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"Boom and Bust" in Asset Markets in the 1980s: Causes and Consequences

Garry J. Schinasi and Monica Hargraves[1]

Beginning in the late 1970s, and extending to the present, a large number of industrial countries initiated a process of financial deregulation and liberalization. The gains from this have been substantial, including increased access to credit markets by households and enterprises, higher rates of remuneration on deposits, and a more market-determined allocation of resources. Major economic sectors have been affected by this process and the responses of these sectors have contributed to important economic developments in the 1980s and early 1990s.

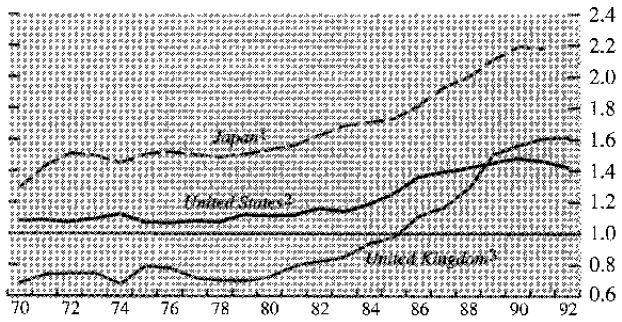
In particular, the confluence of structural changes in financial markets and expansionary macroeconomic policies in the mid- to late 1980s permitted an excessive accumulation of debt and a boom in asset markets which, in retrospect, could not be sustained. An important consequence of the corresponding asset price inflation and then deflation has been a long period of balance sheet adjustment and, in some cases, financial fragility. Households, businesses, and financial intermediaries have worked to restore financial positions to a level consistent with the new financial environment and the losses experienced during the asset deflation. The asset price cycle and the associated real and financial adjustments have deepened and prolonged the recessions in some countries and have weakened the economic recoveries now under way.

In the private nonfinancial sectors of the affected economies, financial liberalization provided households and businesses with greater access to credit markets. This contributed to the long period of expansion during the 1980s. Private saving rates declined as the level of outstanding credit rose sharply to finance consumption, housing, and commercial real estate booms in the United States, the United Kingdom, and the Nordic countries, and to finance strong consumption growth and an investment boom in Japan (Charts 1 and 2). This credit expansion exceeded the growth in economic activity by a wide margin. The decline in asset markets that followed the monetary tightening in a number of countries at the end of the decade altered balance sheets considerably. The effects of balance sheet adjustments on the shape of the business cycle have been most notable in the United States and the United Kingdom. In Japan, where growth has slowed considerably, asset price deflation and private sector financial positions are expected to be important in shaping the short-term outlook. Policymakers have already responded to these expectations with several large fiscal stimulative packages. There also have been relatively severe adjustments in smaller industrial countries including Australia, New Zealand, Finland, Norway, and Sweden.

In financial sectors, financial liberalization and innovation allowed established institutions to work in new ways; new institutions emerged and developed new services and a broader array of financial instruments. This broadening and deepening of the

Chart 1. Selected Countries: Total Private Nonfinancial Sector Debt

(Debt-GDP ratio; end of period)



Sources: For the United States, Data Resources, Inc. data base; for the United Kingdom, Central Statistical Office, *Financial Statistics;* and for Japan, Economic Planning Agency, *National Income Accounts.*

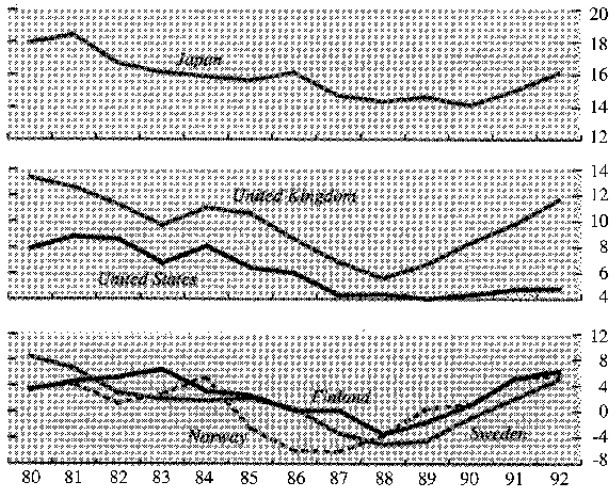
[1]Total financial liabilities of the private nonfinancial sectors less trade credit.

[2]Total credit market debt outstanding of the private nonfinancial sectors.

[3]Total financial liabilities of the personal and the industrial and commercial sectors, less outstanding domestic trade credits and ordinary and preference shares. Data for 1992 are through the third quarter.

[1]The authors gratefully acknowledge the many useful comments and suggestions from their colleagues throughout the Fund, particularly Peter Clark, David Coe, and Flemming Larsen. This paper synthesizes the analyses in International Monetary Fund (1992a), (1992b), and (1993).

Chart 2. Personal Saving Rates[1]
(Saving as a percent of disposable income)



Source: National sources; and IMF staff estimates.
[1]Capital gains are not included in the national income accounting definition of disposable income, so saving rates can be negative even when the stock of wealth is rising.

financial sector was associated with heightened competition among commercial banks and other financial institutions. Many entered riskier lines of business and, later, increased the share of their assets held in highly leveraged transactions, leveraged buyouts, developing country debt, off-balance-sheet derivative products, and real estate markets. This higher risk business made banks and other financial intermediaries more vulnerable to cyclical developments, particularly asset price adjustments. The inflation and deflation in commercial and residential real estate markets, and in some cases in corporate equity markets, in the mid- to late 1980s created fragile conditions in the financial sectors of several countries.

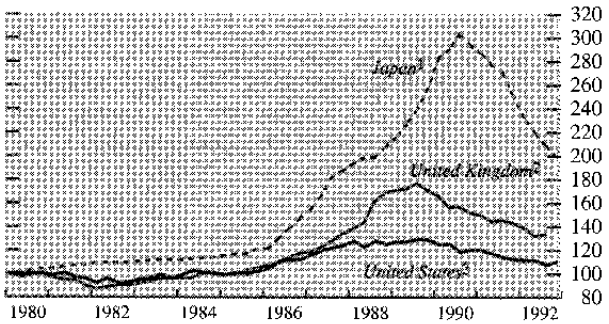
The conduct of monetary policy was also affected by disintermediation stemming from financial deregulation and liberalization, which rendered monetary indicators less reliable. Asset prices and interest rates became more volatile as new instruments were introduced, as competition increased, and as new arbitrage opportunities between the new instruments and markets were discovered. An important implication of financial market liberalization appears to be that monetary policies may have a more direct impact on asset prices than before. To the extent that asset prices and their movements are not captured by consumer price and wholesale price indices, however, monetary authorities may have ignored important information about the short-term and medium-term effects of their policies. Whether the increased sensitivity of asset prices to changes in monetary policies was temporary, and related to the transformation of financial systems, or is now a permanent feature of the new financial environment is uncertain.

Asset Prices and Nonfinancial Sector Balance Sheet Adjustments

Process of Accumulation in the 1980s

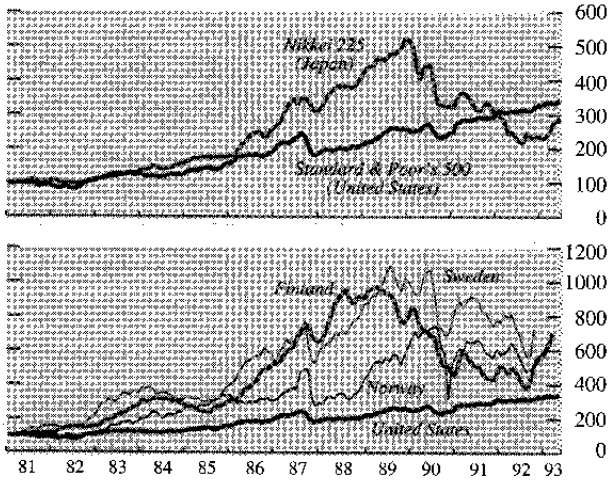
Partly as a result of major changes to their financial systems, several industrial countries had a boom in asset markets associated with a period of asset accumulation, an unprecedented buildup of debt, a sharp increase in relative asset prices, and related increases in household wealth. The appreciation of real estate values provided homeowners with unrealized capital gains, which further encouraged households to reduce saving rates and acquire assets on the expectation of even greater price appreciation. The asset markets most affected were the residential and commercial real estate markets in Japan, the United Kingdom, Australia, New Zealand, and the Nordic countries, but adjustments also have occurred on a more limited scale in the United States and some continental European countries. Inflation-adjusted residential property prices increased at an annual average of 13¾ percent (19½ percent nominal) in the United Kingdom during 1986–89 and 6¼ percent (10¼ percent nominal) in the United States (Chart 3). In Japan, real land prices increased sharply, recording an annual average increase of 20¼ percent (21¾ percent nominal)

Chart 3. Selected Countries: Property Prices
(As a ratio to the consumer price index: 1980:Q1 = 100)



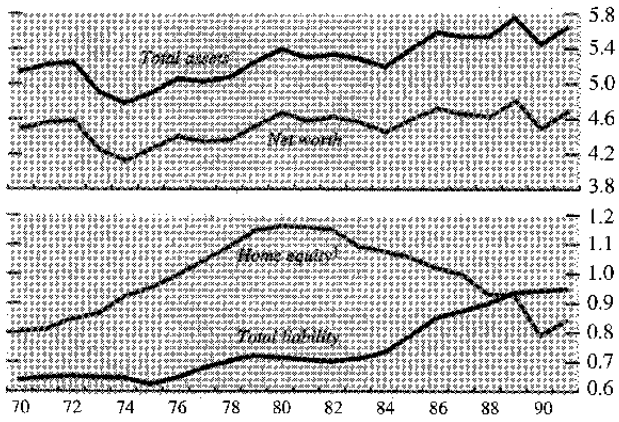
Sources: For the United States, Data Resources, Inc. data base; for the United Kingdom, Central Statistical Office, *Financial Statistics*; and for Japan, Japan Real Estate Institute, *Bulletin of Japan Land Prices.*
[1]Urban residential land price in six largest cities.
[2]Index of prices on dwellings.
[3]Average price of a new house.

Chart 4. Selected Countries: Stock Market Indices
(January 1981 = 100)



Sources: For the United States, Data Resources Inc. data base; for Japan, Nikkei Services; and for Finland, Norway, and Sweden, IMF, *International Financial Statistics*.

Chart 5. United States: Household Assets, Liabilities, Net Worth, and Home Equity
(As a ratio of disposable income)

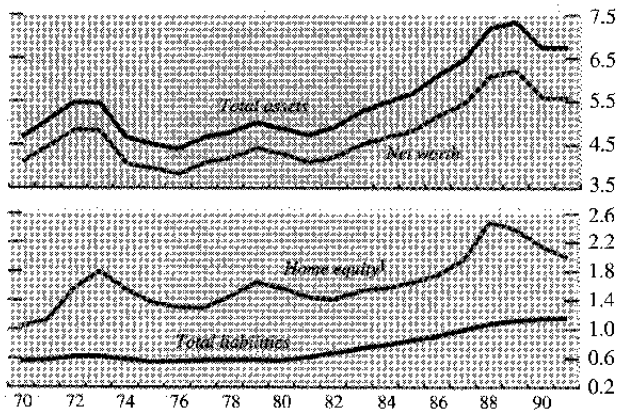


Source: Federal Reserve Board, *Balance Sheets for the U.S. Economy*. Total assets include tangible assets, valued at current cost net of straight-line depreciation, and financial assets, consistent with the flow-of-funds accounts.
[1]Owner-occupied residential structures plus owner-occupied land less home mortgages.

during 1986–90. In some countries there were also sharp increases in stock prices, most notably in Japan, but also in others including the Nordic countries (Chart 4).

The economic expansions of the 1980s in the United States and the United Kingdom shared a number of features that may explain the balance sheet adjustments that have occurred recently in these countries, and the impact these adjustments have had on consumer and business spending. During the 1980s, the household sectors in both the United States and the United Kingdom accumulated assets at an unusually rapid pace, financed by a strong increase in liabilities; in the latter country this was associated with a sizable increase in net worth positions relative to income (Charts 5 and 6). In both countries, this accumulation was associated with a large volume of transactions in housing markets, financed in large part by rising mortgage debt.[2] The expansions were accompanied by strong growth in investment expenditures, heavily concentrated in commercial real estate markets. Real estate prices increased sharply relative to prices of consumption goods, and this created expectations of continued capital gains on both residential and commercial real estate. Unlike most expansionary periods, personal saving rates declined in both countries; in the United Kingdom these declined dramatically and the personal and the industrial and commercial sectors incurred financial deficits.

Chart 6. United Kingdom: Personal Sector Assets, Liabilities, Net Worth, and Home Equity
(As a ratio of disposable income)



Sources: Central Statistical Office, *Financial Statistics* and *Economic Trends;* and IMF staff estimates. Total assets include tangible assets, valued at current market prices, and financial assets, consistent with flow-of-funds data.
[1]Owner-occupied residential structures plus owner-occupied land less home mortgages.

[2]For the United States, see Testimony by Alan Greenspan, Chairman, Board of Governors of the Federal Reserve System, before the Committee on Ways and Means, U.S. House of Representatives (December 18, 1991) and before the Committee on Banking, Housing, and Urban Affairs, U.S. Senate (February 25, 1991); and Bank of England (1992). For the United Kingdom, see Sargent (1991); and "Personal Sector Saving, Wealth and Debt" (1991).

