

ASSET MARKET HANGOVERS AND ECONOMIC GROWTH

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**Federal Reserve Bank of New York
Research Paper No. 9704**

February 1997

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During the early 1990s, asset prices and investment were unusually weak throughout the industrial world. This paper highlights this stylized fact, and connects it with another: in most of the industrial world, asset markets boomed for several years before collapsing around 1989. The paper suggests that the sluggish asset markets and investment growth of the early 1990s may represent, in part, symptoms of an “asset market hangover,” that is, the lingering effects on real activity of collapsing speculative bubbles. The analysis relies on cross-country data for equity and real estate markets in all major and some minor industrial countries.

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International Economics Function
Federal Reserve Bank of New York

January, 1997

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During the early 1990s, asset prices and investment were unusually weak throughout the industrial world. This paper highlights this stylized fact, and connects it with another: in most of the industrial world, asset markets boomed for several years before collapsing around 1989. The paper suggests that sluggish asset markets and investment growth in the early 1990s may represent, in part, symptoms of an “asset market hangover,” that is, the lingering effects of collapsing speculative bubbles.

The boom-bust pattern in asset prices over 1984-93 was common to nearly all OECD countries. Prior to their peaks around 1989, inflation-adjusted prices for equities, houses and commercial property typically grew in excess of 10 percent per annum, and often in excess of 20 percent. The subsequent drop in these prices during the early 1990s was equally widespread, though generally not quite as dramatic. Although observers were aware of the boom-bust pattern in many individual countries, the shared nature of the pattern was less widely recognized. The sharp boom-bust pattern itself suggests the first of the two central conjectures examined in this paper: *speculative excesses may have driven asset prices well above their fundamental values during the late 1980s, leading to an offsetting collapse of prices in the early 1990s.*

As asset prices collapsed during the early 1990s, investment first tumbled and then remained weak in most OECD countries. The coincidence of stagnant investment with general economic recovery in many countries was particularly notable, since investment typically leads economic activity during recoveries. This unusual behavior of investment, combined with the sharp and widespread drop in asset prices, suggests the second of our two central conjectures:

falling asset prices may have contributed to anemic investment growth during the early 1990s.

As discussed later, falling asset prices could have discouraged investment by reducing the attractiveness of individual investment projects, by increasing the cost of credit, or by reducing the availability of credit.

After documenting the commonality of these patterns across the OECD, we examine the empirical evidence for each of our two conjectures. The analysis relies on cross-country data for equity and residential property prices. These, in turn, are related to machinery and equipment investment and investment in residential properties, respectively. We attempt throughout to control for the role of other economic forces which may have driven asset prices and investment. In each case our analysis supports our conjectures, suggesting that an “asset market hangover” may indeed have played an important role in exacerbating the recessions and impeding the recoveries of the early 1990s.

Numerous policy questions arise if our conjectures prove to be correct. For example, should policy-makers attempt to prevent or contain speculative bubbles, as part of their broader effort to stabilize economic activity? If so, which branch of government should undertake this responsibility, and which policy tools would be most appropriate? We return to these questions in the concluding section of our paper.

Section I begins with a brief review of salient economic events between 1984 and 1993 in the industrial world, highlighting the near universality of boom-bust pattern in asset prices and investment. In Section II we turn to our first conjecture, discussing the concept of a speculative bubble and showing in greater statistical detail that the developments listed in Section I seem consistent with the notion that speculative price bubbles inflated asset prices in the 1980s.

Section III turns to our second conjecture, first examining the ways in which asset prices could have dampened real investment during the early 1990s and then presenting evidence suggesting that they did indeed have such effects. Section IV discusses how the asset-market hangover hypothesis may help explain why investment was weak in some countries as they recovered from their early 1990s' recession, while investment was not unusually weak in other countries. Section V offers our conclusions.

I. HISTORICAL OVERVIEW

Economic activity grew briskly among industrialized countries during the late 1980s. GDP expanded by an average 3.3 percent per year during 1984-1989 for our sample of 18 industrialized countries ("the OECD"), easily out-pacing the 2.3 percent annual growth achieved during the previous decade (Chart 1A). A pick-up in the growth of gross fixed investment, to an average of over 5.9 percent, more than accounted for this acceleration in GDP growth. Overall, this measure of investment contributed 38 percent of total output growth during 1984-89, despite that fact that it represents barely 20 percent of total output. Both components of investment—machinery and equipment (MEQ) and construction—grew rapidly.

Booming economies brought with them booming asset markets. Inflation adjusted (real) share prices rose by an average of 66 percent across the OECD over 1984-89, while real residential property prices rose by 28 percent. Rapid asset price rises occurred in almost every OECD country, though not all asset prices surged in all countries. Real commercial property prices, for example, rose over 150 percent in Sweden, but only a bit over 50 percent in nearby Finland. To highlight the near universality of these asset price booms, Table 1 shows price

inflation for equities, residential property (“housing”) and commercial properties for 10 OECD countries.

I.A. The End of the Economic Boom

Tight monetary conditions spread around the OECD towards the end of the 1980s, as central banks responded to accelerating inflation, helping to draw the curtain on the good economic times. Every OECD country entered a recession at some point during 1989-93, with average peak-to-trough GDP declines of 3.2 percent. A pronounced slide in investment accounts for nearly 90 percent of the growth slowdown between 1984-89 and 1989-93 (Chart 1A). MEQ investment and construction contributed about equally to this slump (Chart 1B).

Gross fixed investment was weak not only in absolute terms but also relative to its behavior during previous business cycles—even though the recessions themselves were not especially severe in most countries. Comparing growth during the current cycle with the average for all previous business cycles, and defining the cycle as two years before to two years after the business cycle trough, we find that MEQ investment was unusually weak in 13 of 14 countries, while construction investment was unusually weak in 10 of 14 countries.¹ Indeed, if gross fixed investment had just managed to keep up with its usual (feeble) recessionary performance, the average GDP decline over the two years leading into the cyclical trough would have been 1.7 percentage points less severe. Moreover, GDP would have grown by an additional 1.2 percentage points over the subsequent two years.

As economic growth skidded to a halt, asset prices plunged precipitously (see Chart 2). The peak-to-trough slide in real share prices averaged 28 percent across the OECD, erasing

almost half of their earlier gains.² Particularly pronounced equity price cycles occurred in Japan and the Scandinavian countries while the U.S. and the U.K. experiences were fairly mild.³

Real house prices faced the same unpleasant fate as share prices after the 1980s economic boom, tumbling on average 20 percent from peak to trough. Scandinavian prices suffered the most: real house prices fell 26 percent in Sweden, 37 percent in Norway and an astonishing 48 percent in Finland (Table 1). This boom-bust episode also appears to have been more dramatic than those of previous business cycles: in the three countries for which we have lengthy quarterly house price series (the U.S., UK and Japan), the peak-to-trough decline in house prices was only 7 percent on average during previous cycles but exceeded 17 percent during the post-1989 downturn.⁴

I.B. Our Thesis

Our review of the facts of the past decade's boom-bust cycle points to a striking pattern across the OECD: the late 1980s saw rising real asset prices and rapid investment growth, while the early 1990s saw the reverse combination with equal frequency. The sluggishness of investment during the early 1990s was unusual even for recessionary times. Our central thesis stems directly from these observations: investment and asset market weakness of the early 1990s may have represented the aftermath of speculative bubbles during the late 1980s.

This thesis can be divided into two separate conjectures:

First Conjecture: The boom-bust cycle in asset prices may have been driven in part by speculative bubbles in many countries.

Second Conjecture: Investment weakness during the early 1990s was partly the result of asset

concurrent market weakness.

Note that these conjectures are independent of each other—each one could be true even if the other turns out to be untrue. If both are true, however, the 1984-93 period provides a striking example of how asset market developments, including those unrelated to fundamental economic factors, can affect the real economy. The following two sections of the paper examine our two conjectures theoretically and empirically.

II. WERE THERE SPECULATIVE BUBBLES IN 1984-1993?

A speculative price bubble occurs when asset prices are pushed upward by investors whose demand is based on expectations of continually increasing demand from other investors, rather than based on fundamental economic factors. Although such expectations can be self-fulfilling or even “rational” in the short run, the absence of an anchor in economic fundamentals renders markets fueled by such speculation easily deflated and, like hot air balloons, the higher such markets fly the farther they ultimately descend.

After reviewing what is known about speculative bubbles in Section II.A, we provide some evidence supporting the existence of speculative bubbles in many countries over our period of interest, 1984-93.

II.A. Speculative Bubbles: An Overview

Observers have long been fascinated with the violent asset market cycles commonly identified as speculative bubbles. As early as 1852, Charles Mackay recorded a number of colorful episodes in his famous book, *Extraordinary Popular Delusions and the Madness of Crowds*. Economists, who began to examine the concept more rigorously a few decades ago,

distinguish between rational and irrational speculative bubbles. A rational bubble (Blanchard 1981) occurs when prices rise above the values justified by fundamentals, with market participants fully cognizant of the potential risks and rewards they face. Speculators who remain in the market recognize the possibility of large losses in a crash. They stay in the market because they rationally calculate that the likelihood of a crash is small, while the likelihood of continued small price increases is substantial. Alternative theories of bubbles rely on the notion that market participants fool themselves into believing the market is correctly priced (see, for example, Kindleberger 1978). Bubbles of this sort have been generated in experimental markets with fairly high regularity (Smith et al. 1988).

One of the more important, if disheartening, lessons to come from research on bubbles is that one can never *prove* that a given boom-bust episode was truly a bubble (Hamilton and Whiteman, 1985). Even the most extreme sequence of sustained price rises followed by precipitous declines could always have been driven by some unobserved fundamental factor. As a result, one should be cautious about accepting any claim that a given asset price development may represent a speculative bubble. This lesson is underscored by the recent emergence of evidence suggesting that some price developments in one of the most notorious “bubbles,” the “tulip mania” of 1634-37, may have been justified by fundamentals after all (Garber 1989).

Even so, the notion that at least some OECD asset markets were held aloft by bubbles during the late 1980s is common in the business press and beyond (see, for example, *Economist* 1990; Maloney and Bergsman 1992; Sterling 1992). In Japan developments were so extreme that the period is now known by all as simply “the bubble era.” Many studies of individual countries, including one published by the Japanese government, support the view that asset developments

in those countries were not fully justified by developments in fundamentals (see Borio et al. 1994; Ito and Iwaisako 1995; Kahkonen 1995; Economic Planning Agency 1993; Schinasi and Hargraves 1993). Poterba (1991) and Abraham and Hendershott (1993, 1994) also find evidence of bubbles in regional U.S. housing markets.

II.B. Speculative Bubbles in 1984-93: Empirical Tests

This section provides empirical evidence supporting our conjecture that some asset markets of the mid-to-late 1980s were inflated by speculative bubbles, the bursting of which could account for later market troubles. We focus on equity and housing prices, since the absence of commercial rent data make it impossible to undertake a parallel analysis of commercial property prices.

We base our analysis of our first conjecture on an important attribute of speculative bubbles: prices that leave their fundamentals farthest behind during the boom part of a bubble will fall the farthest later on. As a first test of whether events of 1984-93 conform to this prediction, Charts 3A and 3B compare cumulative real asset price rises (in percent) over 1984-89 with corresponding real asset price declines over 1989-93. For both equities and residential property, the hypothesized relationship seems clearly visible.

These simple comparisons, although suggestive, leave many questions unanswered. Most important, asset prices could simply have been rising and falling along with other dominant forces in their respective countries. What other factors could have been driving asset prices over this period? We turn to standard economic theory to answer this question.

A standard model of asset price determination implies that the current price of an asset

should equal the asset's expected future income stream discounted to the present. For equities, this implies a relationship commonly known as the “dividend discount model”:⁵

$$Share\ Value_t = \frac{Dividend^e_{t+1}}{1 + r_t} + \frac{Dividend^e_{t+2}}{(1 + r_t)^2} + \frac{Dividend^e_{t+3}}{(1 + r_t)^3} + \dots$$

(Here a superscript “e” indicates that the share price is based on the *expected* value of future dividends.) When applied to real estate markets (as in Poterba, 1991; Case and Browne, 1993) a similar expression results, with expected rental income appearing in place of dividends in the numerator. The discount factor, r , depends on both market interest rates and the riskiness of the investment. We can summarize this simple asset price formula by saying that asset prices should be positively related to expected future income and negatively related to current market returns and risk.

