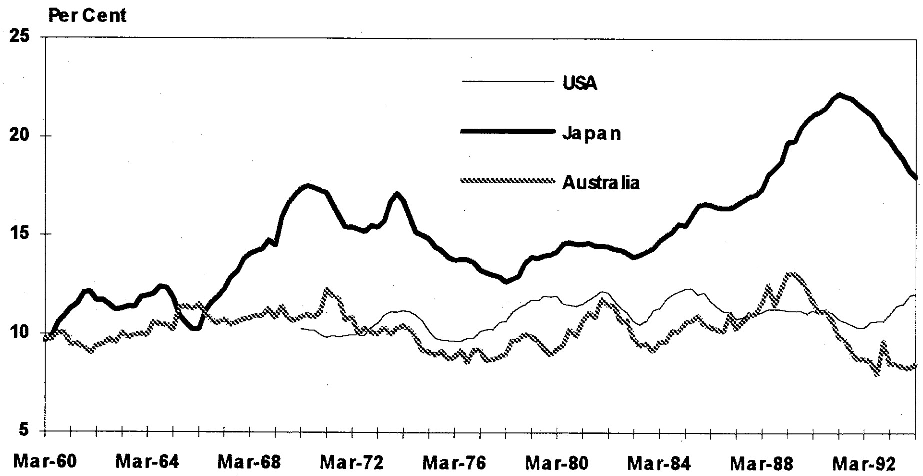

Chart 1: Business Investment as a Share of GDP
Source: OECD Quarterly National Accounts, Main Economic Indicators

The second feature of Chart 1 is that the share of investment in Japan has been high compared with that of Australia and the US, particularly during the Bubble period. The Japanese investment share also remains relatively high notwithstanding the fall in investment in the most recent recession. The level of investment as a share of GDP is closely related to the growth rate of the capital stock and hence GDP growth. As such, the high investment

2) The Nixon Shock of mid-1971 which involved, inter alia, a significant Yen revaluation and tariff cuts, presumably eroded Japanese competitiveness and made the investment climate less favourable. The expansionary monetary and fiscal policies which followed appear to have temporarily lifted the investment share just prior to the First Oil Shock. The oil shock and the tight macroeconomic policies subsequently adopted to quell the inflation caused by the oil shock and the earlier expansionary macroeconomic policies, saw investment fall significantly. A description of the economic conditions and policies of this era can be found in Kosai (1986) Part Ⅲ.

share in Japan is reflective of its past favourable growth performance. Looking to the future, it is now more commonly expected that the rate of growth of Japan will be lower than historical experience because of low population growth and fewer opportunities for "catch up" technical progress. If so, the relative growth slowdown in Japan implies a structural fall in the investment share and a slower average growth rate in the capital stock relative to the rest of the world (unless the capital intensity of the Japanese economy grows much more quickly than previously). This raises the interesting question of whether the recent fall in the Japanese investment ratio has a structural as well as a cyclical element. The issue of deregulation of the economy is also relevant to the outlook for investment. However, given that the effects of such deregulation will depend importantly on the measures themselves, discussion of this issue is beyond the scope of this paper. Most of the analysis in this paper focuses on the cyclical question, but we return to a very brief qualitative discussion of the structural and deregulation issues in the concluding remarks.

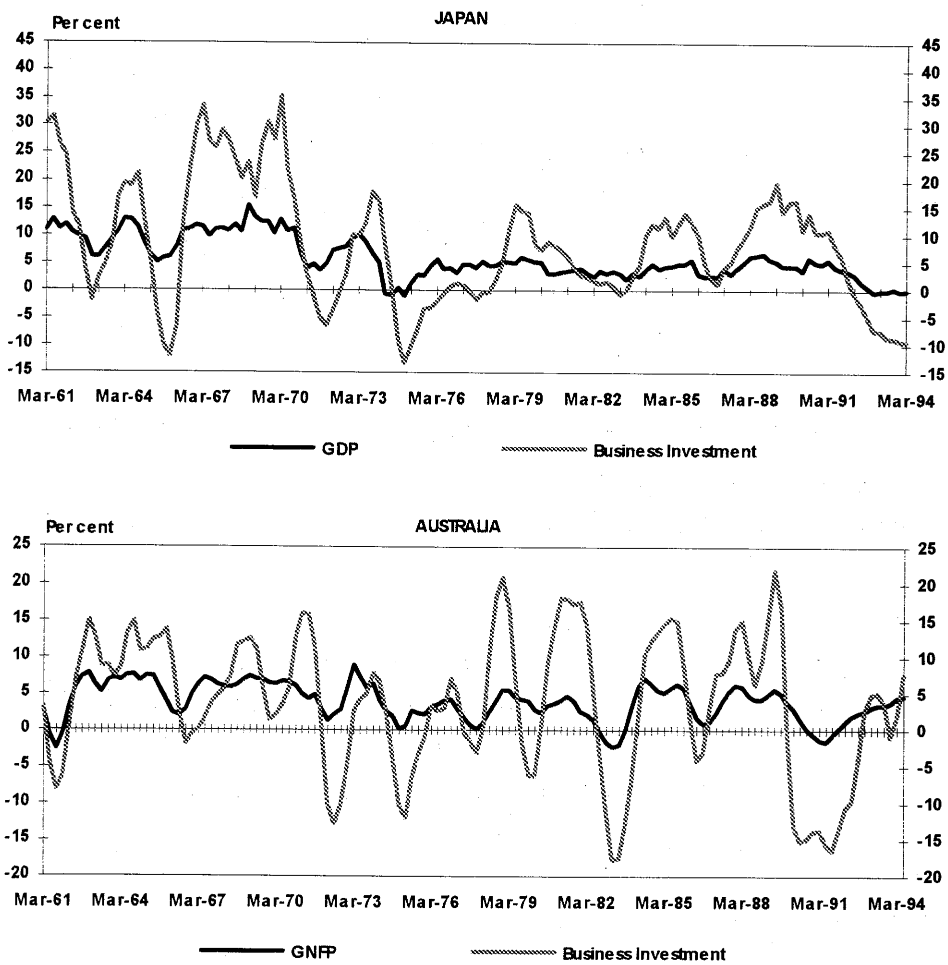

Chart 2: Investment and GDP Growth in Japan and Australia

Australia: Business Investment for Australia excludes the effect of second hand asset transactions between sectors. Gross Non-farm Product is used instead of GDP and both investment and non-farm GDP have been smoothed with a 5-term Henderson moving average.
Source: Australia: ABS National Accounts. Japan OECD Main Economic Indicators

Chart 2 shows the cyclical relationship between in GDP and business investment. There is a high degree of correlation, but investment is more volatile than output. This consistent with typical accelerator models of investment. Because of this high volatility and correlation, business investment is one of the major contributors to the overall economic cycle as is illustrated in Chart 3. However, other components also make important cyclical contributions to aggregate demand. Given the limited scope of this paper, the conclusions drawn about the outlook for the economy are necessarily limited.

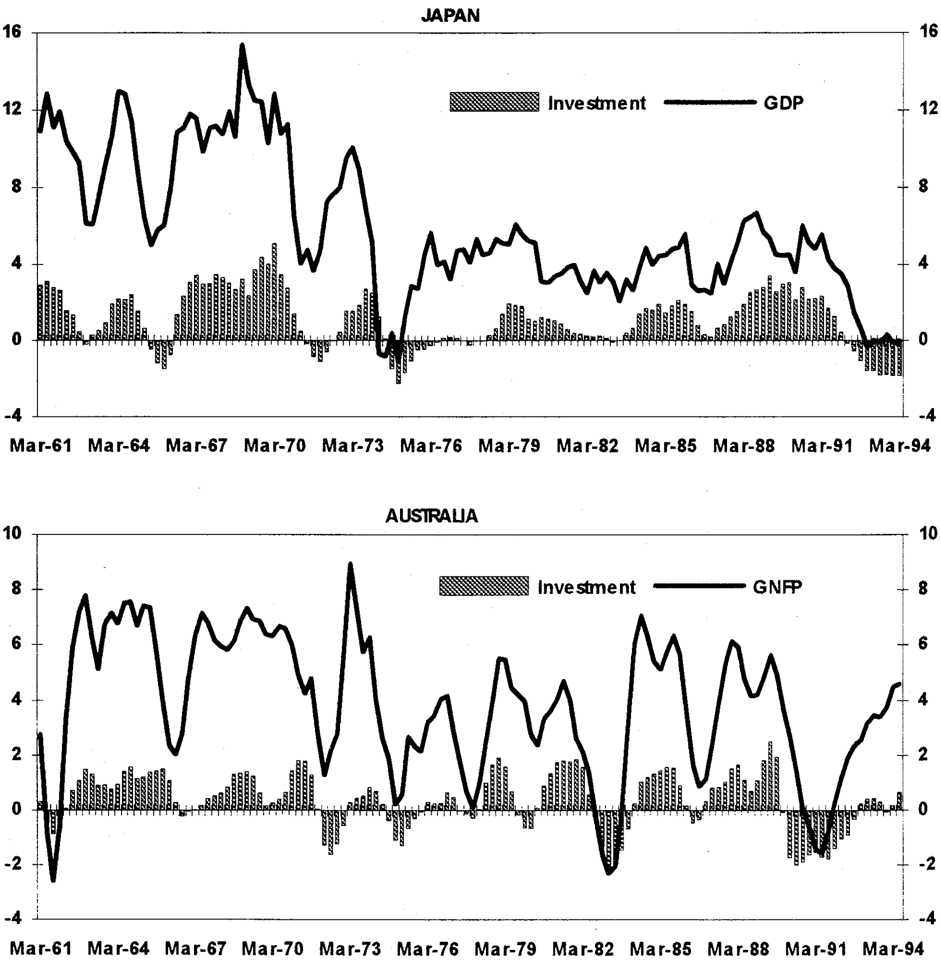

Chart 3: **Contribution of Business Investment to Economic Growth**

Australia: Contribution to Gross Non-Farm Product growth on one year earlier. Japan: Contribution To GDP growth on one year earlier.
Source: Australia, ABS National Accounts. Japan, OECD Main Economic Indicators