Table 1. Selected Financial Balance Indicators

	1970–74	1975–79	1980–84	1985	1986	1987	1988	1989	1990
United States[1]									
Business assets	1.55	1.61	1.68	1.54	1.56	1.54	1.53	1.52	1.53
Business liabilities	0.62	0.54	0.55	0.57	0.61	0.63	0.65	0.68	0.68
Business net worth	0.92	1.08	1.13	0.97	0.95	0.91	0.88	0.85	0.85
Business net interest payments	2.08	2.03	2.80	2.65	2.73	2.75	2.92	3.22	3.22
Business debt-equity ratio	0.62	0.81	0.73	0.69	0.65	0.60	0.72	0.67	0.71
United Kingdom[2]									
Business assets	...	1.70	1.78	1.86	1.91	1.94	...	...	...
Of which: Financial assets	0.55	0.58	0.62	0.70	0.75	0.75	0.76	0.87	0.82
Business liabilities	1.24	1.01	1.05	1.26	1.45	1.50	1.56	1.80	1.65
Business net worth	...	0.69	0.72	0.61	0.46	0.44	...	...	...
Business net interest payments	...	...	0.23	0.21	0.20	0.17	0.19	0.28	0.32
Capital gearing	...	...	8.64	10.70	12.90	13.40	16.90	20.00	19.30
Japan[3]									
Household assets	5.23	4.96	6.15	6.49	7.26	8.55	9.03	9.82	9.70
Household liabilities	0.62	0.67	0.82	0.89	0.92	1.01	1.07	1.12	1.16
Household net worth	4.61	4.29	5.32	5.61	6.34	7.54	7.95	8.71	8.54
Business assets	3.48	3.52	3.76	3.85	4.19	4.75	5.04	5.38	5.07
Business liabilities	1.91	1.90	1.94	1.98	2.00	2.12	2.16	2.17	2.23
Business net worth	1.57	1.61	1.82	1.88	2.20	2.63	2.88	3.21	2.85
Business net interest payments	49.32	63.06	53.63	46.67	44.35	40.81	38.72	40.94	49.14
Business debt-equity ratio	2.52	2.70	2.35	2.01	1.42	1.26	0.98	0.78	1.26

Sources: For the United States, Federal Reserve Board, *Balance Sheets for the U.S. Economy*; for the United Kingdom, Central Statistical Office, *Financial Statistics*; and for Japan, *National Income Accounts*.

[1]The business sector is the nonfinancial corporate sector; each variable is expressed as a ratio to nonfarm business output, except net interest payments, which are expressed in percent of nonfarm business output and the debt-equity ratio.

[2]The business sector is defined as industrial and commercial companies; each variable is expressed as a ratio to GDP, except capital gearing, which is net debt at book value in percent of fixed capital at replacement cost, and net interest payments, which is a ratio to after-tax income.

[3]Household data as a ratio to disposable income; the business sector is defined as the nonfinancial corporate sector; each variable is expressed as a ratio to GDP, except the debt-equity ratio and business interest payments, which are in percent of available income.

In the United States, the long expansion in the 1980s was associated with a decline in the personal saving rate and a boom in spending on consumer durables, motor vehicles, and housing (see Chart 2). Purchases of consumer durables and motor vehicles were financed in part by installment debt, which rose from 12 percent of disposable income in 1980 to 16 percent in 1989. The housing market was particularly active, partly reflecting the formation of households by the baby-boom generation and the widespread expectation that the rapid increase in house prices would continue and would lead to substantial capital gains. The sharp rise in mortgage debt during this period was also associated with the restructuring of household debt in favor of mortgages following the elimination of the deductibility of interest payments on consumer credit. As a result, households assumed a large increase in mortgage debt, which rose from 48 percent of disposable income in 1980 to 65 percent in 1990.

In the business sector of the U.S. economy, there was a protracted period of debt accumulation in the 1980s. Part of that accumulation was used for massive investment in commercial real estate, mostly office buildings, that eventually far exceeded the demand. The boom in commercial real estate was partly due to a change in the tax law in 1981 that made these investments more attractive. Also during the decade there were many mergers and leveraged buyouts, often involving the substitution of debt for equity that led to a relatively large increase in debt held by the business sector. Total liabilities of the nonfinancial corporate sector in the United States rose as a share of nonfarm business output from about 55 percent in 1980–84 to almost 70 percent in 1990 (Table 1). As a result of these higher levels of debt, net worth declined from over 110 percent of nonfarm output to 85 percent over the same period, and net interest payments as a share of corporate income rose substantially.[3]

In the United Kingdom, the period of fast economic growth in the second half of the 1980s also reflected a consumption and real estate boom. New attractive mortgage instruments and the privatiza-

[3]The rapid pace of debt accumulation was often highlighted as a major risk, especially given the high real interest rates during the 1980s. See, for example, Friedman (1986); Kaufman (1986); and Bernanke and Campbell (1988).

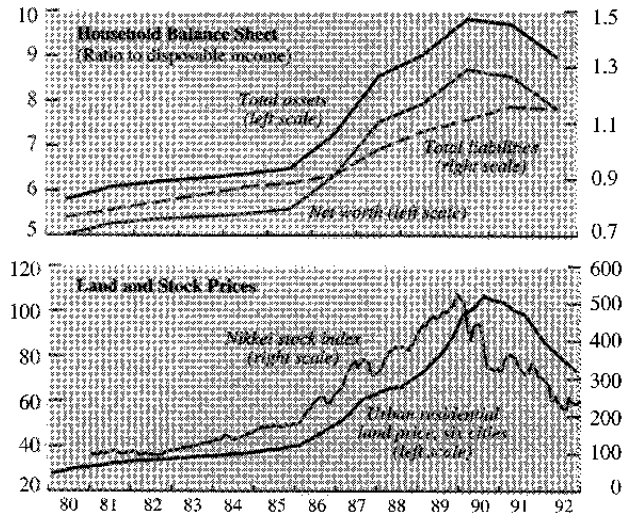
tion of council housing contributed to the boom in real estate markets. Financial deregulation earlier in the decade encouraged greater household borrowing in general. This borrowing was associated with a sharp decline in the personal saving rate after 1985 to historically low levels—from an annual average of 11¼ percent of disposable income during 1979–85 to an average of 7 percent of disposable income during 1986–88—in contrast to typical saving behavior in periods of economic expansion (see Chart 2). During 1986–88, saving fell short of personal sector investment outlays (mainly in real estate) so that the sector moved into financial deficit. Nevertheless, personal sector net worth continued to rise rapidly because capital gains on assets—particularly in real estate—more than offset the substantial rise in liabilities (see Chart 6).

The expansion in household financial activity in the United Kingdom during the 1980s was paralleled by a sizable boom in investment spending and an increase in corporate debt. The structure of balance sheets was also affected by mergers and acquisitions that led to a further expansion in corporate debt. From 1980–84 to 1989, financial liabilities of the business sector nearly doubled as a share of GDP, rising from about 105 percent to 180 percent (see Table 1). Reflecting this buildup of debt, interest payments as a share of after-tax income rose from nearly 25 percent to over 30 percent, and capital gearing doubled.

During 1985–89, household net worth in Japan rose at an annual average rate of 16 percent—from 5½ times annual household disposable income at the end of 1985 to 8¾ times income by the end of 1989 (Chart 7). Capital gains on land holdings accounted for about 70 percent of the rise in net worth during this period, and those on stock holdings for another 13 percent. The rise in stock prices far exceeded the appreciation in stock values in other countries (see Chart 4). Real property prices also appreciated significantly. Tax provisions created incentives for the construction of apartment houses and condominiums, and changes in the capital gains tax treatment of real estate transactions encouraged upgrade purchasing. The stock and land price "bubbles" were linked because a portion of the initial stock price increase was related to increases in the perceived market value of corporate land assets.

In the business sector in Japan, expanded opportunities for direct participation in securities and money markets encouraged an increase in borrowing, and a shift in corporate financing away from banks toward direct securities markets. The strength of equity markets brought a steep rise in corporate borrowing as firms took the opportunity to borrow cheaply by attaching equity warrants (an option to convert debt into equity at a predetermined price) to debt issues. Profits and new stock issues financed a boom in plant and equipment.[4] Corporate leverage measured in debt-equity ratios declined significantly by 1989, although the ratio of gross debt to total assets rose steadily through the 1980s. During 1988–90, real business fixed investment rose by nearly 15 percent annually.

Chart 7. Japan: Household Balance Sheet, and Land and Stock Prices



Sources: Economic Planning Agency, *National Income Accounts;* Nikkei Services; and Japan Real Estate Institute, *Bulletin of Japan Land Prices.*

By the second half of the 1980s, the economies of many industrial countries were producing at high levels of resource utilization, and demand pressures were increasing. To maintain policies consistent with medium-term objectives of noninflationary growth, monetary policies were tightened. By 1991, economic recessions were experienced in North America, the United Kingdom, and in smaller industrial countries, including Australia, Finland, New Zealand, Norway, Sweden, and Switzerland, and growth slowed sharply in Japan.

Asset Price Deflation and Its Macroeconomic Consequences

By the late 1980s, the balance sheet expansion left households and businesses unusually vulnerable to the effects of higher interest rates. The tightening of monetary conditions in several countries in 1988–89 brought an end to asset price inflation.

[4]Corporations also increased their holdings of financial assets in the late 1980s. See Hargraves, Schinasi, and Weisbrod (1993).

House prices leveled off or declined—in some regions substantially—and the turnover of existing homes and housing starts fell rapidly. Coupled with the drop in house prices and the continued rise in liabilities, household net worth positions declined substantially in real terms and relative to personal disposable income. A notable feature of the recent recessions has been the record number of businesses and households in many countries that failed to meet debt-service obligations, resulting in insolvencies, bankruptcies, and repossessions of mortgaged properties.

A deterioration of net asset positions in the household and business sectors affects spending decisions in various ways. In the household sector, for example, a reduction in net worth through market revaluations of assets may reduce the growth of consumer spending as households adjust consumption patterns to new lower wealth levels. In addition, a rise in debt relative to income increases the share of income required to make interest and amortization payments, and leaves less for consumption spending. A similar adjustment would occur in the corporate sector as businesses cut back outlays on plant and equipment and devote a larger share of income to servicing existing debt, maintaining dividend payments, and rebuilding net worth positions to maintain creditworthiness and stock prices.

The decline in household net worth in the United States stemmed mainly from a large reduction in home equity. This represented an acceleration in the unprecedented downward trend in home equity that began after the initial recovery from the recession in the early 1980s (see lower panel of Chart 5). During the mid-to-late 1980s, the reduction in home equity resulted to some extent from a tax-induced restructuring of household debt in favor of mortgages. More recently, the erosion in home equity has been associated with the decline in house prices. Home ownership constitutes the largest component of household assets, and home equity is one of the most tangible measures of household wealth. The recent decline in house prices in some parts of the United States reduced consumer confidence significantly and led households to postpone purchases, in part to reduce their outstanding balances of credit. For 1991 as a whole, households reduced their outstanding consumer installment credit by 1 percent, the first such annual reduction since 1958.

In contrast, the United Kingdom saw a positive trend rate of growth in home equity throughout the 1980s; during the recession, however, the real estate boom collapsed and home equity declined substantially (see lower panel of Chart 6). The increase in unemployment and, until recently, high interest rates made it difficult for households to service their mortgage debt, which led to a record number of delinquencies and foreclosures. Following the decline in net worth and the increased difficulties in servicing debt, households in the United Kingdom have attempted to improve their balance sheets. This has been manifested in part by a dramatic rebound in the personal saving rate.

Thus far in Japan, although asset prices have fallen dramatically, balance sheet adjustments and their real effects have been less pronounced. In 1991–92, it is likely that net worth declined further, as both equity prices and (especially) land prices continued to decline dramatically. At the end of 1992, residential land prices in the six largest cities in Japan had fallen by 30 percent (see Chart 3); they still appear high in real terms relative to previous levels.

The impact on demand of this change in wealth in Japan is difficult to quantify because of uncertainty about the relationship between consumption and unrealized capital gains on stock and property holdings. Households hold a small portion of outstanding stocks, and land holdings are rarely sold because they tend to be transferred within families. On these grounds, the impact on household behavior of falling asset prices is expected to be small. Nevertheless, growth in private consumption expenditure declined from 4 percent in 1990 to 2¼ percent in 1991 and to less than 2 percent in 1992.

The weakness in asset prices in Japan has also adversely affected investment. With the downturn in the stock market, equity financing has been sharply reduced, and profitability has declined as asset values (including land) continued to fall. Growth in gross fixed capital formation slowed from an average of about 10 percent in 1987–90 to 3 percent in 1991 and declined more than 1 percent in 1992. At the same time, growth in business fixed investment slowed to 6 percent in 1991 and the level of business investment declined by 4 percent in 1992. Current projections for output assume that the effects of asset price adjustments will continue to be contained and that business investment, after stagnating in 1992, will recover moderately in 1993. An important uncertainty, however, is that the need to refinance the large volume of outstanding equity warrants at much higher interest rates than when the debt was originally issued may lower profits and increase the cost of capital over the next few years.