Another factor that could have influenced asset prices during our period of interest is suggested by the business press. During the early 1990s it was frequently suggested that excessive investment during the 1980s left a substantial backlog of spare capacity (see, for example, Radics 1993, Rappaport 1992, Vail 1993), with potentially depressing effects on related asset prices. This hypothesis may in some measure be related to the bubble hypothesis: the same excessive optimism which leads investors to bid up asset prices past the levels justified by fundamentals might lead builders to construct new homes and offices, or businesses to install new plant and equipment, past levels justified by a sober analysis of potential demand growth. Nevertheless, the overbuilding view points to an alternative causal link between 1980s boom and 1990s bust, and we add overbuilding to our list of possible asset price determinants. The

appendix describes how we measure overbuilding and our other explanatory variables, as well as our data sources.

Asset prices may also have been inflated by excessive credit growth in the wake of widespread financial deregulation in the early 1980s (Borio et al. 1994; Schinasi and Hargraves, 1993). Unfortunately, we are unable to test this hypothesis, since sectoral credit data are unavailable for many countries, and rarely comparable across countries when they do exist. It is important to note, however, that a possible role for credit growth is not incompatible with the bubble hypothesis. A bubble occurs whenever asset prices rise beyond the levels justified by fundamentals; this remains true even if the bubble is accompanied or somehow fueled by rapid credit growth.

To summarize the analysis thus far, we have seen visually that there was a very strong, negative relationship between asset price rises in the late 1980s and their subsequent declines over 1989-93. Before concluding that a causal relationship exists, we need to investigate whether both the early rise and subsequent decline could have been driven by other factors. To address this issue we will regress the cumulative decline of asset prices over 1989-93 on asset price rises during 1984-89, along with four other potentially important factors: income, interest rates, risk and overbuilding.

A few caveats are in order before we begin our analysis. The cross-section analysis which follows is limited by the small number of countries for which relevant data are available. At its largest our sample includes 18 countries, a small sample by most statistical standards, for which reason considerable uncertainty surrounds the precise magnitude of the relationships we estimate.⁶ The small sample size also makes it difficult for us to control carefully for alternative

factors that might explain the estimated relationships.

Despite the small sample sizes, there are good reasons to take our results seriously. First, our sample includes two thirds of the countries in the OECD, which together account for some 95 percent of OECD GDP. Even for our smallest samples, the countries with relevant data cover well over 70 percent of OECD GDP. Thus, it seems likely that the patterns we observe hold for the developed world as a whole. Second, we have chosen an estimation procedure tailored to our small sample setting. Our procedure, known as “minimum absolute distance (MAD) estimation,” attaches a lower weight to outliers than does the traditional “least squares” estimator. This is appropriate here because statistical results are more easily distorted by extreme observations in small samples.⁷

Our results, reported in Table 2A, support the notion that speculative excesses in the 1980s may have contributed to asset price deflation in the early 1990s. After allowing for the role of other potentially important factors in determining asset prices, a negative and statistically significant relationship remains between asset price run-ups during 1984-89 and asset price declines during 1989-93. This is true for both housing and equity prices.⁸

Not only might there have been bubbles in some of these markets, but the bursting of these bubbles may have been the major factor behind the asset price declines of the early 1990s. According to the regression results, a 10 percent rise in real residential property prices above the OECD average during 1984-89 was associated with a 1989-93 price decline 7 percent steeper than average. The average price increase of 28 percent during 1984-89 implies a slightly larger average price decline during 1989-93 than was in fact observed, implying that changes in the other explanatory variables or unmodeled factors were working to boost prices during the latter

period. For the equities, the regression results indicate that a 10 percent rise above the OECD average during 1984-89 was associated with a decline 4 percent greater than average during 1989-93.⁹ Again, the average 1984-89 price run-up is more than sufficient to account for the average 1989-93 price decline, implying that other forces were working to boost prices during the latter period.¹⁰

An Alternative Statistical View: So far we have focused exclusively on events during 1984-93, and examined cumulative growth rates over periods of several years. This has permitted us to construct a *direct* test of one implication of the speculative bubble hypothesis—that there should be a strong, negative relationship between early and late asset price growth rates. However, this approach has the disadvantage of constraining us to a limited set of observations, thus reducing the certainty that the estimated relationships are close to their true values. We now turn to evidence which has the advantage of coming from a much larger data set. This should allow us to derive statistically superior estimates of the contribution of observed fundamentals to asset price growth. However, this advantage comes at the cost of providing only an *indirect* test of the bubble hypothesis.

We expand our sample size not by increasing the number of countries—the relevant data apparently do not exist for other developed countries—but by including more observations across time. Specifically, we draw on annual data spanning 1960 to 1994 for the same countries and sectors considered previously. We approach the possibility of speculative bubbles by asking whether standard fundamental variables seem sufficient to explain asset price behavior. If much of the asset price boom-bust over 1984-93 remains unexplained after the influence of fundamentals is captured, then additional, nonfundamental factors are presumably involved. If

the unexplained portion of asset price behavior follows the boom-bust pattern characteristic of a bubble, the results of the direct test constructed above will be indirectly corroborated.

We rely on the same basic model of asset pricing discussed earlier, with the exception that we take advantage of our enlarged data set and add oil prices as an explanatory variable for share prices (following Chen et al. 1986). We assume that the estimated relationships, shown in Table 2B, are the same for each country.

As discussed above, we are interested in the portion of annual asset price movements *not* explained by annual economic fundamentals. For both housing and equities, real price levels generally rose well above the values predicted by our economic fundamentals during 1984-1989, and fell back towards those values during 1990-93 (Chart 4). This pattern is consistent with the pattern that would be expected if speculative bubbles in fact influenced asset price behavior in many OECD countries. (The chart also highlights a less sustained episode unexplained by fundamentals, the collapse of equity prices in late 1987.)

So far we have provided graphical and statistical evidence indicating that speculative price bubbles during the 1980s may have been important sources of asset price weakness in the 1990s. Though the results suggest that speculative bubbles may have influenced asset prices during 1984-93, they do not indicate that bubbles were the only factors influencing asset prices. Nor does our analysis prove that bubbles were important: as mentioned earlier, it is impossible to know for certain whether a given asset boom truly represents a speculative bubble, as some unobserved fundamental could always be driving prices. Nevertheless, the results do place the alternative, non-bubble hypothesis in sharper relief, by limiting the unobserved or unmeasured fundamentals consistent with observed asset price behavior. In particular, if bubbles do not

explain the boom/bust cycle of 1984-93, the unobserved or unmeasured fundamentals which do explain the cycle must have deteriorated most sharply during 1989-93 in precisely those countries where they improved most sharply during 1984-1989. Thus, even if our empirical model fails to capture important fundamental determinants of asset prices, the alternative, non-bubble hypothesis appears to require an unlikely confluence of events.

In short, our results are best viewed as corroborating substantial existing evidence, both rigorous and anecdotal, suggesting the importance of asset price bubbles of the late 1980s for the OECD bear markets of the early 1990s. In the next section we turn our attention to real activity, and investigate whether the unusually sluggish investment of the early 1990s may have been caused in part by concurrent asset price declines.

III WAS INVESTMENT IN THE EARLY 1990S DAMPENED BY WEAK ASSET PRICES?

Our second conjecture is that falling asset prices during the early 1990s could have been a source of the early 1990s investment slump. After discussing various mechanisms through which asset prices may affect investment, this section provides evidence focused more narrowly on asset price-investment connections during 1984-93.

III.A Asset Prices and Investment: An Overview

A number of theories suggest that asset prices should influence investment. We begin by discussing Tobin's "q" theory, which implies a direct effect, and then consider other theories which imply that asset prices could influence investment through indirect channels involving net worth and credit markets.

Tobin's q theory (Tobin, 1969; anticipated in Keynes, 1936) notes that investment will be

encouraged whenever the market value of business or residential capital exceeds its replacement cost. For example, a firm will have an incentive to expand when it can raise its equity value by \$1 by adding capacity which costs only \$0.80 to build. Of course, the link also operates in the other direction: no sensible firm would choose to invest when it costs \$0.80 to build a new factory that would only be valued at \$0.50 by the market. Thus, when equity prices fall, the number of firms for which asset value exceeds asset replacement costs will also fall, and investment should decline. Unfortunately, the many empirical studies of q theory have found scant supporting evidence (see, for example, Chirinko, 1986; Oliner et al., 1995).

Several recent theories suggest that the chain of causation between asset prices and investment could be less direct. Specifically, asset price declines lower the net worth of borrowers and lenders; lower net worth leads in turn to a contraction in the supply of credit; finally, the contraction in the supply credit leads to lower investment. We consider first how lower lender net worth might lessen the availability of credit.

With respect to lenders, declining asset prices can lower net worth either directly (banks are major equity holders in Germany, Japan and some other countries) or indirectly, by increasing borrower default rates. Lower lender net worth can also directly affect creditors' ability or willingness to lend: for example, banks may find their capital cushion falling below statutory minimum levels, and may react by shrinking their balance sheets. This type of "credit crunch" appears to have hit some areas of the United States during the late 1980s (Bernanke and Lown 1992; Federal Reserve Bank of New York 1994). Capital constraints due to high loan losses may also have depressed Japanese banks' lending in the U.S. (Peek and Rosengren 1996).

With respect to borrowers, a decline in house or equity values lowers household net worth

directly; and declining equity values can reduce firm net worth by lowering the value of shares held in other firms. A decline in borrower net worth may bring a fall in investment for two reasons: first, investors may prove unwilling to undertake new projects; second, potential investors be viewed as insufficiently creditworthy by potential lenders. We examine these two links in turn.

Investors with impaired net worth may be unwilling to undertake new investment projects which require borrowing and the associated increase in leverage. Similarly, individual investors may avoid increased leverage because bankruptcy becomes more likely if the investment project turns out badly. Firm managers may also be concerned about leverage and potential bankruptcy, since bankruptcy could cause a manager to lose her job (Chamberlain and Gordon 1989).

Potential investors who do wish to invest may be unable to do so if lenders view them as insufficiently creditworthy. The connection between net worth and creditworthiness stems from information asymmetries between borrowers and lenders: lenders rarely have full information about the creditworthiness of potential borrowers, or borrowers' use of funds once credit has been extended. The most direct way for creditors to deal with this information asymmetry is to extend collateralized loans—thus protecting the lender if a borrower has chosen a poor project or uses the funds irresponsibly. Borrower net worth, of course, is the source of collateral. Moreover, even when collateral is not required, lenders recognize that borrowers with lower net worth are more likely to default.¹¹

The discussion above has identified several channels through which asset prices may affect investment. Some of these channels are direct; for example, the mechanism described by Tobin's q theory. Other channels are indirect; for example, those mapped out by theories which

stress the link between asset prices and borrower or lender net worth. The key point is that all the mechanisms support the second of our two main conjectures: declining asset prices in the early 1990s may well have played a role in the early 1990s investment slump.

III.B. Asset Prices and Investment During 1989-93: Empirical Tests

This section provides empirical evidence for our conjecture that widespread asset market weakness in the early 1990s may have contributed to the early 1990s investment slump. Our approach relies on the observation that, if asset price deflation (whether due to bursting bubbles or to other factors) depressed investment activity, the countries with the biggest asset price busts should generally have suffered the biggest investment declines. Note that our analysis is not designed to assess the relative strength of the various channels by which asset prices may have depressed investment. While such an investigation would be illuminating, data limitations (such as our inability accurately to measure q and the paucity of sectoral credit data) preclude such an assessment in a multi-country context.