As noted in the introduction, the recovery in investment in Australia was slow by past standards. The 1994-95 Budget Statement described recent developments in business investment in Australia as follows:

> Business investment, ... , has been the missing ingredient in the recovery to

> date. Despite high business profits and low interest rates, significant levels of excess capacity resulting from the investment boom of the late 1980s have been a major constraint on investment. In recent years, however, investment has been consistently lower than suggested by historical relationships based on capacity utilisation and other fundamental determinants of investment. This suggests that other factors apart from excess capacity are constraining business investment - or that the productivity of capital is increasing as improved work practices permit more intensive usage and greater effective capacity.
>
> Weak investment may partly reflect changing attitudes towards debt following the experience of the late 1980s. It may also reflect slow adjustment by business of 'hurdle' rates of return used to evaluate investment decisions to reflect the low inflation and low interest rate environment. Some surveys report that hurdle rates of return are beginning to fall but there is probably scope for these to fall further in line with falls in inflation. Until recently, there was also a considerable degree of uncertainty about the strength of the economic outlook reflecting the initial slowness of the recovery and the lack of synchronised growth in the world's three major economies. Such uncertainty may have contributed to delaying the investment recovery.

The discussion in the Budget Statement went on to note that capacity utilisation was rising and the other constraining influences were declining. Consequently, business investment was expected to recover very substantially through 1994 and beyond[3]. This forecast was considered to be optimistic at the time by many private commentators but it now appears likely to be fulfilled.

The main themes of the Australian Budget discussion of this issue, ie capacity utilisation, debt, uncertainty and structural change, are also evident in recent publications by the Japanese Economic Planning Agency (EPA). Some of the empirical findings of these publications are summarised in the following sections.

In addition to these macroeconomic influences, the EPA White Paper (1993) Chapter 1.3 notes a number of important microeconomic features of the most recent cycle in Japan that exacerbated the degree of the downturn compared with previous cycles. Firstly, investment by the non-manufacturing industry is typically less volatile than for the manufacturing industry, reflecting the lower relative volatility of output in the tertiary sector. The absence of perfect correlation in investment by the two sectors usually dampens movements in total investment to some degree. Conversely, in the most recent down turn there was a significant and

3) It can also be noted that subsequent upward revisions to national accounts estimates of business investment have removed some but not all of the "missing investment".

contemporaneous downturn in both manufacturing and non-manufacturing investment. The previous episode where this occurred was in the period following the First Oil Shock. Secondly, small and medium enterprises have tended to be more sensitive to economic conditions than large firms and investment by small firms has tended to lead investment by large firms. In the most recent cycle, this leading relationship broke down. Apparently, confidence (as measured by the diffusion index for business outlook) in the small and medium business sector did not deteriorate to the same degree as for large business prior to the peak in activity. Accordingly, when the downturn began, there was a virtually simultaneous decline in investment by all firms. This tended to amplify the extent and rapidity of the downturn.

The EPA have also undertaken some preliminary analysis of the effect of the Bubble in this investment cycle and have concluded that it is likely to have amplified the extent of the downturn. Research of this type is inherently difficult, but the EPA White Paper (1994) Summary notes the following possible effects. Firstly, the burst of the Bubble apparently affected consumer confidence and dampened consumption, thus reducing capacity utilisation. This mechanism is seen as being the primary cause for why investment did not recover even though capital stock growth had fallen to historically low levels. Secondly, the effect of the bursting of the Bubble on business sentiment is examined in terms of the degree of revision of investment plans during the downturn, which were larger than in previous episodes. However, tracing the exact cause of these downward revisions is difficult. Thirdly, the EPA notes that banks did not aggressively lend to smaller enterprises after the Bubble. This contrasts with previous downturns when a decline in the demand for funds by large firms saw banks shift their focus to small firms. In the most recent cycle, banks lent aggressively to small industries during the Bubble period but not afterwards, perhaps because of balance sheet constraints faced by the banks or collateral difficulties by borrowers.

The following section briefly reviews the theoretical and empirical literature on the determinants of investment to provide a context for the empirical analysis presented in Section Ⅳ.

Ⅲ. Determinants of Investment: Survey of the Literature

Neoclassical growth theory includes a well defined description of the determinants of investment[4]. Firms are assumed to maximise the value of the firm to its owners[5] which is equal to the discounted value of future cash flows. Hayashi (1982) and others have shown that under assumptions regarding the completeness of markets, adjustment costs and the

4) Blanchard and Fischer (1989) Chapter 2 and 6, provides a useful survey of this literature. What follows is a highly simplified summary given space constraints.

absence of monopoly power, neoclassical growth theory encompasses Tobin's q theory of investment. In simple models, the rate of investment (investment divided by the capital stock) depends **only** on q, which is the ratio of the marginal rate of return on capital to the cost of capital[6).]If the return on investment is greater than its cost, q is greater than 1 and investment will increase (and vice versa). Changes in interest rates, or taxes or demand influence investment through their effect on q. Conversely, neoclassical growth theory predicts that investment should not be affected by the level of debt nor savings decisions in an open economy (assuming mobile capital and an exogenous world interest rate).

It is important to note that the relevant concept of q is a **marginal** one and it is thus difficult to observe. However, Hayashi (1982) demonstrated that if a firm is a price taker and has constant returns to scale, marginal q would be equal to average q. Average q is observable, eg. as the ratio of market valuation of existing capital to its replacement cost. Hayashi (1982) also carefully set out how estimates of q should be modified to take account of the effect of taxation on the cost of capital.

Although neoclassical investment theory is well defined, it has been difficult to validate empirically, including for Japan. As documented by Shapiro (1986), there is a long history of empirical estimates of the sensitivity of investment to variations in **average** q which tend to suggest that investment responds very slowly to apparent profit opportunities and thatadjustment costs must, therefore, be high. Conversely, the stylised macroeconomic fact that investment is more volatile than and highly correlated with activity requires that adjustment costs are not too high if cyclical investment behaviour is to be consistent with neoclassical theory - see Blanchard and Fischer (1986) p 300. Shapiro (1986) offers an explanation for slow adjustment on the basis that the stock market is more volatile than investment. However, q based theories can only explain the low volatility of investment relative to the volatility in the stock market (and hence average q) by high adjustment costs. Conversely, better specified investigations of marginal investment conditions, such as Shapiro(1986), find more plausible adjustment rates but quickly become difficult in theory and,

5) The validity of this assumption might be questioned in the case of Japanese firms, which are sometimes said to run for the benefit of the employees, rather than capital, and thus act as sales maximisers. Blinder (1993) examines the implications of such behaviour when a sales maximising firm is competing against a profit maximising firm. The sales maximising firm "wins" in the sense that the output of the profit maximiser falls. The sales maximiser invests beyond the profit maximising level, but a critical condition for this result is that the sales maximiser has a source of capital that is insensitive to the consequently low rate of return.

6) Equivalent formulations of q are the shadow price of capital in terms of consumption goods, or the present value of future marginal products of capital, or the ratio of the market value of an additional unit of capital to its replacement cost. This simple formulation of q does not hold in more complicated situations characterised by uncertainty, monopoly power or non-constant returns to scale. See Blanchard and Fischer (1989) p 297-301.

like the careful tax adjusted estimates of q calculated by Hayashi (1985) for Japan, have demanding data requirements which force empirical compromises. In general, there is little empirical agreement about the importance of the user cost of capital. For example, the estimates by Hayashi (1985) for Japan imply a negative relationship between the cost of capital and investment, although q was positively related as expected. This unexpected negative relationship with the cost of capital is interesting. There are at least two possible explanations. Firstly, perhaps, it could be suggestive of a dominant influence by supply shocks which, as noted by Shapiro (1986), might increase both investment and the cost of capital. However, this would conflict with the finding by West (1992) that supply shocks have been relatively unimportant in Japan. Secondly, it might reflect a counter-cyclical movement in the cost of capital as a result of increases in excess demand for funds during periods of economic expansion.

