

**T**his chapter contains two essays on the macroeconomic and financial after-effects of the bursting of an asset price bubble. This issue is topical given the large and persistent decline in equity prices since 2000 and concerns that the fallout will continue to be a drag on the recovery.

The first essay reviews the experience with asset price busts in industrial countries in the postwar period, seeking to draw out common patterns in macroeconomic and financial developments. The essay finds that equity price busts occurred on average every 13 years, lasted for 2½ years, and were associated with GDP losses of about 4 percent of GDP. Housing price busts were less frequent, but lasted nearly twice as long and were associated with output losses that were twice as large, reflecting greater effects on consumption and banking systems, which are typically heavily exposed to real estate. Against this background, the recent equity price bust itself has been similar to earlier episodes in terms of decline and duration. However, output and investment growth have fallen more than usual, likely reflecting higher-than-typical investment growth before the bust. Another important difference is that housing prices in a number of countries have continued to increase throughout the equity price bust, in many cases by more than the threshold for a housing price boom. This is a particular concern since housing booms have been followed by busts about 40 percent of the time, and have been associated with larger output losses.

The second essay looks at the impact of equity price busts on corporate financial health, and—through that—on investment behavior. The essay finds that equity price booms are generally associated with a large increase in corporate

investment and borrowing, driven by buoyant domestic demand, strong expected rates of return, and strong cash flow. Once it becomes clear that profitability will fall short of expectations or that corporate financial health is in danger, this process is reversed, as firms try to adjust by retrenching their balance sheets and reducing investment. The impact of the recent equity price bust on corporate balance sheets has so far been somewhat smaller than in the episodes of the late 1980s and early 1990s—in part because valuations have remained above historical levels, sharply lower interest rates have helped shore up corporate liquidity, and the boom was concentrated in the information technology (IT) sector, where low leverage helped mitigate spillovers to the banking sector. However, corporate leverage remains relatively high, and may continue to be a drag on recovery for some time, particularly in Europe where investment is largely financed through bank borrowing rather than equity issuance.

### Real and Financial Effects of Bursting Asset Price Bubbles<sup>1</sup>

The long bull market and the exuberance associated with the new economy boom of the 1990s came to a halt in 2000. Since then, broad equity price indices in industrial countries have fallen sharply and persistently. Asset price crashes or busts have often been associated with declines in economic activity, financial instability, and, sometimes, large budgetary costs from the recapitalization of banking systems. However, while many countries have experienced economic slowdowns after the most recent wave of equity price busts, the downturns have not been especially severe. Similarly, while equity prices

<sup>1</sup>The main authors of this essay are Thomas Helbling and Marco Terrones. Emily Conover provided research assistance.

have fallen by large amounts, financial institutions' health in many countries has (so far) turned out to be relatively resilient. Looking forward, what does the post-equity-bubble environment imply for the buoyancy of consumption, the recovery of investment, and the strength of housing prices?

To shed light on the relationships between asset price busts and macroeconomic and financial fluctuations, this essay describes the main empirical regularities across industrial countries over the past four decades. The appropriate conduct of monetary policy during an asset price boom will not be addressed, as it was dealt with extensively in a recent *World Economic Outlook*.<sup>2</sup> The focus on the stylized facts of asset price busts obviates the need to measure or explain “bubbles,” which—despite the frequent use of the term—remains highly controversial.<sup>3</sup> While every asset price bust is different and depends on circumstantial factors such as the underlying shocks, the analysis shows that asset price busts and concurrent macroeconomic developments in the postwar period share common patterns that provide a relevant point of reference for assessing the current busts. These patterns are identified using event analysis—that is, on the basis of their timing, which does not imply causality. In particular, the essay will address the following questions:

- How frequent and how big are equity and housing price busts? Do all booms end in busts? Are busts synchronized across countries? What is the link between equity and

housing price boom-bust chronologies and business cycles?

- What macroeconomic and financial developments are associated with asset price busts? Are they always severe? If not, what are the conditions for busts to have serious implications?
- How do the most recent busts compare with earlier episodes and what are the implications for the outlook?

### Asset Price Booms and Busts in the Postwar Period

To put the recent equity price crashes into perspective, earlier busts need to be identified. The analysis will focus on large and persistent increases (booms) and decreases (busts) in the broad markets for equities and housing, which together account for most of household wealth.<sup>4</sup> Equity price indices are generally available from 1959 for 19 industrial countries; housing price indices generally start in 1970 and are available for 14 countries (both indices are deflated by the CPI). Drawing on business cycle analysis, peaks and troughs in asset prices are first identified.<sup>5</sup> Then, a bust is defined as a peak-to-trough decline where the price change fell into the top quartile of all declines during bear markets; similarly, a boom is defined as a trough-to-peak rise where the price increase was in the top quartile of all increases (see Appendix 2.1 for details). This procedure does not require booms to be followed by busts, as the two types of events are determined independently.

<sup>2</sup>See Chapter III of the May 2000 *World Economic Outlook*. See also Bernanke and Gertler (2001) and Cecchetti and others (2000) for recent studies that focus on the role of monetary policy in dealing with asset price booms and busts.

<sup>3</sup>In principle, a bubble refers to a situation when the price for an asset exceeds its fundamental price by a large margin (see, for example, Cochrane, 2001). However, there are important differences of view regarding the proper measurement of bubbles, including about the assumptions needed to quantify the unobserved expected future values of the fundamentals (on which the fundamental asset price depends), and what explains bubbles, including whether they are just “rational” gambles (e.g., Flood and Garber, 1994) or systemic problems that may require policy intervention (e.g., Allen and Gale, 1999, 2000; Kindleberger, 2000; or Shiller, 2000).

<sup>4</sup>Unfortunately, official statistics do not provide price indices for commercial property in many countries. Indications are that booms and busts in commercial property prices often coincide with those in housing prices (e.g., Borio and Lowe, 2002).

<sup>5</sup>See Box 3.1 in the April 2002 *World Economic Outlook* for a summary of business cycle concepts and measurement and dating issues. Bordo and Jeanne (2002) and Mishkin and White (2003) are recent studies that also use asset prices to identify booms and busts.

Using this methodology, 52 equity price busts were found in the 19 countries between 1959:Q1 and 2002:Q3. This is equivalent to roughly one crash a country every 13 years.<sup>6</sup> All countries have experienced at least one equity price bust during the period of analysis, but the number of crashes varied considerably across countries. To qualify as a crash in this sample, an equity price bear market contraction had to exceed 37 percent. Within the set of crashes, however, this cut-off level is only the upper bound. On average, equity price crashes involved price declines from peak to trough of about 45 percent and unfolded over a period of 10 quarters (Table 2.1). About half of all crashes were recorded during the 1970s. Among those, the most virulent ones were those that occurred in conjunction with the breakdown of the Bretton Woods regime of pegged exchange rates and the first oil shock, as the average equity price decline amounted to 60 percent.

Most equity booms recorded during 1959 to 2002 were followed by average price declines during the ensuing bear markets—only one-fourth ended in busts.<sup>7</sup> A similar result was found for stock price indices in the United Kingdom and the United States over the past 200 years: of the 37 crashes in the two countries, only 12 were preceded by a boom (Box 2.1). The weak association between booms and busts may be due to two reasons. First, the so-called distress phase at the end of a boom, when some investors and firms begin to suffer from being financially overextended, may be long-lasting but economic activity may remain largely unaffected in the absence of a large shock (e.g., Kindleberger, 2000). Under this scenario, the financial vulnerabilities that arose during a previous boom may linger on and only be exposed later. Second, large enough adverse shocks may render previously healthy balance sheets tenu-

**Table 2.1. Equity and Housing Price Bear Markets in Industrial Countries**  
(Median over all episodes)

	Real Equity Prices		Real Housing Prices	
	Contraction <sup>1</sup> (percent)	Duration <sup>2</sup> (quarters)	Contraction <sup>1</sup> (percent)	Duration <sup>2</sup> (quarters)
Bear markets <sup>3</sup>	-24.4	5	-5.7	5
Busts <sup>4</sup>	-45.5	10	-27.3	16
1960s	-40.5	11	—	—
1970s	-49.5	10	-27.3	19
1980s	-47.6	10	-28.5	16
1973 <sup>5</sup>	-60.1	10	—	—
2000 <sup>6</sup>	-43.6	10	—	—

Source: IMF staff calculations.

<sup>1</sup>Contraction from peak to trough in real equity and housing prices, respectively.

<sup>2</sup>Time from peak to trough (excluding the peak quarters).

<sup>3</sup>All bear markets including busts.

<sup>4</sup>All bear markets in the bottom quartile (see text).

<sup>5</sup>Busts beginning during 1972–74.

<sup>6</sup>Busts beginning at the peaks recorded in 2000 and ending in 02:Q3 (end of sample).

ous even in the absence of significant financial vulnerabilities due to a preceding boom.

To qualify as a bust, a housing price contraction had to exceed 14 percent, compared with 37 percent for equities. Housing price busts were slightly less frequent than equity price crashes. In 14 countries with real residential housing prices between 1970:Q1 and 2002:Q3, 20 housing price crashes were recorded (compared with 25 equity price crashes). This corresponds to roughly one bust a country every 20 years. Most housing price busts clustered around 1980–82 and 1989–92, while equity price busts were more evenly distributed across time (see Appendix 2.1).

Housing price crashes differ from equity price busts also in three other important dimensions. First, the price corrections during housing price busts averaged 30 percent, reflecting the lower volatility of housing prices and the lower liquidity in housing markets. Second, housing price

<sup>6</sup>This number is based on completed equity price cycles. At the current juncture, if the on-going bear markets that began in 2000–01 and qualified as crashes based on price declines up to 2002:Q3 were included, the number would increase to 59.

<sup>7</sup>The evidence even suggests that a mild bear market after a boom is almost as likely as a bust and that a bust after a below-average bull market is even more likely than after a boom.

### Box 2.1. A Historical Perspective on Booms, Busts, and Recessions

Stock market booms and busts are a recurrent feature of modern (post-1800) economic history. How do the recent boom and bust in technology stocks and the ensuing recession compare to earlier boom-bust episodes? General evidence from the historical experiences of the United Kingdom and the United States during the past two centuries suggests that historical precedents to busts and ensuing recessions after technology-driven booms exist. However, this box also shows that the severity of some of the recessions in the past seemed largely explained by banking panics and bank failures following the bust.

The table lists all stock market busts or crashes for the two countries up to World War II (annual data). They are defined as peak-to-trough price declines of more than 20 percent, (the same threshold as in Mishkin and White, 2003), although the table also includes some episodes that are widely recognized as crashes in the literature (e.g., the rich man's panic of 1902–04). Also listed are indications as to the likely cause, the GDP decline if a recession overlapped with the crash, the price increase during a preceding boom if one could be identified, a banking crisis indicator, and an indicator of other financial distress (based on Bordo, Dueker, and Wheelock, 2001, 2002).

Four salient patterns emerge from the comparison of the crash episodes:

- Stock market crashes in both countries were frequent (10 in the United Kingdom, 13 in the United States).
- More than half of the crashes in each country were associated with recessions (five in the United Kingdom, nine in the United States).
- Only about one-third of all crashes were associated with a preceding boom, but based on historical narratives, only a few of these could be defined as technology booms.
- Most of the crashes cum recessions were triggered by monetary policy tightening and involved banking panics. Many also involved

other financial distress (business failures, insolvencies).

Three salient boom-bust episodes that have relevance for the recent experience illustrate how the interaction of financial weaknesses and monetary policy may help to explain the severity of the ensuing recessions.

The earliest and probably most infamous boom-bust in the modern era ended with the 1824–25 stock market crash in the United Kingdom (Neal, 1998, and Bordo, 1998). After the Napoleonic wars and the successful resumption of the gold standard in 1821, the British economy enjoyed a period of rapid expansion, stimulated by both an export boom to the newly independent states of Latin America and investment in infrastructure projects (e.g., gas lighting, canals, and railroads). The sale of stocks to finance those ventures, in addition to gold and silver mines (some real, some fictitious) in Latin America, propelled a stock market boom fueled by the Bank of England's easy monetary policy. Indications are that the April 1825 collapse in stock prices was related to the prior tightening of the Bank of England's monetary policy stance (Clapham, 1945). The collapse triggered bank failures, which, once they reached important city banks, precipitated a full-fledged panic in early December. Only then did the Bank of England begin to act as a lender of last resort, and it was too late to prevent massive bank failures, contraction of loans, and a serious recession in early 1826.<sup>1</sup>

The 1840s railroad mania in the United Kingdom was a close precedent to the recent information technology boom (Crafts, 2000). After the first successful railroad was established in 1830, optimistic expectations about potential profits that later turned out to be overly optimistic led to massive investment in rails and rolling stock, which extended the network

<sup>1</sup>The annual data used in the table, based on an industrial production index, does not pick up this recession but it is evident in monthly series on unemployment and business failures in Gayer, Rostow, and Schwartz (1953).

Note: The main author of this box is Michael Bordo.

## Stock Market Crashes, Booms, and Recessions: United Kingdom and United States, 1800–1940

Crashes		Real stock price changes (percent)	Major Causes	Recessions	Preceding Booms	Banking Panic	Other Severe Financial Distress
Peak	Trough			GDP contraction (percent)	Stock price changes (percent)		
<b>United Kingdom</b>							
1808	1812	-54.5	War	—	—	1810	—
1824	1826	-33.6	Latin America mania	—	78.4	1825	—
1829	1831	-27.0	Political agitation	—	—	—	—
1835	1839	-39.1	American boom	-0.6	—	1837	1839
1844	1847	-30.5	Railroad boom	-2.5	51.9	1847	1847–48
1865	1867	-24.5	Overend gurney crisis	—	48.4	1866	1866
1874	1878	-19.7	European financial crisis	-2.0	—	—	—
1909	1920	-80.5	World War I	-23.6	—	1921	—
1928	1931	-55.4	Great Depression	-5.6	—	—	—
1936	1940	-59.9	Housing boom, war scare	—	—	—	—
<i>Memorandum</i>							
2000	2002	-26.7	Information technology boom	—	78.4	—	—
<b>United States</b>							
1809	1814	-37.8	War	-1.6	—	1804	—
1835	1842	-46.6	Bank war	-9.4	57.2	1837	1837
1853	1859	-53.4	Railroad boom	-8.6	—	1857	1857
1863	1865	-22.5	Civil war	-6.2	20.5	—	—
1875	1877	-26.8	Railroad boom	—	50.5	1873	1873–76
1881	1885	-22.2	Railroad boom	—	51.3	1884	—
1892	1894	-16.4	Silver agitation	-3.0	—	1893	1893–94
1902	1904	-19.4	Rich man's panic	—	29.9	—	—
1906	1907	-22.3	World financial crisis	-6.9	—	1907	—
1916	1918	-42.5	War	—	—	—	—
1919	1921	-24.5	Disinflation, disarmament	-8.3	—	—	—
1929	1932	-66.5	Roaring 20s and policies	-29.7	201.8	1930–33	1931–32
1936	1938	-27.0	Tight monetary policy	-4.5	—	—	—
<i>Memorandum</i>							
2000	2002	-30.8	Information technology boom	—	165.2	—	—

Source: Bordo (2003).

across the country. The boom was accompanied by widespread fraud, including “criminally deceitful accounting practices” (Crafts, 2000). The end of the railroad boom was associated with the banking panic of 1847—one of the worst in British history. The crash and the panic, as in earlier episodes, may have been triggered by tightening of the Bank of England’s monetary policy stance, reflecting its concern over declining gold reserves (Dornbusch and Frenkel, 1984). The panic led to many bank failures and a serious recession.

The episode in the United States with the most resonance for today is 1928–33. The 1920s experienced a major stock market boom associ-

ated with massive investment that brought the major inventions of the late nineteenth century—for example, electricity and automobiles—to fruition. In addition, major innovations also profoundly changed industrial organization and the financial sector, including the increased use of equity as a financial instrument. As during the 1990s, new companies with no dividend record but potential were favorites of the stock market (White, 1990).

The crash of the market in October 1929 is usually blamed on the tightening of the monetary policy stance in 1928–29, which reflected the U.S. Federal Reserve’s increasing concern over stock market speculation, and the ensuing

**Box 2.1 (concluded)**

recession that began in July 1929. While the crash had a major effect on the recession dynamics initially, it is not considered the pivot of the Great Depression (Friedman and Schwartz, 1963; and Romer, 1993).<sup>2</sup> The recession turned into the “great” depression in late 1930 when the Federal Reserve failed to prevent a series of banking panics over the next three years, which led to a money supply collapse, massive deflation, and financial disintermediation (Friedman and Schwartz, 1963; and Bernanke, 1983).

The historical record suggests that the key element that seemed to deepen stock market crash-related recessions was financial weakness.

<sup>2</sup>See also Box 3.1 in the April 2002 *World Economic Outlook* on the Great Depression.