As before, we begin with a brief visual examination of the data. Real asset price growth during 1989-93 is plotted against investment growth (relative to GDP) over the same period in Charts 5A and 5B. The charts reveal a strong positive correlation between these variables. Of course, the relationship depicted in these charts may be due to other economic forces. For example, if investment growth and asset prices were both driven by some unobserved third factor in the early 1990s, such as profits, we might observe a strong correlation between the two even in the absence of any causal relationship.

To select the central variables to include in our statistical analysis, we take the

neoclassical theory of business investment as our starting point. This theory, summarized in Box 2, suggests that the crucial determinants of net business investment are a project's expected cost, referred to as the "user cost of capital," and its expected contribution to revenues. Following Poterba (1991) and others, we apply essentially the same theoretical framework to housing investment. We also add overbuilding to our models of both business and housing investment, in light of the business commentary regarding excess capacity, as well recent academic research (Gilchrist and Williams 1996).

Recent theoretical work also suggests that cash flow may be also be a crucial determinant of investment. Higher cash flow could lead to higher investment for a number of reasons. First, when firm managers' or individuals' can finance investment out of cash flow they can avoid debt, and its associated danger of bankruptcy (Chamberlain and Gordon 1989). Moreover, higher cash flow may also provide managers interested in self-aggrandizement with the opportunity to increase their command over economic resources (Jensen 1986). Finally, the importance of cash flow may reflect the presence of information imperfections in the market for credit, which drive the cost of debt or equity exceed the cost of internally generated funds. Put simply, when potential creditors are imperfectly informed about a firms' or individual's financial health, and cannot fully collateralize a loan, they may demand a premium to extend loans or purchase equity (Myers and Majluf 1984).¹² The higher the cost of external funds relative to internal funds, the stronger the incentive for firms or individuals to rely on the latter.¹³

With this background, our list of investment determinants beyond asset prices will be the cost of capital services (measured as described in Box 1), profits—to capture expected future profits as well as cash flow—the lagged capital stock, and overbuilding. Since investment

projects typically take some time to materialize, we lag the determining variables by two years (our basic results are not sensitive to this choice). The fact that profits are used as proxies for both expected future income and current cash flow implies that our empirical model cannot distinguish between the effects of these variables. Fortunately this limitation does not affect our ability to examine our central concern, which is whether investment is affected by asset prices.

As shown in Table 3A, the relationship between asset prices and investment implied by our second thesis stands up well to this statistical scrutiny. After expanding our model to include fundamental forces such as expected income and the cost of capital, we find the expected positive relationship between asset prices and investment to be significant at the one percent level. The connections appear substantial in economic terms as well. The measured relationship is strongest for housing, where every extra 10 percent decline in property values was associated with an additional 10 percentage point decline for housing construction. This, in turn, suggests that falling house prices could account for *** 13 ½ percentage points of the average 20 ½ percent decline in housing investment over 1989-93. In OECD stock markets, an additional 10 percent decline in real prices beyond the OECD average was associated with an additional 9 percent decline in MEQ investment, implying that falling share prices could account for 5 ½ percentage points of the average 12 ½ percent drop in this type of investment over 1989-93.***^{14,15}

A More Sophisticated Statistical View: We can refine our analysis of the connections between asset prices and investment by turning to the annual data described earlier. This panel data set permits a direct test of our second conjecture—that investment weakness in the early 1990s owed in part to concurrent asset market weakness—superior to the relatively simple

regressions just reported. (Recall that the panel data permitted only an indirect test of our first conjecture.) This larger data set allows us to measure the relevant economic relationships more precisely.

The model we use to examine this new data set, explained in detail in Box 2, is based on the conceptual framework already outlined (see Box 1). Of course, it would be possible to develop a better model of investment for a single country with abundant data, such as the U.S. or Japan. However, since our goal here is to highlight a *common* OECD pattern during the past decade, we continue to limit our empirical model to variables available for most OECD countries.

The results, presented in Table 3B, support our earlier evidence suggesting an independent effect of asset price growth on investment activity.¹⁶ The estimated short-run and long-run effects are both economically and statistically significant. For example, our results suggest that a 10 percentage point increase in house price growth is associated with an additional 4 percent growth in housing investment over the short-run and 5 percent over the long-run.¹⁷ Likewise, if the growth rate of share prices is raised 10 percentage points in a given year, the growth rate of MEQ investment one year later will be 1 percentage point higher. A sustained 10 percentage point rise in the rate of share price growth would ultimately lead to a sustained rise in the growth of MEQ investment of 2.4 percentage points.¹⁸

On average across our OECD countries, house prices declined by about 20 ½ percent, of which, according to these panel regressions, 6 percentage points can be explained by the concurrent decline in housing prices. Likewise, in the countries for which we have complete data, MEQ investment declined by about 13 percent, of which, according to our regressions,

some three percent is explained by declining share prices. Both of these estimated contributions of share prices to investment growth are rather smaller than the corresponding estimates based on our earlier, smaller data set *******(which were 13 ½ and 5 ½ , respectively)*******. In terms of accuracy, we would tend to place more faith in the smaller estimates based on the panel regressions. The important point is, however, that both approaches agree that the effect of falling asset prices on investment during the early 1990s could have been substantial.

Our evidence thus far suggests the following: consistent with our first conjecture, speculative excesses of the 1980s may have contributed to the sagging asset markets of the early 1990s. In turn, asset price deflation seems likely to have been a drag on investment, consistent with our second conjecture. In sum, our evidence is consistent with our overall thesis that tumbling asset prices and anemic investment of the early 1990s may have been symptoms of a "hangover" from speculative bubbles in the late 1980s.

IV. ASSET PRICES AND THE TIMING OF ECONOMIC RECOVERY

If we accept the hypothesis that asset price declines contributed to the investment slump of the early 1990s, we can build on this insight to gain further understanding. In particular, the timing of the investment recoveries could well be explained with reference to asset price developments. In some countries investment remained on its sickbed well after the rest of the economy was up and walking; in others, investment and GDP returned to health roughly concurrently. This difference may stem from corresponding differences in the timing of countries' recessions relative to the asset price bust.

Property and equity prices all began to fall around 1989, and property prices, in particular,

continued dropping well into the 1990s. In countries where recession began relatively early, such as the U.S., the U.K., Australia, and Canada, investment remained weak even as GDP recovered because asset prices were still falling (Chart 6). In these countries, GDP growth fit the pattern stressed at the beginning of this note: recovery was unusually weak and investment failed to be a driving force. In continental Europe, by contrast, the recession took hold only around 1992, by which time asset prices were beginning to bottom out; here GDP recovery roughly coincided with recovery in investment. Not surprisingly, the stronger recoveries in these countries were better supported by investment.

IV. SUMMARY AND CONCLUSIONS

This note has used cross-country data to document a striking pattern in recent OECD economic history: in country after country, asset price booms during the go-go years of the 1980s collapsed around 1989, and investment came down with them. Across the OECD, investment declines in the early 1990s either intensified countries' recessions or were a drag on economic recovery.

Based on our statistical analysis of the period we draw two tentative conclusions. First, we conclude that housing and equity prices may have been inflated by speculative price bubbles in many countries, and that asset price declines of the early 1990s may thus represent a “hangover” from these earlier bubbles. We base this conclusion on our observation that countries whose asset prices rose the farthest in the late 1980s found their asset prices falling the farthest during the 1990s, a result which remains true even when we account for the influence of economic fundamentals.

Our second conclusion is that the asset price declines of the early 1990s may help explain the puzzling concurrent sluggishness of investment. Other potential sources of investment weakness, such as overbuilding and interest rate developments, provide little help in explaining the cross-country pattern of investment during this period. Together, our two conclusions imply that the late 1980s' asset market excesses may have contributed to the unusual weakness of investment during the early 1990s.

None of our analysis should be viewed as conclusive. As noted earlier, our statistical treatment of the 1984-89 and 1989-93 periods is constrained by the limited number of observations--there are only a few industrialized countries, only some of which have adequate

data. Although our more detailed analysis of annual data provides a helpful consistency check and enhanced statistical rigor, it represents only a preliminary investigation of the connections between OECD asset prices and investment. A more conclusive analysis of these issues could require firm-level data.

The notion that asset market behavior could have substantial effects on real economic activity is not new: it goes at least as far back as Irving Fisher, who claimed in 1933 that debt deflation contributed importantly to the great depression.¹⁹ More recently, economists have fleshed out our theoretical understanding of these real-financial linkages, and much evidence has accumulated suggesting the importance of such linkages in earlier historical episodes.²⁰ Our results support the idea that financial market developments—whether or not justified by fundamentals—continue to affect real activity.

Our evidence suggests several important policy issues. We introduce these issues here, though we take no stand on their resolution. The central issue is this: Should governments try to contain or prevent speculative asset price bubbles? In considering this question, governments could choose among policy alternatives including monetary policy, tax policies, or regulation.

Monetary policy could be tightened in response to excessive speculative activity: higher interest rates would discourage the heavy borrowing typically associated with speculation, as would the associated decline in the value of assets used as collateral. Though this policy is fairly certain to have the desired effect on asset prices if pursued with sufficient vigor, it has numerous drawbacks. First, lengthening the list of monetary policy's intermediate targets would make it even more difficult for observers to understand policy shifts. Second, identifying when to intervene would be difficult: for example, though it is by now widely accepted that Japan's stock

and property markets were inflated by speculative bubbles in the late 1980s, there was no such agreement at the time. In fact, our best statistical methodologies even have difficulty identifying bubbles in *past* episodes. One possible solution to this difficulty would be to focus on rapid asset price rises only when they are accompanied by rapid credit growth (see Schinasi and Hargraves 1993 for a detailed discussion). Finally, monetary policies intended to deflate bubbles would also dampen economic activity not fueled by bubbles.

Tax policies or regulation could provide more carefully targetted attacks on speculative bubbles. As an example of tax policies, note that capital gains taxes in some countries already attempt to discourage speculative turnover by promoting long-term ownership of investment assets. Regulations such as minimum required downpayments on residential mortgages could also discourage speculative activity. Other regulations could actually prohibit speculative activity, as in some central European countries where banks have historically been barred from financing commercial building construction until future occupancy is fully committed. Tax policies and regulation could be applied permanently or only when the danger from bubbles appears imminent, much as the Japanese government limited banks' real estate lending during 1990. This, of course, brings back into focus the difficulty of identifying bubbles as they arise.

In short, in deciding whether to attempt to contain or prevent bubbles, governments must choose whether to apply monetary, tax, or regulatory policy, and they must choose between permanent measures and those adopted as speculative pressures appear to build.

Even if one accepts our suggested conclusions about the potential for asset market distortions to affect real economic activity, many questions remain. If there were speculative bubbles across the OECD during the late 1980s, what triggered them? What kept them going?

What punctured them? If asset prices contributed to later investment weakness, what were the critical causal mechanisms? Were credit markets among those mechanisms? These represent important questions for future research.

BOX 1: SUMMARY OF THE STANDARD NEOCLASSICAL MODEL OF BUSINESS INVESTMENT²¹

The neoclassical theory of investment begins with the assumption that a firm operating in the absence of constraints would achieve some ideal capital stock, K_t^* , in each period. The ideal capital stock depends on the firm's estimates of the future revenues and costs associated with each project it undertakes. In standard mathematical representations of the theory, ideal capital turns out to be proportional to the ratio of output (as a measure of potential revenues from the project) to the cost of capital services:

$$K_t^* = \gamma \frac{Q_t}{C_t} .$$

Here Q_t represents output, C_t represents the cost of capital, and γ is the coefficient of proportionality. In this case, net investment would simply represent each period's change in the ideal capital stock: $I_t^{Net} = K_t^* - K_{t-1}^*$. Since our data concern gross investment rather than net investment, we add an expression for capital depreciation, treating it as a constant proportion, δ , of the existing capital stock. This adjustment leaves us with: $I_t = K_t^* - K_{t-1}^* + \delta K_{t-1}$.