A more extensive discussion of the performance of the neoclassical model in explaining investment in a number of countries can be found in Ford and Poret (1990) who reach the rather pessimistic conclusion:

> "There seems to be no trend, or co-integrating relationship among these variables [investment, output and the cost of capital]. Even the high-frequency relationships are not robust, as revealed by regression analysis and "causality" tests: for most of the OECD economies examined [including Japan], the best explanation of current investment may be its own past.

Investment decisions necessarily depend on expectations about the future and, consequently, uncertainty about the future is another factor which is commonly investigated in studies of the determinants of investment. Under certain assumptions, neoclassical investment theory predicts that investment will rise with increased **price** uncertainty because of the potential for higher profit if prices rise: see Abel (1983). However, this result conflicts with common perceptions about the effect of uncertainty. The common perception accords with the results of "options" theories which model the timing of investment: see Dixit (1992). Firms have the option to invest now or wait - investing now effectively surrenders that option. However, the option can be shown to have a value that is positively related to the level of uncertainty. Therefore, the expected net return on investment, which equals the return on the investment less the value of the option foregone, will fall with increased uncertainty. Accordingly, increased uncertainly reduces investment because firms are more likely to wait before committing to an investment.

Empirical studies of the effect of uncertainty on investment have produced mixed results. Ferderer (1993) found a significant negative relationship between uncertainty and the investment in the US using a neoclassical investment model. Including uncertainty also appeared to correct for mis-specification problems that were present in its absence.

Conversely, EPA (1993) found that the impact of uncertainty was not always negative nor highly significant for Japanese business investment. One of the inherent difficulties in this area of research is the fundamental question of how to measure uncertainty.

Another branch of the literature is that of "equilibrium credit rationing" which examines the influence of financial markets given information asymmetries between borrowers and lenders. Banks are not perfectly informed about the credit risks of their clients because such information is costly and necessarily involves uncertainty about the future. In these circumstances, banks may choose to ration credit rather increase interest rates when the demand for loans is greater than the supply. This result occurs because increasing interest rates may generate an "adverse selection" reaction which increases the average riskiness of those applying for loans. Such an increase in risk may, in turn, reduce the return to the bank by more than the increase in return generated by a higher interest rate. As discussed by Blanchard and Fischer (1989) p 485-6 such credit rationing is not necessarily sub-optimal but in some models, the aggregate level of investment falls because of rationing. More interesting for our purposes is the role of credit rationing/collateral in generating economic cycles. Credit rationing theory provides a rationale for banks to require collateral. A collateral requirement can amplify the effect of shocks to the economy to the extent that those shocks affect the value of collateral. This provides a link between balance sheet quality and investment and, in particular, can be used to explain "debt deflation" recessions. See the discussion by Blanchard and Fischer (1989) p 486-8. Although there appears to be relatively little empirical work in this area, it does provide a rationale for a linkage between rising (falling) real land prices and rising (falling) investment.

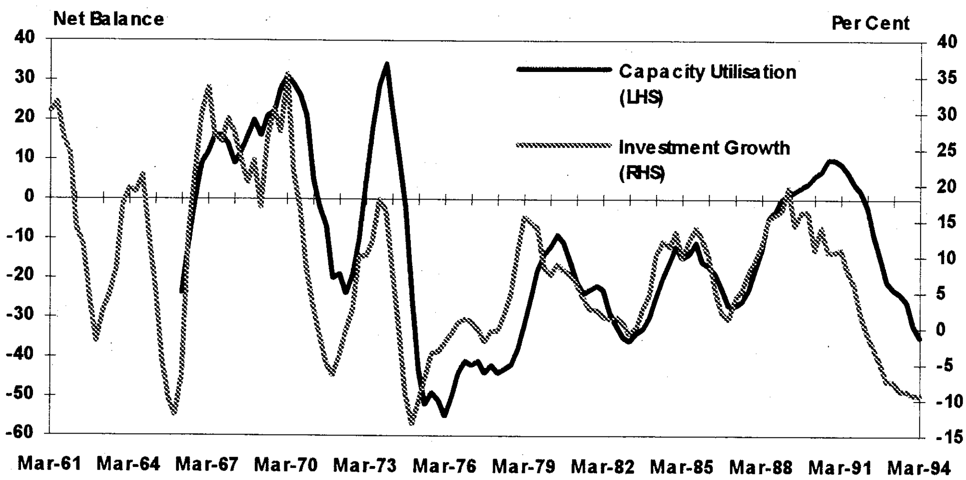

Chart 4: Investment and Capacity Utilisation: Japan

Source: OECD Main Economic Indicators. Capacity utilisation is Net Balance for Manufacturing Industries from Bank of Japan Short Term Economic Survey of Principal Enterprises

It is an empirical fact that investment is highly correlated with capacity utilisation. See

Chart 4, which illustrates the relationship for Japan. The stock adjustment process modelled in the following section relies on this empirical regularity, but the theoretical reason for the linkage appears not to have been well explored in the literature. It may be that profits and confidence in future profits are high when capacity utilisation is high, making firms more willing to invest and lenders more willing to lend in these circumstances. If this is the transmission mechanism, direct measures of confidence or profitability should dominate capacity as an explanation for investment. The empirical analysis in the next section does not find a dominant role for profitability, either in Australia of Japan. In the most recent Australian cycle, corporate profits rose to historically high levels before business investment rose significantly. More simply it may be that the expected profit from a marginal investment is likely to be low when capacity utilisation is low because of the increased probability that a new investment will lie idle.

It can be argued that a linkage between capacity utilisation and investment is implied by inventory theory in the following terms. Contrary to the predictions of "production smoothing" models of inventory behaviour, one stylised fact of many economies is that production is more volatile than sales. As explained by Blanchard and Fischer (1989) p304, the reason for this is that there is some uncertainty about the level of demand and demand is serially correlated. Consequently, an unexpected increase in sales in one period implies the likelihood of a higher level of sales in the next period. Broadly speaking, production in the next period will be increased to meet the expected higher sales in the next period plus the unexpected run down in inventories in the previous period, otherwise the firm will run an increased risk of running out of stock.

This inventory theory should have implications for investment decisions. The higher variance of output than sales implies that at some times output must be higher than expected sales. Also, because investment takes time to build and involves some sunk costs, a firm can not instantaneously adjust its capital stock to a theoretically desired level at each point in time - rather the capital stock is at least partly determined by past decisions. Since one factor to be taken account of in those decisions is the need for the firm to periodically produce in excess of expected sales, this implies that firms should choose install production capacity that is in excess of expected sales. The degree of desired excess capacity should be a positive function of the uncertainty and serial correlation in sales. This clearly suggests a reason for the observed empirical relationship between capacity utilisation and investment. Since firms have a desired level of excess capacity and output displays significant persistence, variations in sales and capacity utilisation away from the expected desired level are also likely to display persistence if firms do not adjust capacity. Conversely, the higher the variability of output, the more firms are likely to allow capacity utilisation to temporarily vary from the desired level[7)].

Capacity utilisation is also relevant to the issue of whether economic cycles and, in particular, the co-movement of business investment with output noted in Chart 2 are the result of demand shocks or supply shocks. In former case, a demand or accelerator type framework should be adequate to analyse investment. On the other hand, if supply shocks are important, with both investment and output reacting jointly to productivity shocks, an accelerator framework could produce spurious results and it would be necessary to properly specify the supply side of the economy[8)]. In the models used in the next section capacity utilisation is used as one of the explanatory variables for investment. Capacity utilisation represents the gap between potential supply and demand. Therefore, these models effectively include a reduced form supply side. For Australia and the Japanese manufacturing sector, the capacity utilisation measures used in the following analysis are survey measures. These measures should, in principle, pick up the influence of productivity shocks[9)]. As such, the issue of demand or supply shocks is not as critical for the following analysis as would be the case in a simple accelerator type model.

The EPA (1994) White Paper examined the influence of capacity utilisation and a number of other determinants of investment in Japan for manufacturing and non-manufacturing firms. Capacity utilisation was found to be the major explanator of investment. The influence of the Bubble, working through gearing ratios and land prices, was also found to be significant. The analysis also explored differences in behaviour patterns by large and medium firms and by small firms. The firm size issue is not pursued further in this paper - broadly speaking the

---

7) Pindyck (1988) argues along somewhat similar lines but reached a different conclusion. Installing excess capacity gives a firm an "option to produce" using that capacity. The value of this "option" rises as uncertainty rises thus making excess capacity more attractive. However, if investment is partly **irreversible**, increased uncertainty actually reduces the level of excess capacity because the value of the "option to wait" before investing rises by more than the value of the "option to produce" from installed capacity. Hence firms will have less capacity in uncertain environments. In these circumstances, a firm will operate at 100 per cent capacity for most of the time, the exception being when there is a large drop demand. It could be argued, however, that there is a problem of composition in this conclusion, ie. not all firms in an economy can behave in this fashion if the economy exhibits even small output fluctuations. One of the assumptions which Pindyck identifies as being important for his result is that there are no delivery lags in investment decisions so that firms can quickly adjust their productive capacity. Conversely, delivery lags are a critical feature of the above discussion, which envisages falls (increases) in capacity utilisation for small falls (increases) in demand.