Virtually every severe recession in United States’ history before World War II involved banking panics and severe financial distress (Zarnovitz, 1992). This was also the case for the United Kingdom in the first two-thirds of the nineteenth century. The institution of effective lender of last resort policies by the Bank of England in the 1870s and the Federal Reserve since the 1930s, as well as the establishment of federal deposit insurance in 1934, are generally credited as being the most important factors in reducing the severity of recessions in the post-World War II era. Nevertheless, as suggested by the more recent experience of Japan, banking weaknesses—even in situations with an effective lender of last resort—remain a critical element in accounting for prolonged stagnation following the bursting of a bubble.

crashes lasted about four years, about 1½ years longer than equity price busts. Third, the association between booms and busts was stronger for housing than for equity prices. The implied probability of a housing price boom being followed by a bust in the sample is about 40 percent. Housing and equity price busts have, however, one important feature in common. During the 1970s to the 1990s, they generally coincided or overlapped with recessions.<sup>8</sup>

In financial history, price busts were sometimes not confined to one asset class or one country, which is not surprising given asset price linkages. Within countries, linkages between equity and housing prices are of great importance, as rising equity wealth during a boom is likely to raise demand for housing and thus housing prices, and vice versa. Comparing the timing of crashes across the two asset classes in the sample suggests that half of all housing price

busts overlapped, at least partly, with equity price crashes, while only one-third of all equity price busts overlapped with housing price busts (Figure 2.1). Hence, joint equity and housing price busts are even less frequent than busts in either asset class.

With cross-border financial integration and trade linkages, asset price dynamics also have an international dimension. Does this mean that asset price busts are synchronized across countries? Comparing the timing of equity price bust periods suggests that many of them were indeed synchronized, especially in times of recessions, which themselves were typically synchronized as well (Figure 2.2).<sup>9</sup> The synchronization of equity price busts in 1973–74, a time when some of the deepest postwar recessions in industrial countries were also recorded, is particularly striking.

A comparison of the timing of housing price busts across countries suggests that they were

<sup>8</sup>Most equity price busts during the 1960s and a few during the early 1970s did not coincide with recessions, given higher average growth rates at the time. However, evidence from the 1970s for the G-7 countries suggests that in the relevant cases, busts in these countries coincided with severe growth recessions (Helbling and Bayoumi, 2003).

<sup>9</sup>See Chapter III of the April 2002 *World Economic Outlook*.

also often synchronized. At the times of the recessions in the early 1980s and those in the early 1990s, they were generally more synchronized than equity busts. This is surprising since the services from residential property ownership are generally considered nontradable and since cross-border trading of residential real estate is much more difficult, as the financial instruments involved are not tradable securities. Against this background, the cross-border synchronization of housing price busts probably does not reflect direct real estate market linkages as in the case of equities, but rather the synchronization of monetary policy and financial deregulation across countries (in addition to general business cycle linkages). First, industrial countries went through two broadly synchronized monetary policy cycles; the accommodation-disinflation cycle of the 1970s and the early 1980s, and the widespread tightening in 1988–89 to reverse the liquidity injections after the 1987 stock market crash. Second, significant steps toward financial deregulation, which triggered or facilitated many of the housing price booms of the 1980s that ended in a bust, were taken in many industrial countries in the late 1970s and early to mid-1980s (e.g., Drees and Pazarbaşıoğlu, 1998, and BIS, 2002).

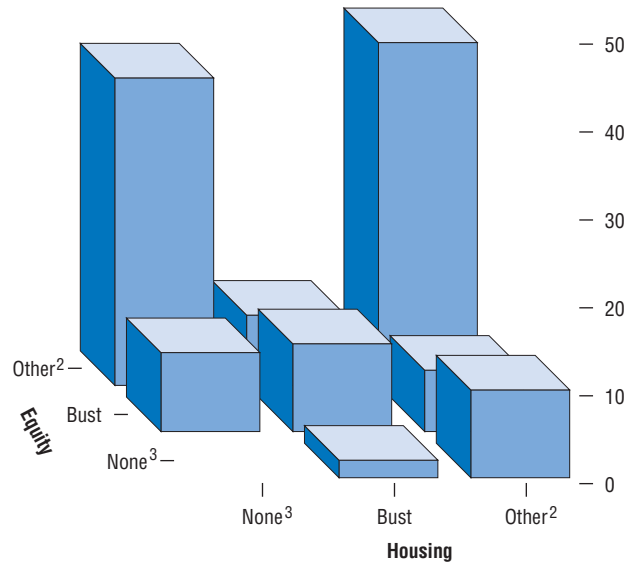
**Macroeconomic and Financial Developments**

The essay now turns to the associations between asset price busts on the one hand and macroeconomic and financial developments on the other in 19 industrial countries between 1960:Q1 to 2002:Q3.<sup>10</sup> Following standard event-

<sup>10</sup>While several studies have documented the effects of asset price busts, they typically cover the experience of only particular countries. For instance, Ito and Iwaisako (1995) and Okina and Shiratsuka (2003) study the Japanese case, Carmichel and Esho (2003) document the Australian experience, and Mishkin and White (2003) study the American experience. Only Bordo and Jeanne (2002) have analyzed asset prices booms and busts for a panel of industrial countries. Bordo and Lowe (2002) relate the probability of financial crises to developments in asset prices, credit, and investment before the onset of crises but they do not analyze asset price bust directly.

**Figure 2.1. Equity and Housing Price Declines<sup>1</sup>**  
(Number of cases)

About one-half of housing price busts overlapped with equity price busts but only one-third of equity price busts overlapped with housing price busts.



Source: IMF staff calculations.

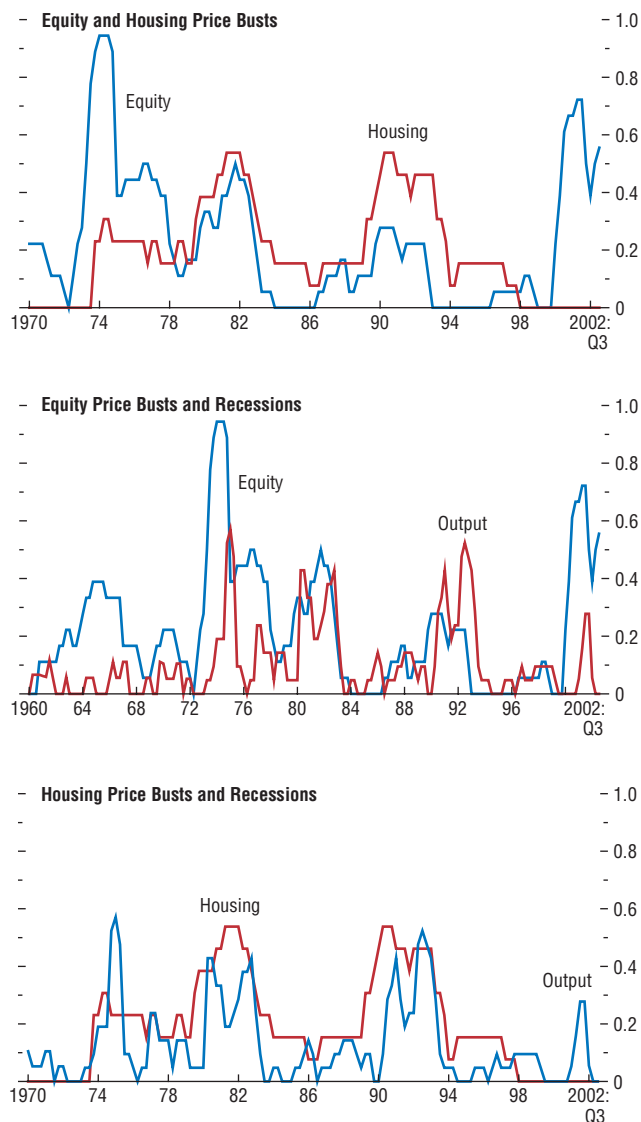
<sup>1</sup>The figure shows the combinations of market constellations for broad equity and housing prices.

<sup>2</sup>Other bear market episodes during which prices fell but not by amounts large enough to qualify as a bust.

<sup>3</sup>No bear market recorded in the asset class.

**Figure 2.2. Comparing Cross-Border Synchronization<sup>1</sup>**  
*(Number of countries in a bust or recession, as a fraction of all countries)*

Equity and housing price busts tend to be synchronized, as manifested by their clustering, and tend to overlap with recessions.



Source: IMF staff calculations.

<sup>1</sup>Recessions are identified on the basis of peaks and troughs in output. See Chapter 3 of the April 2002 *World Economic Outlook* for details.

study methodology, the behavior of key macroeconomic and financial variables before and during an asset price bust is compared.<sup>11</sup> The dates of the asset price peaks associated with subsequent busts, which are taken from the chronology established in the previous section, constitute the event. As discussed above, all countries in the sample have experienced at least one asset price reversal during 1959 (1970) to 2002, which adds to the robustness of the analysis.

Figures 2.3 and 2.4 show the behavior of key macroeconomic and financial variables three years before and after a peak in asset prices that was followed by a bust. All chart panels include the median, which is representative of the typical behavior, and the bottom and top quartiles.<sup>12</sup> The latter allow one to gauge the risks. The bottom quartile, for example, serves as an indication for worse-than-average outcomes.

The postwar experience clearly suggests that asset price busts were associated with substantial output losses, as output growth decreases noticeably (Figure 2.3). On average, the output level three years after an equity price bust was about 4 percent below the level that would have prevailed with the average growth rate during the three years up to the bust. In the case of a housing price bust, the output loss was 8 percent of the level based on average growth rates before the bust. Hence, during 1970–2002, even though housing price busts involved much smaller price declines, they were associated with output effects that were about twice as large as those of equity

<sup>11</sup>This methodology has been widely used in the literature to study a variety of events, including currency crises, debt crises, banking crises, current account reversals, and stabilization programs, among others. Bordo and Jeanne (2002) used this methodology to document the boom-bust cycles of asset prices in OECD countries using yearly data for 1970–2001, although their analysis focuses on the behavior of only three variables (output gaps, inflation, and domestic credit).

<sup>12</sup>The bottom quartile is the highest value of the worst 25 percent of all observations while the top quartile is the lowest value of the best 25 percent of all observations. Medians instead of averages were used to avoid the typical behavior being influenced by outliers in the data.



price busts.<sup>13</sup> The worse-case output effects of housing price busts exceeded those of equity price busts by a substantial margin. Moreover, the slowdown after a housing price bust lasted about twice as long (measured from the time output growth began falling to the time when output growth rebounded).

In terms of timing, the beginning of the output slowdown after a housing price bust coincided roughly with the beginning of bust itself. In the case of an equity price bust, the slowdown began only three quarters after the bust. With regard to the timing of the recovery in output after a crash, however, equity and housing price busts were remarkably similar. Typically, the recovery started nine quarters after the bust. The timing and duration of the slowdown after a bust did not depend on the severity of the output effects, suggesting that a large adverse output effect had no bearing on the timing of the recovery.

The differences in the strength and timing of the output effects associated with equity and housing price busts reflected differences in the behavior of key components of private domestic absorption.<sup>14</sup> Real private consumption, real private gross fixed capital formation in machinery and equipment, and real private investment in construction all experienced larger and faster falls in their growth rates during housing price busts. These sharper falls were reflected in much

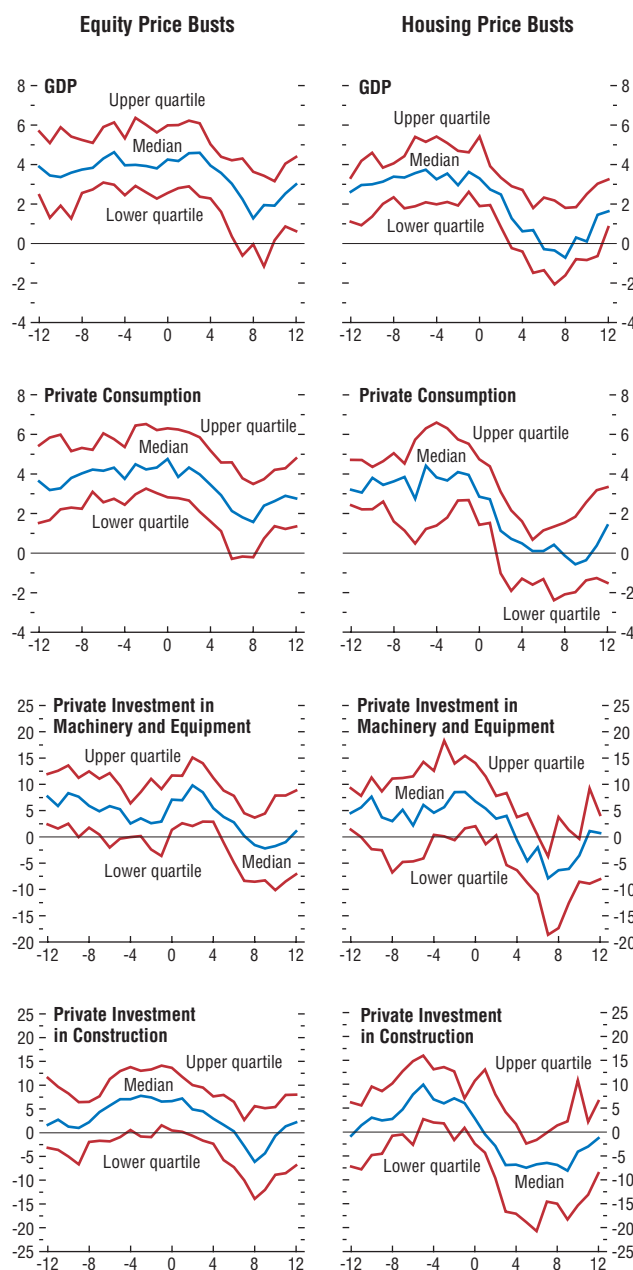
<sup>13</sup>The losses are illustrative and should not be considered output gaps, as the latter are based on sustainable trend growth rates while the pre-bust growth rates may or may not be sustainable. The losses are, however, indicative of the magnitude of the slowdown, which bears on the implications for financially overextended households and firms.

<sup>14</sup>The behavior of key components of private domestic absorption after asset price busts resembles their behavior during recessions (e.g., Chapter III of the April 2002 *World Economic Outlook*). For example, the relatively larger fall in investment growth compared with consumption growth is a well-established empirical regularity in the business cycle literature. The finding of sharper falls in consumption after housing price busts is consistent with the finding that more severe recessions have been associated with consumption contractions whereas milder recessions have not.

**Figure 2.3. Equity and Housing Price Busts: Macroeconomic Associations<sup>1</sup>**

(Percent change from a year earlier, constant prices; x-axis in quarters)

Growth rates of output and key components of domestic private absorption typically decrease following an asset price bust.



Source: IMF staff calculations.  
<sup>1</sup>Zero denotes the quarter after which a bust in equity and housing prices begins (peak in the level of real equity or housing prices).

**Table 2.2. Relative Contributions to Output Growth Before and After Asset Price Busts**

	Equity Price Busts		Housing Price Busts	
	Before <sup>1</sup>	After <sup>2</sup>	Before <sup>1</sup>	After <sup>2</sup>
Average contribution to GDP growth (percent of GDP growth)				
Private consumption	57.4	55.2	61.5	36.5
Private fixed investment in machinery and equipment	18.5	3.6	19.8	-19.1
Private investment in construction	7.7	-1.4	10.4	-32.7
Other <sup>3</sup>	16.4	42.7	8.2	115.3
<i>Memorandum</i>				
Average annual growth in GDP (percent) <sup>4</sup>	4.0	2.6	3.4	0.8

Source: IMF staff calculations.

<sup>1</sup>Average for period beginning 12 quarters before the bust and ending with the peak in GDP growth.

<sup>2</sup>Average for period beginning 1 quarter after the peak in GDP growth and ending 12 quarters after the bust.

<sup>3</sup>Includes government consumption and fixed investment, net exports, and changes in inventories.

<sup>4</sup>Average of changes against the same quarter in the previous year.

lower or even negative contributions to GDP growth (Table 2.2). In fact, if it were not for other demand components (inventories, net exports, and government consumption and investment), the output effects would have been substantially larger. With regard to their timing, the declines in the growth of all these demand components roughly coincided with those in output for busts in both asset classes, as did the recovery.

The behavior of domestic private absorption and output reflected and, through feedback effects, compounded the impact of the fall in asset prices on the financial positions of firms and households, which in turn affected their savings and investment decisions through a variety

of channels.<sup>15</sup> The effects of the equity and housing price busts on key financial variables are shown in Figure 2.4.

Private credit growth declined after a bust, reflecting both lower demand owing to lower investment but also reduced supply on account of the financial accelerator and other supply-side mechanisms.<sup>16</sup> With regard to the timing of the credit response, the decline coincided with the bust. In the case of housing price busts, the fall in credit growth was larger and faster, as the low was reached after four quarters, compared with seven quarters after equity price busts. The recovery in credit growth lagged the recovery in output, in particular after housing price busts. During the initial stages of an output recovery, credit growth remained flat, suggesting that credit played less of a role in the recovery of private investment. The behavior of broad money mirrored that of private credit, including with regard to the timing of decline and recovery, and the differences between equity and housing price busts. This illustrates the strains in household and firm liquidity after a bust, reflecting declines in income and revenue on the one hand and declines in the growth of outside financing. In the case of housing price busts, the decline in liquidity growth coincided with roughly unchanged short-term real interest rates (see below).