Since investment projects are subject to long planning and execution lags, current net investment will be a function of lagged changes in the ideal capital stock:

$$I_t = \sum_{i=0}^{\infty} \beta_i (K_{t-i}^* - K_{t-i-1}^* + \delta K_{t-i-1}) .$$

Combining the theoretical representation of desired capital with the above expression for I_t , and truncating the number of lags at n , gives:

$$I_t = \sum_{i=0}^n b_i \left\{ \frac{Q_{t-i}}{C_{t-i-1}} - \frac{Q_{t-i-1}}{C_{t-i-2}} \right\} + \sum_{i=0}^n d_i K_{t-i-1}$$

To derive our final estimating equation we adjust this expression in a number of ways. First, we measure investment as its log. Consistent with this, we allow output and the user cost of capital to enter separately, instead of entering their ratio. Third, we rely on real business-sector profits rather than output to measure of the expected income flow associated with investment projects (we derive similar results relying on real GDP.) Finally, we take differences across time in all variables, so that the the constant terms drop out of the estimating equation.

The cost of capital associated with this framework will conform to an expression like the following:

$$C_t = pk_t \frac{(r_t + \delta)(1 - k - \tau z)}{(1 - \tau)} .$$

where pk represents the price of capital relative to the price of output, r represents the after-tax financial cost of capital, k represents the rate of investment tax credit, z represents the discounted value of tax depreciation allowances, and τ represents the relevant income tax rate. Of these variables, the ones available to us for both sectors and for our full sample of countries are pk , r , and δ . For business investment only, we are able to approximate the corporate income tax rate for all countries, τ , as the ratio of direct business taxes to total business income. We take the depreciation rate for MEQ investment to be 14 percent and the rate for houses to be 3.5 percent, following the convention described in Summers and Heston (1995b).

For business investment, the financial cost of capital should be a weighted-average of the cost of short-term debt, long-term debt, and equity. We measure short-term real interest rates as nominal short-term rates less expected inflation for the coming year. Long-term real interest rates are measured as nominal long-term rates less average expected inflation for the coming five years. (Our measures of expected inflation are described in Box 1.) We are able to measure the cost of equity as the dividend/price ratio (following Ford and Poret 1991, among others), but only for a subset the countries in our sample. The reported results use the full sample of countries, measuring r simply as the (unweighted) average of short-term and long-term interest rates.²² Unreported results show that our central conclusions are unchanged if we restrict ourselves to the smaller sample and use the more complete measure of the financial cost of capital.

As for housing, the financial cost of capital, r , is best measured by the cost of long-term debt, as fixed rate mortgage financing generally dominates in this sector. We rely on real rents as our measure of the earnings potential of residential investment. It should be noted that most of the previous literature uses demographic factors and real income growth to proxy for expected rents. Adopting such a specification does not materially alter the link found here between house prices and housing investment.

BOX 2: DERIVATION OF THE INVESTMENT EQUATIONS FOR PANEL REGRESSIONS

We assume that investment in a given country (i) in a given year (t) is determined by expected profits, current profits as a measure of cash flow, the cost of capital services, lagged capital stocks, and asset prices, as suggested by our earlier analysis. We also allow for country- and time-specific effects.²³ Because investments projects take time to plan and execute, we include additional lags of the various variables, as well as lags of investment itself (which may also help to capture unobserved fundamentals):

$$I_{it} = \sum_{i=1}^2 \alpha_i I_{t-i} + \beta Y_{t+1}^e + \sum_{i=0}^2 \beta_i Y_{t-i} + \sum_{i=0}^2 \gamma_i c_{t-i} + \sum_{i=1}^2 \mu_i K_{t-i-1} + f_i + \lambda_t + \epsilon_{it}$$

Here Y_t represents income, c_t represents the cost of capital, K_t represents the actual capital stock, f_i represents the country-specific effect for country i , and λ_t represents the time-specific effect for time t (that is common across countries). If we take expected income to be a simple linear function of current income, lagged income, and the other right-hand-side variables, we can drop Y^e from the variable list and reinterpret the coefficients on the other income terms accordingly, giving the expression:

$$I_{it} = \sum_{i=1}^n \alpha_i I_{t-i} + \sum_{i=0}^n \beta_i Y_{t-i} + \sum_{i=0}^n \gamma_i c_{t-i} + \sum_{i=0}^n \mu_i K_{t-i} + f_i + \delta_t + \epsilon_{it}$$

Consistent with our focus on investment growth, we take as our dependent variable the change in (the log of) investment, $\Delta I_{it} \equiv I_{it} - I_{it-1}$, which can be expressed:

$$\Delta I_{it} = \sum_{i=1}^n \alpha_i \Delta I_{t-i} + \sum_{i=0}^n \beta_i \Delta Y_{t-i} + \sum_{i=0}^n \gamma_i \Delta c_{t-i} + \sum_{i=0}^n \mu_i \Delta K_{t-i} + \delta_t + \Delta \epsilon_{it}$$

Note that $\Delta f_i = 0$, and that the time dummies are conceptually unaffected by differencing.

This provides our estimating equation. In order to control for reciprocal causation between investment and the various explanatory variables, the equations are estimated using two-stage least squares. Our instruments include appropriate lags of the various left-hand-side and right-hand-side variables, plus a few other relevant variables. Differencing the original investment equation, as we do in moving from the expression for I_{it} to that for ΔI_{it} , produces a moving-average error term correlated with I_{it-1} . For this reason, I_{it-2} was the most recent lag of investment used as an instrument, and used techniques described in Newey and West (1987) to control for the moving average component of the error term.

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APPENDIX: DATA SOURCES AND METHODS

Data Sources

Our data set includes the 18 following **countries**: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, the UK and the U.S.

Investment and other national accounts data were taken from the OECD database wherever possible. However, MEQ investment data were taken from *Penn World Tables, Mark 5.6* (Summers and Heston, 1995) when they were not available from national accounts sources. This applied to Japan, Ireland and Switzerland. This data source ends in 1992, which limits the number of observations in certain cross-section regressions. **Capital stock** data were also taken from this source.

Interest rate, share price, rent, business income and price data were also taken from the OECD database. Long-term interest rates generally refer to yields on government bonds with five years or more to maturity. (For a few countries, this series was taken from the *International Financial Statistics* of the IMF: line 61, "government bond yields".) Short-term interest rates refer to what the OECD considers to be the benchmark market-determined three-month rate. These are generally interbank or government bill rates.

House price data come primarily from the authors of Borio et al. (1994), who supplied data extending from 1970 to 1992. For ten countries the house price data updated to 1993 using information provided by Berg and Galvenius (1994); for Denmark and the Netherlands the house price data were updated using national sources; it was not possible to update the house price data for Belgium. No house price data were available for the following countries: Austria, Ireland, Italy, Spain and Switzerland.

Certain statements and graphs concerning **peak-to-trough changes in investment or GDP** rely on quarterly data, which are available for a somewhat smaller set of countries. Quarterly data concerning GDP and gross fixed capital formation were unavailable for two countries, Belgium and Ireland. Quarterly data concerning construction and MEQ investment were unavailable for Belgium, Ireland, Japan and Switzerland.

Variable Measurement

Real Interest Rates. We measure real interest rates as the annual average short-term nominal rate less expected CPI inflation for the concurrent year. Expected inflation is derived from an autoregression on two previous years' inflation.

Income. For equity prices we would ideally have expected future dividend income by country. However, since we lack information on current dividends (to say nothing of their expected future values), we use current real business income as a proxy (dividends figures are unavailable for some countries and cover a short time span for others.) More specifically, we take the national accounts measure of after-tax business income divided by the GDP deflator. To measure expected real “house rents” we take the current CPI for rents divided by the aggregate CPI.

Risk. Our measures of risk are based on the principle that only non-diversifiable risk will be rewarded in the market place. We begin by measuring annual equity returns in each country in terms of a common currency (the U.S. dollar). We then construct an index of world-wide equity market returns as the GDP-weighted average (percent) change in these share prices over 1970-1989. We then take a GDP-weighted average of short-term nominal interest rates, which we use as a measure of risk-free returns. The difference between these two measures we interpret as a (crude) measure of non-diversifiable excess returns to the world market portfolio of equities.

To measure an individual country’s equity market risk we regress that country’s annual share returns against this measure of the world market excess returns. (This is analogous to the common approach to measuring an individual firm’s “beta” by regressing returns to owning that firm’s shares on country-wide excess equity returns.) Measuring an individual country’s housing market risk is conceptually more involved, since housing is not very actively traded across countries. If we view investors within a country as choosing between local housing, local equities, and foreign equities, then a relationship between world equity market returns and domestic housing returns should be established indirectly. With this in mind, we measure a country’s housing price risk by regressing that country’s annual real house price changes against our measure of the world market excess returns to equities.

Overbuilding. Our benchmark measure of overbuilding is the deviation of the capital-output ratio from its country-specific trend for each of the two sectors. This approach implicitly assumes that the country-specific trends capture the evolution of the equilibrium capital-output ratios. Because it is not clear whether this assumption is valid, we experimented with alternative measures of overbuilding, including growth in the capital-output ratio over 1984-89 and growth in the investment-output ratio over the same period. For brevity we only report results using the first measure; estimation with the other two measures has little effect on our central results.

Levels vs Changes. Since we are interested in how asset prices change, we focus our empirical analysis on changes in expected income and interest rates. Changes in income are measured as the cumulative change in the natural log of income over the period; changes in interest rates are the difference between the interest rate at the end of the period and its value at the beginning of the period.

NOTES

1. This analysis of investment activity around GDP troughs requires quarterly data, which are available for 16 of our 18 countries for gross fixed investment, and 14 countries for MEQ and construction investment. We also rely on the smaller set of countries with quarterly data for Graph 1A and Graph 1B. Details concerning data sources and variable measurement are found in the Appendix.
2. The figure here is calculated using annual data, for comparability with the available house price data. The average peak-to-trough decline in real equity prices using quarterly data was substantially larger, at 44 percent.
3. The synchronicity among asset price developments around the OECD is not fully understood. The simultaneous *rise* of asset prices around the world during the late 1980s may be explained in part by the global character of the economic boom. Some evidence shows that widespread financial market deregulation, which generally eased lending to consumers, also contributed to the simultaneous rise in house prices (see Borio et al. 1994). The general *fall* in asset prices after 1988 (see Table 1) seems likely to have been precipitated in part by the nearly synchronous turn to tighter monetary policies throughout the industrial world. Strong international linkages among equity and commercial real estate markets may also help explain the rough coincidence of declines in these markets.
4. We use countries with quarterly house price series since these allow a relatively accurate assessment of peak-to-trough price movements.
5. See, for example, Copeland and Weston 1988, pages 20-22, or Brealey and Myers 1987, pages 44-45. A more sophisticated version of this formula would have each future dividend discounted at a slightly different rate. The dividend to be received in one year would be discounted at the current one-period interest rate; the dividend to be received in two years would be discounted at the current two-period interest rate, etc.
6. Our sample includes the U.S., Japan, Germany, France, the U.K., Italy, Canada, Australia, Denmark, Sweden, Norway, Finland, Belgium, the Netherlands, Austria, and Spain, Ireland, and Switzerland.
7. An excellent informal discussion of methods for dealing with outliers is provided in Kennedy (1992). A more sophisticated treatment is provided in Davidson and MacKinnon (1993). See also Greene (1993). We use the MAD estimation procedure provided by the statistical software package RATS.
8. These results bear some resemblance to evidence for mean reversion in stock prices presented Lehmann (1990) and Fama and French (1988). However, Lehmann's results concern weekly returns, so comparability with our results is quite limited. The results of Fama and French do concern long-horizon returns, consistent with our results, but the credibility of those results has been undermined by subsequent research. Kim et al. (1991) showed that "mean reversion is entirely a pre-war phenomenon." Subsequently, McQueen (1992) showed that previous mean reversion results were distorted by statistical procedures.
9. For equities, the systematic relationship between boom and bust—which we interpret as indirect evidence of the presence of bubbles—appears to unique to the recent price cycle. We estimated similar regressions relating growth

in equity prices during one period to growth during the previous period, as follows: 1989-84 vs. 1984-79, 1984-79 vs. 1979-73 and 1979-73 vs. 1973-67. No relationship is found for the earlier periods.