In Canada, net worth positions have not deteriorated to the extent they did in the United Kingdom or the United States; they seem not to have been a major factor in the sluggishness of the recovery. Liabilities in the household sector rose rapidly in the latter half of the 1980s, and home equity declined during the recession, but net worth essentially stabilized rather than declined. In continental Europe, where economic growth has been somewhat sluggish, balance sheet positions have not

Table 2. Indicators of Growth in the Financial Industry

	Share in Total Employment			Share in Value Added[1]		
	1970	1979	1989	1970	1979	1989
United States	3.8	4.2	4.8	4.1	4.5	5.7[2]
Japan	2.6	2.8	3.4	4.5	4.9	5.6
United Kingdom[3]	6.0[4]	7.0	11.4	12.5	14.8	20.0
Finland	2.4[5]	2.5	3.1	3.1[5]	3.0	3.9
Norway	1.9	2.2	3.0	2.3	3.1	4.4
Sweden	...	1.7[6]	2.0	...	3.1[6]	4.4

Source: Bank for International Settlements (1992), p. 197.
[1]GNP/GDP plus imputed bank service charge, at current prices.
[2]1987.
[3]Including real estate and business services.
[4]1971.
[5]1976.
[6]1980.

deteriorated as much as in the United Kingdom, and are not expected to be a major factor constraining economic growth in the near term. However, property market problems similar to those experienced in Japan and the United Kingdom have emerged in France; these represent an important risk for the banking and insurance industries—both of which lent heavily in the property market.

In some of the smaller industrial countries, economic growth has been constrained by private sector financial consolidation, most notably in Australia, New Zealand, Norway, Finland, and Sweden. In the Nordic countries, long-standing elements of the tax code, such as the deductibility of interest payments, coupled with very high marginal tax rates amplified the accumulation of debt and the acquisition of real estate as credit markets were liberalized. While the adjustment process has been unique in each country—because of timing, sectoral coverage, or intensity—there have been common causes and consequences associated with the adjustments. Notable among the causes was the deregulation of financial markets in the mid-1980s.[5] In each country, financial deregulation was accompanied by accommodative, if not lax, monetary policies that led to an acceleration of prices in asset markets, concentrated in the residential and commercial real estate markets. Subsequently, monetary policies were tightened and, as interest rates rose, asset market prices adjusted, leaving some sectors with lower net worth positions. All of these countries had output losses as households, businesses, and some financial institutions experienced financial distress and reduced expenditures to adjust balance sheets.[6]

Balance Sheet Adjustment in the Financial Sector

Structural Changes in Financial Systems

Financial systems in industrial countries expanded significantly in the past two decades. This growth occurred through the expansion of balance sheets and off-balance-sheet activity and the expansion of trade and payments on securities markets. It is also reflected in the financial industry's employment growth and its share in total value added (Table 2).

Underlying this expansion were substantial structural changes within the financial industry. Before deregulation, banks were governed and protected by a network of regulations and restrictions. Deregulation and liberalization lowered barriers to new domestic and foreign entrants, eliminated interest rate regulations, and weakened restrictions on bank activities. This new financial environment is distinguished by its competition-driven disintermediation from banking systems—particularly from wholesale banking systems—into securitized money and capital markets. The volume of mutual fund assets has expanded considerably in many countries, and commercial paper markets were established and have grown rapidly, offering households and firms alternatives to traditional banks. Because of the increased concentration of saving in large "collective" institutions, notably pension funds, the movement of funds has become more responsive to price differentials.[7]

[5]See Lehmussaari (1990).

[6]In Norway, aggregate output increased in 1991 only because of growth in the oil and shipping sectors.

[7]For a more detailed discussion of these changes, see Goldstein and others (1992); and Bank for International Settlements (1992).

Table 3. Bank Profitability in Selected Countries

(Ratio of before-tax profits to total assets; in percent)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
United States										
Commercial banks	1.00	0.88	0.84	0.84	0.90	0.80	0.28	1.14	0.78	0.73
Large commercial banks	0.84	0.74	0.72	0.73	0.90	0.85	0.01	1.23	0.62	0.59
Japan										
Commercial banks	0.45	0.50	0.54	0.49	0.46	0.52	0.60	0.64	0.46	0.36
Large commercial banks	0.41	0.45	0.49	0.46	0.43	0.50	0.63	0.68	0.46	0.33
Germany										
Commercial banks	0.43	0.53	0.60	0.72	0.83	0.81	0.60	0.73	0.70	0.63
Large commercial banks	0.44	0.59	0.84	0.86	1.05	0.99	0.61	0.89	0.92	0.83
United Kingdom										
Commercial banks	...	...	...	0.88	1.09	1.19	0.19	1.52	0.11	0.65
Large commercial banks	1.21	0.84	0.82	0.81	1.09	1.21	0.12	1.51	0.03	0.50
Norway										
Commercial banks	0.72	0.54	0.91	0.85	0.64	0.64	−0.24	−0.32	0.17	−1.02
Sweden										
Commercial banks	0.41	0.35	0.44	0.35	0.34	1.00	0.73	0.59	0.47	0.22
Finland										
Commercial banks	0.48	0.51	0.42	0.49	0.54	0.63	0.45	0.77	0.22	0.21
Denmark										
Commercial and savings banks	0.95	1.20	5.08	0.09	3.72	−0.37	0.35	0.96	0.28	−0.27

Source: Organization for Economic Cooperation and Development (1991).

Banks have had to meet two challenges in the new competitive environment: to retain their volume of business and client bases, and to manage the industry-wide squeeze on profit margins. In addition, the new capital adequacy standards of the Basle Accord have sharpened attention on risk-weighted capital-asset ratios.[8] Banks have responded with aggressive innovations, expansion into new markets, and a shift toward noninterest income.

New types of bank loans and accounts have prevented even greater disintermediation but have also reduced net interest margins because more deposits now earn market-related rates of return. For city banks in Japan, for example, the proportion of liabilities bearing market-related interest rates rose from 10 percent in 1980 to over 70 percent in 1990. Competition from other nonbank financial intermediaries has placed additional pressure on industry-wide profit margins; as a result, bank profitability broadly declined in the 1980s (Table 3). Competition encouraged banks to expand into activities that provided fee-based income rather than traditional interest income (Chart 8). Banks have increased their advisory services, trading, brokerage, underwriting, and other financial support activities as far as regulations permitted. Conglomeration also has been important—particularly in Europe, where fee-based insurance and real estate brokering have been significant. In the United States and Japan, recent regulatory and legislative initiatives have laid the groundwork for expansion into the securities industry.

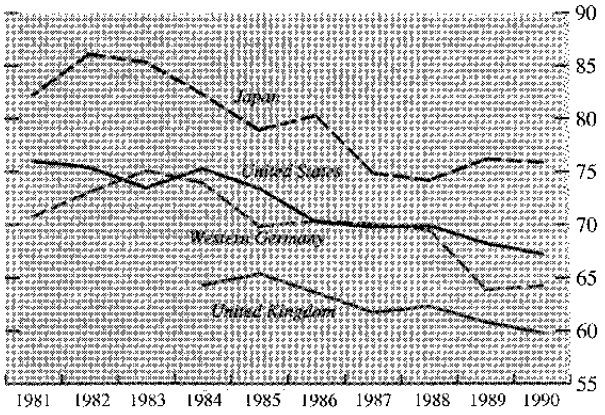
Increased competitive pressures and the decline in the special role of banking may have induced large wholesale banks to shift to high-risk, high-return investments. Given their exclusive direct links to central banks, banks are the only provider of risk-free liquidity to financial and payments systems. This unique role has been a primary source of banks' "franchise value." But with the securitization and expansion of financial systems, the need for customers to have direct access to bank-provided liquidity has diminished, and banks have seen their traditional sources of income weaken.[9] In the United States, the loss of market share and heightened price competition may have contributed to increased risk taking by banks. This was reflected in an increase in lending to developing countries in the 1970s and early 1980s, and to off-balance-sheet activity and lending for highly leveraged transactions and real estate later in the 1980s.

[8]See Bank for International Settlements (1988).

[9]For a detailed analysis of this link and the consequences of declining franchise value, see Weisbrod, Lee, and Rojas-Suárez (1992).

Chart 8. Selected Countries: Contribution of Interest Income

(Commercial banks' net interest income as percent of gross income)



Source: OECD, *Bank Profitability: Statistical Supplement—Financial Statements of Banks*, 1981–1990 (Paris, 1992).

Table 4. Bank Real Estate Lending in Selected Countries[1]

	1985	1987	1991
	(As percent of total loans outstanding)		
United States			
Total	29	34	42
Commercial	13	17	17
United Kingdom			
Total	19	23	31[2]
Nonhousing[3]	7	8	12[2]
Japan[4]	13	15	17
	(As percent of loans to private sector)		
Canada	33	39	49
France	29	29	31
Germany	46	45	40
Norway	48	41	52
Portugal	28	33	32
Spain	19	20	29
Switzerland	28	29	34[5]

Source: Bank for International Settlements (1992), p. 201.

[1]Data are not fully comparable across countries.

[2]Break in series resulting from the inclusion of a building society that was converted into a bank.

[3]Construction and property companies.

[4]Construction and real estate management firms.

[5]1990.

The attraction of growing securities markets and the associated opportunities for fee-based income have contributed to an expansion in banks' off-balance-sheet activity, particularly in the form of trade in derivative securities, such as futures, options, and swap contracts. The increase in banks' exposure (and that of their customers) to the volatility of interest rates and exchange rates has made these securities an attractive hedging device. The value of the outstanding stock of financial derivative instruments has grown from 10 percent of GDP in OECD (Organization for Economic Cooperation and Development) countries in 1986 to 40 percent in 1991.[10] The difficulty of accurately assessing the resulting risk to banks has attracted the attention of regulators.

There also was a significant shift in bank portfolios toward real estate in the late 1980s driven by increased demand for real estate investments and the expectation of high returns (Table 4). Heightened competition for market shares provided incentives for banks to provide loans to this growing market. The resulting increase in exposure to price risks in real estate markets has had serious consequences in countries where there have been sharp declines in property values.

The economic downturn in the United States and other major industrial countries made these financial adjustments more difficult. Business failures and personal bankruptcy rates have increased significantly in Japan and the United Kingdom. Loan-loss rates at banks and other financial institutions are historically high. Mergers and acquisitions in the financial sector have occurred rapidly and on a large scale. Bank share prices have fallen throughout the 1980s, in some countries very sharply (Chart 9).

By the end of the decade, bank lending had slowed significantly in many countries, in contrast to previous growth rates of 15 percent or higher (Table 5). These developments reflected general pressures on bank balance sheets, a cyclical decline in the demand for loans, and deliberate efforts to reverse the excessive growth of real estate lending and to restore balance to bank portfolios.[11]

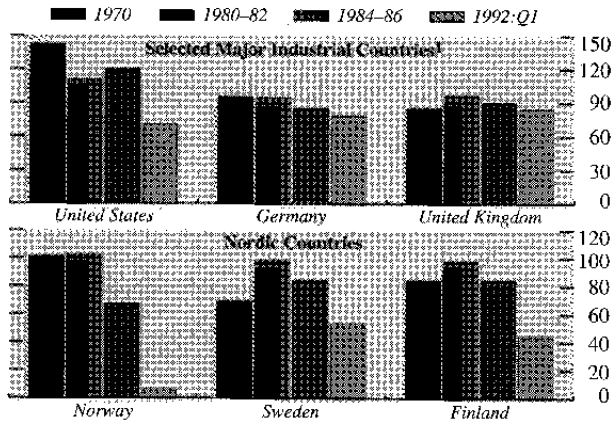
Part of the reduction in bank lending reflected the use of other sources of funding by households and businesses, such as the commercial paper market and nonbank financial intermediaries. This shift is an integral part of the deregulation and liberalization of financial systems. Many nonbanks expanded heavily into real estate lending in the 1980s, however, and are now faced with portfolios weakened

[10]These amounts reflect the value of assets underlying these contracts and are stated on a gross basis; on a net basis they would be zero.

[11]In Japan, concern about banks' exposure to real estate lending led the Ministry of Finance to impose quantitative limits on the growth of that portion of banks' portfolios during 1990–91.

Chart 9. Selected Countries: Relative Strength of Bank Stocks

(Bank index relative to overall index, 1980 = 100)



Source: Bank for International Settlements, *Sixty-Second Annual Report* (Basle, 1992).

[1]Data on bank share valuation for Japan are not included because of distortions from restrictive arrangements that were lifted in the mid-1980s.

by the asset price deflation and relatively slow economic growth. In Japan, by the end of fiscal year 1989, real estate loans made up roughly 40 percent of nonbank loans.

Experiences in Selected Countries

The scale and possible consequences of restructuring and retrenchment have been well illustrated by the savings and loan crisis in the *United States*. Savings and loan institutions were established to provide long-term financing for housing, but at the same time they relied on short-term deposits for funding. Interest rate increases in the 1970s and early 1980s greatly reduced profit margins because of the mismatch in maturity between assets and liabilities. By the early 1980s, the industry was severely undercapitalized.[12]

The initial policy response expanded the lending activities of savings and loan institutions, and safety nets (deposit insurance, for example) encouraged institutions to take on excessively risky investments. By the mid-1980s, financial weakness had become widespread within the U.S. thrift industry, and the Financial Institutions Reform, Recovery, and Enforcement Act of 1989 was a comprehensive response to the resulting crisis. The costs, however, have been high: the Congressional Budget Office

[12]See Fries (1992).