A bust in either equity or housing prices has clear spillover effects on prices in the other asset class. Housing price growth accelerated up to the equity price bust and decreased in tandem with equity prices afterward. On average, housing price growth turned negative; that

<sup>15</sup>There are four main channels through which asset prices affect aggregate demand: (1) household wealth, which influences consumption; (2) the market value of the capital stock relative to its replacement value, which influences fixed investment; (3) balance sheets of financial intermediaries, other firms, and households; and (4) capital flows, which affect demand through the real exchange rate. In addition, sharp asset price changes may also affect aggregate demand through their effects on confidence.

<sup>16</sup>The financial accelerator refers to the interaction between a borrower's net worth, which depends in part on asset prices, and the costs and availability of external funds relative to internal funds (cash flow from operations). A decrease in net worth increases the relative costs of external funds while an increase reduces these costs. Another important supply channel is the bank (insurance) capital channel, which operates through the effects of asset prices on intermediaries' equity positions, which in turn determine their supply of intermediation services (e.g., the amount of bank lending). See Bernanke (1993) and Bernanke, Gertler, and Gilchrist (1999) for surveys on how the financial sector transmits and amplifies shocks to the economy or asset prices.

is, housing price levels fell (but not by amounts that would qualify as a bust). The equity price reaction after a housing price bust was more virulent, in terms of both magnitude and the speed of the fall. Comparing the magnitudes of the price declines in the other asset class for each of the two types of busts suggests that the spillover from housing price busts to equity prices was larger than vice versa. For the lowest quartile, equity prices dropped by amounts considered as busts according to the definition in this essay. In the case of equity price busts, even the fall in the lower quartile was smaller than required to qualify as a housing price bubble. This matches the earlier result that housing price busts were more likely to coincide (or overlap) with equity price busts than vice versa. Equity prices rebounded four quarters after a housing price bust while housing prices fell gradually for 11 quarters after an equity price bust. This difference is consistent with the finding that equity prices are more forward-looking than housing prices and less influenced by current output and income developments than the latter.<sup>17</sup>

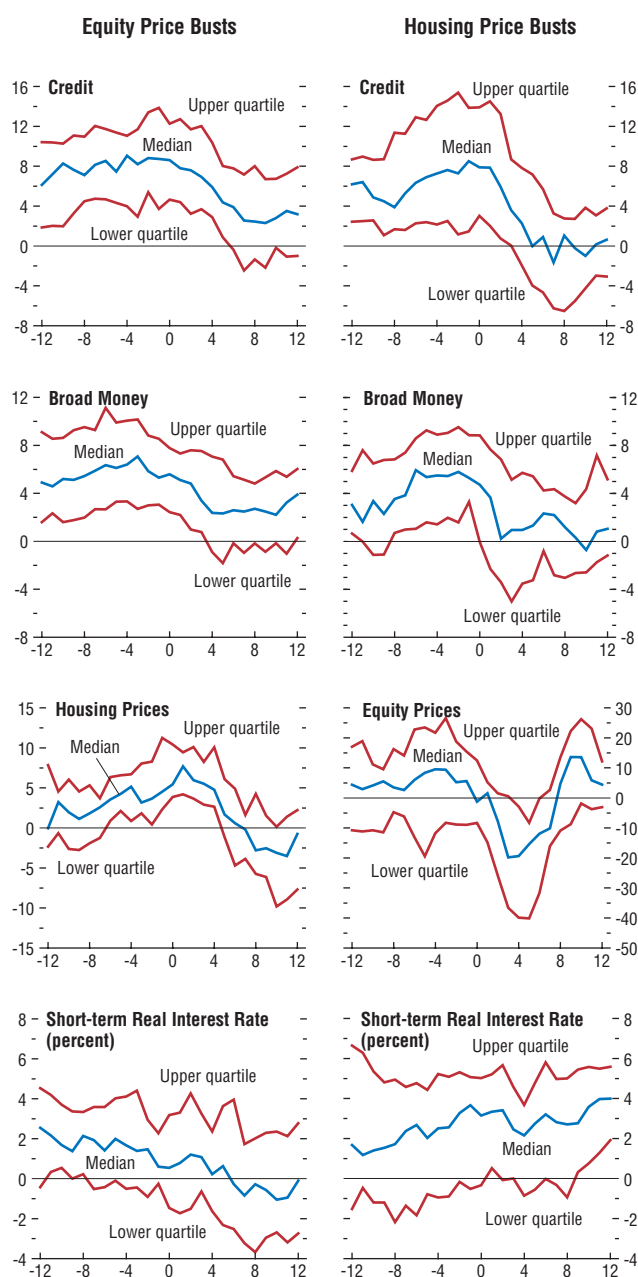
The behavior of short-term real interest rates after a bust depends on the asset class. In the case of equity price busts, rates typically fell after the event, which is consistent with the ensuing decline in output growth and monetary easing, while their behavior before the event did not indicate a clear pattern. In the case of housing price busts, however, short-term rates clearly increased prior to the event and remained about constant thereafter, which is consistent with the notion that the bust may reflect monetary policy tightening.

Finally, macroeconomic developments after an asset price bust are found to depend on the structure of the financial system. In this regard, a widely held belief is that countries with bank-based financial systems are more vulnerable to asset price reversals than countries with market-based financial systems, as the latter offer more

**Figure 2.4. Equity and Housing Price Busts: Financial Associations<sup>1</sup>**

(Percent change from a year earlier unless otherwise noted, constant prices; x-axis in quarters)

Credit and broad money growth typically decrease following an asset price bust. Interest rate behavior after the bust depends on the asset class.



Source: IMF staff calculations.

<sup>1</sup>Zero denotes the quarter after which a bust in equity and housing prices begins (peak in the level of real equity or housing prices).

<sup>17</sup>See Chapter III of the May 2000 *World Economic Outlook*.

variety in the sources of financing that allow for a better diversification of risks (e.g., Herring and Wachter, 2003). To explore this possibility, the authors split the sample of equity and housing price busts according to whether they occurred in bank-based and market-based financial systems.<sup>18</sup> The comparison suggests that bank-based systems tend to be more affected by housing price busts than market-based systems, but that the latter are more affected by equity price busts.<sup>19</sup> The slowdowns in consumption and investment growth following an equity price bust were sharper and faster in market-based systems than in bank-based systems, which is consistent with the larger wealth effects of equity price changes in market-based systems found in Bayoumi and Edison (2003). Conversely, adverse macroeconomic developments were more severe in bank-based systems following housing price busts, consistent with the high exposure of the banking sector to real estate lending. Since banks are the dominant source of financing in bank-based systems, the banks' problems affected the financing of private sector activities more widely than in a market-based system. The more protracted response also reflected the longer adjustment of consumption to changes in wealth in bank-based systems.

An important theme running through the foregoing analysis is that housing price busts were associated with more severe macroeconomic developments than equity price busts. Coupled with the fact that housing price booms were more likely (than equity price booms) to be followed by busts, the implication is that housing price booms present significant risks. The differential macroeconomic associations of

equity and housing price busts also provide analytical clues about some of the factors that determine the severity of busts. In particular, five factors seem to account for the greater severity of housing price busts.

- *Housing price busts have larger wealth effects on consumption than do equity price busts.* Private consumption fell sharply and immediately in the case of housing price busts while the decline was smaller and more gradual after equity price busts. These findings are consistent with recent research that found larger short-term (impact) and long-run effects of changes of housing wealth compared with equity wealth (e.g., Chapter 2 of the April 2002 *World Economic Outlook*; Bayoumi and Edison, 2003; and Case, Quigley, and Shiller, 2001).<sup>20</sup>
- *Housing price busts were associated with stronger and faster adverse effects on the banking system than equity price busts.* The behavior of private credit and broad money clearly suggests that, relative to equity price busts, housing price busts had larger adverse effects on the capacity and willingness of the banking system to lend, which in turn may explain the more severe real economy implications—for example, the sharper decrease in private investment. Standard banking system indicators support this conclusion (Figure 2.5). First, banks faced more rapid increases in provisioning costs with housing price busts, reflecting larger amounts of nonperforming loans. Second, the capital-to-asset coverage of banks decreased by more and faster, implying that their lending capacity is more constrained. Third, pretax profits of banks are lower after housing price busts, indicating a reduced willingness to lend.

<sup>18</sup>Following Levine (2002) and Chapter II of the April 2002 *World Economic Outlook*, countries are classified as bank- or market-based depending on the ratio of the value of domestic equities traded on the domestic stock markets (as percent of GDP) to the claims on the private sector by commercial banks (also as percent of GDP). The group of bank-based financial system comprises Austria, Belgium, Denmark, Finland, France, Germany, Italy, Japan, Norway, New Zealand, and Spain, while the group of market-based financial system includes Australia, Canada, Ireland, the Netherlands, Sweden, Switzerland, the United Kingdom, and the United States.

<sup>19</sup>Nevertheless, it should be noted that housing price busts were associated with worse output losses in both types of financial systems.

<sup>20</sup>Using the short-term and long-term elasticities for equity and housing wealth reported in Chapter 2 of the April 2002 *World Economic Outlook* to assess the consumption effects of the median price changes during busts confirms that the smaller housing price drop has a larger impact and long-run effects on consumption than does the larger equity price fall.

Moreover, in some cases, banks were affected by solvency problems after housing price busts. Indeed, according to the chronology of banking crisis reported by Eichengreen and Bordo (2002), all major banking crises in industrial countries during the postwar period coincided with housing price busts.

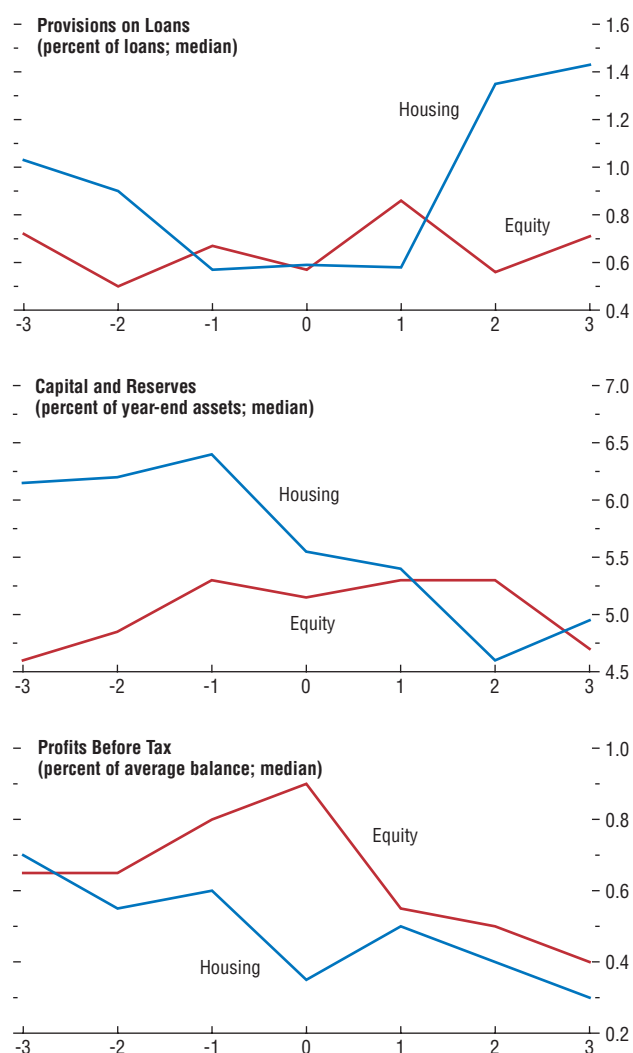
- *Housing price busts were more likely to have been preceded by a boom so that there were larger imbalances to be unwound.* As discussed earlier, the connection and incidence between boom and bust is stronger for housing than for equity prices. This matters because in a regression analysis of the main determinants of the adjustment in asset prices and investment following an asset price bust, the authors found evidence that there are significant bull-bear market feedback effects.<sup>21</sup> Specifically, the results suggest that the change in the average growth rate of asset prices three years before and after the bust increases with the level of the average growth rate in the three-year period ending with the bust. Similarly, the magnitude of the adjustment in the average growth rate of investment in machinery and equipment and in construction was found to increase with the three-year average growth rate up to the bust. These findings are consistent with the commonly held belief that asset price and investment correction following an asset price bust are proportional to prior excesses.
- *Price spillovers across asset classes matter, as evidenced by the fact that housing price busts were more likely associated with generalized asset price bear*

<sup>21</sup>The regression analysis controlled for other factors, such as financial deepening (measured as the ratio of broad money to GDP), changes in the rate of growth of credit, and changes in short-term real interest rates. Another important finding was that reductions in the average growth rate of private credit magnified the adjustment in asset prices and investment after a bust. Although the regression analysis uses changes in credit growth rather than direct measures of a credit crunch, the results are consistent with the notion that the effects of credit crunches in the aftermath of an asset price bust could be so severe that a proactive monetary policy aimed at diffusing an asset price boom may be warranted, as argued by Bordo and Jeanne (2002).

**Figure 2.5. Equity and Housing Price Busts: Implications for Banks<sup>1</sup>**

*(Years prior, during, and after the bust; x-axis in years)*

The banking sector is typically more vulnerable to housing price busts than to equity price busts.



Source: OECD; and IMF staff calculations.

<sup>1</sup>The charts are only based on episodes from 1980 to 2000, reflecting the availability of data.

*markets or even busts than equity price busts.* Two hypotheses that could explain the generally stronger spillover effects of housing price busts have been put forward.<sup>22</sup> First, the contagion may have reflected common fundamentals (e.g., interest rates and growth prospects). Indeed, equity price growth began falling already about three to four quarters before a housing price peak before it sharply dropped after the bust. Second, rising housing prices may foster speculative investments in equity with borrowed funds, as housing assets can be used as loan collateral.

- *Housing price busts were associated with tighter monetary policy than equity price busts*, reflecting the fact that most housing price busts occurred during either the late 1970s and early 1980s or the late 1980s, when reducing inflation was an important policy objective. The disinflation increased the real burden of debt, which exposed inflation-related over-investment and associated financial frailty.<sup>23</sup>

### Modern Asset Price Busts: A Synopsis

The analysis of asset price busts in the postwar period suggests the following main points.

- Equity price busts on average occurred about once every 13 years, lasted for about 2½ years, and involved price declines of about 45 percent (though the busts in the mid-1970s averaged about 60 percent). Housing price busts on average occurred about once every 20 years, lasted about 4 years, and involved price declines of about 30 percent. While only about one-fourth of equity price booms were followed by busts, about 40 percent of housing price booms ended in busts. Both types of busts were highly synchronized across countries.
- Both equity and housing price busts were associated with output losses (relative to the simple extrapolation of the pre-bust growth rate),

reflecting declines in the growth rates of all the main components of private final domestic demand: consumption, investment in machinery and equipment, and investment in construction. The output loss associated with the typical housing price bust (about 8 percent of GDP) was twice as large as that associated with a typical equity price bust (about 4 percent of GDP). Output usually started to recover about nine quarters after the start of either an equity or a housing price bust.

- There were significant price spillovers across asset classes. In an equity price bust, housing prices tended to decline in tandem with equity prices, while in a housing price bust equity prices fell more quickly and by a larger amount than housing prices. Asset price busts were also linked with reductions in the growth rates of private credit and broad money. Again, housing price busts were associated with more severe slowdowns in these monetary aggregates than equity price busts.
- The magnitude of the asset price fall during a bust depended in part on the size of the run-up in prices prior to the bust. Similarly, the extent of the slowdown in investment growth during a bust depended in part on the earlier pace of investment.
- Bank-based financial systems tended to suffer larger output losses than market-based financial systems during housing price busts, while market-based systems tended to suffer larger output losses than bank-based systems during equity price busts. This is consistent with the high exposure of banks to real estate lending, and the importance of equities in household assets in market-based systems.

An important theme running through these results is that housing price busts have been associated with more severe macroeconomic and financial developments than equity price busts. This reflects several factors, including larger

<sup>22</sup>Ito and Iwaisako (1995) provide evidence for the case of Japan.

<sup>23</sup>Schwartz (1995) argued that sustained inflation encourages speculative investments, especially in real assets, because investors expect rising prices, which reduces the real value of their borrowing but not of their investments (see also Bordo and Wheelock, 1998).

wealth effects on consumption, deeper effects on the banking system, the need to unwind greater imbalances, and the higher degree of contagion across asset classes.