We performed a similar experiment for housing, using only the two paired intervals for which data were available: 1989-84 vs. 1984-79 and 1984-79 vs. 1979-73. We found no relationship between price growth during 1989-84 and 1984-79 periods. We did, however, find a significant negative correlation between house price growth during the 1984-79 and 1979-73 periods.

10. We also estimated these regressions using instrumental variables, in order to correct for the possibility of a correlation between the error and the expected income terms. The results conform with those reported in the text. We do not report these regressions due to the poor small-sample properties of IV techniques (Davidson and MacKinnon 1993, p. 222-23)

11. This discussion condenses and, inevitably, simplifies an enormous literature on the subject of asymmetric information and the role of credit in business cycles. Surveys can be found in Bernanke et al. (1996), Kashyap and Stein (1994), Bernanke (1993) and Gertler (1988).

12. Schiantarelli (1995) summarizes other potential sources of the premium on outside funds, and thus the importance of cash flow for investment.

13. Although there is little consensus as to the precise mechanism linking cash flow to investment, the empirical importance of cash flow for investment is well-established. The standard empirical approach to this issue is to investigate whether cash flow continues to help explain the behavior of investment after controlling for standard fundamental variables. Kopke (1985) and Chamberlain and Gordon (1989) show that models including cash flow outperform many other models. Fazzari et al. (1988) and Calomiris and Hubbard (1995) find a strong influence of cash flow on investment, especially for firms that might be expected a priori to have difficulty obtaining external funds.

14. In assessing these results, we must consider the possibility that our estimated relationships might be biased. As will be shown below, however, any such feedback effect would bias the price coefficient the housing investment regression toward zero. Since our estimated coefficients are already economically large and statistically significant, eliminating the simultaneity bias should only make them larger.

This potential problem of simultaneity bias stems from the reciprocal nature of the causal relationships between asset prices and investment. Asset prices may affect investment—for example, by raising expected capital gains—but investment can also affect asset prices. In the residential property market, most importantly, more building, by increasing the total stock of buildings, can lead to lower prices even while lower prices would tend to lead to less building. Though the effect of one year's construction on asset prices that same year is probably negligible, over the four- and five- year intervals considered here the effect could well be substantial.

15. Our basic results remain unaffected if we use alternative measures of overbuilding.

16. Again, it is worth stressing that these results say little about the precise nature of the connection between asset prices and investment, since almost any theory of investment would imply that asset prices and investment should move in parallel. The fact that other variables, especially cash flow, also have an effect on investment, even

controlling for asset prices, might be taken as evidence against Tobin's "q" theory, and in support of theories based on credit channels. However, asset prices are at best a crude proxy for "q" (the ratio of a firm's asset value to its replacement value), so that any such inference would be unwarranted.

17. The short- and long-run effects of asset price growth differ because price growth also influences current investment indirectly through lagged investment.

18. The marginal significance of these long-run effects is in each case below 0.001, using a chi-squared test.

19. See Fisher (1933).

20. For recent reviews on this topic, see Bernanke and Gertler (1995) or Bernanke et al. (1996). For additional empirical evidence, see Hubbard (1994).

21. The analysis in this section draws heavily on Clark (1979) and Kopke (1985).

22. It would be preferable to weight the components of the financial cost of capital by the actual shares of each type of financing within total business capital, but information on these actual shares is unavailable for most countries. Sensitivity analysis shows that changing the weights in this expression has no noticeable effect on our empirical results.

23. Our empirical specification is similar to that used by Barro (1989), who found strong stock-market effects on U.S. and Canadian investment. For a recent discussion of empirical investment models, see Chirinko (1993).

Table 1: PERCENT CHANGES IN ASSET PRICES ACROSS THE OECD

Country	Real House Prices			Real Commercial Property Prices (Major Cities Only)			Real Share Prices		
	Peak Year	5 Years to Peak	Peak to Trough	Peak Year	5 Years to Peak	Peak to Trough	Peak Year	5 Years to Peak	Peak to Trough
Australia (begins '86)	'89	32.5	-2.5	'88	76.4	-66.2	'87	179.0	-29.6
Canada	'89	54.6	-9.7	'89	28.2	-41.6	'89	31.7	-20.1
Finland	'89	58.6	-47.8	'89	51.9	-46.3	'89	129.9	-54.8
France (begins '85)	'90	23.0	-4.0	'90	78.0	-42.3	'89	132.2	-15.4
Germany	No Peak Around 1989			'91	136.2	-35.6	'90	45.9	-18.1
Italy	No Data			'90	111.0	-42.6	'89	132.1	-40.3
Japan	'90	75.8	-22.8	'89	174.0	-41.5	'89	194.6	-50.7
Norway	'87	44.4	-36.6	'87	62.3	-56.8	'90	70.6	-20.7
Spain	No Data			'90	209.3	-70.9	'89	219.3	-36.0
Sweden	'90	37.8	-25.9	'88	150.5	-66.1	'89	114.7	-40.2
United Kingdom	'89	70.1	-25.2	'88	65.6	-67.6	'89	69.3	-10.0
United States	'88	14.2	-4.8	'87	24.4	-49.1	'89	63.1	-3.2

Note: Annual data. Nominal property values are deflated by the CPI.

Table 2A: Were Asset Price Declines Over 1989-93 Driven in Part by Asset Price Rises over 1984-89?

	Growth in Real Asset Prices, 1989-93			
	Residential		Equity	
	Coefficient	t-Statistic	Coefficient	t-Statistic
Real Asset Price Growth 1984-89	-0.74	-2.35	-0.39	-4.15
Income Variable 1989-93	0.74	0.98	7.10	3.04
Interest Rate 1989-93	-1.79	-1.61	-0.99	-1.25
Overbuilding 1984-89	0.64	0.86	-0.37	-2.37
Risk	-19.38	-0.69	-1.65	-0.14
R^2	0.53		0.64	
$Rbar^2$	0.13		0.48	
Number of Observations	12		18	

- Coefficients estimated using minimum absolute distance (MAD) estimation procedure.

Table 2B: Panel Regression Estimates of the Determinants of Asset Price Growth

	Growth in Real Asset Prices			
	Residential		Equity	
	Coefficient	t-Statistic	Coefficient	t-Statistic
Income Variable (0-2)	0.86	2.55	0.13	4.57
Interest Rate (0-2)	-0.005	-0.65	-0.029	-2.13
Overbuilding (0)	0.02	2.43	-0.07	-1.59
Risk (0)	-0.04	-1.86	-0.017	-0.66
Oil Price (0-2)			-0.195	-2.77
R^2	0.04		0.26	
$Rbar^2$	0.01		0.24	
Number of Observations	259		401	

- Reported coefficients represent the sum of coefficients on all lags. Lags indicated in parentheses. *t*-statistics are calculated accordingly.
- Regressions estimated using two-stage least squares.
- Instruments lists for both regressions included lagged values of the following variables: a constant, short- and long-term real interest rates, real gdp, unemployment rates, gdp deflator, the rate of return to business, the sectoral measure of overbuilding, sectoral asset prices, sectoral income, sectoral investment, a deflator for sectoral output and current sectoral measures of risk.
- The instrument list for house prices also included lagged business investment, lagged share prices, the lagged rate of return to business, and the lagged price of business investment.
- The instrument list for equity prices also included real consumption, money supplies, and the price of oil.

Table 3A: Was Investment Weakness During 1989-93 Driven in Part by Concurrent Asset Price Declines?

	Investment Growth, 1989-93			
	Residential Construction		Machinery and Equipment	
	Coefficient	t-Statistic	Coefficient	t-Statistic
Real Asset Price Growth 1989-93	0.75	5.64	0.51	2.81
Income Variable 1987-91	0.32	0.25	1.08	0.30
User Cost 1987-91	2.38	2.22	-1.28	-0.57
Overbuilding 1984-89	-0.17	-0.18	0.29	1.79
R^2	0.65		0.49	
$Rbar^2$	0.45		0.29	
Number of Observations	12		15	

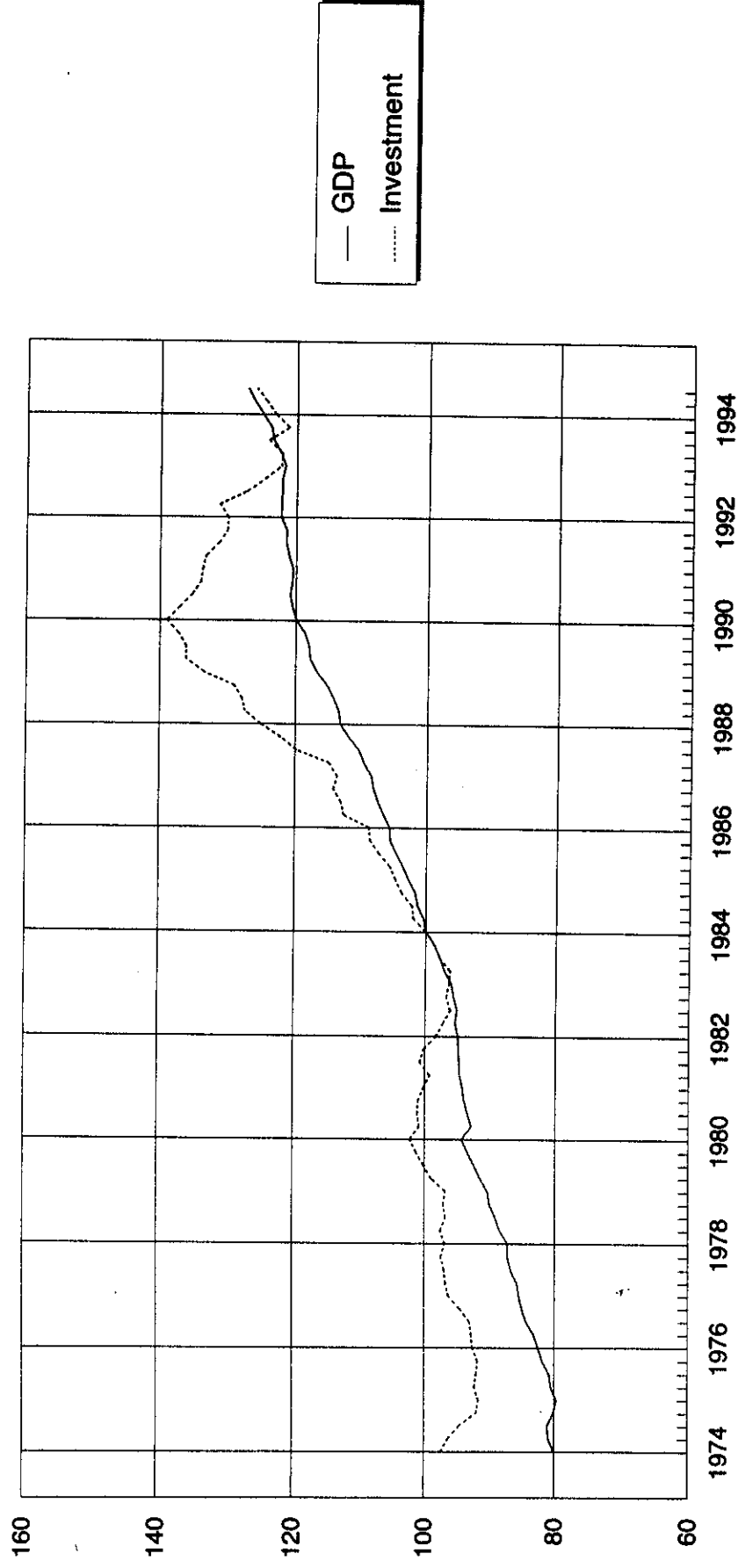
- Coefficients estimated using minimum absolute distance (MAD) estimation procedure.