8) An empirical method for examining the relative importance of demand and supply shocks was set out by Blanchard and Quah (1979) with a number of variants adopted by subsequent authors. West (1992), using a related methodology, examined the sources of cycles in Japan and tentatively found that demand shocks were relatively more important than supply shocks; only around 10 per cent of the variance of growth in GDP could be accounted for by cost (supply) shocks.

9) This issue arose in some unpublished empirical work done in the Australian Treasury. It was noticed that survey measures of capacity utilisation were not increasing in 1993 as quickly as synthetic measures derived from an estimated production function. This could be due to either (i) measurement errors in investment and the capital stock data used to estimate potential output, or (ii) a productivity shock.

most significant differences found in the EPA study appear to be that small firms are more responsive to capacity utilisation than large firms and small firms also appear to face moresignificant financial constraints than larger firms. The issue of the effect of uncertainty is also not pursued in this paper because of measurement difficulties and because of the lack of clearly significant results in the EPA (1993) analysis of this issue.

IV. Analysis of the Data

The research in this paper extends the EPA analysis in a number of ways. Firstly, the issue of whether it is capacity utilisation per se or expectations of future prospects which determine investment behaviour is explored for the manufacturing sector in Japan. Secondly, the role of international competitiveness is explored to throw some light on the "hollowing out" issue. Thirdly, the simulation properties and the structural stability of the resulting models is analysed to help judgements on whether the Bubble was 'different' to past behaviour. A comparison is made with the EPA results and the implications of the models for the investment outlook are briefly explored in the concluding section.

The objective in this analysis is to estimate a class of models of the investment／capacity utilisation relationship that allow comparisons between sectors and across different countries[10). As such the emphasis was on parsimony rather than "fine tuning" estimated equations. For Japan, the sectors analysed are total manufacturing and total non-manufacturing (excluding electricity). This industry based data and land price and gearing data was supplied by the EPA and is the same data as used in EPA (1994)[11). For Australia, the required data by industry is readily available only on an annual basis. Given the limitation on data points the sectoral issue was not pursued for Australia. As a result, the Australian analysis is for total business investment. Data limitations have also prevented a comparable direct estimation ofthe influence of debt and land prices in Australia. However, this issue can still be analysed indirectly for Australia by examining the simulation properties of the model through the most recent recession.

In each case the dependant variable is the investment ratio, ie investment as a proportion of the net capital stock in the previous period[12). The basic research strategy followed was to estimate an unrestricted lag structure for the explanatory variables, including lagged dependent

10) The analysis draws on unpublished work done in the Treasury to analyse the recent investment cycle. Economists involved in that work include Peter Downes, Rochelle Edge Meghan Quinn and myself.

11) All other data is sourced from the various OECD data bases and the Australain Bureau of Statistics Time Series Database.

variables. The most insignificant regressor at the longest lag for any variable was then dropped in a stepwise fashion until all variables were significant. The resulting models almost always included a significant lagged dependant variable, which dominated other unrestricted lag structures - this most likely reflects the typical persistence behaviour of investment. Obtaining consistent parameter estimates in such models is importantly dependent on the absence of autocorrelation, so careful attention has been paid to this aspect in the diagnostic statistics reported in the results presented in Tables 1,2 and 3.

Variables that were included in the initial modelling but which were dropped for lack of significance include: output growth (for Japan), business profitability; interest rates, the price of capital goods relative to consumption goods and wage rates relative to capital goods prices. These results are interesting in that they suggest that capacity utilisation tends to dominate over more traditional accelerator models. It also suggests that the data again fails to provide clear empirical support to those variables central to neoclassical investment theory. A number of other variables were insignificant in some models as discussed below.

The variables remaining in the models can be grouped into three groups: capacity utilisation variables, competitiveness variables, and balance sheet or bubble variables. All variables are in natural logs with the estimation period being quarterly from 1976:1 to 1994:1.

The effect of the Bubble is analysed as follows. If the balance sheet aspect of the Bubble was indeed important in explaining the recent cycle then a model excluding balance sheet or bubble variables should under predict investment during the Bubble period and over predict investment in the subsequent period. In addition, if changed behaviour was important in the Bubble, then a model estimated on a pre-Bubble sample should also tend to exhibit similar under and over prediction if simulated through the Bubble period. Hence, the Bubble issue can be examined in terms of the structural stability of the models and their simulation performance.

12) There are two reasons for using this formulation. Firstly, neoclassical theory is couched in terms of the investment ratio since this ratio and the depreciation rate determine the growth rate of teh net capital stock. Secondly, the investment ratio tends to be a stationary variable while investment and income are not. Accordingly, issues of co-integration and spurious regressions are less likely to be important if this research strategy is followed - recall the conclusion of Ford and Poret(1990) noted above. That said, preliminary investigations of the time series properties of the data used in this analysis indicated that the investment ratio failed standard stationarity tests. This appears to result from the fact that the investment ratio has fallen outside of the historical range in the recent recessions and thus tends to exhibit drift or a time trend. The same is true of capacity utilisation. This non-stationarity may be an artifact of the sample period which could be resolved once investment has recovered to more normal levels. Given this non-stationarity, a test was conducted for co-integration between the investment ratio and capacity utilisation but was rejected for the Japanese manufacturing sector. (Other sectors were not tested). Consequently, an error correction model was not pursued and the lag structure of the models was examined directly.

Model Results

Capacity Utilisation

The OECD Main Economic Indicators database includes a quarterly survey measure of capacity utilisation and "prospects" in the Japanese manufacturing sector. This data is taken from the Bank of Japan Short Term Economic Survey of Principal Enterprises, being the net balance of Production Capacity ("Insufficient" less "Excessive") and Business Conditions ("Favourable" less "Unfavourable") respectively. The OECD economy wide estimate of capacity utilisation from the Economic Outlook Database was used as a proxy for capacity utilisation in the non-manufacturing industries. The Australian capacity utilisation index is a net balance measure from the Australian Chamber of Commerce and Industry／Westpac Survey of Industrial Trends

The results presented in Tables 1,2 and 3 point suggest that capacity utilisation is an important explanatory variable for business investment both in Japan and Australia. These results concur with those of the EPA(1994).

The Australia and Japanese manufacturing capacity utilisation variables have larger variance because of their net balance compilation and thus play an important role in the equations notwithstanding the small absolute size of the coefficient. It is notable that the Japanese manufacturing industry models which include the prospects variable rather than capacity utilisation are superior. Indeed, in preliminary testing of models including both capacity utilisation and prospects variables, prospects dominated capacity utilisation. This is an important result as it confirms forward looking behaviour in investment decisions. That said, the manufacturing capacity utilisation and prospects variables are highly correlated - this suggests that capacity utilisation may affect investment partly through its influence on firm's confidence about the future.

The measurement of capacity utilisation in the non-manufacturing industries is rather more problematic, particularly in the some service sectors. As far as I am aware, there is no survey based measure of capacity utilisation for the non-manufacturing industry. Consequently, the capacity utilisation variable used in the non-manufacturing investment equations (Table 2) is the OECD estimate of economy wide capacity utilisation which is based on the gap between actual and estimated potential output. This measure proves to be a good explanator of non-manufacturing investment. The OECD measure has a much lower variance than the survey measures of manufacturing capacity utilisation. Since the OECD measure is largely determined by demand growth, the coefficient can be interpreted similarly to that in typical accelerator model. The estimated coefficients of around 2 or 3 are, therefore, plausible. However, the fact that the OECD measure is not a survey based measure raises the draw back (see footnote 9), that such econometric estimates will not capture the effects of productivity shocks on supply in the short term. Therefore, it is interesting to note that some of the equations reported in Table 2 fail a Reset test for functional form or excluded variables. This could be due to a variety of causes, but if the survey based measure of manufacturing capacity utilisation is used instead of the OECD economy wide estimate, the equations no longer fail a Reset test. This points to a possible problem that the OECD measure is not picking up a significant supply shock.

The results for Australia are, in general, rather less satisfactory than for Japan. The Australian data is quite volatile and includes a number of brief cycles. As a result, output growth was found to be significant-it helps the model to follow the shorter term investment cycles. Nevertheless, capacity utilisation plays an independent role in determining investment. The difficulties with the Australian data may be partly due to a too high level of aggregation in the analysis. It is more common in Australian studies to separately model the machinery and equipment and construction components of business investment and to control for the effect of mining and resources booms.

<u>Competitiveness Variables</u>

Unit labour cost data and terms of trade data were taken from the OECD Main Economic Indicators and Quarterly National Accounts database.

The results indicate that both the terms of trade and unit labour costs are negatively related to investment by Japanese manufacturing sector, but the terms of trade is not significant for the non-manufacturing sector. The coefficient on unit labour costs tends to be larger if bubble variables are included.