### The Recent Equity Price Bust in Perspective

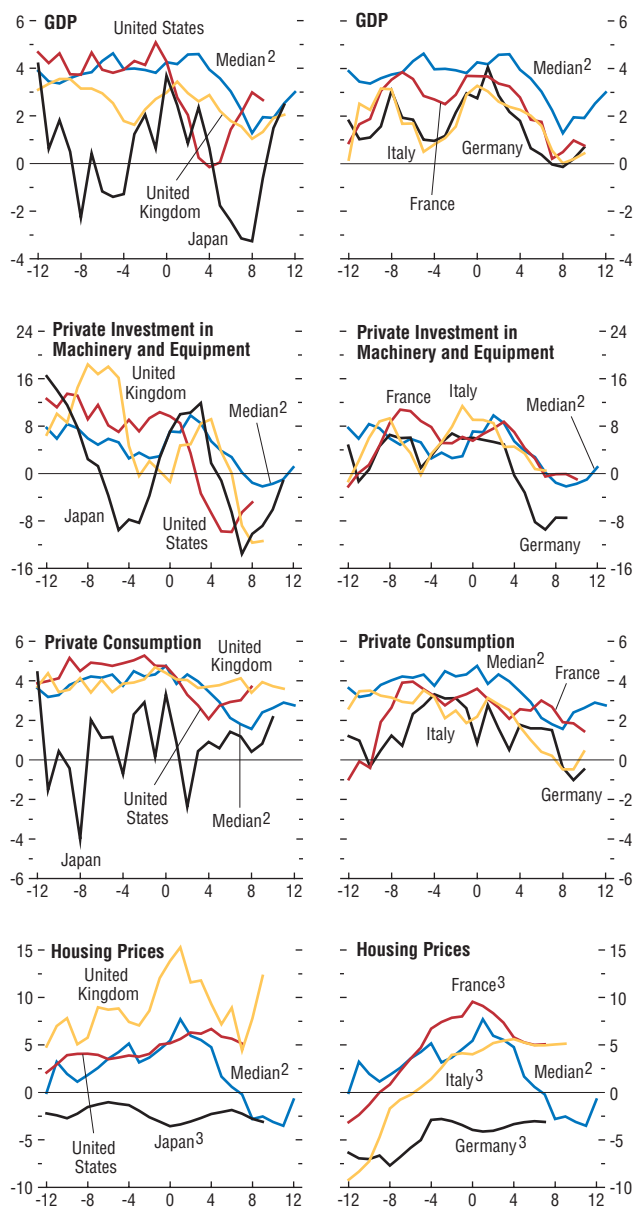
How does the most recent wave of equity price busts in industrial countries that began in 2000 compare with the typical equity price bust in the postwar period? The recent busts in broad equity price indices have so far been similar to earlier episodes in terms of the magnitudes, the lengths, and the cross-country synchronization of the price declines. However, macroeconomic and financial developments differ from the median postwar experience in three important respects (Figure 2.6).

- The decline in output growth began earlier in all Group of Seven (G-7) countries and has been larger than usual in most countries, reflecting the relatively sharper falls in private fixed investment in most countries. The steeper declines in investment are consistent with the higher-than-typical growth in investment in the preceding booms, likely reflecting the impetus from the rapidly rising equity prices.
- The growth of private consumption has been more buoyant than is typical in some G-7 countries (the United States, the United Kingdom, and to a lesser extent France), reflecting in part stronger-than-usual housing prices. In Germany and Italy, consumption growth has been weaker than average.
- Short-term real interest rates declined more quickly and by larger amounts than usual in the United States and, to a lesser extent, Canada. In Japan, interest rates have remained steady, while in France, Germany, Italy, and the United Kingdom, interest rates have generally remained higher than is typical.

The analysis in this essay suggests one important ray of hope for the outlook and one important risk. The ray of hope is that the growth rate of private investment in machinery and equipment typically reaches a trough about eight quarters after the beginning of an equity

**Figure 2.6. The Recent Equity Price Bust in Perspective<sup>1</sup>**  
(Percent change from a year earlier, constant prices; x-axis in quarters)

The recent wave of equity price busts has some resemblances to and differences from previous events. An important difference concerns the behavior of housing prices.



Source: IMF staff calculations.

<sup>1</sup>Zero denotes the quarter after which a bust in equity and housing prices begins (peak in the level of real equity or housing prices).

<sup>2</sup>Median of previous equity price busts.

<sup>3</sup>Interpolated data, for Japan and Italy using semiannual data, and for Germany and France using annual data.

price bust. While a detailed breakdown is not available for all countries yet, investment growth may now be stabilizing in the United States, as is typical, though it seems to be still falling in the euro area and Japan. The risk is that housing prices in many countries have increased by more than the threshold for a boom, and booms have been followed by busts about 40 percent of the time.<sup>24</sup> Housing price busts have been associated with more severe macroeconomic and financial developments than equity price busts.

### Corporate Fragility and Investment: What's Different About the Recent Bubble?<sup>25</sup>

Having examined the behavior of macroeconomic variables in the aftermath of asset price busts, this chapter now turns to the issue of corporate financial health and its relationship with private investment. The topic is clearly timely in light of the much publicized financial excesses of the corporate sector in the United States and other advanced countries during the recent stock market bubble. Among those “excesses,” the unprecedentedly high levels of corporate debt, together with indications of overinvestment in some sectors, have been suggested as potential constraints on an investment recovery in the near term, with adverse implications for the strength of overall economic growth going forward.

The emergence of corporate financial excesses during asset market booms is hardly new. Kindleberger's (2000) classic study on the anatomy of financial crises, for instance, surveys multiple historical recurrences of the phenomenon and shows how it is systematically linked to an initial favorable shock—often affecting one or a handful of industries—which gradually

spreads through the economy via expectational factors and sufficiently liquid asset markets. A typical pattern is the growing expectation of higher future earnings after an initial positive shock, which induces firms to invest well ahead of demand and finance investment through rising leverage. Given favorable monetary conditions, the initial sectoral boom then spreads to other sectors through a variety of goods and asset market linkages. As aggregate demand fuels cash flows and earnings growth, while higher stock market valuations reduce the ratio of debt to market capitalization, balance sheets look healthier and perceived corporate risk is thereby lowered. Borrowing costs then drop, feeding back into more corporate borrowing and investment—a mechanism dubbed the “financial accelerator” in the modern literature (Bernanke and Gertler, 1990; Bernanke, Gertler, and Gilchrist, 1999). As Kindleberger's description clearly shows, different types of shocks can set the process into reverse; and as with the onset of the bubble, problems often start in one sector of the economy and become generalized against a background of unrealistic earnings expectations and excessive leverage. Whether or not aggravated by monetary policy tightening, this typically leads to an unraveling of balance sheet positions as firms try to adjust to the dwindling supply of external finance by reducing debt and cutting investment spending. The ensuing process of deleveraging will hamper investment as long as firms' debt levels are seen as abnormally high and the gap between investment and the availability of internal funds (cash flows) continue to be positive, since overindebted and less liquid firms are more likely to pass up on new investment opportunities.<sup>26</sup>

In light of this framework, this essay looks at the experience of the 1980s and 1990s concern-

<sup>24</sup>This probability is obviously affected by several factors, including the monetary policy stance, which in the case of housing price busts in the sample appears to have been tight.

<sup>25</sup>The main author of this essay is Luis Catão. Emily Conover provided research assistance.

<sup>26</sup>As extensively discussed in the modern finance literature, this is due to a combination of higher external financing costs stemming from asymmetric information between managers, bondholders, and investors, as well as from the fear of bankruptcy when leverage is high and new investment opportunities are riskier. See, for example, Stein (2001) for a recent and comprehensive survey of this literature.



ing the links between corporate financial vulnerabilities and investment during asset boom and bust episodes in advanced countries. The essay examines to what extent some of the key empirical regularities highlighted in Kindleberger (2000) and formalized by modern corporate finance literature hold for the period starting from the financial liberalization of the early 1980s and ending with the information technology boom and bust of the late 1990s and early 2000s. Similarities as well as differences between the recent boom-bust cycle and its predecessors are discussed and the links between corporate leverage and investment are examined in some detail. Among other things, this may shed new light on the severity of the recent investment slump and help draw inferences about recovery.

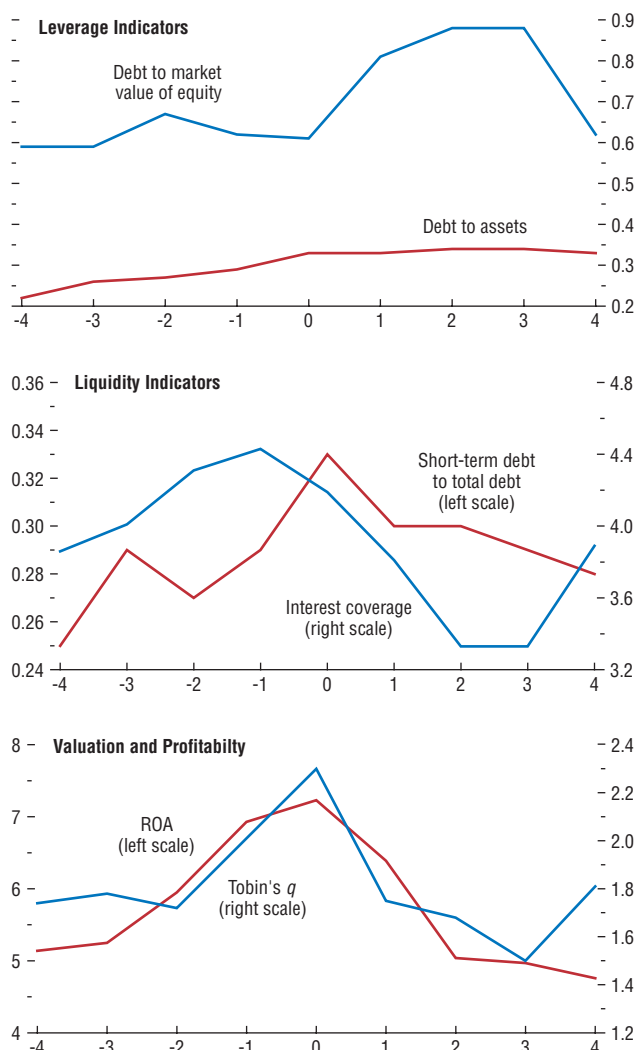
### Corporate Financial Health During Previous Boom and Bust Cycles

Assessments of corporate health typically focus on three sets of indicators. The first consists of classic leverage measures, such as the ratios of debt to assets and debt to the market value of equity. The second set of corporate health indicators comprises interest coverage (the ratio of earnings before interest, taxes, and depreciation allowances to interest expenses)—a yardstick to gauge debt-servicing risk and also the firm's liquidity position—together with the ratio of short-term debt to total debt.<sup>27</sup> The third set of indicators includes two well-known measures of market valuation and profitability—namely, the ratio of market to book value of equity (a proxy for Tobin's  $q$ ) and the rate of return on assets (ROA).<sup>28</sup>

Figure 2.7 plots the typical evolution of these three sets of indicators using firm-level data for

**Figure 2.7. Corporate Financial Indicators Over the Bubble<sup>1</sup>**

Corporate vulnerability typically follows a well-defined pattern over asset market bubbles.



Sources: Thomson Financial Worldscope database; and IMF staff calculations.

<sup>1</sup>Zero denotes the quarter after which a bust in equity and housing prices begins (peak in the level of real equity or housing prices).

<sup>27</sup>As usual in the literature, short-term debt is defined as debt liabilities with a residual maturity no longer than one year.

<sup>28</sup>The other commonly used measure of corporate profitability—the rate of return on investment—was also considered. But since it yields very similar trends as those in ROA, it is not reported both to save space and also because the ROA, being a broader profitability measure, seems more relevant from a macro standpoint.

12 advanced countries previously identified as having experienced stock and property price bubbles (see the previous essay in this chapter).<sup>29</sup> Each indicator in the figure is constructed as annual averages of individual countries' ratios in the four-year run-up to the peak of the asset price ( $t = 0$ ) and through the subsequent four years after the bubble burst. As already mentioned, the period spans from 1980 to the last observation before the current bubble, which, as discussed in the previous essay, peaked in early 2000. As international accounting practices are known to differ across countries, the focus of the analysis is on trends rather than on absolute levels.

Looking first at leverage indicators, a main "stylized fact" in the run-up to stock market crashes is the rise in corporate leverage. This is clearly apparent from the rise in the debt-to-asset ratio in Figure 2.7. Also consistent with the historical account is the evidence provided in Figure 2.7 that rising stock market valuations (as gauged by the Tobin's  $q$  indicator in the bottom panel) tend to mask the increase in leverage and make balance sheet positions look good, as the debt-to-market capitalization ratio remains essentially flat despite growing corporate debt. Likewise, favorable monetary conditions and rising corporate earnings relative to interest payments are also reflected in the rise in interest coverage during the boom despite the fact that the debt structure becomes slightly tilted toward short-term liabilities (see middle panel of Figure 2.7). Finally, a combination of rising earnings relative to interest expenses and buoyant

demand is reflected in higher returns on assets (ROA).

As the process goes in reverse, the behavior of these various indicators is also conspicuous and consistent with the historical experience. In particular, the ratio of debt to market value of equity rises markedly as valuations suddenly drop, and the process of deleveraging usually takes a few years. But even more interesting is the behavior of the interest coverage indicator, which in fact begins to turn around a year before the bust begins and thus somewhat anticipates looming balance sheet problems. This in part reflects preemptive monetary policy tightening, which was significant in countries such as Japan and helped to trigger the crashes in the early 1990s. In addition, the decline in interest coverage is typically dramatic, taking some four years before the indicator returns to pre-bubble levels. A similarly clear downward trend is observed for Tobin's  $q$  and ROA—the main difference being that the decline in asset valuations (Tobin's  $q$ ) is typically sharper and its recovery precedes that of corporate profitability.

Complementing this aggregate evidence, Figure 2.8 highlights another important historical regularity. Asset valuations do not move together in all sectors, but instead follow developments in a leading sector or a handful of leading industries. To illustrate this point, the figure plots the sectoral dispersion of the market to book value ratio (a proxy for Tobin's  $q$ ) across sectors for countries that experienced a bubble.<sup>30</sup> If the ratio is higher (lower) than one, the cross-sectional dispersion of valuations is above

<sup>29</sup>The data source is the Worldscope database, which has two important advantages in the present context. First, its broad geographical coverage and availability of similar balance sheet items across firms facilitates international comparisons. Second, disaggregate firm-level data allow us to examine cross-sectional phenomena that might have a bearing on economic aggregates. On the other hand, a critical issue with this data is its macroeconomic representativeness. In the case of the United States, the data are very comprehensive, spanning between a minimum of 1,549 firms in 1980 to a maximum 6,420 in 1999. For other countries, coverage varies widely. It is relatively high for the United Kingdom from the late 1980s and for Japan in the second half of the 1990s (over 1,100 firms), but far more modest for smaller European countries. Since the analysis of this section focuses on the G-7 and the euro area as a whole, the data are believed to capture the broad trends in corporate performance. This is so even if *levels* may differ somewhat from national aggregates, partly owing to coverage and partly owing to different accounting definitions used by national authorities.

<sup>30</sup>The proposed dispersion measure is based on the standard deviation of the market to book value across 24 industries in a country in a given year, then scaled by the overall standard deviation for the same country over the entire 1984–2001 period.

(below) its historical average. During the late 1980s bull market, the sectoral dispersion clearly increased in Canada, Japan, and the United Kingdom. In the case of Japan, in particular, dispersion clearly rose well above the historical average, largely due to the quadrupling of the market to book value ratios in construction and infrastructure—sectors at the center stage of the property market boom in that country—even though other sectors experienced a twofold increase on average in their market to book value ratios, as the boom became generalized, Figure 2.8 also shows that such a growing dispersion of stock market valuations following the displacement led by a single sector (information technology) has likewise been a key feature of the recent boom. In fact, the dispersion of valuations has been even greater than in the late 1980s experiences, as discussed further below.

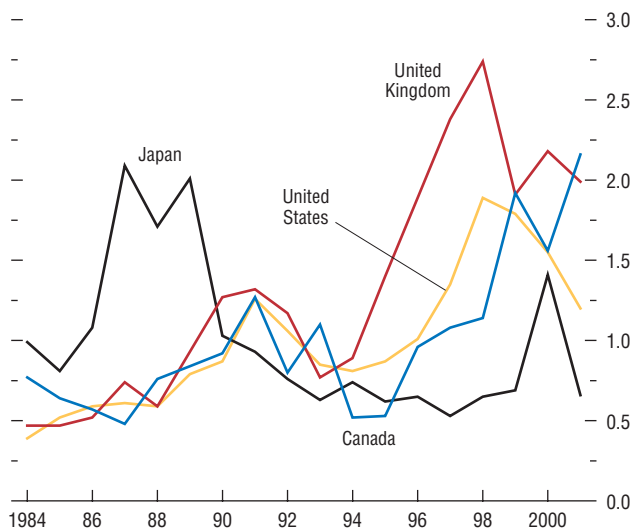
### Balance Sheet Adjustment and Investment

As discussed in the introduction to this essay, a key counterpart of the observed improvement in balance sheets during asset price booms is firms' greater ability to finance investment. While corporate cash flows rise in the boom, and these usually are the firm's cheapest source of investment financing for most firms (Fazzari, Hubbard, and Petersen, 1988, 1996), expectations of more profitable investment opportunities increase even faster, requiring an increase in the firm's dependence on external funds to undertake those projects. Since improved balance sheets themselves tend to reduce the firm's perceived risk, which combined with sufficient aggregate liquidity tends to lower financing costs, corporate borrowing rises in tandem with investment.