Table 3B: Panel Regression Estimates of the Determinants of Investment Growth

	Investment Growth			
	Residential		Machinery and Equipment	
	Sum of Coefficients	t-Statistic	Sum of Coefficients	t-Statistic
Real Asset Price Growth (1-2)	0.41	2.89	0.17	5.36
Investment Growth (1-2)	0.16	1.35	0.30	2.81
Income (0-2)	-0.16	-0.37	0.05	4.07
Cost of Capital (0-2)	0.001	0.08	-0.01	-1.53
Overbuilding (1)	-0.10	-2.72	0.01	0.44
Capital Stock (1-2)	-0.09	-0.67	-0.08	-1.00
R^2	0.47		0.30	
$Rbar^2$	0.38		0.23	
Number of Observations	258		423	

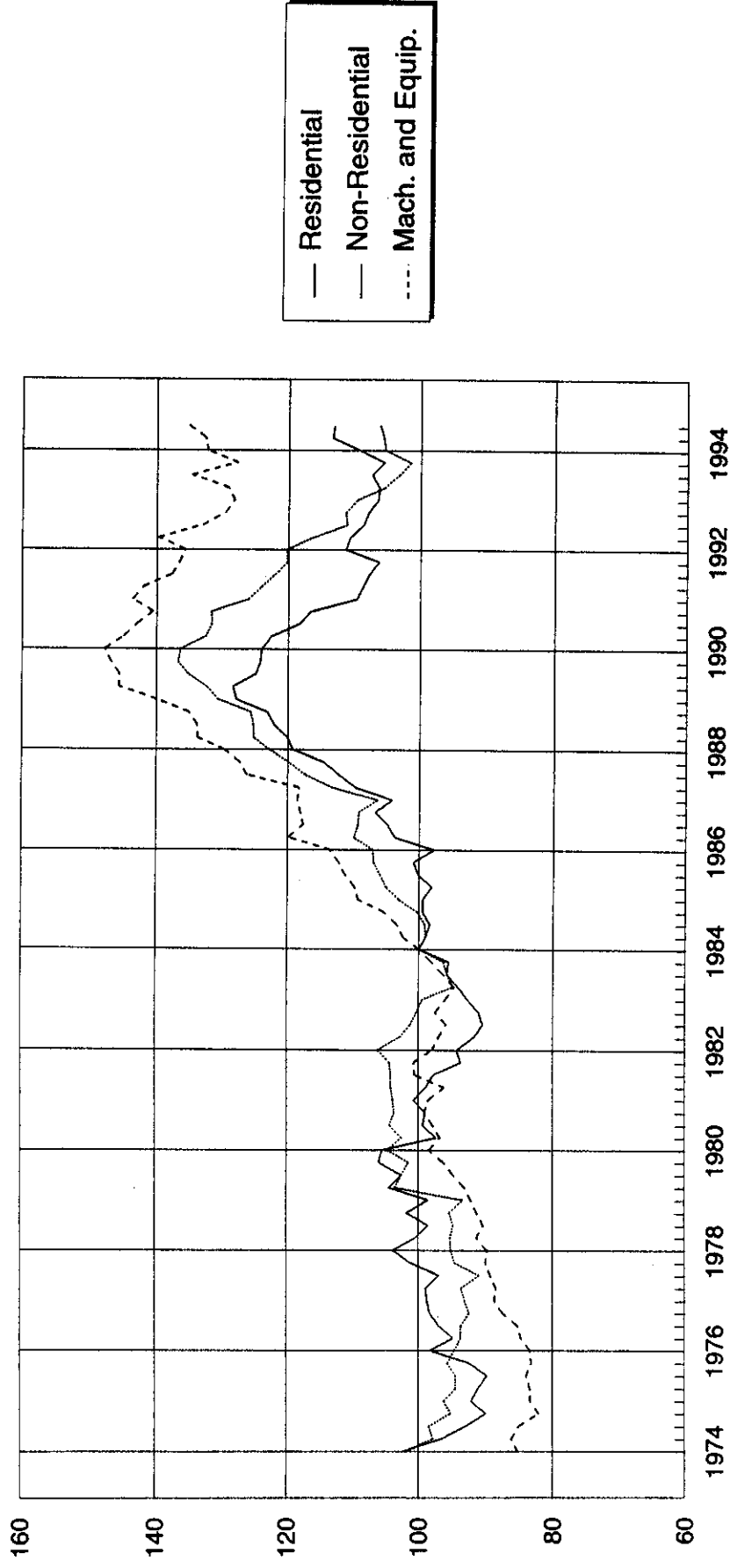
- Time dummies suppressed.
- Reported coefficients represent the sum of coefficients on all lags. Lags indicated in parentheses. *t*-statistics are calculated accordingly.
- Regressions estimated using two-stage least squares.
- Instruments lists for both regressions included lagged values of the following variables: a full set of time dummies, sectoral investment growth, sectoral asset price growth, sectoral income growth, sectoral user cost of capital, sectoral capital stocks, and sectoral overbuilding.

Chart 1A: Investment Drives the Recent Business Cycle



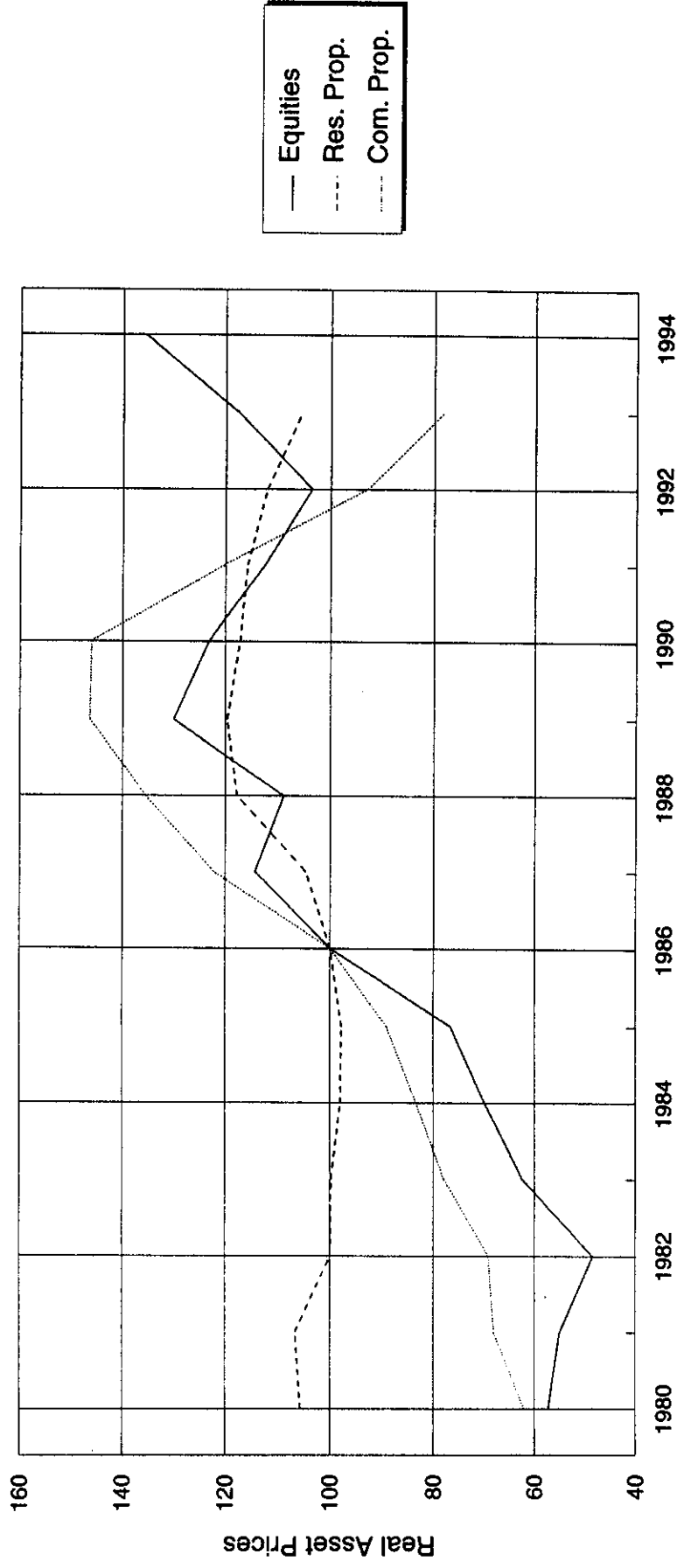
Note: Unweighted averages for 16 OECD countries. 1984:Q1 = 100.

Chart 1B: OECD Investment: From Boom to Bust



Note: Unweighted averages including 14 OECD countries for machinery and equipment, 10 countries for residential construction and 9 countries for commercial construction. 1979:Q1 = 100.

Chart 2: The OECD Asset Market Boom / Bust Cycle



Note: Unweighted averages including 18 OECD countries for equities, 11 for commercial property and 13 for residential property.

Note: Nominal asset prices deflated by CPI. 1986=100.

Chart 3A: Share Prices: Bubble?

Price Growth, 1989-93 vs. 1984-89

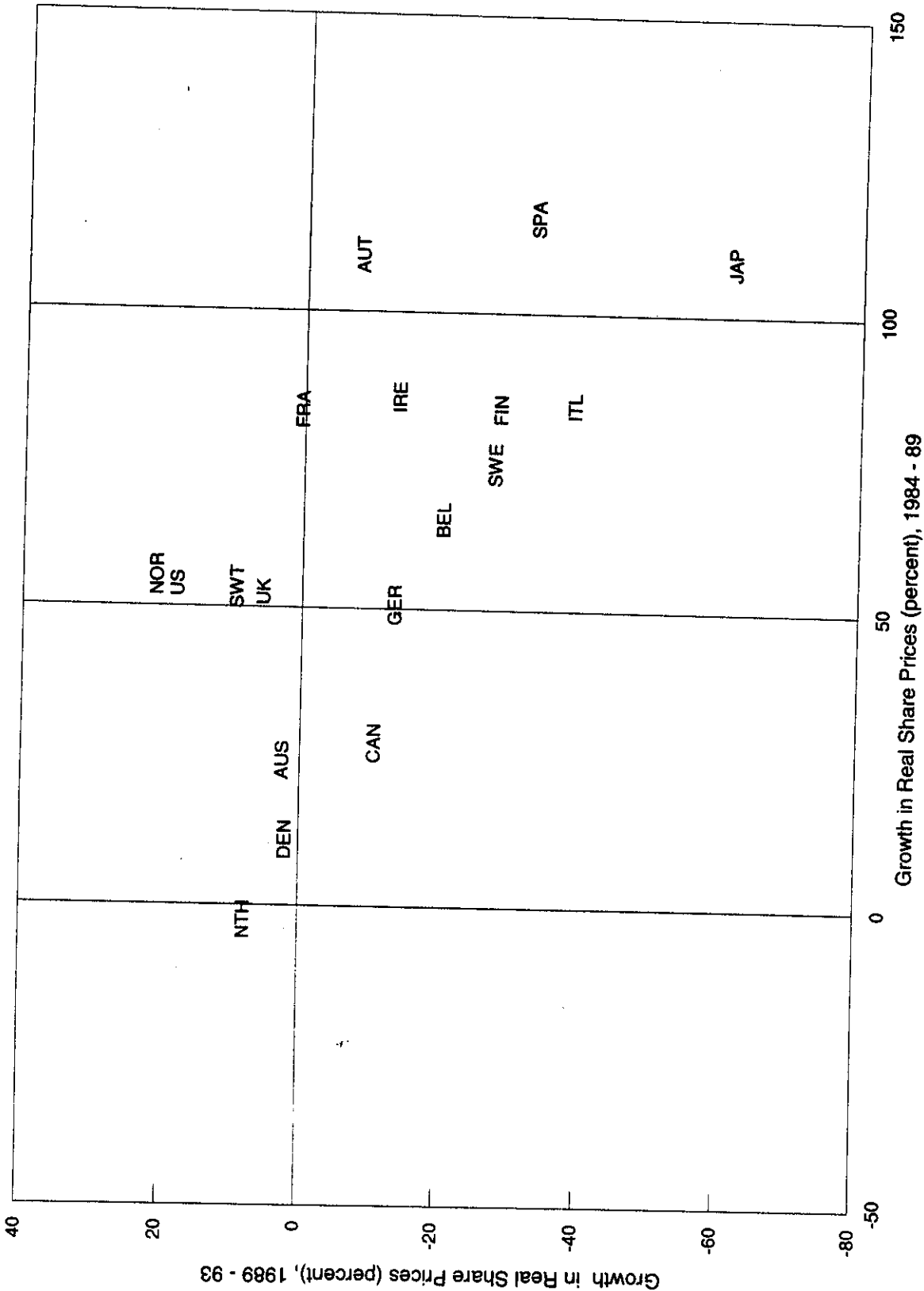


Chart 3B: House Prices: Bubble?