The result for the terms of trade is interesting. In the absence of a (short term) effect on the terms of trade from changes in the exchange rate , it could be expected that the effect of changes in the terms of trade on investment would be ambiguous. For example, if the terms of trade rise because of a fall in the price of imported raw materials relative to export prices, this might be associated with a rise in investment, other things being equal[13]. Conversely, if the terms of trade rise because of a fall in the price of imported manufactures relative to domestic manufactures, this could be associated with a fall in investment. That said, the two main influences on the terms of trade in the period in question appear to be the rise and subsequent fall of oil prices and the rise of the exchange rate. In so far as oil prices are concerned, it may be that the negative coefficient on the terms of trade is picking up the

13) It could be argued that because commodity prices are positively associated with world industrial output, low commodity prices are likely to be associated with low activity and investment. However, in the context of the estimated equations, this effect should be controlled for by the capacity utilisation or prospects variable.

positive influence of higher oil prices on energy conservation or substitution investment. In so far as the exchange rate is concerned, the negative coefficient may be picking up the negative competitiveness effects of a higher exchange rate which reduce import prices and increase the terms of trade in the first instance. Over the longer run, the negative competitiveness impact of a higher exchange rate can be offset by improvements in productivity which would allow export prices, and thus the terms of trade, to fall. The productivity aspect should also be captured by the unit labour cost variable (wage growth less productivity growth). The negative sign on the unit labour cost variable implies a positive influence on investment from productivity improvements. Unit labour costs include a cyclical element because of pro-cyclical movements in productivity. As such, this variable might also be playing a role in helping the equation fit the cycle in investment.

These competitiveness variables, and the terms of trade in particular, can be used to examine the issue of hollowing out in the manufacturing sector[14)]. All of the manufacturing sector models reported in Table 1 suggest a long run elasticity of around -0.5 between the terms of trade and investment, ie. a 10 percent appreciation in the exchange rate, which would cause a permanent 10 per cent increase in the terms of trade **if there was no offsetting improvement in productivity**, implies a fall in the level of manufacturing investment of about 5 per cent, other things equal. This result seems broadly plausible. That said, this issue is clearly deserving of further research, including using alternative formulations to model the influence of competititveness.

It is notable that the terms of trade does not appear to significantly affect investment in the non-manufacturing industries. This also tends to confirm the interpretation that the terms of trade is picking up competitiveness effects and or energy substitution investment, because non-manufacturing industries (excluding electricity) tend to be less trade exposed and less energy intensive than the manufacturing sector. Moreover, investment in the non-manufacturi-ng sector also appears to be less responsive to variations in unit labour costs[15)]

The issue of the effect of wages on investment warrants one further comment. Neoclassical

---

14) As a check on this interpretation, an equation was estimated using **relative** unit labour costs (unit labour costs in Japan adjusted for the exchange rate compared with the rest of the world (sourced from the OECD Economic Outlook database) which should completely capture the competitiveness effects. In this equation either the terms of trade or **relative** unit labour costs had a significantly negative coefficient, but not both - the choice between them was marginal. This result supports the above interpretation of the joint effect of the terms of trade and unit labour cost on investment. The use of **relative** unit labour cost data was not pursued further because joint terms of trade an unit labour cost models dominated. Moreover, relative unit labour cost data did improve the results for Australia.

15) Some caution is needed in this interpretation because data limitations forced the use of manufacturing unit labour cost data in the non-manufacturing sector equations.

theory predicts a capital-labour substitution effect in response to higher wages. Such an effect was found by the EPA (1994) in the form of a negative coefficient on the **growth** over four quarters of investment goods prices relative to wages costs. To test this in the context of a model which controls for competitiveness, the growth of wages relative to capital goods prices was included in the models (note this is the inverse of the variable used by the EPA). A positive but insignificant capital-labour substitution effect was found and other coefficients were not significantly changed. This result tends to suggest that the positive effect of higher wages on investment from capital-labour substitution is dominated by a negative effect resulting from lower competitiveness (other things equal) which would motivate companies to invest offshore - such a result seems plausible in a capital mobile world.

The analysis did not find significant competitiveness effects on Australian investment. The terms of trade variable tended to be slightly positive but insignificant. This may reflect a variety of offsetting influences, including the positive influence on mining investment during periods of high commodity prices-hence the tradition in Australia to control for mining booms in investment models. One further point worth noting in this context is that the Australian analysis also excluded the any effect from bubble variables. However, in the case of Japan, the inclusion of bubble variables tended to make the competitiveness variables more significant.

<u>Bubble Variables</u>

This data was provided by the EPA, covering industrial and commercial land prices and corporate long term debt. Land prices were deflated by the GDP deflator and corporate debt was expressed as a ratio to the nominal capital stock.

Examining the effect of the Bubble is rather difficult. There is, as yet, no settled theoretical framework which is applicable, but credit rationing／collateral models discussed above offer some insights as to why gearing ratios might be an important determinant of investment, contrary to the prediction of neoclassical growth theory. However, at this stage, empirical analysis of these issues can still be regarded as in the developmental stage. The analysis used in this paper is slightly different to that used by the EPA (1994), although it is based substantially on data provided by the EPA.

If gearing (debt to tangible assets excluding land) is important, the relevant consideration for agents should be the difference between actual and desired gearing ratios. In the following discussion this difference is referred to as the debt gap for brevity. Unfortunately, desired gearing ratios are difficult to observe. However, if the desired gearing ratio is constant, this presents little difficulty for empirical analysis. Specifically, the coefficient on the **actual** gearing ratio in a regression will be the same as that on the unobserved debt gap - only the constant term in the regression would be different if the true debt gap ratio had been used instead. Unfortunately, it is most probably the case that desired gearing ratios are not constant, but vary in some way in the bubble process. It seems plausible that desired gearing ratios would be higher if asset prices are rising. This rather complicates empirical analysis if desired gearing ratios can not be observed. In this case, the coefficient on the debt ratio no longer has a simple interpretation, since it will be influenced by whatever has actually happened to desired gearing ratios, unless there is some other variable in the regression which can act as a proxy for the desired gearing ratio. Moreover, if land acquisition is financed significantly by debt, and if land prices are rising more quickly than capital goods prices, the gearing ratio could be positively correlated with investment - this will tend to obscure any negative influence from rising debt.

So far as collateral and land prices are concerned, it is notable that while land prices in Japan have been falling in recent years, they remain high compared with the pre-Bubble period. Yet, the decline in land prices since the peak of the Bubble is commonly seen as important in dampening investment. This could be explained if perceptions about the adequacy of collateral depend not only on the value of land, but also on whether prices are rising or falling. This seems plausible because lenders are likely to require a greater margin of safety in asset valuations when prices are falling. This suggests that the rate of change of land prices should also be important in any bubble processes, perhaps in addition to the level of land prices.

In line with the above discussion, preliminary modelling included the gearing ratio, the real land price and the rate of change of the real land price. All variables had the expected sign, but the debt ratio and the land price were not significant for the non-manufacturing sector-the growth of real land prices was significant in all sectors. The preliminary results had a particularly notable feature. The magnitude of the coefficients on the gearing ratio and land price variables had very similar magnitudes but opposite signs. This feature of the results was tested with F tests of the linear restriction that the debt and land price variables sum to zero. This restriction was found to be accepted with an exceptionally high degree of significance for the manufacturing sector ($F<0.1$, compared with a critical value of around 4.0 at the 5 per cent significance level) and a high level of significance for the nom-manufacturing sector ($F <1.9$). Since the gearing ratio and the real land price have the same absolute coefficient they can be combined into a single variable (without significant loss of explanatory power) which is the gearing ratio less the real land price. This result is important because it permits a strong interpretation of the data. In this form, the land price can be interpreted as acting as a proxy for the unobserved desired gearing ratio so that the combined variable can be interpreted as a proxy for the unobserved the debt gap ratio. This linear restriction also increases the power of significance tests for the bubble variables, making the gearing ratio and land price level significant for the non-manufacturing sector for the full sample estimation. In Tables 1 and 2, the equations are presented in the debt gap ratio form.

It is notable that, in addition to being significant, the inclusion of the bubble variables reduces the degree of parameter instability as evident from the Chow tests and reduces the role played by the lagged dependent variable. The role played by the capacity utilisation and prospects variables is also reduced somewhat, possibly suggesting that the transmission mechanism from the bubble variables to investment operates partly through a confidence effect.

As such the bubble variables are important for the model, but they do not eliminate parameter instability all together. This raises the possibility that behavioural change was also involved in the Bubble process and not just increased land prices and gearing levels.

Some further light is thrown on this issue by comparing the results of estimating the models on a pre-Bubble sample period (Table 1 and 2, right half). The pre-Bubble estimation period used in this analysis is from 1976:1 to 1988:2. It is commonly said that the Bubble period began in 1986 when the growth of land prices began to accelerate. However, the choice of 1988:2 as the date in this analysis reflects the desire to maximise the number of observations in the pre-Bubble sample and the fact that it is only after 1988 that the investment ratio moved outside of its historical range. Note that the apparent autocorrelation problem in the non-manufacturing sector pre-Bubble estimates is not a concern because the lagged dependant variables in these models is not significant - the Durbin Watson statistic for these equations was 2.3..