Table 5. Bank Loan Growth Rates

(Annual percent average growth)

	Period	Business	Housing	Individuals
United States	1983–90	6.5	14.3	8.6
	1991	−4.0	3.3	−4.1
Japan	1983–90	7.7	19.0	14.6
	1991	2.4	4.4	6.1
United Kingdom	1983–90	18.0	14.9	16.4
	1991	6.3	4.3	3.6

Source: Bank for International Settlements (1992), p. 117.

estimates the total net present value costs of the savings and loan cleanup to be $180 billion (1990 dollars). Over 1,100 institutions left the industry between 1987 and 1991; the Congressional Budget Office forecasts the departure of another 500 to 700 institutions by the time the industry reaches a healthy stable size.[13]

The savings and loan crisis has focused attention on the risks inherent in financial reform and has raised concern about the strength of the U.S. commercial banking industry. Although not comparable with the losses in the savings and loan industry, bank losses have been substantial. The number of bank failures declined from 206 in 1989, the highest since the Great Depression, to 124 in 1991, but the size of failed banks has increased substantially. The asset value of failed banks in 1991 exceeded $60 billion, roughly double the amount in 1988–89. Consolidation in the U.S. banking industry has proceeded in part by merger, although the evidence that mergers reduce costs and improve efficiency is mixed.[14]

A critical issue has been whether weakness in the financial sector has created a credit crunch, and thus worsened the recession. Studies of bank lending show that commercial loan growth was lower at banks in districts with weak employment, at banks with weaker capital positions, and at banks with lower-quality loan portfolios.[15] It is unclear whether this slowdown was due primarily to decreased demand or to changes in bank behavior. Survey evidence on the number of senior loan officers reporting tight credit conditions is also ambiguous. The recession and the general increase in nonbank sources of funds for high-quality borrowers are likely to have changed the mix of borrowers with whom banks deal. Aggregate figures on borrowing from nonbanks show declines similar to the declines observed in bank short-term lending. This suggests that decreased demand is important in

[13]See United States (1992) and (1993).

[14]See Berger and Humphrey (1991).

[15]See Johnson (1991).

the overall slowdown in lending. Moreover, supply shortages have been partly offset by a surge in foreign bank lending to U.S. corporations.[16]

Recent financial adjustments in the financial systems of Norway, Finland, and Sweden stand out because of the scale of government intervention that has been required to sustain the banking systems. Rigid and anticompetitive regulatory structures in all three countries were replaced with deregulated systems. Access by foreign institutions was increased, competition was intensified, and interest rates were liberalized in stages. High marginal tax rates and the tax deductibility of interest payments also encouraged speculative booms in real estate, which fed the real estate price inflation. Subsequent policy tightening and external shocks resulted in an economic contraction, sharp drops in real estate prices, and significant increases in commercial bankruptcy rates. All these contributed to a sharp weakening in the financial position of the banking system. Because securities markets and nonbank institutions are not as extensive in these economies as in others, weakness in the concentrated banking sector is of even greater concern to policy authorities.

Finland is currently in its worst recession of the postwar period, partly because of the collapse in trade with the countries of the former Soviet Union and the decline in world demand for forest products. The financial sector has been severely weakened after the rapid expansion of lending in the late 1980s that included increased risk taking, expansion into relatively unknown markets, and reduced attention to asset quality and portfolio risk. Profitability has been squeezed by lingering interest rate rigidities, which have kept many outstanding loans at low rates of interest while deposits increasingly earn market rates of interest. The recession has made debt servicing more difficult for firms and households; this has added to the pressure on banks. Nonperforming loans amounted to almost Fmk 50 billion in August 1992—roughly 12 percent of outstanding bank loans.[17] Severe credit losses at a major bank led to a temporary takeover by the Bank of Finland in September 1991, after which the bank was sold to the newly created Government Guarantee Fund. Costs to the Bank of Finland of the takeover alone totaled Fmk 5.3 billion.[18] Given the weakness of banks, concern about a credit crunch arose because share and bond markets now play a smaller role in providing finance than in normal times.

In *Norway,* a boom in business and household borrowing and a substantial increase in real estate lending were counteracted in the late 1980s by tight fiscal and monetary policies. Commercial and savings banks posted net operating losses during 1988–91, primarily because of losses on loans. Through the third quarter of 1992, finance company operating profits were positive but savings banks results were only just above zero, and mortgage companies and commercial banks posted losses.[19] Real estate values dropped sharply in the late 1980s; by 1991 prices of office space had fallen 50 percent from their peak in 1987. House prices fell 35 percent in real terms from mid-1988 through 1992. In 1991, commercial bankruptcies rose 29 percent, and bank stocks fell 79 percent.[20] The Norwegian Government's response has been extensive.[21] The Government Bank Insurance Fund was set up in March 1991 to support the private funds whose ability to meet bank needs had come into question by the end of 1990. The Government Bank Investment Fund was established in November 1991 to help viable banks obtain new capital. Direct government support through these funds totaled Nkr 15½ billion in 1991.[22] More recent estimates of the total funds committed by the government, by the private insurance funds, and by the Central Bank between 1988 and 1992 are on the order of Nkr 30 billion, or 4 percent of GDP. Public ownership of bank assets rose about 50 percent in 1992, from 20 percent in 1988.[23] Economic activity strengthened in 1992, but remains weak, and financial system adjustments continue on a large scale.

Adjustments in the financial system in *Sweden* have also been substantial, although not on the scale of those in Finland and Norway. The stock of private sector loans at banking institutions grew 140 percent in the second half of the 1980s, rising from 92 percent of GNP in 1985 to 140 percent by the end of 1990. Credit losses at financial institutions in 1991 amounted to Skr 48 billion, or 3.4 percent of GDP. Loans against real estate, provided mainly in 1989 and 1990, accounted for 80 percent of the credit losses at banks.[24] Special problems at two large banks elicited government loans and guaran-

[16]See McCauley and Seth (1992).

[17]See Nyberg (1992).

[18]Statement by Governor Sirkka Hämäläinen of the Bank of Finland on the closing of the accounts for 1992. Statements by Governor Kullberg of the Bank of Finland on the closing of the accounts for 1990 and 1991, and Homberg and Soltilla (1992), review the position of the banking sector.

[19]See Norges Bank (1992/4).

[20]See "European Finance and Investment; Nordic Countries" (1992).

[21]See Skånland (1993).

[22]See Norges Bank (1992/1).

[23]See Organization for Economic Cooperation and Development (1993).

[24]See Dalheim, Lind, and Nedersjö (1992).

tees. Loan losses in 1991–92 at a large majority state-owned bank led the government to purchase the shares remaining in public hands and restructure the bank by creating two institutions—a state-owned company that retained the bank's bad assets and a bank with the performing assets. Both received additional equity capital from the government.

Japan entered the 1980s with a tightly regulated, heavily client-based financial system. Interest rate regulations, as well as relatively limited development of money and corporate debt markets in the 1980s, constrained the possibilities for arbitrage. The pricing and allocation of funds were therefore not fully market determined. Extensive reform measures since 1984 have included liberalization of interest rates on deposits; easing of restrictions on large time deposits, certificates of deposits, and money market certificates; and the introduction of markets for commercial paper, futures and options, and offshore transactions. The associated declines in the portions of household and business deposits held at banks, and in borrowing from banks, have been more pronounced in Japan than elsewhere. Recent legislative reforms have further lowered barriers between banking and securities business, permitting banks to establish subsidiaries that provide brokerage services and allowing securities firms to establish banking subsidiaries.

Japanese banks were at first able to withstand the loss of franchise value without measurable changes in their policy toward risk taking. City banks were able to maintain equity earnings through a combination of increased leverage (capital-asset ratios at both city and regional banks declined through the mid-1980s), increased noninterest income and reduced noninterest expense, and innovative responses to changes in customer needs.

An important factor easing the transition of the banking system was the exceptional strength in equity and property markets (to which bank activity had contributed). Between 1982 and their peak in 1989, inflation-adjusted share prices more than quadrupled. The surge in stock prices expanded bank profits by raising earnings on securities dealings and by generating substantial capital gains. In 1989, capital gains on city bank portfolios amounted to ¥20,000 billion, approximately a tenfold increase in before-tax profits. These gains more than compensated for increased costs from the payment of market-based interest rates on deposits. Capital gains provided crucial backing for banks' expansion into real estate and interbank and overseas markets. Capital gains and the ease of equity issues during the boom also had a crucial effect on banks' capital-asset ratios. Because 45 percent of unrealized capital gains may be counted toward Tier-II capital under the Basle Accord, at the end of the decade Japanese banks had reached ratios well above the required levels.

From its peak in 1989 to the low point in mid-August 1992, the Nikkei stock index fell by 63 percent (38 percent in 1990, 6 percent in 1991, and 26 percent in 1992 overall). The Nikkei average rebounded following the government spending package announced in August 1992, and more so following the announcement of the 1993 stimulus package. However, it remains far from 1989 levels. The decline meant that capital gains on securities could no longer compensate for reduced earnings elsewhere in bank portfolios. Moreover, the drop made it more difficult for banks to meet the Basle Accord's capital adequacy standards set for March 1993.[25] Given the state of Japanese equity markets, a possible alternative for some banks will be to reduce risk-weighted assets by curtailing new lending, by securitizing existing loans, or by issuing subordinated bonds. So far the retrenchment has occurred primarily in a withdrawal from the international interbank market. In 1991, Japanese banks reduced their international assets by $90 billion and their international liabilities by $232 billion.

The direct effects on Japanese banks of the decline in the stock market are compounded by other sources of weakness in portfolios. In the property boom of the mid-1980s, banks increased lending for real estate both directly and indirectly, with a substantial increase in loans to nonbanks that lent heavily on real estate. At the end of 1989, 80 percent of nonbank funds came from bank loans, and 40 percent of nonbank loans were for real estate. The sharp fall in property values clearly puts this portion of the portfolio at risk. The rate and magnitude of Japanese bankruptcies have risen sharply since 1989, with individual bankruptcies in 1991 doubling over the previous year. Corporate bankruptcies in 1992 rose at a recent rate of 32 percent. Estimates of nonperforming loans range from an official total of ¥12.3 trillion at the end of September 1992 for the 21 major banks, to unofficial estimates of the total for all banks as high as ¥40 trillion. Information on bank profitability is difficult to obtain, but the credit quality of Japan's leading banks may remain under pressure for most of the 1990s.[26]

[25]Banks initially compensated for some of the loss in revaluation reserves by issuing subordinated debt, but this outlet is limited: under the Basle Accord, such debt may not exceed 50 percent of Tier-I capital. Increased capital from subordinated debt issues and from reduction in risk-adjusted assets, and the improvement in equity prices, have recently strengthened banks' capital ratios. The average capital ratio of the 21 major banks was expected to exceed 9 percent at the end of March 1993—up from 2.3 percent a year earlier.

[26]See Moody's Rating Agency (1992).

The dramatic decline in trading volume on the Japanese stock market led to substantial net losses at the major securities firms: of the top 25 brokerage houses, 20 reported before-tax losses in fiscal 1991. This is of concern because of potential customer losses and because securities houses rely heavily on banks for short-term liquidity for their market-making activities. Life insurance companies, Japan's largest institutional investors, reported the lowest postwar growth of assets for the year ended March 1992. This was attributed partly to demographic factors and partly to poor returns on investments—insurance companies moved aggressively into the domestic loan market in 1991, taking business from the banks.

The earlier stock market surge and the declining role of banks in corporate funding have weakened the stability of the system of cross shareholdings in Japan. Roughly two thirds of the shares of most listed companies are held by other companies; financial institutions hold almost half of all outstanding shares. These holdings solidify links between corporations and banks that lower the cost of debt. The higher debt-equity ratios of Japanese corporations compared with U.S. corporations, lower observed rates of bankruptcy, and lower cost of capital are due in part to this system. If the system unwinds—and there is some evidence of this occurring—then other mechanisms will have to replace the oversight and control exercised by banks as joint debt and equity holders in corporations. In the longer term, corporate structure and the cost of capital are likely to change significantly in response to the changing role of banks in the Japanese financial system.

Financial Change and Monetary Policy

This section examines the adaptation of monetary policy to the changing financial environment in the 1970s and 1980s. An analysis of the relationship between monetary growth and inflation in the mid- to late 1980s attempts to shed light on the reasons for the concentration of inflation pressures in asset markets during this period. The discussion examines how financial deregulation and liberalization in the 1980s—and the globalization of financial markets—made it increasingly difficult to assess the stance of monetary policy and changed the ways in which monetary actions affected the economy.

Role of Monetary Policy in Asset Price Inflation

Because the asset price inflations were associated with very rapid expansions of credit and, in some places, excessive money growth, it is important to consider the role that monetary policy may have played in permitting these sharp price increases to occur. There were several factors that made it difficult for policymakers to judge the stance of monetary policy and the impact of policies on asset prices and, more generally, on the economy.

First, financial liberalization distorted the intermediate targets used to conduct monetary policy and altered the transmission of monetary policy to the real economy. Many analysts at the time suggested that credit aggregates were more accurate indicators for assessing the stance of monetary policy than were monetary aggregates. Others suggested that in a deregulated and liberalized financial environment without credit rationing, interest rates would tend to become more volatile and would have to change more sharply to tighten or ease credit conditions. As a result of these arguments and events, by the end of the 1980s many central banks had adopted more eclectic approaches toward monetary policy. In retrospect, it is apparent that earlier adjustments to the framework underlying monetary policy might have provided a more timely response to the accumulation of credit.

Second, more than in other recent inflation episodes, conventional measures of inflation in the 1980s did not adequately reflect the strong price pressures that ultimately led to unsustainable increases in the prices of tangible and financial assets. For example, conventional measures of inflation in Japan were below 2 percent throughout the 1980s, yet money and credit growth were excessive and asset prices soared. In the United States, inflation rose slightly but was relatively stable during this period, while there were large price increases in commercial and residential real estate markets.