Price Growth, 1989-93 vs. 1984-89

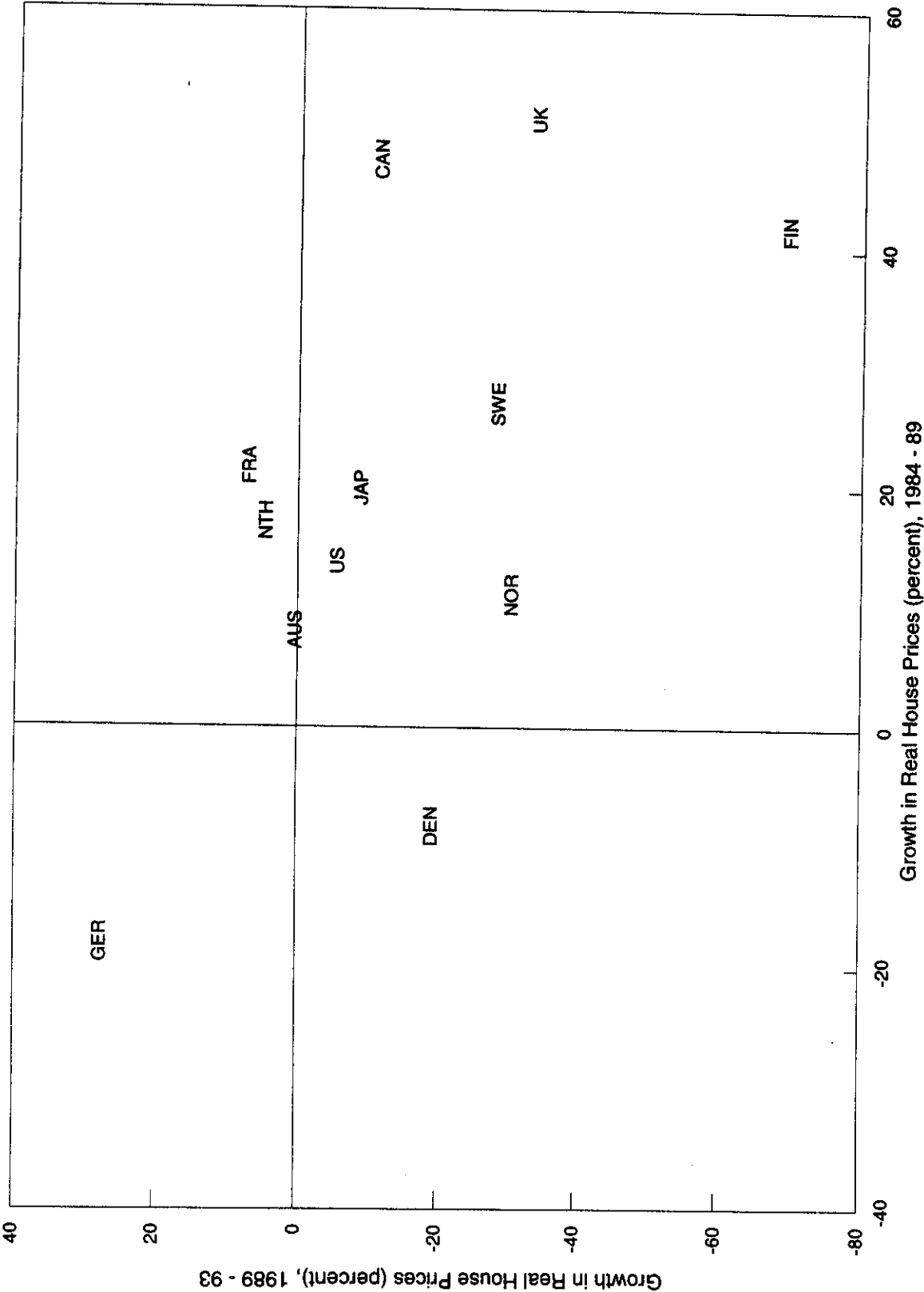
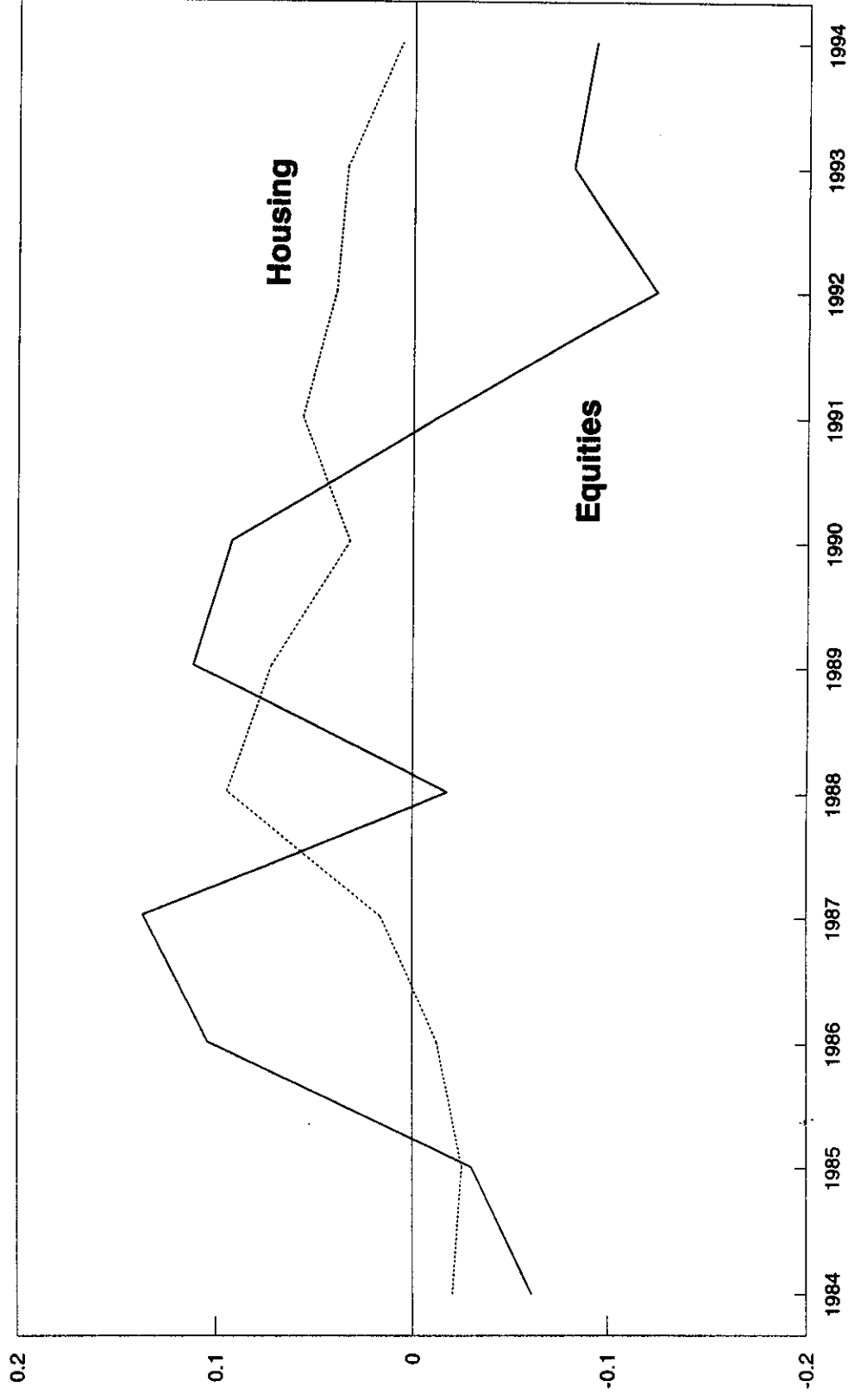


Chart 4: Unexplained Component of Asset Prices, 1984-1993
OECD Average



Cumulative unexplained growth in asset prices averages across countries (18 for equities and 12 for housing).