The notable differences between the pre-Bubble and full sample results is that the bubble variables (land price growth in particular) are less significant in the in the pre-Bubble estimates. The robustness of this result is tempered by the fact that there is only one significant Bubble episode in the data. However, in the pre-Bubble estimation for the manufacturing sector, the bubble variables do help to explain the fall in investment in the late 1970s as a consequence of falling real land values. (This can be seen in the simulation results discussed below.) The prospects variable has a larger coefficient and is more significant in the full sample estimates than the pre-Bubble estimates, again possibly flagging a confidence transmission mechanism, but the results for capacity utilisation are mixed. Finally, the size and significance of the terms of trade and unit labour cost coefficients are greater in the full sample estimates. Similarly, the inclusion of bubble variables has the same effect. One possible explanation for this is that the manufacturing sector has become more sensitive to competitiveness signals, but further research would be needed to confirm this.

Simulation Results

The simulation properties of these models are also informative about the effect of the Bubble. Dynamic simulations have been used for this analysis given the inclusion of a lagged dependant variable in the models. A dynamic simulation involves using successive predicted values of the dependent variable (rather than actual values) to predict the dependant variable in the next period. If such simulations capture the cyclical features of the dependant variable, it is the result of the independant explanatory variables rather than presence of the lagged dependant variable.

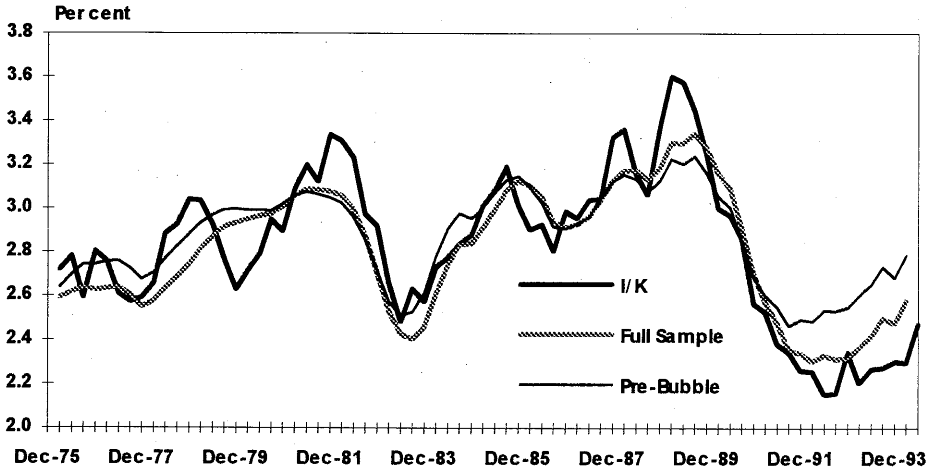

Chart 5: Dynamic Simulation of Australian Models

I/K is the investment ratio, being the dependent variable

Full Sample is a dynamic simulation of Model AF, Pre-Bubble is a dynamic simulation of Model AP. See Table 3

Chart 5 shows the results of simulating the Australian models. The models have some difficulty following the cycle in investment in the late 1970s and the subsequent resources boom in investment following the Second Oil Shock. Of more interest in present circumstances is the performance of the models in the most recent recession. The simulation of the pre-Bubble model through the Bubble period is a dynamic out-of-sample forecast after 1988:2 and is indicative of the model's ability to predict the upturn and downturn given knowledge about the independent variables and the pre-Bubble relationship between those variables and the dependent variable. This model clearly displays the "missing investment" phenomenon noted in Section II. Even given actual knowledge about the down turn, the Full Sample Model over predicts recent investment, although to a lesser degree than the pre-Bubble model.

Chart 6 shows the results of dynamic simulations for the full sample models of the Japanese manufacturing sector. It is evident from these results that the bubble variables help the simulation properties of the models, particularly for the model based on capacity utilisation, which under predicts the extent of the Bubble pick-up and downturn in the absence of the bubble variables. The prospects based model predicts the cycle well, but is assisted by the bubble variables to predict the extent of the pick-up during the Bubble. The relatively smaller influence of the bubble variables in the prospects model simulation also points to the likelihood that the transmission mechanism from the bubble variables to investment occurs partly through a confidence channel which is captured by the prospects variable but not the

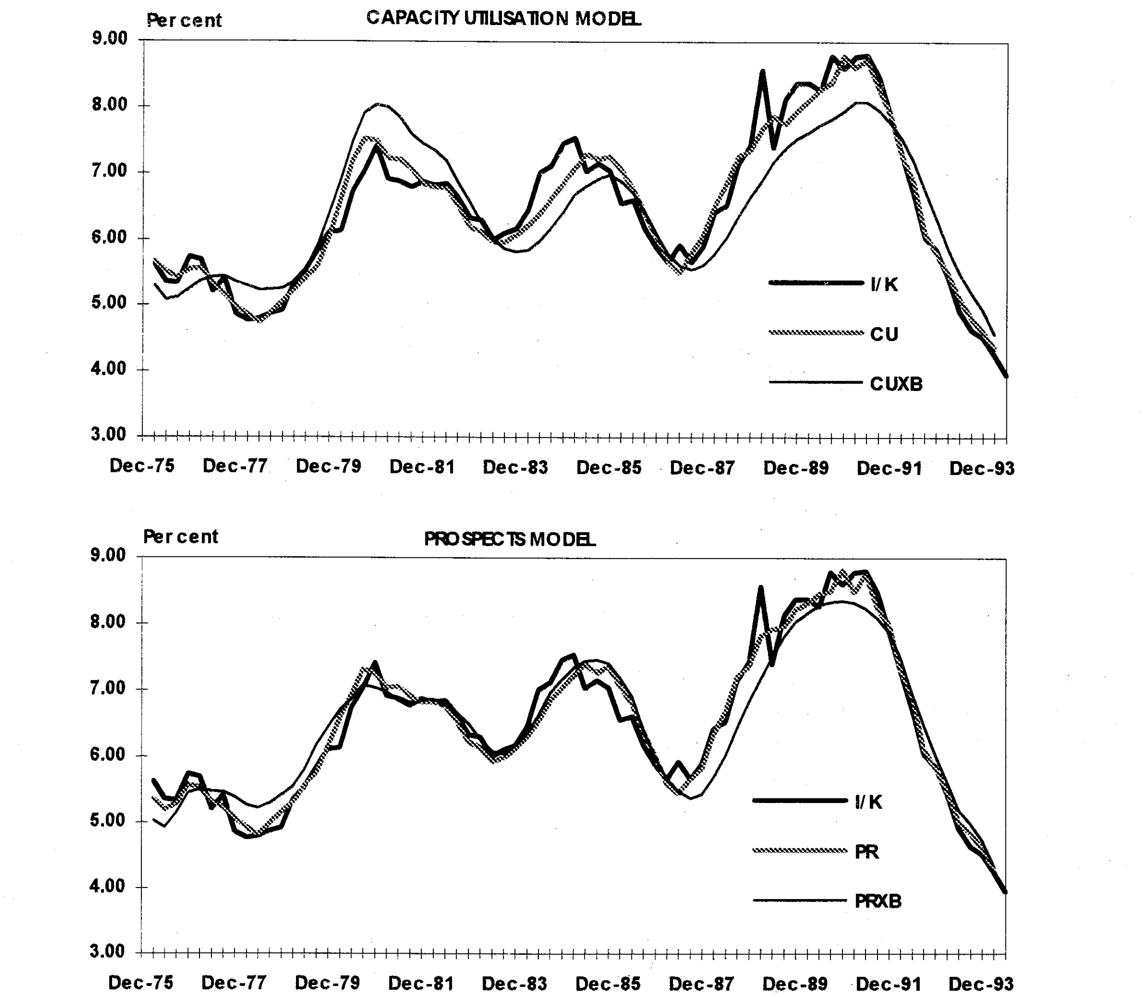

Chart 6: **Dynamic Simulation of Full Sample Models: Japan Manufacturing**

I/K is the investment ratio of the manufacturing sector, being the dependant variable

CU is a dynamic simulation of Model M4F which is based on capacity utilisation and includes Bubble variables, while CUXB is a dynamic simulation of Model M3F based on capacity utilisation but excluding Bubble variables. See Table 1

PR is a dynamic simulation of Model M2F which is based on the prospects survey and includes Bubble variables, while PRXB is a dynamic simulation of Model M1F based on the prospects survey but excluding Bubble variables. See Table 1

capacityu tilisation variable.

Chart 7 illustrates the results of simulating the prospects models for the manufacturing sector estimated on the pre-Bubble sample. These simulations are dynamic out-of-sample forecasts after 1988:2. These results illustrate that neither the extent of the upturn nor the extent of the downturn could have been predicted in advance with models of this class, even if a forecaster had perfect knowledge about what would actually happen to land prices and gearing ratios in the Bubble period and in the recession. This chart is somewhat similar to the pre-Bubble Australian simulation and indicates the behaviour changed in the Bubble period. Chart 8 shows a similar result for the non-manufacturing industries.