Given the emphasis placed on conventional measures of inflation—which focus on prices of the flow of goods and services—important information contained in asset prices was not given sufficient attention. This is not to suggest that monetary policy should explicitly target asset prices or that policymakers should react to sharp movements in stock prices, for example, whenever they occur. However, it is clear that the indicators of inflation used by policymakers to judge the appropriateness of money and credit policies did not provide a complete and accurate assessment of the inflation pressures that were building during the mid- to late 1980s. Additional transactions-based measures of prices, with broader coverage than the income- or consumption-based measures, might have alerted policymakers earlier to the strong inflation pressures.

Third, there was an initial tendency to view the sharp asset price increases as relative price adjustments related solely to changes in tax policies, demographic changes, and other structural changes. This explains much of the acquiescence to the run-

up in asset prices and the related rapid growth in credit aggregates. With the benefit of hindsight, only a part of the increase in asset prices appears to have been caused by structural factors, and in most countries—especially in Japan and the United Kingdom—much of the relative price adjustment was reversed as a result of the monetary tightening in 1989–90 (see Chart 3).

This appears to have been less true in the United States, where property price changes—which were small compared with other countries—were directly related to tax reforms that provided incentives for real estate investment and to capital inflows that reflected international portfolio adjustments. Part of the subsequent decline in U.S. property prices resulted from the reversal in 1986 of tax incentives provided earlier in the decade and was therefore unrelated to monetary tightening. Nevertheless, there clearly were excesses in the U.S. commercial property market which experienced high inflation and overbuilding.

Monetary Policy and Inflation

The widespread commitment to monetary aggregate targeting in the 1980s had its roots in the 1960s and 1970s when there were relatively strong links between changes in the money supply and changes in prices. The transmission of excessive money growth to inflation was generally understood as follows: expansionary monetary policy increased bank reserves and lowered interest rates; banks provided more loans and issued more deposits, which expanded both sides of their balance sheets; loans to the private sector supported increased spending; and as monetary growth continued and production constraints were reached, prices and price expectations rose. In the absence of a large shift in the pattern of transactions, conventional price measures, such as the consumer price index or the GDP deflator, which measure the average price of goods and services consumed or produced in a period, were adequate gauges of economy-wide inflationary pressures.

Expansion of the money supply affected real economic activity in the short term because of rigidities in the price- and wage-setting process, but generally led to price increases in the medium term. Changes in monetary aggregates, which reflected changes on the liability side of bank balance sheets, were useful indicators of the stance of monetary policy. Changes in credit aggregates, which reflected changes on the asset side of bank balance sheets, were also useful indicators, although monetary policy was thought to have a more direct influence on bank deposits.

In the United States, target ranges for M1 growth were announced throughout the 1970s. The U.K. authorities set targets for broad money starting in 1976; the Deutsche Bundesbank established targets for central bank money in 1974; other central banks shifted similarly. The Bank of Japan did not target a monetary aggregate, but in 1978 it began to include "projections" for the broad aggregate M2 + CDs in its policy announcements.

By the early 1980s, control of inflation became the primary concern of economic policy in the major industrial countries. Determined reductions in money growth, sharp increases in interest rates, and a deep recession in 1981–82 brought inflation down (Table 6). By 1985, the strong and persistent rise of the dollar in currency markets and other external factors prompted greater policy coordination following the Plaza Accord. Thereafter, monetary policy eased decisively in many industrial countries.

Concern about the effects of the stock market crash in October 1987 led to a further easing of monetary policy; the crash itself may have been an early warning of growing financial imbalances and latent inflation pressures, especially in asset markets. The correction of stock market prices suggested that the earlier revaluation of corporations was not consistent with fundamental changes in their values. Asset market developments prompted the Bank of Japan in 1987 to urge caution in bank lending practices. Inflation pressures led to tightening in the United Kingdom in mid-1988; short-term interest rates were raised significantly. By 1988, concern about overheating in the United States led to progressive increases in the federal funds rate. Policy was tightened in 1989 in Japan, and by the end of 1990 interest rates had been raised considerably and the growth of broad money slowed.

During the 1980s, deregulation made monetary targeting and the assessment of monetary conditions increasingly difficult in many countries. As a result, many countries used a broader range of economic indicators to monitor monetary and financial conditions. Emphasis shifted in the United States to broader aggregates and to the federal funds rate, and in the United Kingdom to a narrower aggregate, to the exchange rate, and to other financial indicators.

Measures of Potential Inflation

The practical problems of monetary targeting in an environment of financial deregulation were evident throughout the 1980s. Less apparent were the changes in the relationships between money and credit growth and a broader measure of inflation that included asset transactions. At the time, it may not have been possible to assess properly the extent to which money and credit policies were adding to inflation pressures in asset markets. In retrospect,

Table 6. Five Major Industrial Countries: Monetary Policy Record Since 1980[1]

(Fourth quarter to fourth quarter changes; in percent, unless otherwise indicated)

	United States			Japan			Germany[2]			France			United Kingdom		
	Money growth			Money growth			Money growth			Money growth			Money growth		
	Target[3]	Actual	Inflation	Projection[4]	Actual	Inflation	Target[5]	Actual	Inflation	Target[6]	Actual	Inflation	Target[7]	Actual	Inflation
1980	4–6.5	7.2	9.4	8	7.6	4.6	5–8	4.8	4.9	11	9.8	11.4	7–11	20	19.2
1981	6–8.5	5.1	10.0	10	10.4	3.7	4–7	3.6	4.1	10	11.4	11.3	6–10	14.6	11.3
1982	2.5–5.5	8.5	6.2	8	8.3	1.7	4–7	6.1	4.4	12.5–13.5	11.5	11.8	8–12	9.8	7.7
1983	7–10	8.5	4.0	7	6.8	1.4	4–7	7	3.5	9	10.2	9.7	7–11	10	5.4
1984	6–9	8.0	4.5	8	7.9	2.3	4–6	4.6	2.1	5.5–6.5	7.6	7.5	6–10	12.3	4.6
1985	6–9	8.8	3.7	8	9	1.6	3–5	4.5	2.2	4–6	7	5.8	5–9	13.6[8]	5.7
1986	6–9	9.4	2.7	8–9	8.3	1.8	3.5–5.5	7.7	3.3	3–5	4.6	5.2	11–15	20.7	3.5
1987	5.5–8.5	4.2	3.1	11–12	11.8	—	3–6	8.1	1.9	3–5	9.1	3.0	2–6	5.8	5.0
1988	4–8	5.2	3.9	10–11	10.6	0.4	3–6	6.8	1.5	4–6	3.9	2.8	1–5	6.1	6.6
1989	3–7	4.5	4.6	9–10	10	1.9	5	4.8	2.6	4–6	4.3	3.2	1–5	6.3	7.1
1990	3–7	3.9	4.3	11–12	10	2.2	4–6	5.5	3.4	3.5–5.5	−0.3	3.1	1–5	2.7	6.2
1991	2.5–6.5	2.8	4.0	2–3	2.2	2.1	4–6	5.2	4.2	5–7	4.1	2.6	0–4	2.2	6.8
1992	2.5–6.5	1.9	2.6	2[9]	−0.5	1.7	3.5–5.5	9.6	4.5	4–6	...	2.8	0–4	2.3	4.7

Sources: Bank for International Settlements, *Annual Report* (Basle, various years); Board of Governors of the Federal Reserve System; and World Economic Outlook data base.

[1]Inflation is measured as the annual percent change in the GDP deflator; "actual" refers to money growth over the target period.

[2]West Germany through December 1990, unified Germany thereafter.

[3]Targets are for M1 through 1982, and for M2 thereafter. For 1983, targets shown are for growth from a February–March 1983 base through the fourth quarter.

[4]The Bank of Japan publishes projections of the growth of M2 + CDs each quarter over the corresponding quarter of the previous year. Projections above are for the fourth quarter over preceding fourth quarter.

[5]Target refers to central bank money through 1987, and to M3 in 1988–92.

[6]For 1980 to 1982, December to December growth rate of M2; for 1983 to 1985, growth from average November–December–January to same period of following year of M2 (in 1983) and M2 holdings of residents (1984–85); thereafter, fourth quarter to fourth quarter. Targeted aggregate is M3 for 1986–87; M2 for 1988–90; M3 for 1991–92.

[7]Through 1984, target periods are from February to April of the following year; then for 12-month periods from May 1985, and from April each year thereafter. The targeted aggregate is M3 through 1986, M0 thereafter.

[8]Actual growth, December to December.

[9]Second quarter to second quarter.

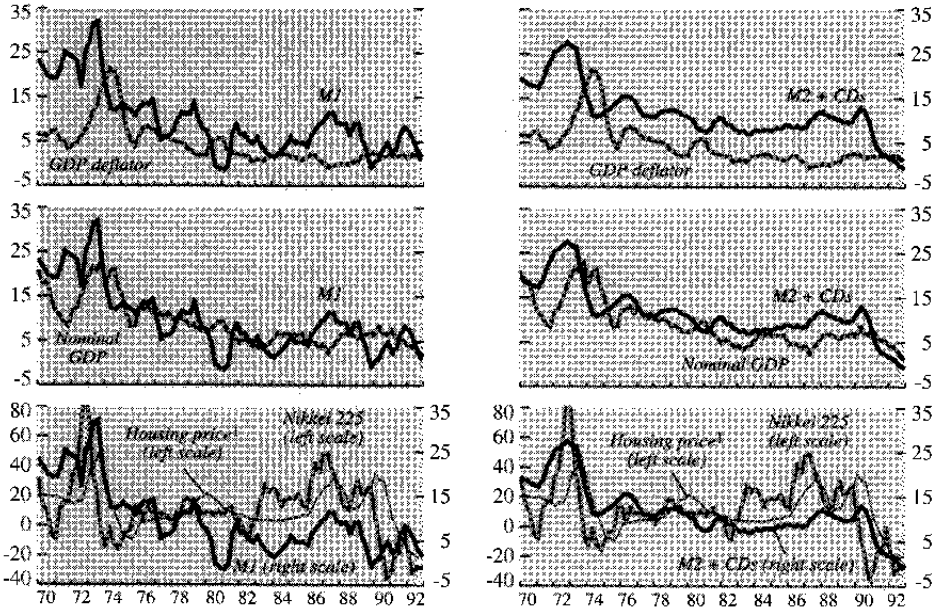
however, monetary and financial data suggest that by 1985–86 both money and credit growth were excessive in Japan and especially in the United Kingdom, and credit growth was unusually high in the United States. Overly expansionary money and credit policies also were evident in many other countries that experienced asset price inflation, including Australia, New Zealand, the Nordic countries, and Switzerland.

In a monetary accounting framework, expansion of the money supply in excess of real GDP growth, which can be referred to as "excess money growth," is potentially inflationary. The gap between this excess money growth and actual inflation (in the GDP deflator) is usually interpreted as a change in velocity—that is, a change in the rate of circulation of money relative to nominal GDP. Changes in velocity are often attributed to improvements in transactions technology or to other institutional factors. Policymakers regularly adjust for velocity changes when they deviate significantly from trend movements or when they are known to be associated with special factors.

An alternative interpretation of this gap—one particularly relevant for the 1980s—is that it is a residual that represents potential inflation pressures in markets not captured by national income account measures of output and prices. If there is a shift in the pattern of economic transactions, for example, this residual may not be due to shifts in the demand for money, but may carry important information about inflation pressures affecting other types of economic transactions. As discussed below, this gap is useful for examining the role that monetary policy may have played in the asset price inflation. By implication, broader transactions-based price indices, although conceptually difficult to define precisely, would have been more complete and useful indicators and could have provided information to policymakers about the inflation pressures building at that time.

For Japan and the United Kingdom, measures of both excess money and credit growth suggested that inflation pressures were building in the mid- to late 1980s. In Japan, growth in the monetary aggregates in the mid- to late 1980s was high—relative to inflation—and variable, yet nominal GDP growth was relatively low and inflation measured by the GDP deflator was steady at its lowest level in decades (Chart 10). This divergence reflected a breakdown in the 1980s of the money-price relationships that had prevailed in the 1970s and was associated with changes in the transmission of money and credit growth to goods prices and asset prices. Excess money and credit growth—that is, money and credit growth in excess of growth in real economic activ-

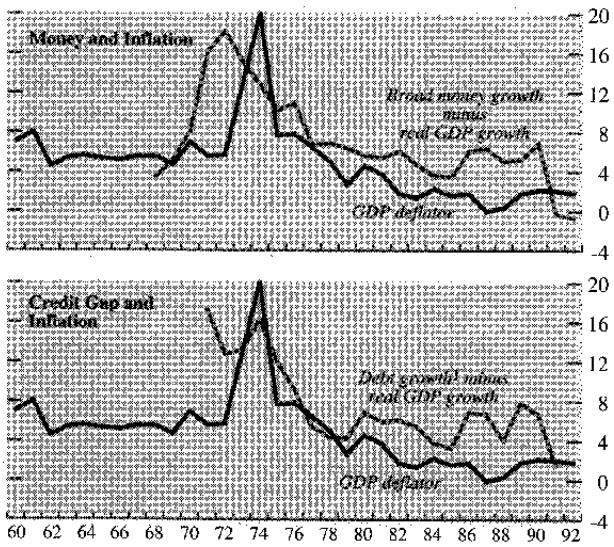
Chart 10. Japan: Money, Income, and Prices
(Percent change from four quarters earlier)



Sources: Nikkei Services; Economic Planning Agency, *National Income Accounts;* and World Economic Outlook data base.