This phenomenon is illustrated in Figure 2.9, which again is based on averages for countries that experienced booms in the 1980s and early 1990s. The figure clearly shows that investment rises not only relative to the current capital stock and sales but also relative to retained earnings. In other words, notwithstanding the fact that firms are then flush with cash, investment rises

**Figure 2.8. Cross-Sectoral Dispersion of Market-to-Book-Value Ratios<sup>1</sup>**

The dispersion in stock market valuations has been higher in the recent bubble relative to the bubbles of the 1980s.

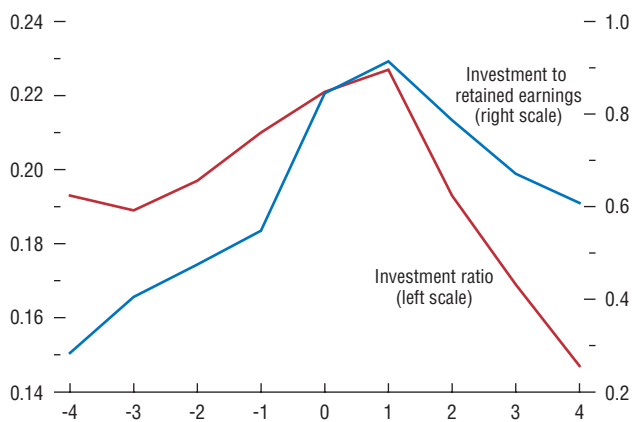


Sources: Thomson Financial Worldscope database; and IMF staff calculations.

<sup>1</sup>Ratio of standard deviation of market-to-book values across 24 sectors in each year over the average standard deviation of market-to-book values over the entire period for each country (using the Worldscope sectoral breakdown).

**Figure 2.9. Corporate Investment Over a Bubble**

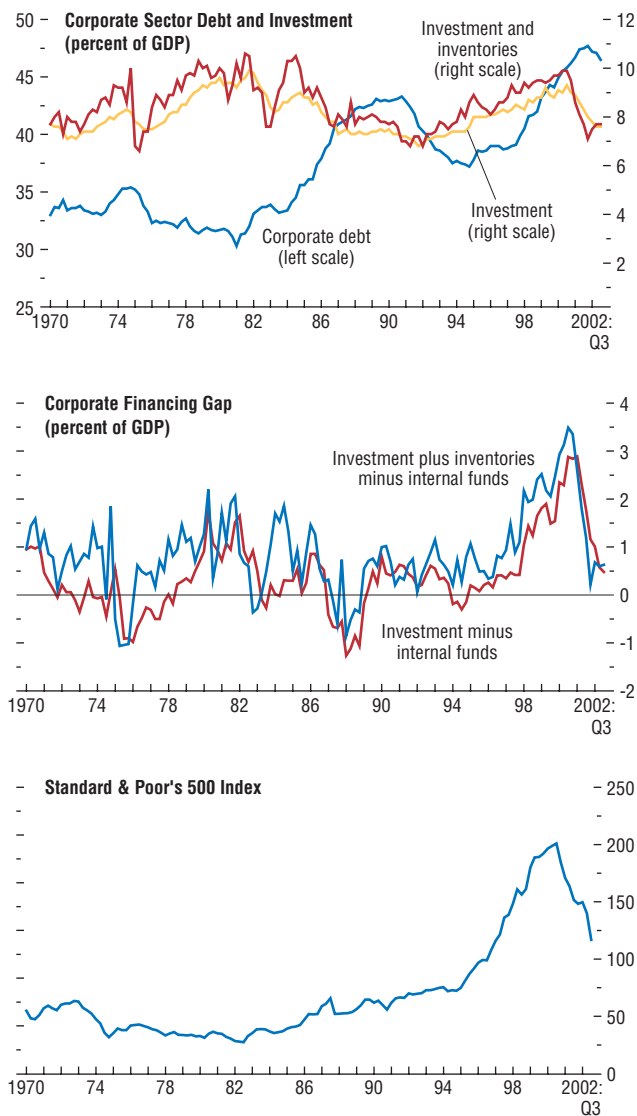
Firms become more reliant on external finance as investment rises during the bubble's upswing.



Sources: Thomson Financial Worldscope database; and IMF staff calculations.

**Figure 2.10. United States: Corporate Financial Indicators**

Upswings in stock prices and investment have been historically accompanied by a rising corporate financing gap.



Sources: Board of Governors of the Federal Reserve, Flow of Funds Accounts of the United States; Haver Analytics; and IMF staff estimates.

even faster than the availability of internal funds. This implies that firms typically increase their dependence on external financing through equity issuance and borrowing.

The availability of a long time series on aggregate corporate data for the United States allows us to see the systematic nature of the phenomenon over the various asset price cycles. As shown in Figure 2.10, rising stock prices have been systematically associated with a widening of the “financing gap”—defined as the share of investment that is financed with funds external to the firm via the issuance of debt or of equity liabilities. Conversely, bear markets have been associated with a marked narrowing of the financing gap; in fact, the latter has at times even turned negative, implying that firms are using internal funds to reduce liabilities or deleverage themselves.

As in the United States, the much greater dependence on external financing has also been a key feature of the recent boom in the euro area, although data limitations preclude a direct comparison with previous booms (Figure 2.11). Relative to the United States, however, growing reliance on external financing in the euro area has been more tilted toward debt—and more particularly to bank debt—rather than equity liabilities, consistent with the more bank-based nature of financial systems in continental Europe.<sup>31</sup>

Against this background, a question of interest is how this process of balance sheet adjustment affects economic activity, and investment in particular. Recent work on the United States suggests that the health of the corporate sector is clearly associated with the severity and length of a downturn and that a broad measure of corporate vulnerability—including corporate leverage,

<sup>31</sup>Notwithstanding the expansion of the corporate bond market in Europe in recent years, the overwhelming majority of nonfinancial corporate debt consists of liabilities to banks. For instance, in 2001, the ratio of bank debt to the total debt of nonfinancial corporations was 89 percent, only marginally below the 1995 ratio (90 percent). See European Central Bank, 2002.

future growth prospects, and current macroeconomic conditions—can be helpful in predicting recessions four to six quarters ahead (Box 2.2).<sup>32</sup> In the current conjuncture, a question of particular interest is the potential impact of balance sheet constraints on investment, which—as discussed in Chapter 1—remains key to the recovery. To this end, the IMF staff has used dynamic panel data techniques to estimate an investment equation comprising not only the usual explanatory variables, such as Tobin's  $q$  and the growth of sales, but also measures of leverage and interest coverage (Box 2.3). The analysis indicates that both variables have the expected statistically significant effects. Higher leverage reduces investment, and the impact is asymmetric over the cycle—being larger in bear markets. Strikingly, corporate leverage appears to have a greater impact on investment in the euro area than in the United States, possibly reflecting the greater bank dependence of the nonfinancial corporate sector in continental Europe. Higher interest coverage tends to boost investment as expected, but the estimated effect is much smaller, so that movements in leverage ratios tend to dominate.

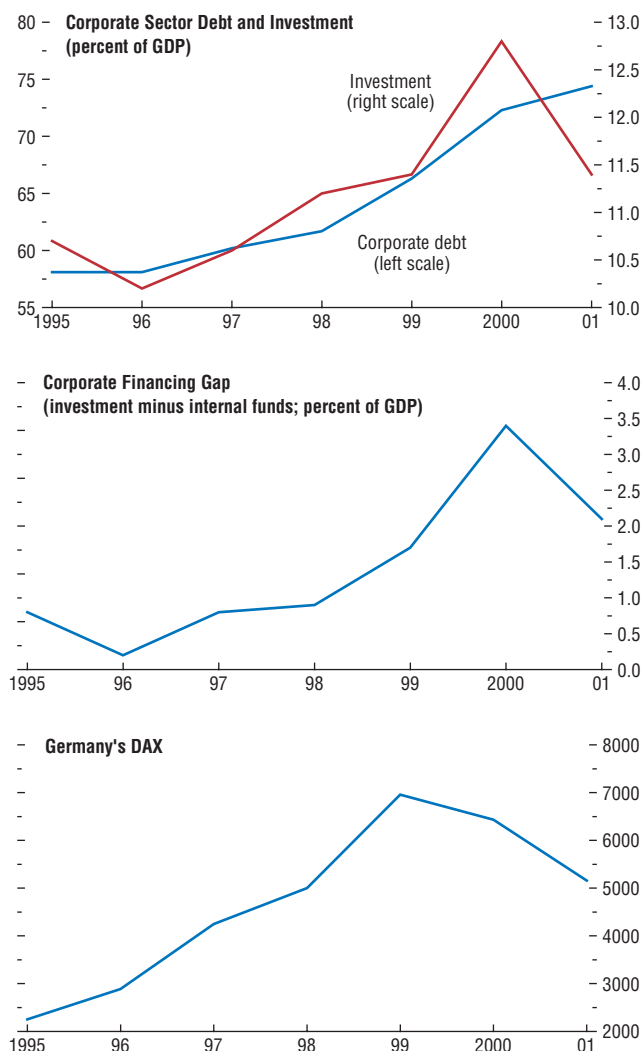
### The Late 1990s Bubble

The slump in capital spending over the past two years, coupled with evidence on the links between corporate financial health and investment discussed above, raises the question of how the behavior of leverage and liquidity indicators over the recent bubble compare with those during previous bubbles. Such a comparison can be useful in allowing us to extrapolate from the stylized patterns depicted in Figure 2.7 and thus come to a judgment about the severity of post-bubble investment slowdown.

Figures 2.12 and 2.13 plot the evolution of corporate health indicators in six advanced economies since the onset of the recent bubble

**Figure 2.11. Euro Area: Corporate Financial Indicators**

As in the United States, rising investment and corporate debt in the euro area has been accompanied by a widening of the corporate financing gap.

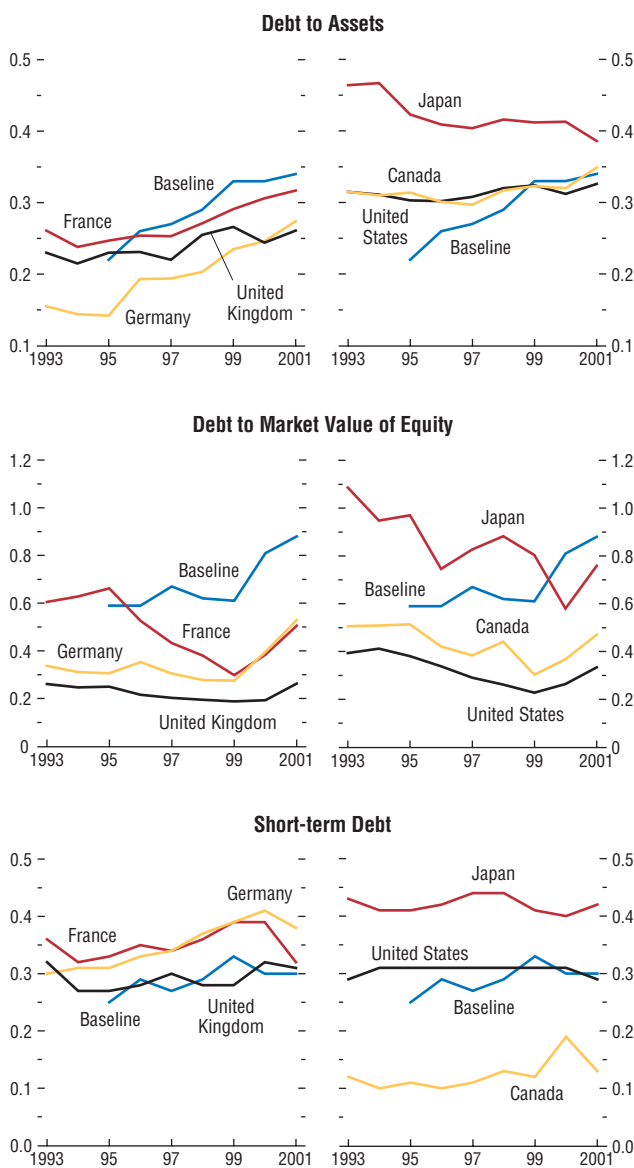


Sources: European Central Bank; and IMF staff estimates.

<sup>32</sup>However, as discussed in Box 2.2, corporate leverage by itself was not found to be significant.

**Figure 2.12. Corporate Leverage in Advanced Countries**

Leverage in the late 1990s bubble did not rise as much as in the bubbles of the 1980s.



Sources: Thomson Financial Worldscope database; and IMF staff calculations.

and compares them with the baseline in Figure 2.7. Some similarities as well as important differences stand out. As in previous bubbles, the debt to market capitalization ratio has been kept in check in all countries in the boom: it has either remained flat or fallen somewhat reflecting the unprecedented rise in stock valuations (see bottom panel of Figure 2.13). However, other indicators of leverage, which do not directly reflect the equity market boom, clearly show that leverage has increased. This is the case with the debt to asset ratio in Europe, and debt to income ratios in the United States (see Figure 2.10). Strikingly, debt to asset ratios in Canada and the United States remained about flat through the upswing, likely reflecting the dramatic rise in equity issuance in these countries during the period. Only in Japan do the different book-value- and stock-market-based leverage measures unanimously point to a similar trend, reflecting the continuing unwinding of the 1990–91 Japanese crash through the 1990s. In sum, although it is clear that corporate indebtedness has dramatically increased over the recent bubble, the debt to market capitalization ratio in Europe and North America and the debt to asset ratio in the United States tend to underplay the extent of the phenomenon.

Turning to solvency and liquidity indicators, a main difference between the recent bubble and its predecessors is the very high level of interest rate coverage in the boom, reflecting strong earnings as well as lower real interest rates (which in turn partly reflects the low inflation environment). Also in contrast with the previous experience, interest coverage remained high well into the second year after the bubble’s burst (2001), notwithstanding its drop since 2000. This no doubt reflects the significant reduction in policy interest rates during the equity price bust, but also the fact that monetary policy during the boom was tightened by less than in the late 1980s. At the same time, and also somewhat in contrast with the late 1980s experience and also with other historical bubble bursting episodes, short-term indebtedness has been essentially flat in some cases (Canada and the

United States), while only inching up in the others. Finally, the behavior of profitability and valuation are generally similar to that in previous bubbles, but with two important differences. First, the rise in the rise in market to book ratios was far more dramatic in the boom; as a result, despite the decline in equity prices since early 2000, valuations remain broadly above pre-bubble levels. This has helped mitigate the deterioration in balance sheet positions and aggregate demand, thus shoring up firms' cash flows and earnings. Second, profitability has dropped particularly sharply in the United Kingdom and the United States, and this is a potential drag on the recovery looking forward.

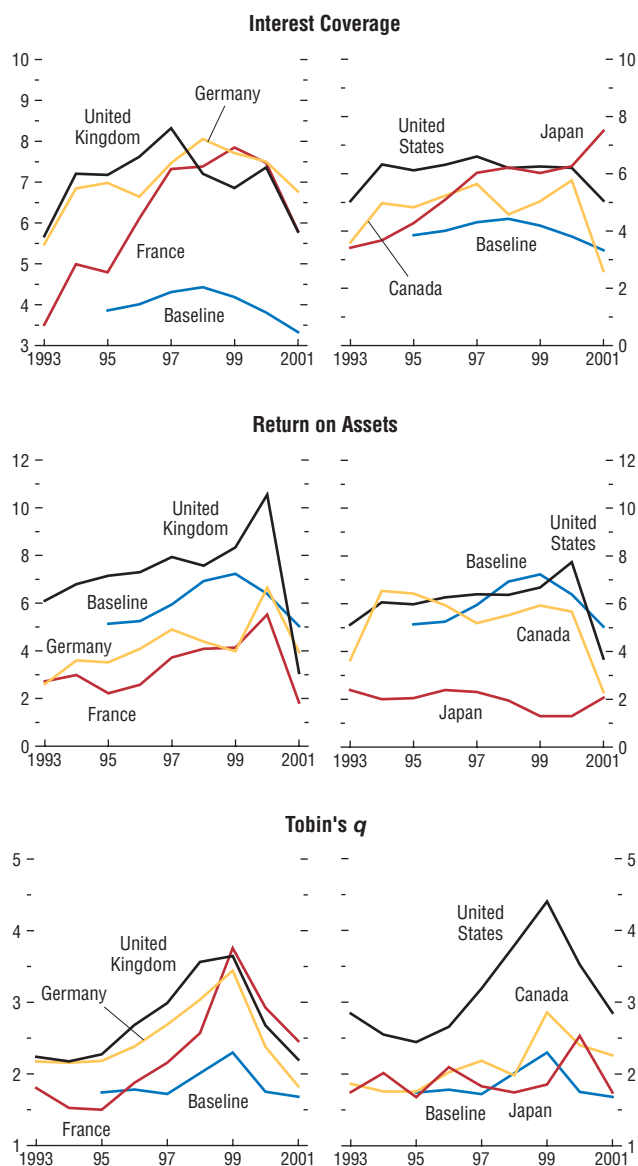
## Conclusions

The recent stock market booms in Europe and North America share some clear similarities with those in the 1980s and early 1990s as well as with previous historical episodes (see Kindleberger, 2000). The rise in market valuations in advanced countries since the mid-1990s led firms to take advantage of the resulting improvement in balance sheets and lower relative price of debt to borrow and invest well ahead of demand—some of it finding its way to riskier ventures that were fueled by investors' greater profit expectations and firms' eagerness not to disappoint. These developments have increased corporate vulnerability to a decline in stock prices and aggregate demand, as was typically the case in previous booms.