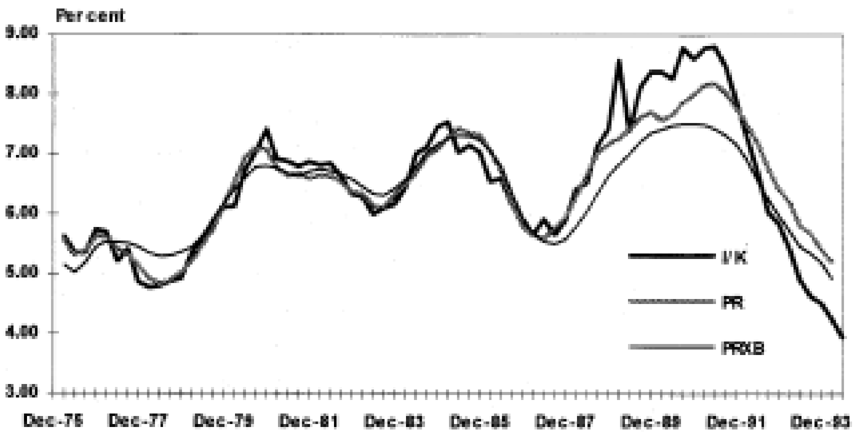

Chart 7: Dynamic Simulation of Pre-Bubble Sample Models: Japan Manufacturing

I/K is the investment ratio of the manufacturing sector, being the dependant variable

PR is a dynamic simulation of Model M2P which is based on the prospects survey and includes Bubble variables, while PRXB is a dynamic simulation of Model M1P based on the prospects survey but excluding Bubble variables. Both models are estimated on a pre-Bubble sample. See Table 1

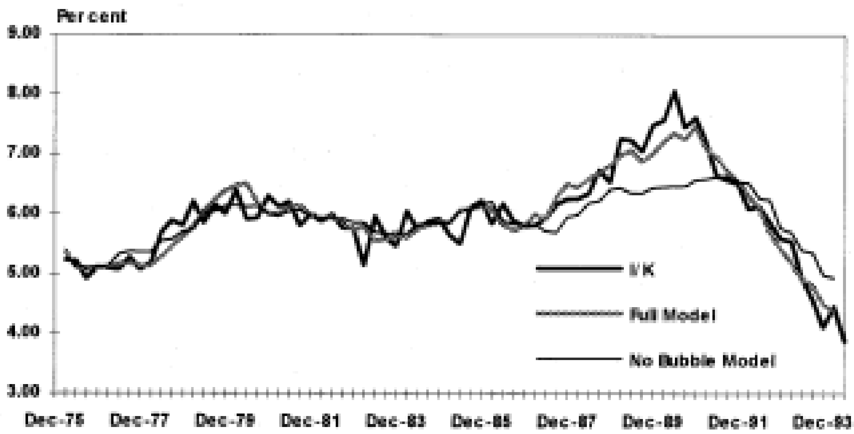

Chart 8: Dynamic Simulation of Non-Manufacturing Model: Japan

I/K is the investment ratio of the non-manufacturing sector, being the dependant variable

Full Model is a dynamic simulation of the full sample Model N2F which is based on OECD capacity measure and includes Bubble variables.

No Bubble Model is a dynamic simulation of pre-Bubble sample Model N1P based on OECD capacity measure but excluding Bubble variables. See Table 2.

V. Interpretation and Conclusions

The above analysis supports the view that capacity utilisation is an important determinant of investment, either directly or through its effect on business confidence. International competitiveness is also important for the manufacturing industry. Finally, rising land prices had a positive impact on investment through the Bubble period, including through increasing firms' ability to borrow and through a likely confidence effect. Conversely, the bursting of the Bubble had a negative influence. The data also strongly supports the view that behaviour changed during the Bubble period, with firms becoming more sensitive to changes in land prices. As a result, even with foresight about developments in land prices and other the determinants of investment, a model based forecast of investment would have tended to under predict both the extent of investment growth in the Bubble period and the extent of the subsequent fall in investment.

This change in behaviour complicates predictions of the future. Even if the change in behaviour is complete, econometric estimates will only pick up this change over time. As such, there is no a priori reason to believe that the models estimated in this paper now fully capture this changed behaviour. Consequently, if these models are used to forecast the future and if firms continue to be sensitive to land prices, the models could tend to over estimate the recovery in investment because they could underestimate the dampening influence on investment of low and falling land prices. This could well be a common feature of any model which displays structural instability as a result of the Bubble or which excludes bubble variables. An possible example of this phenomenon can be seen in the simulation results of the recent recovery period in Australia. A simmilar bias could result if there has been a structural fall in the investemnt ratio which the models pick up an an increased negative influence from the presently high level of excess capacity. lf so the models may over predict the stimulatory influence on investment of rising capacity utilisation in the period ahead.

In qualitative terms the three main influences bearing on the <u>initially</u> slow recovery of investment in Australia after the most recent recession are thought to be : (i) the extended period of weak growth in world economic activity resulting from the disjunction of economic cycles in the major economies, which kept the terms of trade subdued and limited volume growth of commodity exports, (ii) stock adjustment of excess capacity and excess debt built up in the Australian "Bubble" period, and (iii) possibly, a lift in productivity associated with structural change at the firm level which have increased the productive capacity of the economy[16).

In comparison, the Japanese recovery is less likely to be constrained by weak world activity, which has improved. Conversely, the high yen and so called "hollowing out" is extra feature not present in the recent Australian experience. To the extent that the models estimated in this paper capture the competitiveness effects through the terms of trade and relative unit labour cost variables, the importance of this issue can be assessed. The models imply that this effect could be relatively strong for the manufacturing sector.

The Bank of Japan capacity utilisation measure for the manufacturing sector is now rising slowly but it still indicates significant excess capacity. At present levels of investment, the capital stock is still growing at around 3 per cent per year. As such, capacity utilisation is not likely to rise quickly unless the pace of growth of industrial production accelerates significantly. Moreover, the negative influences of the earlier deterioration in capacity utilisation and land prices is still flowing through the lag structure implicit in the models. Finally, the effect of the fall out from the Bubble is likely to persist for some time and the negative competitiveness effects of the increase in the Yen in 1994 will be a further constraining influence. As a result, it is difficult to see business investment undergoing a sharp recovery for a considerable period unless there is some other stimulus to another component of aggregate demand which accelerates overall growth. This view is consistent with the present indications from the various investment intention surveys which point to further falls in investment, albeit by a smaller amount than earlier surveys[17)]

However, business investment will eventually recover relatively strongly, even if the overallrecovery continues to be weak for some period. Gradually rising output will continue to absorb excess capacity and also generate strong profit increases, particularly given labour hoarding practices of Japanese firms. In the absence of investment opportunities firms will reduce debt (or increase offshore investment). Increased capacity, lower debt and higher cyclical productivity will, at some point, come together to generate an acceleration of investment growth and economic activity generally. The timing of this acceleration is, however, uncertain.

---

16) Such productivity shocks will in the long run increase investment output and welfare. However, a relatively robust empirical result in Australian macroeconometric models is that the **short-run** dynamic response to an increase in labour productivity is a fall in investment, an increase in exports and little change in output. The rise in exports results from improved competitiveness while the fall in investment results from the fact that less labour and capital in required to produce a given level of output. Over the **medium-term** investment and activity increase to higher equilibrium levels as a result of lower unit labour costs／higher profitability and wealth. See Taplin and Lewis (1993). The results from a capital productivity shock are likely to similar in so far as investment is concerned.

17) It should be noted that the third quarter 1994 national accounts for Japan, which were released after the completion of the analysis in this paper, showed a slight rise in business investment. However, the investemnt ratio still fell because the growth in investment was less than the growth rate of the capital stock.

This paper focusses on the cyclical aspects of business investment within a relatively short time frame. However, as noted at the outset, a full appreciation of the outlook for business investment also requires an appreciation of the implications of the structural slowdown in Japanese potential economic growth and the effect on investment of various deregulation measures. A full discussion of these issues is far beyond the scope of this paper but the following points can be noted. The slowdown in Japanese growth resulting from the slowdown of population growth implies a structural fall in the investment ratio, the rate of growth of the capital stock and the share of business invesment in GDP. This is the other side of the coin of the shift to a more "consumer orientated" economy. The question of how much of the fall in the investment ratio is due to lower long run growth potential and how much is due to cyclical factors, clearly influences judgements about the recovery of investment over the longer term. Examining this issue would require a much longer data set than that used in this paper and the model would need to have well specified long run as well as cyclical properties. This is a topic for further research. The effects of the various deregulatory measures which have been implemented and which are presently being considered will also be important. The effects will depend importantly on the manner and scope of the changes, which have not been discussed in this paper. Generally speaking, deregulation should lead to higher levels of productivity as resources flow to their most productive uses. Ultimately, that should involve an increase in investment, particularly if the deregulatory measures reduce upward pressures on the exchange rate and thus lessen the 'hollowing out" pressures presently bearing on the manufacturing sector.