[1]Urban residential land price in six largest cities.

Chart 11. Japan: Money, Debt, and Inflation

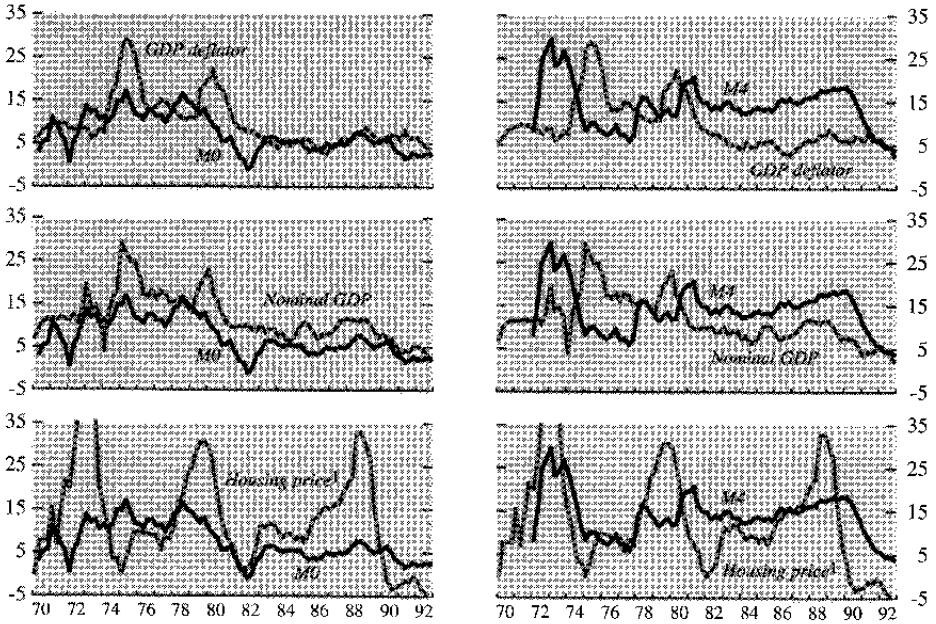


Sources: Economic Planning Agency, *National Income Accounts;* and World Economic Outlook data base.
[1]Total financial liabilities of the private nonfinancial sectors less trade credits.

ity—increased and remained high during this period (Chart 11). Moreover, the annual gaps between excess money growth and measured inflation (GDP deflator), and between excess credit growth and inflation, averaged 3¼ percentage points and 3¾ percentage points, respectively. By construction, these gaps represent either a sharp change in behavior—in the form of a significant change in the demand for money and credit balances—or a substantial shift in the pattern of transactions toward assets and other markets not captured in national income measures of final goods transactions. Viewed in this way, the money and credit gaps represented inflation pressures in the economy that were fully consistent with the inflation in asset markets.

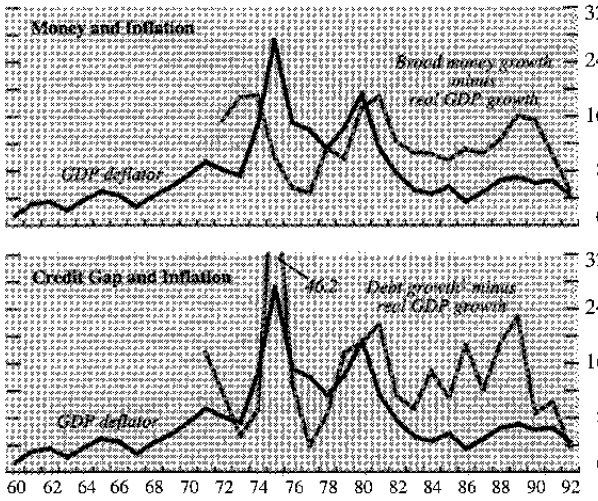
In the United Kingdom, narrow money growth and inflation had been closely linked in the 1970s, and the relationship strengthened in the 1980s (Chart 12). Growth in the broad aggregate remained high and increased in the second half of the decade, but changes in the GDP deflator remained relatively low and even declined, although housing prices increased sharply. Both excess money and credit growth emerged in the United Kingdom in the mid-1980s and persisted through the end of the decade (Chart 13). The differences between these measures and actual inflation averaged 5¾ percent-

Chart 12. United Kingdom: Money, Income, and Prices
(Percent change from four quarters earlier)



Sources: Central Statistical Office, *Financial Statistics;* and World Economic Outlook data base.
[1]Index of prices on dwellings.

Chart 13. United Kingdom: Money, Debt, and Inflation



Sources: Central Statistical Office, *Financial Statistics;* and World Economic Outlook data base.

[1]Total financial liabilities of the personal and the industrial and commercial sectors less outstanding domestic trade credits and ordinary and preference shares.

age points and 7¾ percentage points, respectively, suggesting the accumulation of potentially strong inflation pressures.

The case is not as clear in the United States. A fairly close relationship had existed between the growth of narrow money and inflation (as measured by the GDP deflator), and between money growth and nominal GDP growth (Chart 14). After the 1981–82 recession, however, higher growth in both the narrow and broad monetary aggregates was associated with lower or stable inflation and lower growth in nominal GDP.[27] This apparent change in the relationship between money growth and inflation was in part the result of much higher real economic growth in the United States in 1983–88. Moreover, during this expansionary period, excess money growth in the United States was generally consistent with measured inflation; the gap between excess money growth and inflation was a negligible annual average of ¼ of 1 percentage point (Chart 15, top panel).

The growth of the monetary aggregates in the United States, which were the primary intermediate indicators for monetary policy, did not suggest that general inflation pressures might be building elsewhere in the economy. In addition, there were reasons to expect higher relative prices in real estate markets. The expansion of credit, however, far exceeded the expansion in the real economy (see Chart 15, bottom panel). Even though money growth was in line with measured inflation, credit growth would have been consistent with much higher inflation (in the GDP deflator), indicating that inflation pressures might be building in the economy. During the 1980s, the annual gap between excess credit growth and actual inflation (in the GDP deflator) averaged 2½ percentage points in the United States. The cumulative effect of this excess credit growth turned out to be considerable, especially in commercial real estate markets.

In retrospect, it appears that within a broader monetary policy framework, one in which measures of transactions prices were used as complementary indicators along with standard inflation indicators for goods and factor markets, the persistence of growth in money and credit in excess of nominal GDP growth—in Japan and the United Kingdom, especially—suggested that inflation pressures were building. The need for an adjustment, however, was not recognized until debt accumulation and asset price inflation had reached a critical stage.[28]

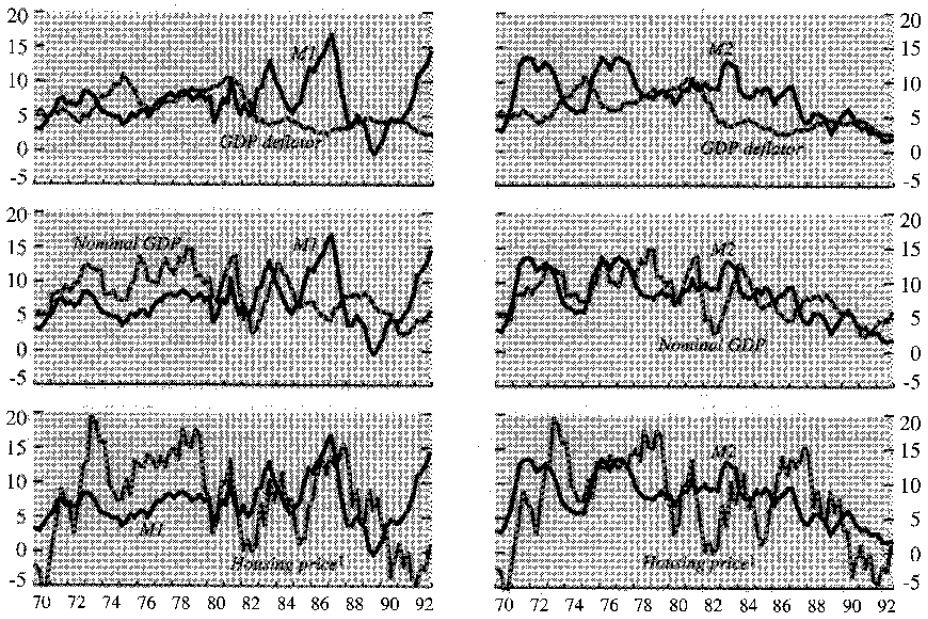
Concentration of Inflation in Asset Markets

Why did the excess liquidity and credit that was provided in the mid-1980s create excess demand for assets rather than greater excess demand for the flow of goods and services? As just described, the transmission from monetary policies to inflation pressures in the late 1980s was unusual; inflation, as conventionally measured, did not increase sharply as in other recent episodes of expansionary macroeconomic policies. A possible resolution of this puzzle is that financial liberalization and innovation and other structural changes in the 1980s created an environment in which excess liquidity and credit were channelled to specific groups active in asset markets. These included large institutions,

[27]These images are supported by econometric evidence. Inflation (GDP deflator) was regressed on its previous value and past values of narrow money growth (using a polynomial distributed lag) over two time periods in the United States, Japan, and the United Kingdom—1970:I to 1982:IV and 1983:I to 1992:II. According to this specification, the relationships between money growth and inflation were relatively strong and statistically significant in the 1970s and, except for the United Kingdom, the relationship was weak and not statistically significant in the 1980s. Supporting evidence for Japan is reported in Meredith (1992) and Corker (1990).

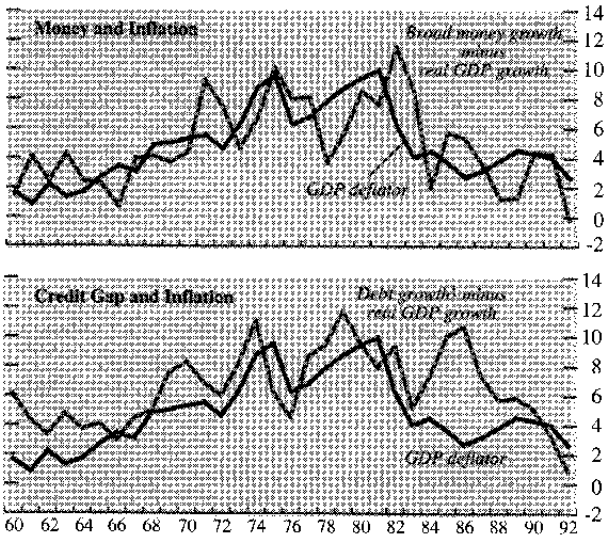
[28]Traditional theories of inflation have focused on how excess liquidity leads to an increase in the average price of the *flow* of goods and services in the relevant time period. Wage developments have been central to macroeconomic stabilization strategies and policies. Economic theories have been helpful in monitoring and explaining inflation, ex post, but judging from the inflation record of the postwar era, they have not been effective in predicting inflationary episodes. Some economists in the early part of this century thought that prices on all types of transactions—both stocks and flows—were important for properly measuring inflationary pressures. See Fisher (1913).

Chart 14. United States: Money, Income, and Prices
(Percent change from four quarters earlier)



Sources: Data Resources, Inc. data base; World Economic Outlook data base.
[1]Average price of a new house.

Chart 15. United States: Money, Debt, and Inflation



Sources: Data Resources, Inc. data base; World Economic Outlook data base.
[1]Total credit market debt outstanding of the private nonfinancial sectors.

high-income earners, and wealthy individuals, who responded to the economic incentives associated with the structural changes. These groups borrowed to accumulate assets in global markets, such as real estate, corporate equities, art, and commodities, such as gold and silver—where the excess credit apparently was recycled several times over.

In the United States, ongoing financial innovation and tax reform provided opportunities and incentives for investment; these opportunities were particularly significant for the corporate sector and high-income earners.[29] The expansion in credit financed, for example, mergers and acquisitions, leveraged buyouts, commercial real estate, and residential real estate. In Japan, tax provisions created incentives for the construction of apartment houses and condominiums, and changes in the capital gains tax treatment of real estate transactions encouraged upgrade purchasing. Spending in the late 1980s

[29]In the United States, much of the increase in debt between 1983 and 1989 was concentrated in families reporting the most financial assets. The mean real home value rose much more than the median, and the increase occurred largely in families with incomes above $50,000. The highest income groups increased the median size of their mortgage debt, while the lowest reduced their median value. See Kennickell and Shack-Marquez (1992).

shifted significantly toward luxury goods and components of demand typically financed on credit, such as business investment, home construction, and durable goods.[30] By contrast, in the United Kingdom, the increase in borrowing was more broadly based, suggesting that the debt accumulation reflected a backlog of unsatisfied demand for credit unleashed after financial liberalization. Although the increase in inflation in the United Kingdom was more broadly based, in that conventional measures of inflation increased, real asset prices rose substantially.

Thus tax changes and financial liberalization contributed to a shift in the pattern of demand for credit. Financial liberalization induced a similar shift in the allocation of the supply of credit. As described above, intense competition among financial intermediaries resulted in high-risk lending in new types of business, which contributed to increased asset market activity. In Japan, competitive pressures were compounded by the shift in corporate financing from banks to securities markets. This decline in banks' corporate business led city banks to lend for real estate transactions and to small and medium-sized businesses. With key safety nets still in place—most notably deposit insurance systems—the removal of earlier restrictions on lending practices (as in the U.S. Savings and Loan industry, for example) also led to increased risk taking. This suggests that supervisory and oversight systems were not expanded sufficiently to keep pace with deregulation. This institutional inertia may have contributed to an environment that encouraged excessively speculative behavior in asset markets.