As discussed above, however, some important differences stand out, notably the relatively high post-bubble level of stock market valuations and interest coverage. Also, because the steepest declines in stock market valuations were concentrated in the information technology (IT) sector, which relied more extensively on equity than on debt and was thus generally less leveraged, the repercussions on the domestic banking sector have been more limited. That said, corporate leverage in the United States and Europe remains relatively high and the aggregate corporate financing gap still lies in

**Figure 2.13. Selected Corporate Financial Indicators in Advanced Countries**

Interest coverage and stock market valuations have been higher in the recent bubble relative to the bubbles of the 1980s.



Sources: Thomson Financial Worldscope database; and IMF staff calculations.

### Box 2.2. Corporate Financial Conditions and the Severity of U.S. Recessions

High levels of corporate debt and high-profile bankruptcies in the United States have raised concerns about the vulnerability of the corporate sector and its implications for macroeconomic prospects. Indeed, highly leveraged corporations are typically seen as more risky and face higher premiums on borrowed funds. Bond spreads have increased in tandem with leverage since the mid-1990s (see the figure). In addition, rising corporate defaults and declining recovery rates have accompanied the increase in corporate leverage.

The financial health of the corporate sector has long been recognized as exerting a powerful effect on the macroeconomy. For example, the structural theory of corporate debt links weakening corporate balance sheets—reflected in increasing corporate leverage—with higher corporate default risk and thus higher costs of external financing, which, in turn, tend to reduce investment, depress future cash flows and output, and thus may trigger a slowdown.<sup>1</sup> Empirical evidence also suggests that leverage and other balance sheet indicators have a major influence on investment spending, inventories, and employment.<sup>2</sup> Moreover, the financial accelerator theory suggests that high corporate leverage can worsen slowdowns by amplifying and propagating initial adverse shocks and by increasing the effects of monetary policy on the real economy.<sup>3</sup> A high debt burden may also inhibit economic recovery by creating liquidity problems that, combined with weak profits, may crowd out productive investments and push up default rates.

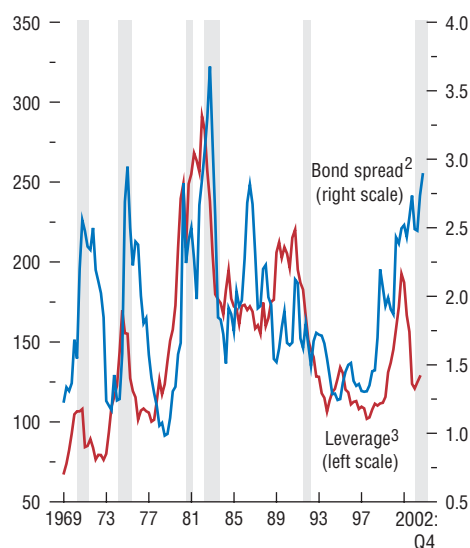
Note: The main author of this box is Iryna Ivaschenko.

<sup>1</sup>See, for example, Merton (1974). Corporate leverage. There are a number of other theories which model the costs of external financing as a function of a firm's balance sheet. See, for example, Kiyotaki and Moore (1997) and Carlstrom and Fuerst (1997).

<sup>2</sup>See, for example, Hoshi, Kashyap, and Scharfstein (1991), Kashyap, Lamont, and Stein (1994), and Sharpe (1994).

<sup>3</sup>See Bernanke and Gertler (1990, 1995) and Bernanke, Gertler, and Gilchrist (1996).

#### Corporate Sector: Leverage and Bond Spreads<sup>1</sup> (Percent)



Sources: Board of Governors of the Federal Reserve, Flow of Funds Accounts of the United States; and IMF staff estimates.

<sup>1</sup>Shaded areas indicate recessions.

<sup>2</sup>The spread between yields on Baa-rated Corporate Bond Index and Composite Treasury Bond Index (maturities of 10 years and above).

<sup>3</sup>Leverage is defined here as the sum of balance sheet leverage (debt as a share of debt plus equity) and debt service burden (gross interest on debt as a share of pre-tax profits).

But how much leverage is too much? A number of theories suggest that an increase in leverage will raise the cost of external funds only if the value of corporate assets is relatively low. Moreover, leverage will increase the probability of bankruptcy only if it is not offset by improved growth expectations, more favorable debt contract terms, or more accommodative monetary policy.<sup>4</sup> This suggests that the vulnerability of the corporate sector to economic shocks and thus the likelihood and severity of recessions should be related to a *combination* of corporate leverage and other fundamentals, such as cur-

<sup>4</sup>See, for example, Anderson and Sundaresan (1996) and Mella-Barral and Perraudin (1997).



rent macroeconomic and policy conditions and future growth prospects.

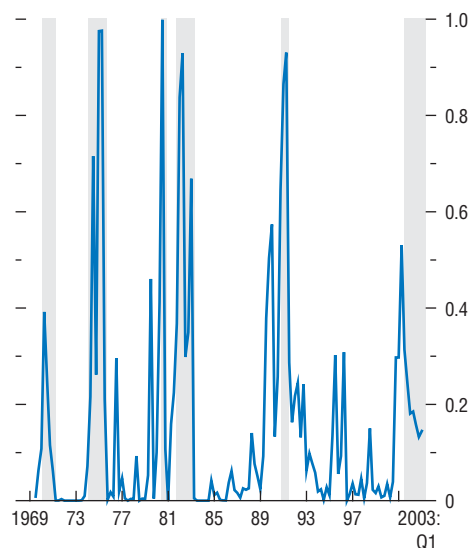
Recent work by the IMF staff proposes a broad measure of corporate vulnerability—the Corporate Vulnerability Index (CVI), which is based on corporate leverage, current macroeconomic and financial conditions, and growth expectations—and examines its empirical relationship with U.S. recessions.<sup>5</sup> The CVI is found to be a significant predictor of the probability of recession four to six quarters ahead, even controlling for other leading indicators.<sup>6</sup> For example, a 10 percent increase in the CVI (at the mean) is associated with a 2.7 percent increase in the probability of recession (at the mean) four quarters in the future. Moreover, the health of the corporate sector is found to be related not only to the occurrence, but also to the severity of recessions: an increase in the CVI is associated with an increase in the probability of a more severe recession three to six quarters ahead.<sup>7</sup> Finally, a higher CVI also raises the likelihood of a longer recession.

<sup>5</sup>Ivaschenko (2003) constructs the CVI as the default probability of the entire corporate sector using the model of perpetual corporate debt by Anderson, Sundaresan, and Tychon (1996). Theory suggests that the CVI is a nonlinear function of leverage, volatility of the firm's value, the risk-free interest rate, bankruptcy costs, the recovery rate, and the dividend payout rate. It is increasing in total leverage and risk-free interest rate, and non-monotonic in asset volatility.

<sup>6</sup>A probit model is estimated with a recession index as the dependent variable and the CVI and selected leading indicators—average weekly hours worked, the Conference Board vendor performance index, housing starts, the slope of the U.S. treasury yield curve, and stock returns—as explanatory variables. The choice of leading indicators was guided by their proven ability to predict U.S. business cycles. The recession index equals one if the economy is in a recession—as defined by the NBER—during the given quarter, and zero otherwise. This approach to predicting the probability of recession follows Estrella and Hardouvelis (1991), Stock and Watson (1993), and Estrella and Mishkin (1997).

<sup>7</sup>An ordered probit model is estimated using the Severity of Recession Index (SRI) as a dependent variable and the CVI and other leading indicators that were used in the estimations in predicting the proba-

### Probability of Recession, Predicted With the Corporate Vulnerability Index<sup>1</sup>



Source: Ivaschenko (2003).  
<sup>1</sup>Shaded areas indicate recessions.

The predicted probability of a recession, based on the CVI and other leading indicators, rose sharply in late 1999 and 2000—to 53 percent in 2001:Q1—anticipating the onset of recession in 2001 (see the figure). Recently, the recession probability has fallen below 15 percent, as macroeconomic vulnerabilities associated with corporate balance sheets have fallen, reflecting declines in both corporate borrowing and debt service burdens. In the past, a sharp fall in the recession probability to a level well below 50 percent has generally coincided with the end of the downturn.

bility of recession as explanatory variables. The SRI is constructed as follows. First, the magnitude of a cumulative decline of real GDP between the prerecession quarter and the last quarter of the recession, normalized by the length of the recession, is calculated. Second, recessions are then ranked, with a smaller rank representing a less severe recession. The SRI is zero during expansion periods.

**Box 2.3. How Do Balance Sheet Vulnerabilities Affect Investment?**

The increase in leverage and other balance sheet vulnerabilities in the recent bubble have caused many to wonder whether this will adversely affect the recovery, particularly of corporate investment. As discussed in the main text of this chapter, the theoretical finance and macroeconomics literature posits that such factors do matter—firms tend to invest less, all things being equal, the higher their leverage and the less liquid they are (Myers, 1977; Fazzari, Hubbard, and Petersen, 1988; Bernanke and Gertler, 1990; Kiyotaki and Moore, 1997; Bernanke, Gertler, and Gilchrist, 1999). While there is substantial empirical evidence that such factors have been historically important in the United States, the sensitivity of investment to leverage and liquidity indicators over more recent asset price cycles, as well as the extent to which these sensitivities may differ between the United States and other main parts of the world economy, remain unclear.

This box provides up-to-date econometric evidence for the United States and novel estimates for the euro area as a whole. Unlike previous studies, the respective regressions are based on the same firm-level data, span a similar period (1982–2001 for the United States, 1983–2001 for the euro area), and have a consistent set of explanatory variables to explain the phenomenon on both sides of the Atlantic. In line with the evidence discussed in the main text of this chapter, “financial accelerator” effects are gauged by leverage and interest coverage indicators.<sup>1</sup> Thus, the following investment equation is estimated:

$$\frac{I_{it}}{K_{it-1}} = \mu_i + \alpha \frac{I_{it-1}}{K_{it-2}} + \beta_1 Q_{i,t-1} + \beta_2 \Delta(S_{i,t-1}/K_{i,t-2}) + \beta_3 LEV_{it-1} + \beta_4 IC_{i,t-1} + \beta_5 Dbear * LEV_{it-1}, \quad (1)$$

Note: The main author of this box is Luis Catão.

<sup>1</sup>The ratio of short-term debt to total debt was also considered but, consistent with evidence that it does not move much over the bubbles and that it has been particularly trendless over the recent bubble, regression analysis did not uncover any significant effect of this variable on investment.

where  $I_{it}$  stands for fixed investment spending of industry  $i$  during year  $t$ ;  $K_{i,t-1}$ , for the respective capital stock net of depreciation at the beginning of the year;  $Q_{i,t-1}$ , for the ratio of market to book value of equity at the end of the previous year;  $\Delta(S_{i,t-1}/K_{i,t-2})$ , for the previous year’s sales growth deflated by the beginning-of-the-period capital stock; and  $LEV$  and  $IC$  for the leverage and interest coverage measures.<sup>2</sup> In addition, the last term in equation (1) allows for the possibility that the effects of leverage are asymmetric over the asset price cycle, differing during bear market periods as defined by the dummy variable  $Dbear$ .<sup>3</sup> All the variables on the right-hand side have been lagged one year, both to mitigate endogeneity problems and to capture typical delays in the response of investment to current economic conditions. Given the presence of a lagged dependent variable term  $I_{it-1}/K_{i,t-2}$  on the right-hand side of equation (1), the standard fixed effects estimator is inconsistent (Nickell, 1981), so the Arellano and Bond (1991) Generalized Method of Moments estimator is employed.

The table presents the estimates for the euro area and the United States based on firm-level data grouped in 26 sectors and comprising four alternative specifications of equation (1). Starting with the euro area, all standard determinants of fixed investment spending—Tobin’s  $q$

<sup>2</sup>Among other possible competing explanatory variables, the significance of cash flows was also considered, in light of the findings of Fazzari, Hubbard, and Petersen (1988). However, given its strong correlation with the sales accelerator and because the sales accelerator variable predominated over cash flows in the regressions, the cash flow variable was dropped from the model.

<sup>3</sup>Gertler and Gilchrist (1994) find that the working of the financial accelerator in the United States displays such business cycle asymmetries. Vermeulen (2000) finds that this is also the case for four European economies (France, Germany, Italy, and Spain). However, neither study directly links these asymmetries to the stock market cycle. In the above equation, therefore, the dummy variable  $Dbear$  is defined to be one during stock price troughs (following the periodization discussed earlier in this chapter) and zero otherwise.

Estimates of Investment Equations in the Euro Area and the United States<sup>1</sup>

	Euro Area		United States	
	//K	//K	//K	//K
$(I/K)_{t-1}$	0.08 (6.84)**	0.09 (9.18)**	0.26 (12.01)**	0.27 (12.68)**
$Q_{t-1}$	0.03 (13.71)**	0.04 (10.21)**	0.01 (8.20)**	0.01 (14.27)**
$\Delta(S/K)_{t-1}$	0.01 (7.02)**	0.01 (6.25)**	0.04 (5.60)**	0.04 (7.65)**
$IC_{t-1}$	0.01 (5.27)**	0.01 (4.81)**	0.01 (11.65)**	0.01 (8.60)**
$(D/MVE)_{t-1}$	-0.04 (7.41)**	...	-0.01 (2.02)*	...
$(D/A)_{t-1}$	...	-0.03 (0.65)	...	-0.07 (2.98)**
$Dbear^*(D/MVE)_{t-1}$	-0.03 (10.10)**	...	-0.01 (3.01)**	...
$Dbear^*(D/A)_{t-1}$	...	-0.14 (18.00)**	...	-0.02 (2.80)**
Constant	-0.011 (36.67)**	-0.011 (20.02)**	-0.003 (12.87)**	-0.003 (9.68)**
Number of observations	412	412	468	468

Notes: The absolute value of the z statistics is in parentheses. One and two asterisks represent significance at 5 percent and 1 percent, respectively.

<sup>1</sup>Based on the Arellano and Bond (1991) GMM two-step estimator.

(proxied by the market to book value of equity), the sales accelerator, and the lagged investment to capital stock ratio—are statistically significant, are estimated with the right sign, and have coefficients comparable to those found in other studies (see Schiantarelli, 1995, for a survey). Also statistically significant throughout and with the expected positive sign is the impact of interest coverage ( $IC$ ), though its magnitude is rather low. Regarding leverage, two alternative indicators are considered—the ratio of debt to the *market* value of equity ( $D/MVE$ ), which tends to exaggerate swings in leverage over the asset price cycle, and the ratio of debt to the *book* value of assets ( $D/A$ ), which tends to underplay those swings. Columns (1) and (2) show that leverage has a significant impact on investment regardless of which measure is used and that this impact is asymmetric over the cycle, being considerably stronger during bear markets. The marginal effect of lever-

age in a bear market is particularly strong through changes in the debt to asset ratio—a 1 percentage point increase in debt to assets leading to a 0.14 percentage point change in the investment ratio on impact, all else constant.

Results for the United States provide an interesting counterpoint to those for the euro area. First, the estimated coefficients on the lagged investment term (0.26 or 0.27) indicate that U.S. business investment is nearly three times as persistent as in the euro area. Thus, a negative (positive) shock to investment in the United States in a given year will have a much greater adverse (favorable) impact on investment the year after than is typically the case in the euro area. Second, U.S. investment appears to be more sensitive to income growth (as proxied by sales growth), but less sensitive to leverage. This can be gauged from the sum of the two estimated coefficients on the lever-

**Box 2.3 (concluded)**

age variables (−0.02 and −0.09, respectively), which are well below their euro area counterparts (−0.07 and −0.17 respectively). As discussed in the main text, this higher impact of leverage on investment in the euro area relative to the United States possibly reflects the greater bank dependency of the continental European corporate sector as well as threshold effects, as leverage in the euro area is signifi-

cantly higher on average than in the United States.<sup>4</sup>

<sup>4</sup>The notion that the effect of leverage on investment is stronger the higher the average leverage follows from an Euler equation approach, in which *squared* debt enters as an explanatory variable of investment (Bond and Meghir, 1994). Adding a squared leverage term to equation (1), however, did not yield a statistically significant coefficient.

positive territory, suggesting that these will continue to be a drag on the recovery. This is likely to be more so in Europe for two reasons. One is that, while the United States flow of funds data indicates that deleveraging began in 2002, there is no evidence that this was the case in Europe.<sup>33</sup> Second, the analysis of the determinants of business fixed investment in Box 2.3 shows that corporate investment is typically hampered by high leverage levels during bear markets in both areas, but the impact is typically greater in Europe than the United States. Finally, the leverage problem in all countries would be aggravated if equity markets were to fall further without a concomitant reduction in the *real* debt burden, something that is more difficult to accomplish in the current low inflation environment (in contrast with the 1970s and much of the 1980s, when higher inflation helped reduce real debt values). Thus, given that a rebound in fixed investment has been a key ingredient of rapid and sustainable recoveries, the process of deleveraging may have to advance somewhat further before a robust recovery is in the offing.