Chart 5A: Share Prices and MEQ Investment
1989-1993

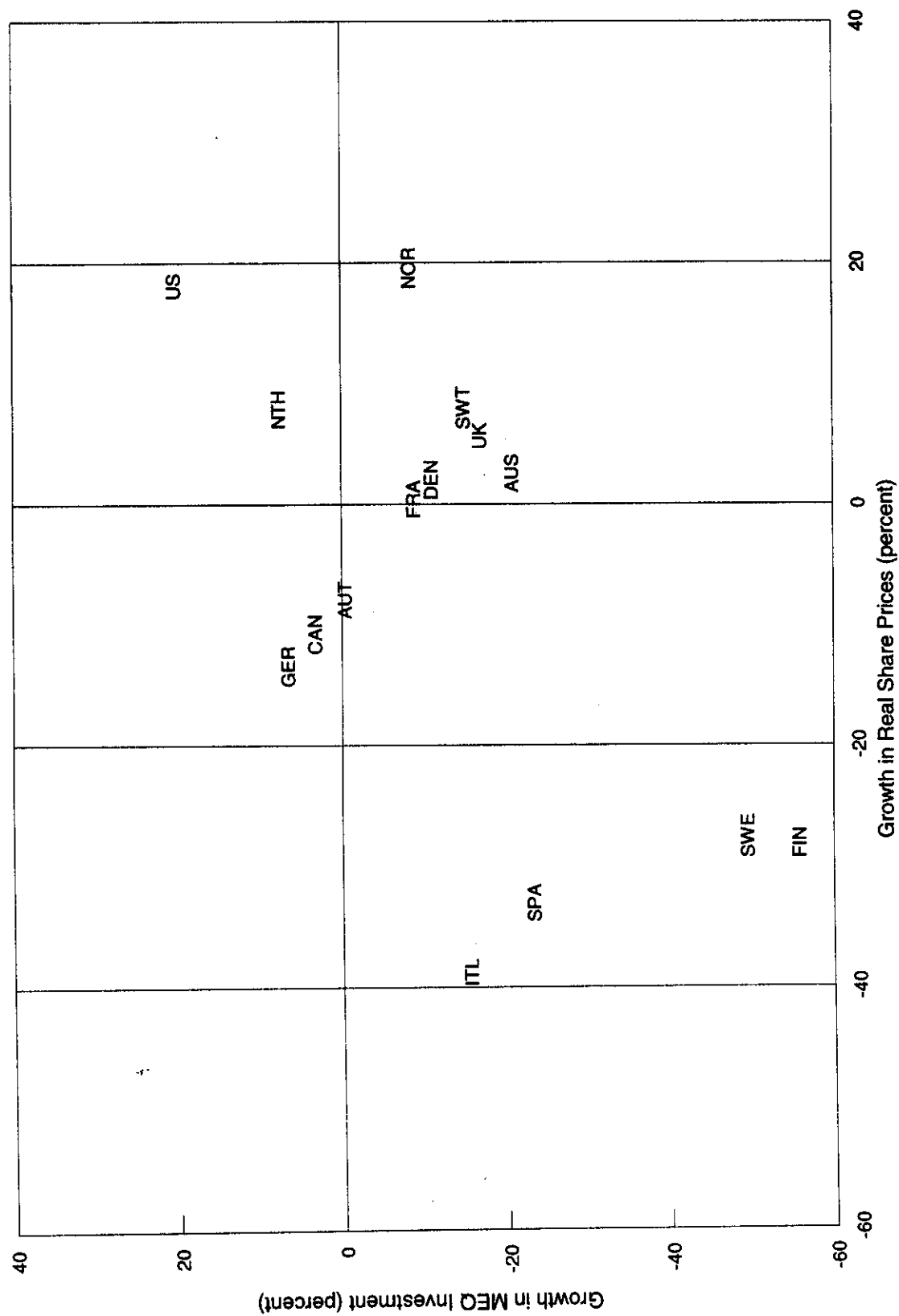


Chart 5B: House Prices and Residential Investment
1989-1993

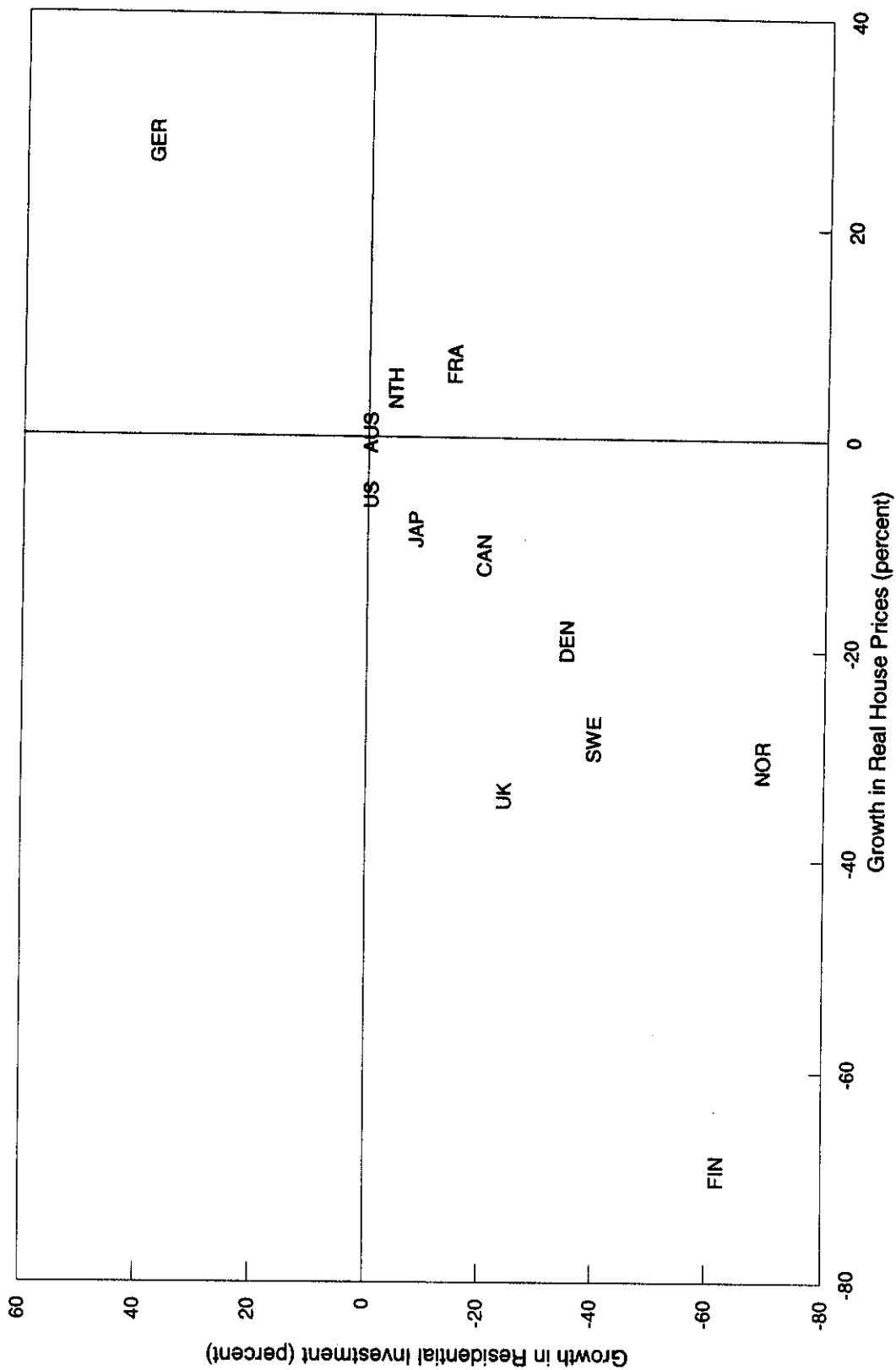
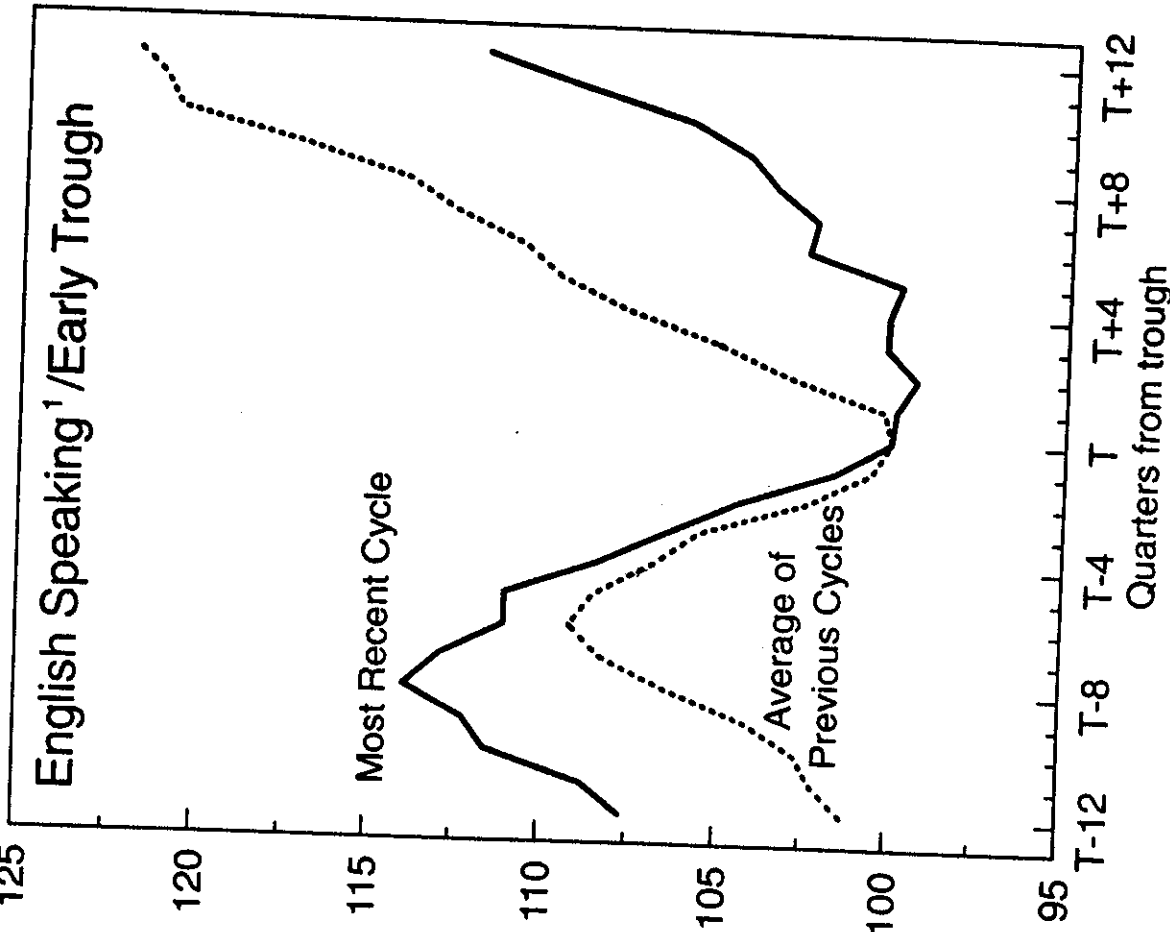


CHART 6

Investment in the Recent Cycle

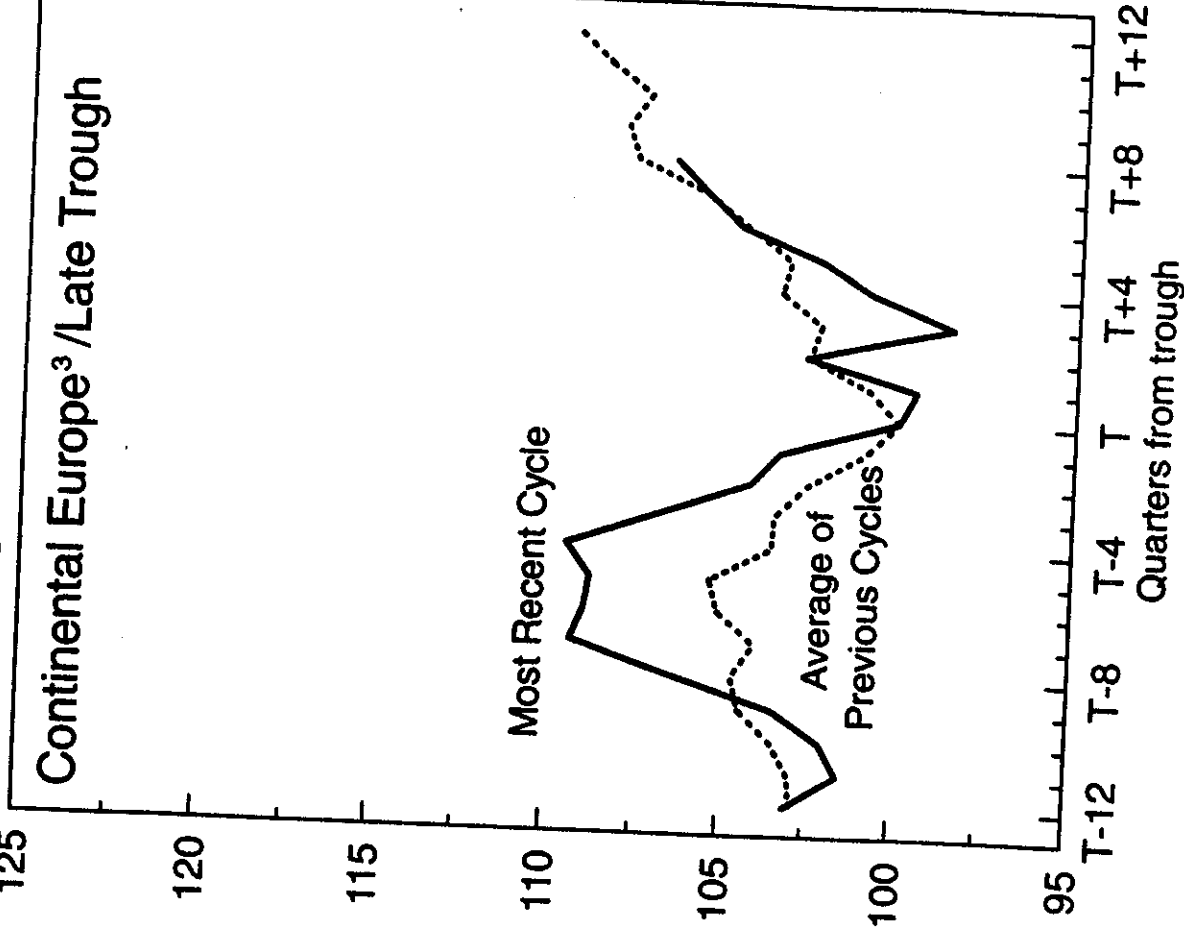
Index: Cyclical Trough² = 100



(1) Note: English Speaking Nations: US, UK, CA & Australia.

(2) Note: 91:1 trough date for CA & US.. 92:1 for UK, and 91:2 for AUS.

Index: Cyclical Trough⁴ = 100



(3) Note: Continental European Nations: FR, GE, IT & NL.

(4) Note: Trough date for FR, GE, NL, 93:1. 93:3 for Italy.

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