Table 1: Business Investment Equation Estimation

JAPAN
Manufacturing Industries
Dependent Variable: Investment Ratio = Investment/Capital Stock

	Sample Period	Full Sample: 1976:1 - 94:1				Pre-Bubble Sample: 1976:1 - 88:2			
	Model Name	M1F	M2F	M3F	M4F	M1P	M2P	M3P	M4P
Constant		**-0.81**	**-1.62**	**-0.65**	**-1.43**	**-0.91**	**-1.73**	**-1.17**	**-1.51**
		(-5.6)	(-8.6)	(-3.9)	(-6.8)	(-3.7)	(-6.4)	(-4.4)	(-5.8)
Capacity Utilisation		-	-	**0.215**	**0.018**	-	-	**0.203**	**0.126**
				(4.3)	(0.3)			(4.4)	(2.1)
Prospects Survey		**0.211**	**0.133**	-	-	**0.144**	**0.098**	-	
		(6.5)	(4.2)			(4.2)	(3.1)		
Terms of Trade		**-0.141**	**0.164**	**-0.118**	**0.152**	**-0.167**	**-0.289**	**-0.206**	**-0.284**
		(-3.2)	(1.3)	(-2.4)	(1.1)	(-2.5)	(-5.0)	(-3.2)	(-4.7)
	Lagged		**-0.476**		**-0.453**				
			(-3.4)		(-2.8)				
Unit Labour Costs		**-0.144**	**-0.394**	**-0.467**	**-0.72**	**-0.019**	**0.107**	**-0.191**	**-0.808**
		(-1.9)	(-1.2)	(-5.9)	(-2.1)	(-0.2)	(0.3)	(-1.9)	(-4.3)
	Lagged		**-0.992**		**-0.945**		**-1.006**		
			(-2.9)		(-2.2)		(-2.5)		
Debt Gap Ratio		-	**-0.546**	-	**-0.655**	-	**-0.522**	-	**-0.389**
			(-5.4)		(-4.9)		(-5.1)		(-4.0)
Land Price Growth		-	**1.776**	-	**2.07**	-	**-0.002**	-	**-0.400**
			(3.9)		(3.9)		(0.0)		(-0.6)
Lag(1) I/K		**0.483**	**0.119**	**0.74**	**0.433**	**0.657**	**0.33**	**0.546**	**0.406**
		(4.0)	(1.0)	(11.5)	(5.2)	(7.2)	(3.2)	(5.4)	(4.0)
Lag(2) I/K		**0.211**	**0.251**	-	-	-	-	-	-
		(2.0)	(2.9)						
Diagnostics									
Rbar2		0.95	0.96	0.93	0.96	0.91	0.94	0.91	0.93
Autocorrelation	DH	1.43	0.44	0.34	-1.4	0.06	-0.45	1.71	0.06
	LB(4)	5.4	1.5	13.6	3.1	5.5	6.4	6.9	5.3
Structural Stability	Chow	2.9*	2.3*	5.9**	3.3**	3.3*	2.6*	2.6*	1.97
Residual Normality	JB	6.3*	4.5	2.19	3.2	0.96	1.7	0.31	0.42
Functional Form	Reset	0.03	0.74	0.29	0.11	0.46	0.82	0.31	0.2

Diagnostics:
Figures in brackets are t statistics.
Autocorrelation. Durbin's H (normal distribution) is resported in favour of the Durbin Watson statistic given the presence of a lagged dependant variables. LB(4) (F distribution) is a Q test for 1st to 4th order autocorrelation adjusted for the degrees of freedom.
Structural Stability: Chow test (F distribution) with a split date half way through the sample.
Residual Normality: Jarque-Bera (Chi2 Distribution)
Functional Form: Reset test (F distribution) using suared and cubed fitted values from the regression.
* and ** indicate failure of the diagnostic test at the 5 and 1 per cent level of significance respectively.

Table 2: Business Investment Equation Estimation

JAPAN
Non-Manufacturing Industries (Excluding Electricity)
Dependent Variable: Investment Ratio = Investment/ Capital Stock

Sample Period		Full Sample: 76:1 - 94:1		Pre-Bubble: 76:1 - 88:2	
Model Name		N1F	N2F	N1P	N2P
Constant		**-1.35**	**-1.99**	**-2.36**	**-2.67**
		(-4.7)	(-6.8)	(-6.0)	(-6.7)
Capacity Utilisation		**2.932**	**2.393**	**3.39**	**2.925**
		(4.3)	(4.0)	(4.6)	(4.1)
Terms of Trade		-	-	-	-
Relative Unit Labour Costs		**-0.118**	**-0.424**	**0.078**	**-0.194**
		(-1.6)	(-2.7)	(0.8)	(-1.1)
Debt Gap Ratio		-	**-0.273**	-	**-0.153**
			(-2.2)		(-1.0)
Land Price Growth		-	**2.22**	-	**1.518**
			(5.0)		(2.2)
Lag(1) I/K		**0.526**	**0.246**	**0.17**	**0.032**
		(5.1)	(2.1)	(1.2)	(0.2)
Lag(2) I/K				-	-
Diagnostics					
Rbar2		0.83	0.87	0.61	0.64
Autocorrelation	DH	-1.6	-1.7	-2.3*	-2.3*
	LB(4)	6.1	4.1	2.9	3.5
Structural Stability	Chow	4.7**	2.3*	0.77	0.57
Residual Normality	JB	0.71	0.51	1.7	4.2
Functional Form	Reset	1.1	4.8*	2	4.3*

See notes for Table 1

Table 3: Business Investment Equation Estimation

AUSTRALIA
All Industries
Dependent Variable: Investment Ratio = Investment/ Capital Stock

Sample Period		76:1-94:2	76:1-88:2
Model Name		AF	AP
Constant		**-1.04**	**-1.36**
		(-3.6)	(-3.6)
Capacity Utilisation		**0.061**	**0.052**
		(2.7)	(2.0)
Output Growth		**2.385**	**2.456**
		(3.1)	(2.9)
Lag(1) I/K		**0.786**	**0.684**
		(13.1)	(7.9)
Diagnostics			
Rbar2		0.90	0.75
Autocorrelation	DH	-0.69	-0.14
	LB(4)	0.82	1.62
Structural Stability	Chow	0.81	0.03
Residual Normality	JB	1.15	0.57
Functional Form	Reset	0.19	0.95

See notes for Table 1.

References

Abel, A. (1983), "Optimal Investment under Uncertainty", *American Economic Review*, Vol 73(2)

AGPS (1994), "Budget Statement Number 2 - Economic Conditions, Prospects and Policy", *Budget Paper No 1 1994-95*, pp 2.27-2.28, Canberra, Australian Government Publishing Service, 1994

Blanchard, O.J. and Fischer, 5. (1989), *Lectures on Macroeconomics* Cambridge, MIT Press 1989.

Blanchard, O.J. and Quah, D. (1989), "The Dynamic Effects of Aggregate Demand and Supply Disturbances", *The American Economic Review*, Vol 74(4) 1989

Blinder, A.S. (1993), "A Simple Note on the Japanese Firm", *Journal of the Japanese and International Economies*, Vol 7(3) 1993.

Dixit, A. (1992), "Investment and Hysteresis", *Journal of Economic Perspectives*, Vol 6(1), 1992.

Economic Planning Agency (1993), *Economic Survey of Japan 1992-93*, Tokyo EPA 1993.

Economic Planning Agency (1994), *Economic survey of Japan 1993-94*, "Summary", Tokyo EPA 1994.

Ferderer, J.P., (1993), "The Impact of Uncertainty on Aggregate Investment Spending: An Empirical Analysis", *Journal of Money Credit and Banking*, Vol 25(1) 1993.

Ford, R. and Poret, P. (1990), "Business Investment in The OECD Economies: Recent Performance and the Implications for Policy", *Working Papers*, OECD Department of Economics and Statistics, Paper No. 88, 1990.

Hayashi, F. (1982), "Tobin's Marginal and Average *q*: A Neoclassical Interpretation", *Econometrica*, Vol 50(1) 1982.

Hayashi, F. (1985), "Taxes and Corporate Investment in Japanese Manufacturing", *NBER Working Paper Series*, Working Paper No. 1753, 1985.

Kosai, Y. (1986), *The Era of High Speed Growth*, Tokyo, University of Tokyo Press 1986.

Pindyck, R.S., (1988), "Irreversible Investment, Capacity Choice and the Value of the Firm", *American Economic Review*, Vol 78(5) 1988.

Taplin, B. and Lewis, C. (1993), "The Macroeconomic Effects of Higher Productivity", *Treasury Model (TRYM) Conference Papers, Number 7*, Canberra, The Treasury 1993.

West, K.D. (1992), "Sources of Cycles in Japan", *Journal of the Japanese and International Economies*, Vol 6(1), 1992.