### Appendix 2.1. Identifying Asset Price Booms and Busts<sup>34</sup>

This appendix describes the procedure used to identify booms and busts in real equity and housing price and reports turning points in these prices for the postwar period.

Drawing on methods developed in business cycle analysis, the procedure used to identify equity and housing price booms and busts involves the following two steps.

- *Determination of asset price cycles.* Turning points in the level of broad real equity and housing price indices define cycles in those prices. Bull and bear markets are the asset market equivalents of expansions and recessions. A bear market, for example, begins in the quarter after a peak quarter and ends in the trough quarter. Following Pagan and Sossounov (2003), the turning points were determined using a slightly modified Bry-Boschan cycle dating procedure.<sup>35</sup>
- *Identification of booms and busts.* Based on the full set of bull and bear market episodes, booms (busts) were identified as those episodes with large price increases (decreases).

<sup>33</sup>Quarterly flows of funds data are not available for the euro area, but preliminary staff estimates indicate that leverage may in fact have increased in the past year. See Jaeger (2002).

<sup>34</sup>The main authors of this appendix are Thomas Helbling and Marco Terrones.

<sup>35</sup>The dating algorithm identifies turning points in the log-level of real equity and housing prices by first searching the input data for maxima and minima in five-quarter data windows and then picking pairs of adjacent, locally absolute maxima and minima that meet the rules for the minimal duration of cycles (five quarters) and phases (two quarters). The constraint for the minimal duration of a phase is ignored if the quarterly price decline is larger than 20 percent. See also Box 3.1 in the April 2002 *World Economic Outlook* on business cycle concepts and measurement issues.

To qualify as large, a price change had to be in the top (bottom) quartile of all recorded peak-peak (peak-trough) price increases (decreases) in the sample.<sup>36</sup> Hence, one-fourth of all bull and bear markets are considered booms and busts. The procedure does not require booms to be followed by busts, as the two types of events are determined independently.<sup>37</sup>

### Equity Price Cycles

Equity price turning points were identified using quarterly real equity price indices for 19 industrial countries. The regular equity price indices were deflated using consumer price indices. The primary data source for these prices was the IMF's *International Financial Statistics*. In some cases, more up-to-date data were taken from Haver Analytics. The data are generally available from 1959. The complete set of turning points (*P* stands for peak, *T* for trough) in each country used in the analysis is listed below (peaks and troughs defining busts are bolded, while pairs of peaks defining booms are italicized).<sup>38</sup>

Australia: *P*: 1960:Q3, *T*: 1961:Q1, *P*: 1962:Q1, *T*: 1962:Q3, *P*: 1964:Q1, *T*: 1966:Q4, ***P*: 1969:Q1, *T*: 1971:Q4, *P*: 1972:Q2, *T*: 1974:Q4, *P*: 1976:Q3, *T*: 1977:Q4, *P*: 1980:Q4, *T*: 1982:Q4, *P*: 1987:Q3, *T*: 1988:Q1, *P*: 1989:Q3, *T*: 1990:Q4, *P*: 1992:Q2, *T*: 1992:Q4, *P*: 1994:Q1, *T*: 1995:Q1, *P*: 1996:Q1, *T*: 1996:Q3.**

Austria: ***P*: 1962:Q1, *T*: 1968:Q4, *P*: 1973:Q2, *T*: 1982:Q3, *P*: 1983:Q2, *T*: 1984:Q3, *P*: 1986:Q2, *T*: 1988:Q1, *P*: 1990:Q1, *T*: 1990:Q4, ***P*: 1991:Q2, *T*: 1992:Q4, *P*: 1994:Q1, *T*: 1995:Q4, *P*: 1998:Q2, *T*: 2001:Q4.****

Belgium: *P*: 1961:Q2, *T*: 1963:Q2, ***P*: 1964:Q1, *T*: 1966:Q4, *P*: 1969:Q2, *T*: 1970:Q3, *P*: 1971:Q2,**

*T*: 1971:Q4, ***P*: 1973:Q2, *T*: 1974:Q4, *P*: 1975:Q2, *T*: 1978:Q1, ***P*: 1979:Q3, *T*: 1981:Q4, *P*: 1984:Q4, *T*: 1985:Q3, *P*: 1987:Q3, *T*: 1990:Q4, *P*: 1991:Q2, *T*: 1992:Q4, *P*: 1994:Q2, *T*: 1995:Q1, *P*: 1999:Q1, *T*: 2001:Q4.****

Canada: *P*: 1962:Q1, *T*: 1962:Q3, *P*: 1965:Q1, *T*: 1966:Q4, *P*: 1967:Q3, *T*: 1968:Q1, *P*: 1969:Q1, *T*: 1970:Q2, *P*: 1971:Q1, *T*: 1971:Q4, ***P*: 1973:Q1, *T*: 1974:Q4, *P*: 1975:Q2, *T*: 1978:Q1, ***P*: 1980:Q4, *T*: 1982:Q2, *P*: 1983:Q3, *T*: 1984:Q2, *P*: 1987:Q3, *T*: 1987:Q4, *P*: 1989:Q3, *T*: 1990:Q4, *P*: 1992:Q1, *T*: 1992:Q4, *P*: 1994:Q1, *T*: 1995:Q1, *P*: 1998:Q2, *T*: 1998:Q3, *P*: 2000:Q3, *T*: 2001:Q3.****

Denmark: ***P*: 1973:Q1, *T*: 1974:Q4, *P*: 1976:Q1, *T*: 1980:Q2, *P*: 1983:Q4, *T*: 1984:Q4, *P*: 1985:Q4, *T*: 1987:Q4, *P*: 1990:Q1, *T*: 1990:Q4, *P*: 1991:Q3, *T*: 1992:Q4, *P*: 1994:Q1, *T*: 1995:Q1, *P*: 1998:Q2, *T*: 1999:Q1.**

Finland: *P*: 1960:Q3, *T*: 1962:Q1, ***P*: 1962:Q3, *T*: 1968:Q1, *P*: 1971:Q1, *T*: 1971:Q4, ***P*: 1973:Q4, *T*: 1977:Q4, *P*: 1979:Q3, *T*: 1980:Q4, *P*: 1984:Q2, *T*: 1985:Q2, *P*: 1987:Q3, *T*: 1988:Q1, ***P*: 1988:Q3, *T*: 1992:Q3, *P*: 1995:Q3, *T*: 1996:Q3, *P*: 1998:Q2, *T*: 1998:Q4, *P*: 2000:Q2, *T*: 2001:Q3.******

France: *P*: 1962:Q1, *T*: 1964:Q2, *P*: 1966:Q1, *T*: 1967:Q2, *P*: 1968:Q2, *T*: 1968:Q4, *P*: 1970:Q1, *T*: 1971:Q4, ***P*: 1973:Q2, *T*: 1977:Q2, *P*: 1979:Q3, *T*: 1982:Q3, *P*: 1987:Q3, *T*: 1988:Q1, *P*: 1990:Q2, *T*: 1990:Q4, *P*: 1994:Q1, *T*: 1995:Q1.**

Germany: ***P*: 1960:Q3, *T*: 1963:Q1, *P*: 1964:Q3, *T*: 1966:Q4, *P*: 1969:Q4, *T*: 1971:Q4, ***P*: 1972:Q3, *T*: 1974:Q3, *P*: 1976:Q1, *T*: 1977:Q1, *P*: 1978:Q3, *T*: 1982:Q3, *P*: 1984:Q1, *T*: 1984:Q3, *P*: 1987:Q3, *T*: 1988:Q1, *P*: 1990:Q1, *T*: 1990:Q4, *P*: 1992:Q2, *T*: 1992:Q4, *P*: 1993:Q4, *T*: 1995:Q1, *P*: 1998:Q2, *T*: 1998:Q4.****

Ireland: *P*: 1961:Q2, *T*: 1961:Q4, *P*: 1964:Q3, *T*: 1967:Q1, ***P*: 1968:Q4, *T*: 1971:Q1, *P*: 1973:Q1,**

<sup>36</sup>Peak-to-peak increases were used since some of the larger trough-to-peak increases in the sample largely reflect earlier busts. However, the main findings in the essay are robust with regard to the choice of the base for the calculation of the price increases.

<sup>37</sup>Bordo and Jeanne (2002) also use a procedure whereby booms and busts are determined independently.

<sup>38</sup>Busts begin one quarter after a peak and end with the trough quarter. Booms begin with the peak and end with the subsequent peak, and they are identified on the basis of price increases over the full cycle.

*T: 1976:Q4, P: 1978:Q4, T: 1983:Q1, P: 1984:Q1, T: 1984:Q4, P: 1987:Q3, T: 1988:Q1, P: 1990:Q1, T: 1990:Q4, P: 1991:Q3, T: 1992:Q4, P: 1999:Q1, T: 1999:Q4.*

Italy: *P: 1960:Q3, T: 1965:Q3, P: 1966:Q1, T: 1967:Q2, P: 1967:Q4, T: 1968:Q4, P: 1969:Q4, T: 1972:Q1, P: 1973:Q2, T: 1978:Q2, P: 1981:Q2, T: 1983:Q4, P: 1986:Q2, T: 1988:Q1, P: 1989:Q3, T: 1992:Q3, P: 1994:Q2, T: 1995:Q4.*

Japan: *P: 1961:Q2, T: 1962:Q4, P: 1963:Q2, T: 1965:Q2, P: 1966:Q1, T: 1967:Q4, P: 1970:Q1, T: 1970:Q4, P: 1973:Q1, T: 1974:Q4, P: 1975:Q2, T: 1977:Q4, P: 1980:Q1, T: 1980:Q3, P: 1981:Q2, T: 1982:Q3, P: 1984:Q1, T: 1984:Q3, P: 1989:Q4, T: 1992:Q4, P: 1993:Q3, T: 1995:Q2, P: 1996:Q2, T: 1998:Q4, P: 2000:Q1, T: 2001:Q4.*

Netherlands: *P: 1961:Q2, T: 1962:Q4, P: 1963:Q3, T: 1966:Q4, P: 1968:Q4, T: 1969:Q3, P: 1971:Q2, T: 1971:Q4, P: 1973:Q1, T: 1974:Q4, P: 1976:Q1, T: 1976:Q4, P: 1977:Q2, T: 1978:Q1, P: 1978:Q3, T: 1980:Q2, P: 1981:Q2, T: 1982:Q3, P: 1987:Q3, T: 1988:Q1, P: 1989:Q3, T: 1990:Q4, P: 1992:Q2, T: 1992:Q4, P: 1994:Q1, T: 1994:Q4.*

New Zealand: *P: 1964:Q3, T: 1967:Q4, P: 1970:Q1, T: 1971:Q4, P: 1973:Q3, T: 1974:Q4, P: 1975:Q2, T: 1977:Q4, P: 1978:Q2, T: 1980:Q1, P: 1981:Q2, T: 1982:Q4, P: 1984:Q1, T: 1984:Q3, P: 1986:Q4, T: 1991:Q1, P: 1994:Q1, T: 1995:Q1, P: 1998:Q1, T: 1998:Q3, P: 1999:Q4, T: 2000:Q4.*

Norway: *P: 1961:Q3, T: 1963:Q1, P: 1963:Q4, T: 1968:Q2, P: 1969:Q4, T: 1970:Q2, P: 1971:Q3, T: 1972:Q4, P: 1973:Q3, T: 1978:Q1, P: 1979:Q4, T: 1982:Q4, P: 1985:Q4, T: 1986:Q3, P: 1987:Q3, T: 1988:Q1, P: 1990:Q3, T: 1990:Q4, P: 1991:Q3, T: 1992:Q4, P: 1994:Q1, T: 1994:Q4, P: 1998:Q2, T: 1998:Q4.*

Spain: *P: 1962:Q1, T: 1967:Q2, P: 1970:Q1, T: 1971:Q2, P: 1973:Q2, T: 1980:Q2, P: 1981:Q3, T: 1983:Q1, P: 1987:Q3, T: 1987:Q4, P: 1989:Q3, T: 1990:Q4, P: 1991:Q2, T: 1992:Q3, P: 1994:Q1, T: 1995:Q1, P: 2000:Q1, T: 2001:Q3.*

Sweden: *P: 1959:Q4, T: 1960:Q2, P: 1961:Q2, T: 1962:Q4, P: 1965:Q1, T: 1968:Q1, P: 1969:Q2, T: 1970:Q4, P: 1973:Q2, T: 1974:Q4, P: 1976:Q2,*

*T: 1977:Q4, P: 1978:Q3, T: 1980:Q3, P: 1981:Q4, T: 1982:Q2, P: 1984:Q1, T: 1985:Q3, P: 1987:Q3, T: 1987:Q4, P: 1989:Q3, T: 1990:Q4, P: 1991:Q2, T: 1992:Q3, P: 1994:Q1, T: 1994:Q3, P: 1998:Q2, T: 1998:Q4, P: 2000:Q1, T: 2001:Q3.*

Switzerland: *P: 1962:Q1, T: 1964:Q2, P: 1966:Q1, T: 1966:Q4, P: 1969:Q2, T: 1970:Q4, P: 1972:Q3, T: 1974:Q4, P: 1977:Q1, T: 1982:Q3, P: 1984:Q1, T: 1984:Q3, P: 1987:Q3, T: 1988:Q1, P: 1989:Q3, T: 1990:Q4, P: 1994:Q1, T: 1995:Q1, P: 2000:Q4, T: 2001:Q4.*

United Kingdom: *P: 1961:Q2, T: 1962:Q3, P: 1963:Q4, T: 1965:Q3, P: 1966:Q1, T: 1966:Q4, P: 1968:Q3, T: 1971:Q1, P: 1972:Q2, T: 1974:Q4, P: 1976:Q1, T: 1976:Q4, P: 1979:Q2, T: 1980:Q2, P: 1981:Q2, T: 1981:Q4, P: 1985:Q1, T: 1985:Q3, P: 1987:Q3, T: 1988:Q4, P: 1989:Q3, T: 1990:Q4, P: 1994:Q1, T: 1995:Q1.*

United States: *P: 1959:Q3, T: 1960:Q4, P: 1961:Q4, T: 1962:Q3, P: 1965:Q4, T: 1966:Q4, P: 1967:Q3, T: 1968:Q1, P: 1968:Q4, T: 1970:Q3, P: 1971:Q2, T: 1971:Q4, P: 1972:Q4, T: 1974:Q4, P: 1976:Q3, T: 1978:Q1, P: 1978:Q3, T: 1980:Q2, P: 1980:Q4, T: 1982:Q3, P: 1983:Q3, T: 1984:Q2, P: 1987:Q3, T: 1987:Q4, P: 1989:Q4, T: 1990:Q4.*

## Housing Price Cycles

Turning points were determined using quarterly real housing price indices for 14 industrial countries. The primary data source was the Bank for International Settlements, which in turn collects the data from national sources. The data are generally available from 1970. The complete set of turning points used in the analysis follows below (turning points for busts are bolded, while those for booms are italicized):

Australia: *P: 1974:Q1, T: 1978:Q4, P: 1979:Q2, T: 1980:Q1, P: 1981:Q2, T: 1982:Q4, P: 1986:Q2, T: 1987:Q3, P: 1989:Q2, T: 1991:Q1, P: 1991:Q3, T: 1992:Q3, P: 1994:Q3, T: 1996:Q1.*

Belgium: *P: 1986:Q3, T: 1987:Q2, P: 1992:Q3, T: 1993:Q1, P: 1995:Q3, T: 1996:Q1, P: 1997:Q3, T: 1998:Q1.*

Canada: *P*: 1970:Q4, *T*: 1971:Q3, *P*: 1974:Q2, *T*: 1974:Q4, *P*: 1976:Q4, *T*: 1978:Q3, ***P*: 1981:Q1, *T*: 1982:Q3**, *P*: 1983:Q1, *T*: 1984:Q3, *P*: 1987:Q1, *T*: 1987:Q3, ***P*: 1989:Q1, *T*: 1991:Q3**, *P*: 1994:Q1, *T*: 1995:Q2, *P*: 1995:Q4, *T*: 1996:Q3, *P*: 1997:Q2, *T*: 1998:Q3.

Denmark: ***P*: 1973:Q3, *T*: 1974:Q3, *P*: 1979:Q2, *T*: 1982:Q4, *P*: 1986:Q1, *T*: 1990:Q4**, *P*: 1991:Q2, *T*: 1993:Q2, *P*: 1994:Q1, *T*: 1994:Q3.