Other, nonfinancial, factors in the late 1980s tended to restrain demand and inflation pressures in markets for goods and services, making it more likely that excess credit and liquidity would be concentrated in asset markets. Structural reforms, along with a general increase in global competition, created pressures on profit margins and discouraged price increases. Wage increases were restrained by high and rising unemployment—particularly in Europe—by reduced inflation expectations, and by government wage policies.

Finally, prices for goods and services may have adjusted more slowly to monetary growth in the mid- to late 1980s. Because asset prices depend on expectations of future economic developments—unlike most goods prices, which are mainly determined as a markup over costs—and are determined in deep active auction markets, they often respond first to monetary stimulus. This was true even before deregulation, but financial liberalization appears to have strengthened the link between money growth and asset prices. Given the expansion in financing possibilities, spending on items that require credit rose more rapidly than spending on other goods, and this shifted the pattern of transactions away from goods and services to assets.

Once the process of asset price inflation started, in the absence of a restrictive monetary policy, expectations of further capital gains apparently became an important aspect of increased demand for assets.[31] To the extent that past price increases determined expectations of future price increases, the expected real cost of borrowing for investment in asset markets was often negative in the United States, Japan, and the United Kingdom. In 1986–89, for example, building society loan rates in the United Kingdom stayed below 15 percent and were often below 12 percent, while housing prices rose annually by 20 percent on average. In Japan, the average new loan rate was below 6 percent and declined for most of the 1985–89 period, while stock prices increased at an annual rate of 27 percent.

Financial Liberalization and Monetary Policy

Even if broader measures of inflation had been closely monitored in the conduct of monetary policy during the 1980s, inflation is a lagging indicator and other indicators would have been necessary to assess monetary and financial conditions. The structural factors described earlier—and the evolving responses to financial deregulation, liberalization, and globalization—altered important relationships between monetary instruments and intermediate targets and the impact of monetary policy on the real economy. The difficulties of quantifying the impact of these structural changes in the daily conduct of monetary policy were compounded by uncertainties created by fundamental changes in the behavior of financial intermediaries, businesses, and households in response to changes in economic incentives.[32]

Monetary Policy Transmission Before Deregulation

Before deregulation, the conduct of monetary policy in the major industrial countries relied heavily on official interest rates. In the United

[30]See Takeda and Turner (1992).

[31]For a detailed analysis of the tendency for persistence in price changes in a broad array of asset markets in a number of countries, see Cutler, Poterba, and Summers (1990).

[32]During the 1980s, there were several studies of the probable consequences of financial deregulation and liberalization for the implementation of monetary policy; see Bank for International Settlements (1984) and (1986).

States, for example, the federal funds rate was a primary policy instrument, but deposit rate ceilings also played a major role in changing the amount of liquidity and credit provided to the private sector. The U.K. authorities conducted open market operations to influence the cash positions of banks and interest rates, but they also relied heavily on changes in the minimum lending rate. Administrative policies, and control of official rates, were central to Japanese monetary policy before the early 1980s.

In addition to interest rate policies, quantity constraints were significant in all three financial systems, although Japanese monetary policy was the most explicitly quantity oriented. In the United States, the tightening effect of an interest rate increase was reinforced in periods when market rates rose above the deposit rate ceilings. Deposit holders shifted their funds out of banks and into accounts earning market rates. This process of disintermediation, prevalent in the 1960s and 1970s, reinforced the contractionary effects of reserve withdrawal on bank balance sheets and forced a further reduction in bank lending. Some borrowers had access to funds from nonbanks, so the initial impact of monetary contraction fell primarily on sectors without such access, such as mortgage borrowers. The disproportionate burden on the housing loan market was mitigated somewhat with the advent of mortgage securitization and government mortgage assistance agencies in the early 1980s.

In the United Kingdom, where lending restrictions largely kept banks out of the residential mortgage market before 1980, quantity rationing also played a role in the transmission of monetary policy. The market was dominated by building societies, who adopted a collective practice of smoothing the interest rate charged on their variable rate mortgages.[33] Periods of excess demand were handled by rationing, either in delayed granting of loans or reductions in loan size. This system was a feature of the exclusive role that building societies enjoyed, and it eroded rapidly once banks entered the market.

The real effects of monetary policy were transmitted through two channels: through changes in official interest rates and through changes in the availability of credit. The magnitude of the effects of policy changes depended critically on the sensitivity of foreign and domestic spending decisions to changes in interest rates and any associated changes in the exchange rate. Interest rate changes affect demand through a substitution effect, by changing the relative cost of current and future consumption; through a wealth effect, by changing the current values of long-lived financial and real assets; and through an income or "cash flow" effect as the size of interest payments and receipts move with current rates. The impact of changes in the availability of credit through disintermediation or rationing depended heavily on the existence of alternative sources of funds, including overseas markets, and on the access that different domestic borrowers had to these alternative sources.

Deregulation and the Monetary Policy Transmission Process

Deregulation changed key aspects of the monetary policy transmission process by changing bank activity and behavior, by encouraging the growth of competing nonbank intermediaries and direct securities markets, by altering the financial opportunities available to businesses and households, and by changing international capital flows. One of the most significant effects of liberalization has been the increase in financial activity outside of banks. Because banks are the intermediaries most closely connected (through reserve accounts and regulations) to central banks, this shift in the locus of financing and saving changed the linkages between monetary policy and economic activity.

Household financial activity also changed considerably in response to deregulation. Studies have found a significant reduction in liquidity constraints in the United States, Japan, France, the United Kingdom, and Canada.[34] Consumption decisions have thus become more responsive to interest rate changes. Reinforcing this has been a change in the income or "cash flow" effect of changes in interest rates. As the proportion of variable rate loans has increased, adjustments in interest payments, and hence spending patterns, have been more rapid. Although households remain net creditors for all debt instruments, in the United Kingdom they have become net debtors in floating rate instruments. Thus, an increase in interest rates requires that a larger portion of current household income be used to meet the obligations of increased interest payments on floating liabilities. This increased effect of interest rates may be partially offset because with variable rate contracts, the initial level of the interest rate is less important in the loan screening process.[35]

The increased internationalization of financial

[33]See Flemming (1992).

[34]See Bayoumi and Koujianou (1989); and Bayoumi (1992).

[35]In the United States, there is some evidence of reduced sensitivity of housing starts to interest rate changes, due in part to the increased use of variable rate instruments which has affected affordability and credit scoring constraints. See Pozdena (1990).

markets has reduced the control that domestic policy authorities have over the quantity of credit; control of interest rates remains the key policy instrument. An example is the role that foreign bank lending played in offsetting credit shortages to U.S. corporations in the late 1980s.[36] Japanese corporations also have increased their use of foreign financial markets: foreign bond issues as a portion of total corporate bond issues rose from 40 percent in 1980 to 60 percent in 1991. Such increased access to external funds reduces the contractionary effect on domestic spending of central bank tightening, at least among certain sectors of the economy. Moreover, the sensitivity of international capital flows to international interest rate differentials makes it more difficult for monetary authorities to balance domestic and external policy objectives when these conflict.

These changes in behavior and opportunities alter, individually, some component of the monetary policy transmission process. The net effects are manifested in changes in historical macroeconomic relationships. Ongoing problems in defining the monetary aggregates, and apparent shifts in money demand functions, have been features of monetary policy discussions since the beginning of deregulation. There was also a change in the relationship between the yield curve and relative growth of broad and narrow monetary aggregates in the 1980s. Policymakers have responded to these problems in part by reducing their exclusive focus on one monetary aggregate and by broadening the set of indicators used to assess the stance of monetary policy. The U.K. authorities suspended targeting of M3 in 1987 and adopted a more broadly based approach that includes attention to M0, the exchange rate, and other financial indicators.[37] The Bundesbank shifted in 1987 from targeting central bank money to targeting M3. In the United States, the Federal Reserve Board reduced its emphasis on M1 targeting in 1982 and ceased setting targets for M1 altogether in 1987. It continues to set targets for the broader aggregates but in recent years has downplayed strict reliance on monetary aggregates and instead considers a range of indicators. The Bank of Japan has not changed its targeted aggregate but was prompted in the mid-1980s to revise substantially its projections for M2 + CDs, as deregulation changed the behavior of the aggregate.

The changes go beyond measurement problems, however, and include changes in the relationship between monetary aggregates, inflation, and nominal GDP. Evidence from vector autoregressions of the relations between monetary aggregates and nominal income indicate important changes associated with deregulation.[38] In the United States, M1 and M2 broke down as predictors of income by 1978. In Japan, M1 and M2 + CDs retained a significant relation to income in the 1970s and 1980s, but the underlying directions of causality appear to have shifted. In the United Kingdom, changes in sterling M3 ceased to serve as predictors of income in 1983.

Deregulation has made it more difficult to assess the stance of monetary policy and forecast future activity. The yield curve has been used increasingly as an indicator of future nominal GNP growth and inflation in the 1980s. In the United States, studies have shown that the best predictor is the spread between the commercial paper rate and the treasury bill rate. Analysis of this relationship in other countries found similar predictive power in Canada and the United Kingdom, but not in Japan, France, or Germany.[39] One explanation for the predictive power of this spread is that monetary tightening curtails bank lending and leads to an increase in commercial paper issuance for those firms that can substitute between bank loans and direct issuance markets; this increase in borrowing in the commercial paper market drives up that interest rate relative to other comparable maturity market rates, and signals the coming contraction in economic activity induced by monetary policy.[40] As deregulation deepens commercial paper markets and increases substitution between bank loans and market instruments, however, this effect can be expected to weaken. Preliminary evidence of this has already emerged in the United States and may emerge in other economies for similar reasons.

Implications for Monetary Policy

As the preceding section indicates, a wide range of forces have affected the monetary transmission mechanism, and some evidence of these changes is already apparent. This section addresses three policy issues: changes in the nature of the monetary control mechanism, prospective shifts in the sectoral impact of monetary policy actions, and adjustments in the set of information variables that are monitored.

One immediate effect of financial liberalization has been a reduction in the monetary authorities' direct control over the quantity of credit. Without regulated deposit rates, the authorities have much

[36]McCauley and Seth (1992).

[37]See Bank of England (1986).

[38]See Blundell-Wignall, Browne, and Manasse (1990).

[39]See Browne and Tease (1992).

[40]See Kashyap, Stein, and Wilcox (1993). For an explanation based on liquidity differences in these instruments, see Garber and Weisbrod (1992).

less ability to influence interest rate spreads and, thus, to induce shifts in business and household financing and saving decisions.[41] The extensive development of alternative sources of funds—both domestic and foreign—has reduced the central bank's influence over intermediation. What remains is the central bank's control over certain interest rates. The channel of monetary policy has thus narrowed—from one in which credit supply repercussions reinforced the effects of interest rate changes, to one in which these rationing elements are greatly reduced if not altogether absent.

Several relationships, therefore, have taken on increased importance. The first concerns the ability of central banks to affect market rates, including those on longer-maturity instruments. As markets deepen and innovation proceeds, arbitrage is likely to strengthen the ties among different market rates. At the same time, deregulation has eliminated sources of inflexibility in many rates, so that long-term rates can be expected to respond more freely to expectations of inflation. The central bank's ability to influence a broad array of market interest rates will therefore depend on the state of the economy and on expectations about future policies. In addition, international integration of capital markets has increased the importance of the exchange rate as part of the policy transmission mechanism.

Some aspects of deregulation have tended to diminish the sensitivity of components of demand to interest rates; others have tended to amplify it. Because more loan contracts are arranged on a variable rate basis, borrowers have less need to worry about being locked into high rates prevailing at a particular time, so borrowing may not be reduced as much by an interest rate increase as it would have been when primarily fixed rate contracts were available. Interest rates play a somewhat smaller role in the loan screening process now, and there are more opportunities for firms to hedge against interest rate changes. But the prevalence of floating rate contracts also means that interest rate changes are transmitted much more rapidly to loan payments, so the impact on disposable income and spending is likely to be larger. In addition, the decreased use of nonprice rationing in the loan market means that borrowers will be responding more exclusively and flexibly to interest rate changes. With respect to consumption, studies have found evidence of diminished liquidity constraints in those countries that have experienced extensive deregulation. The response of exchange rates to interest rate differentials, and the elasticities of foreign demand for domestic goods are more important in an environment of increasingly integrated capital and goods markets. The net effect of these various changes on aggregate demand remains to be determined in empirical studies. Estimates in the United Kingdom, where the proportion of variable rate loans is much higher, have indicated that the interest rate effect on spending is clearly stronger than in the pre-deregulation period.[42]

One consequence of the increased securitization and integration of financial markets—particularly of the mortgage market but also of markets for corporate financing—is that the impact of monetary policy is likely to be spread more broadly throughout the economy and to be less concentrated on certain sectors. In the United States, the increased flexibility of deposit interest rates has significantly reduced the phenomenon of cyclical disintermediation, which has reduced the impact of monetary tightening on the residential housing market.[43] Monetary policy will continue to have different sectoral effects, however, because access to and dependence on international capital flows differ. To the extent that central banks can control short-term interest rates to a much greater extent than long-term rates, the impact of policy is likely to be felt in sectors that are sensitive to short-term rates. These effects may be offset by the expanded use of hedging devices, such as swap contracts, that can insulate firms from exchange rate and interest rate changes.