Finland: *P*: 1984:Q3, *T*: 1985:Q4, ***P*: 1989:Q1, *T*: 1993:Q1**, *P*: 1994:Q2, *T*: 1995:Q4, *P*: 2000:Q2, *T*: 2001:Q3.

Ireland: ***P*: 1979:Q2, *T*: 1986:Q1**, *P*: 1986:Q3, *T*: 1987:Q2, *P*: 1990:Q3, *T*: 1991:Q2, *P*: 1992:Q1, *T*: 1993:Q1

Netherlands: *P*: 1971:Q4, *T*: 1972:Q2, *P*: 1974:Q1, *T*: 1975:Q1, ***P*: 1978:Q2**, *T*: 1983:Q1, *P*: 1983:Q3, *T*: 1985:Q1, *P*: 1986:Q3, *T*: 1987:Q4, *P*: 1990:Q2, *T*: 1991:Q1, *P*: 1992:Q3, *T*: 1993:Q1, *P*: 1994:Q3, *T*: 1995:Q1.

New Zealand: *P*: 1991:Q4, *T*: 1993:Q1, *P*: 1996:Q2, *T*: 1998:Q3, *P*: 2000:Q2, *T*: 2000:Q4.

Norway: *P*: 1971:Q4, *T*: 1973:Q1, *P*: 1974:Q4, *T*: 1976:Q1, ***P*: 1976:Q4, *T*: 1983:Q4**, *P*: 1986:Q3, *T*: 1993:Q1, *P*: 1994:Q3, *T*: 1995:Q1, *P*: 1998:Q2, *T*: 1998:Q4, *P*: 2000:Q2, *T*: 2001:Q4.

Spain: ***P*: 1991:Q4, *T*: 1997:Q1**.

Sweden: *P*: 1971:Q1, *T*: 1971:Q3, *P*: 1972:Q2, *T*: 1974:Q3, *P*: 1977:Q2, *T*: 1978:Q1, ***P*: 1979:Q3, *T*: 1985:Q4**, *P*: 1990:Q1, *T*: 1993:Q3, *P*: 1994:Q3, *T*: 1995:Q4.

Switzerland: ***P*: 1973:Q3, *T*: 1976:Q3**, *P*: 1982:Q1, *T*: 1982:Q3, *P*: 1984:Q2, *T*: 1984:Q4, ***P*: 1989:Q4**, *T*: 1993:Q4, *P*: 1994:Q2, *T*: 1997:Q4, *P*: 1998:Q2, *T*: 2000:Q1.

United Kingdom: *P*: 1970:Q3, *T*: 1971:Q1, ***P*: 1973:Q3, *T*: 1977:Q2**, *P*: 1980:Q3, *T*: 1982:Q1, *P*: 1983:Q3, *T*: 1984:Q1, ***P*: 1989:Q3, *T*: 1993:Q4**, *P*: 1994:Q3, *T*: 1996:Q2.

United States: *P*: 1973:Q4, *T*: 1975:Q4, *P*: 1979:Q2, *T*: 1982:Q4, *P*: 1989:Q4, *T*: 1993:Q1, *P*: 1994:Q1, *T*: 1995:Q1, *P*: 1996:Q1, *T*: 1996:Q3.

## References

- Allen, Franklin, and Douglas Gale, 1999, "Bubbles, Crises, and Policy," *Oxford Review of Economic Policy*, Vol. 15 (Autumn), pp. 9–18.
- , 2000, "Bubbles and Crises," *Economic Journal*, Vol. 110 (January), pp. 236–55.
- Anderson, Ronald, and Suresh Sundaresan, 1996, "Design and Valuation of Debt Contracts," *Review of Financial Studies*, Vol. 9 (Winter), pp. 37–68.
- , and Pierre Tychon, 1996, "Strategic Analysis of Contingent Claims," *European Economic Review*, Vol. 40, pp. 871–82.
- Arellano, Manuel, and Stephen Bond, 1991, "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economic Studies*, Vol. 58 (April), pp. 277–97.
- Bayoumi, Tamim, and Hali Edison, 2003, "Is Wealth Increasingly Driving Consumption?" forthcoming IMF Working Paper (Washington: International Monetary Fund).
- Bank for International Settlements, 2002, "Turbulence in Asset Markets: The Role of Micro Policies," Report by the Contact Group on Asset Prices (Basel: BIS).
- Bernanke, Ben S., 1983, "Non-Monetary Effects of the Financial Crisis on the Propagation of the Great Depression," *American Economic Review*, Vol. 73 (June), pp. 257–76.
- , 1993, "Credit in the Macroeconomy," *Federal Reserve Bank of New York Quarterly Review*, Vol. 18 (Spring), pp. 50–70.
- , and Mark Gertler, 1990, "Financial Fragility and Economic Performance," *Quarterly Journal of Economics*, Vol. 105 (February), pp. 87–114.
- , 1995, "Inside the Black Box: The Credit Channel of Monetary Policy Transmission," NBER Working Paper No. 5146 (Cambridge, Massachusetts: National Bureau of Economic Research).
- , 2001, "Should Central Banks Respond to Movements in Asset Prices?" *American Economic Review, Papers and Proceedings*, Vol. 91 (May), pp. 253–57.
- , and Simon Gilchrist, 1996, "Financial Accelerator and the Flight to Quality," *Review of Economics and Statistics*, Vol. 78 (February), pp. 1–15.
- , 1999, "The Financial Accelerator in Quantitative Business Cycle Framework," in

- Handbook of Macroeconomics*, Vol. 1C, ed. by John Taylor and Michael Woodford (New York: North-Holland), pp. 1341–93.
- Bond, Steven, and Costas Meghir, 1994, “Dynamic Investment Models and the Firm’s Financial Policy,” *Review of Economic Studies*, Vol. 61 (April), pp. 197–222.
- Bordo, Michael, 1998, “The Financial Crisis of 1825 and the Restructuring of the British Financial System: Commentary,” *Federal Reserve Bank of St. Louis Review*, Vol. 80 (May/June), pp. 77–82.
- , 2003, “Stock Market Crashes, Productivity Boom and Bush, and Recessions: Some Historical Evidence” (unpublished; Washington: International Monetary Fund).
- Bordo, Michael, Michael Dueker, and David Wheelock, 2001, “Aggregate Price Shocks and Financial Stability, The United Kingdom 1796–1999,” NBER Working Paper No. 8583 (Cambridge: Massachusetts: National Bureau of Economic Research).
- , 2002, “Aggregate Price Shocks and Financial Instability: A Historical Analysis,” *Economy Inquiry*, Vol. 40 (October), pp. 521–38.
- Bordo, Michael, and Olivier Jeanne, 2002, “Boom-Busts in Asset Prices, Economic Instability, and Monetary Policy,” NBER Working Paper No. 8966 (Cambridge, Massachusetts: National Bureau of Economic Research).
- Bordo, Michael, and David Wheelock, 1998, “Price Stability and Financial Stability: The Historical Record,” *Federal Reserve Bank of St. Louis Review*, Vol. 80 (September/October), pp. 41–62.
- Borio, Claudio, and Philip Lowe, 2002, “Asset Prices, Financial and Monetary Stability: Exploring the Nexus,” BIS Working Paper No. 114 (Basel: Bank for International Settlements).
- Carlstrom, Charles, and Timothy Fuerst, 1997, “Agency Costs, Net Worth and Business Fluctuations: A Computable General Equilibrium Analysis,” *American Economic Review*, Vol. 87 (December), pp. 893–910.
- Carmichel, Jeffrey, and Neil Esho, 2003, “Asset Price Bubbles and Prudential Regulation,” in *Asset Price Bubbles: Implications for Monetary, Regulatory, and International Policies*, ed. by William Hunter, George Kaufman, and Michael Pomerleano (Cambridge, Massachusetts: MIT Press).
- Case, Karl, John Quigley, and Robert Shiller, 2001, “Comparing Wealth Effects: The Stock Market Versus the Housing Market,” NBER Working Paper No. 8606 (Cambridge, Massachusetts: National Bureau of Economic Research).
- Cecchetti, Stephen, Hans Genberg, John Lipsky, and Sushil Wadhvani, 2000, *Asset Prices and Central Bank Policy*, Geneva Report on the World Economy; 2 (London: Center for Economic Policy Research, and Geneva: International Center for Monetary and Banking Studies).
- Clapham, John H., 1945, *The Bank of England, a History*, Vol. II, 1797–1914 (Cambridge: Cambridge University Press).
- Cochrane, John H., 2001, *Asset Pricing* (Princeton, New Jersey: Princeton University Press).
- Crafts, Nicholas, 2000, “Historical Perspectives on the Information Technology Revolution,” unpublished background paper for the October 2001 *World Economic Outlook* (Washington: International Monetary Fund).
- Dornbusch, Rudiger, and Jacob A. Frenkel, 1984, “The Gold Standard and the Bank of England in the Crisis of 1847,” in *A Retrospective on the Classical Gold Standard, 1821–1931*, ed. by Michael D. Bordo and Anna J. Schwartz (Chicago, Illinois: University of Chicago Press), pp. 233–71.
- Drees, Burkart, and Ceyla Pazarbaşıoğlu, 1998, *The Nordic Banking Crisis: Pitfalls in Financial Liberalization*, IMF Occasional Paper No. 161 (Washington: International Monetary Fund).
- European Central Bank, 2002, *Report on Financial Structures* (Frankfurt: ECB).
- Eichengreen, Barry, and Michael D. Bordo, 2002, “Crises Now and Then: What Lessons from the Last Era of Financial Globalization?” NBER Working Paper No. 8716 (Cambridge, Massachusetts: National Bureau of Economic Research).
- Estrella, Arturo, and Gikas Hardouvelis, 1991, “Term Structure as a Predictor of Real Economic Activity,” *Journal of Finance*, Vol. 46 (June), pp. 555–76.
- Estrella, Arturo, and Frederic Mishkin, 1997, “Predicting U.S. Recessions: Financial Variables as Leading Indicators,” *Review of Economics and Statistics*, Vol. 80 (February), pp. 45–61.
- Fazzari, Steven M., R. Glenn Hubbard, and Bruce Petersen, 1988, “Financing Constraints and Corporate Investment,” *Brookings Papers on Economic Activity: 1*, Brookings Institution, pp. 141–206.
- , 1996, “Financing Constraints and Corporate Investment: Response to Kaplan and Zingales,” NBER Working Paper No. 5462 (Cambridge, Massachusetts: National Bureau of Economic Research).



- Flood, Robert P., and Peter M. Garber, 1994, *Speculative Bubbles, Speculative Attacks, and Policy Switching* (Cambridge, Massachusetts: MIT Press).
- Friedman, Milton, and Anna J. Schwartz, 1963, *A Monetary History of the United States, 1867–1960* (Princeton, New Jersey: Princeton University Press).
- Gayer, Arthur D., Walt W. Rostow, and Anna J. Schwartz, 1953, *The Growth and Fluctuation of the British Economy, 1790–1850* (Oxford: Clarendon Press).
- Gertler, Mark, and Simon Gilchrist, 1994, “Monetary Policy, Business Cycles, and the Behavior of Small Manufacturing Firms,” *Quarterly Journal of Economics*, Vol. 109 (May), pp. 309–340.
- Helbling, Thomas, and Tamim Bayoumi, 2003, “Are They All in the Same Boat? The 2000–01 Growth Slowdown Under the G-7 Business Cycle Linkages,” forthcoming IMF Working Paper (Washington: International Monetary Fund).
- Herring, Richard, and Susan Wachter, 2003, “Bubbles in Real Estate Markets,” in *Asset Price Bubbles: The Implications for Monetary, Regulatory, and International Policies*, ed. by William Hunter, George Kaufman, and Michael Pomerleano (Cambridge, Massachusetts: MIT Press).
- Hoshi, Takeo, Anil Kashyap, and David Scharfstein, 1991, “Corporate Structure, Liquidity, and Investment: Evidence from Japanese Industrial Groups,” *Quarterly Journal of Economics*, Vol. 106 (February), pp. 33–60.
- Ito, Takatoshi, and Tokua Iwaisako, 1995, “Explaining Asset Bubbles in Japan,” NBER Working Paper No. 5358 (Cambridge, Massachusetts: National Bureau of Economic Research).
- Ivaschenko, Iryna, 2003, “How Much Leverage Is Too Much, or Does Corporate Risk Determine the Severity of a Recession?” IMF Working Paper 03/3 (Washington: International Monetary Fund).
- Jaeger, Albert, 2002, “Corporate Balance Sheet Restructuring and Investment in the Euro Area” (unpublished; Washington: International Monetary Fund, European I Department).
- Kashyap, Anil, Owen Lamont, and Jeremy Stein, 1994, “Credit Conditions and the Cyclical Behavior of Inventories,” *Quarterly Journal of Economics*, Vol. 109 (August), pp. 565–92.
- Kindleberger, Charles P., 2000, *Manias, Panics, and Crashes: A History of Financial Crises* (New York: John Wiley & Sons, 4th ed.).
- Kiyotaki, Nobushiro, and John Moore, 1997, “Credit Cycles,” *Journal of Political Economy*, Vol. 105 (April), pp. 211–48.
- Levine, Ross, 2002, “Bank-Based or Market-Based Financial Systems: Which Is Better?” *Journal of Financial Intermediation*, Vol. 11 (October), pp. 398–428.
- Mella-Barral, Pierre, and William Perraudin, 1997, “Strategic Debt Service,” *Journal of Finance*, Vol. 52 (June), pp. 531–56.
- Merton, Robert, 1974, “On the Pricing of Corporate Debt: The Risk Structure of Interest Rates,” *Journal of Finance*, Vol. 29 (May), pp. 449–70.
- Mishkin, Frederic S., and Eugene N. White, 2003, “U.S. Stock Market Crashes and Their Aftermath: Implications for Monetary Policy,” in *Asset Price Bubbles: Implications for Monetary, Regulatory, and International Policies*, ed. by William Hunter, George Kaufman, and Michael Pomerleano (Cambridge, Massachusetts: MIT Press).
- Myers, Stewart, 1977, “Determinants of Corporate Borrowing,” *Journal of Financial Economics*, Vol. 5 (November), pp. 147–75.
- Neal, Larry, 1998, “The Financial Crisis of 1825 and the Restructuring of the British Financial System,” *Federal Reserve Bank of St. Louis Review*, Vol. 80 (May/June), pp. 53–82.
- Nickell, Stephen, 1981, “Biases in Dynamic Models with Fixed Effects,” *Econometrica*, Vol. 49 (November), pp. 1417–26.
- Okina, Kunio, and Shigenori Shiratsuka, 2003, “Japan’s Experience with Asset Price Bubbles: Is It a Case for Inflation Targeting?” in *Asset Price Bubbles: Implications for Monetary, Regulatory, and International Policies*, ed. by William Hunter, George Kaufman, and Michael Pomerleano (Cambridge, Massachusetts: MIT Press).
- Pagan, Adrian R., and Kirill A. Sossounov, 2003, “A Simple Framework for Analyzing Bull and Bear Markets,” *Journal of Applied Econometrics*, Vol. 18, Issue 1, pp. 23–46.
- Romer, Christina, 1993, “The Nation in Depression,” *Journal of Economic Perspectives*, Vol. 7 (Spring), pp. 19–39.
- Schiantarelli, Fabio, 1995, “Financial Constraints and Investment: A Critical Review of the Methodological Issues and International Evidence,” in *Is Bank Lending Important for the Transmission of Monetary Policy?* ed. by Joe Peek and Eric S. Rosengren (Boston: Federal Reserve Bank of Boston).

- Schwartz, Anna J., 1995, "Why Financial Stability Depends on Price Stability," *Economic Affairs*, Vol. 15 (Autumn), pp. 21–25.
- Sharpe, Steven, 1994, "Financial Market Imperfections, Firm Leverage, and the Cyclicity of Employment," *American Economic Review*, Vol. 84 (September), pp. 1060–74.
- Shiller, Robert J., 2000, *Irrational Exuberance* (Princeton, New Jersey: Princeton University Press).
- Stein, Jeremy, 2001, "Agency, Information and Corporate Investment," NBER Working Paper No. 8342 (Cambridge, Massachusetts: National Bureau of Economic Research).
- Stock, James, and Mark Watson, 1993, "A Procedure for Predicting Recessions With Leading Indicators: Econometric Issues and Recent Experience," in *Business Cycles, Indicators, and Forecasting*, Vol. 28, ed. by James Stock and Mark Watson (Chicago, Illinois: University of Chicago Press), pp. 95–156.
- Vermeulen, Philip, 2000, "Business Fixed Investment: Evidence of a Financial Accelerator in Europe," European Central Bank Working Paper No. 37 (Frankfurt: European Central Bank).
- White, Eugene N., 1990, "When the Ticker Ran Late: The Stock Market Boom and Crash of 1929," in *Crashes and Panics: The Lessons from History*, ed. by Eugene N. White (New York: Dow Jones-Irwin), pp. 143–87.
- Zarnowitz, Victor, 1992, *Business Cycles: Theory, History, Indicators and Forecasting* (Chicago, Illinois: University of Chicago Press).