To the extent that aggregates are used as policy guides, greater attention is likely to be paid to the asset side of the balance sheet of financial intermediaries. Changes in bank assets will continue to be important sources of information on borrowing and spending behavior in the household and small business sectors, which will continue to rely heavily on intermediated finance.[44] Broader credit aggregates that include nonbank financial institutions and capture financing activity outside banks will provide information about the financing behavior of larger private sector entities with more direct access to securities markets.

[41]Before financial deregulation and liberalization, monetary tightening in the United States affected the supply of credit to households and businesses through the banking system; banks, in effect, rationed the *quantity* of credit as reserves were withdrawn from the system. Because there are now many alternatives to bank lending, this quantity-rationing mechanism may have become less important, and price adjustments in asset markets (including interest rates) may have become more prominent in both reflecting and transmitting monetary policy changes to the real economy. For a discussion of some of these issues, see Wojnilower (1980).

[42]Bank of England (1990).

[43]See Throop (1986).

[44]For a discussion of the effects of credit supply in the Canadian economy, see Lee (1993).

Because of the decrease in central banks' direct control over the volume of lending, interest rates are likely to become more important indicators of the stance of monetary policies. Because asset prices can convey important information about the supply of liquidity, as they did in the late 1980s, changes in asset prices may be incorporated judgmentally into policy analyses. The U.K. authorities now include asset prices among their indicator variables. The recent episode suggests that changes in monetary policy will continue to affect asset prices beyond the current adjustment period.

Lessons for the 1990s

Financial deregulation and liberalization have led to heightened competition and a shift from traditional banking toward new institutions and markets. This was intended to increase the efficiency and availability of financial services. The resulting structural changes contributed to the economic expansion in many countries during the 1980s, with rapid growth in aggregate lending by financial institutions. The benefits from these changes led to a significant increase in financial activity, increased access to credit for both households and enterprises, and significant increases in rates of remuneration on deposits. These positive features of financial liberalization also were accompanied, however, by increased risk taking, by speculative booms in real estate markets and stock markets (in some cases), and by asset price inflation.

Without the confluence of events—structural changes in financial markets, expansionary fiscal policies, and expansionary monetary policies—the asset price cycle and the associated economic booms and recessions might not have occurred. The sharp downward adjustments in asset prices have led to balance sheet adjustments and, in some countries, to financial fragility, and these adjustments have been important factors in the recessions and restrained recoveries in a number of countries. Although economic policy should not be designed to offset regulatory and structural changes explicitly, dealing with the effects of such changes should be a vital part of the policy strategy.

Some countries have had to respond to crises in their financial sectors. In some cases, the speed and scope of deregulation resulted in excessive risk taking or allowed financial institutions to move into new and unfamiliar lines of business. This placed heavy and unexpected demands on supervisory institutions, which were not fully prepared for the consequences of deregulation. Thus, it would appear that supervisory practices need to be strengthened as deregulation proceeds. Prudential regulation, oversight, and increased capital standards are needed to ensure that the gains from increased competition in financial markets are not offset by the systemic weaknesses arising from the insolvency of financial institutions. The sequencing and pace of deregulation, and the need for coordination among regulators, are critical components of any deregulation effort. Moreover, experience in many countries clearly suggests that there should be greater coordination of macroeconomic and regulatory policies.

Some of the problems that complicated monetary policy during the 1980s stemmed from the underappreciation of the innovative ability of the private sector and of the effects of competition on the financial sector. In the past it has been sufficient for monetary authorities to concentrate on inflation in consumer prices—or more broadly on the prices of the flow of goods and services—and to consider asset price inflation only insofar as it was a signal of future general inflation. The recent period, however, has demonstrated that inflation in asset prices can occur without significant movement in standard price indices. In retrospect, monetary policy in some countries inadvertently permitted an overly rapid expansion of money and credit during the 1980s, and there was not a full appreciation of the emerging financial imbalances in both the financial and nonfinancial sectors. Policymakers allowed the real cost of credit for real estate and equity purchases to remain too low for too long.

Many questions remain unanswered, but perhaps the most important is whether the asset price inflation was a temporary development, associated with a particular combination of structural changes in financial markets and expansionary macroeconomic policies, or whether it can be expected to be a permanent feature of the transmission process of monetary policy. Key features of financial liberalization in the 1980s were the expansion of the nonbank financial sector and the increased level of financial activity undertaken by both businesses and households. Policymakers should have expected, as some did, that the components of expenditure that would be most affected would be those typically financed with credit, rather than those financed out of current income and profits.

Although standard price measures will continue to be the main focus of monetary policy, it is important to realize that they may not adequately identify inflation pressures in all parts of the economy. Perhaps the most dramatic example is what occurred in Japan, where, by conventional measures, price stability was maintained throughout the 1980s, even during the dramatic asset price inflation during 1986–90. The flow of goods and services is only a small part of total transactions that occur during any given period and focusing on consumer or producer prices discards much of the information available for measuring inflation pressures. Although asset

prices are volatile and are determined by many factors other than monetary policy, they should not be ignored when there is reason to believe that excess liquidity is being channeled into asset markets rather than flow markets.

Another question is whether monetary policy should respond to sharp movements in asset prices. To the extent that asset prices adjust rapidly because of portfolio adjustments or other fundamental changes in the real economy for example, monetary policy would have little, if any, role except to ensure that these adjustments occur in a stable financial environment. However, to the extent that asset price changes are related to excess liquidity or credit, monetary policy should view them as inflation and respond appropriately. There is nothing unique about asset markets that would suggest that asset prices can permanently absorb overly expansionary monetary policies, without ultimately leading to costly real and financial adjustments. One very clear lesson of this experience is that an excessive buildup of private debt to finance asset accumulation in certain sectors can have significant adverse macroeconomic consequences including deep recessions, slower economic recoveries from recession, and sharp and costly adjustments in many parts of the private sector.

Broadly defined transactions-based price indices could serve as useful complementary indicators for economy-wide inflation.[45] If asset price changes reflect relative price adjustments, the aggregate transactions-based price index would remain unchanged, as increases in some asset prices would be offset by decreases in others. Increases in an aggregate transactions-based price index that were large, persistent, and not attributable to special or temporary factors would suggest the need for a tighter monetary policy.

The problem goes beyond that of inadequate price measures, however. Policymakers regularly review a broad set of price indices, including those for commodities and assets. The fundamental problem is that the analytical framework used in most countries to assess the stance of monetary policies was not sufficiently broad and flexible to assess developments in key asset markets properly. In effect, the asset price developments were not viewed as requiring an adjustment in monetary policy. Thus, it would appear that the conventional framework—and more specifically the class of models—used to formulate monetary policies and targets, needs to be re-examined and altered in light of the experience of the late 1980s.

Finally, although international capital flows did not play a prominent role in recent episodes of asset price inflation, they seem likely to become increasingly important features of the global financial environment in the coming years—as they already have in Europe. These developments may require a further shift in the policy framework in the future. As has been clear from recent experience, historical macroeconomic relationships may not be reliable guides and it may be necessary to evaluate developments from a microeconomic, as well as macroeconomic, perspective. In the asset price inflation episode, for example, greater attention to shifts in the composition of borrowing and the channels of spending might have alerted policymakers to changes in the way monetary policy is transmitted to inflation.[46] Reliance on the historical links between monetary policy and standard price indices turned out to be misleading.

[45]See Fisher (1913) for a discussion on the construction of such indices.

[46]See Hargraves, Schinasi, and Weisbrod (1993).

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II

How Accurate Are the *World Economic Outlook* Projections?

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Economic activity is affected by decisions that are based on projections of future growth and inflation. Consumption and investment decisions rely heavily on projections of future economic developments. Governments plan budgets and set macroeconomic policies based on forecasts of future economic activity. Because large deviations from anticipated conditions may prove to be costly in terms of lost output and employment, it is important to assess whether forecasts are accurate, given the information that is available when they are made.

A useful discussion about forecasting accuracy needs to provide a qualitative assessment of the way in which various forms of inefficiency in a projection are related. These inefficiencies may be due to the way in which past errors are used to make current projections or because the economic model is not the minimum variance model. Forecasting accuracy has been the subject of numerous examinations over the last three decades.[2] Most of the previous studies on forecasting accuracy evaluate the accuracy of a projection based on the characterization of the *regression* error. A major difficulty with this criterion is that it provides only a joint test of unbiasedness and efficiency. Yet, a distinction between the different properties of a projection would yield information that is useful in improving its accuracy.

This paper evaluates the accuracy of a forecast based on the properties of the *forecast* error, defined as the difference between the realization and the projection. The optimality conditions of a forecasting optimization problem are used to show that under rational expectations the usual test for efficiency is necessary, yet not sufficient, to ensure efficiency. The necessary and sufficient conditions for efficiency are presented and two statistics are derived to measure these conditions. It is shown that the optimality conditions under rational expectations yield insight into the relation between different kinds of inefficiency. Moreover, the criterion provides simple adjustment factors that reduce the inefficiency of a forecast. This provides a consistent framework to evaluate the accuracy of projections.

The optimality conditions are used as criteria to examine the accuracy of the World Economic Outlook projections of output growth and inflation for industrial and developing countries. The accuracy of growth and inflation projections in each of the business cycles in this period is also examined for the seven major industrial countries. The analysis extends the sample beyond the 1971–86 period covered by Artis (1988), thereby permitting a comparison of the World Economic Outlook projections for 1990–91 with the projections in previous recessions.

The World Economic Outlook projections are conditional on a number of assumptions about economic policies, exchange rates, and commodity prices. The relationship between these factors and deviations from projection outcomes are, however, beyond the assessment presented below. For developing countries that are engaged in Fund-supported stabilization and structural adjustment programs, the projections assume that policies aimed at achieving the growth and inflation objectives are adopted and implemented. Thus, the deviations between the conditional projections and outcomes may be interpreted as a measure of the extent to which the policies specified in the programs were not fully implemented, or as a reflection of the fact that the assumptions about the international economic environment faced by these countries have not always been realized. To evaluate the effect of this sort of conditionality on the World Economic Outlook projections for developing countries, forecasting accuracy tests are performed for a sample of countries that were not engaged in Fund-supported programs. The tests performed for the nonprogram countries correspond more closely to the evaluation of unconditional growth and inflation forecasts and, thus, are similar to those performed for industrial countries.

Time-series models are estimated for output

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[2]See, for example, Blake, Beenstock, and Brasse (1986); Hansen and Hodrick (1980); Holden and Peel (1985) and (1990); McNess (1978); Murfin and Ormerod (1984); and Urich and Wachtel (1984).

growth and inflation for the seven major industrial countries and the accuracy of the forecasts generated by these models is examined relative to the projections of the World Economic Outlook. To examine the relevance of past errors in forming projections, the fraction of the previous years' errors in projections of growth and inflation that are incorporated into the forecast of growth and inflation for the current year is calculated. This illustrates how a time-series model incorporates previous errors to generate current forecasts. Moreover, the proposed criterion implies that judgmental projections can be adjusted in a similar fashion to improve the accuracy of a forecast. The forecasts derived from these time-series models are then used as a benchmark to evaluate the relative efficiency of the World Economic Outlook projections.

A Simple Forecasting Accuracy Criterion

The basic idea of Muth's (1961) rational expectations hypothesis is that expectations of future events are essentially the same as the projections of the economic model that incorporates in a systematic fashion all relevant information, including current and past realizations of economic variables. The motivation behind rational expectations is that agents use the information available to them in an efficient manner. Rational expectations thus implies that agents will not be systematically wrong in making projections, given this information,

$$E(R_{+1} \mid \phi) = R_{+1} + \xi_{+1}, \tag{1}$$

where R_{+1} is the next period realization of a random variable and ξ_{+1} is a stochastic error with $E(\xi_{+1}) = 0$, $E(\xi^2_{+1}) < \infty$, $E(\xi \cdot \xi_{+1}) = 0$, $E(\xi_{+1} \cdot \phi) = 0$, and ϕ represents a set of current and past values of R.[3] Thus, ξ_{+1} is not predictable from information known in the current period. Equation (1) implies that at any particular time the rational expectation can be inaccurate because a random shock occurs. Yet, the projection is correct on average.

Frenkel (1977), Frenkel and Razin (1980), and Artis (1988), among others,[4] test for the efficiency of a projection by estimating equation (2) by ordinary least squares,

$$R_{+1} = \alpha + \gamma \cdot F + v_{+1}, \tag{2}$$

where F is the forecast of R_{+1} given information available in the current period, and v_{+1} is the random error of the equation. The conventional criterion implies that a forecast is efficient if the estimated coefficients are $\alpha = 0$ and $\gamma = 1$. Moreover, this criterion is also used to evaluate unbiasedness.[5] It is demonstrated below, however, that under rational expectations, this is a necessary but not sufficient condition for efficiency in the sense that a set of projections could satisfy this test and still not be the minimum variance forecast.

A property of the disturbance term that has been extensively examined is the problem of serial correlation in the regression error (v). The standard test is not sufficient, however, for efficiency because the problem of autocorrelation in the forecast error (ξ) has been largely ignored.[6] The relation between the forecast error and the forecast itself is derived by subtracting F from both sides of equation (2) and replacing $R_{+1} - F$ by ξ_{+1},

$$\xi_{+1} = \alpha + (\gamma - 1) \cdot F + v_{+1}. \tag{3}$$

Equation (3) implies that the forecast error (ξ) is linearly related to the forecast by $\gamma - 1$, α and the random error v. Note that v is equal to ξ only if α and $\gamma - 1$ are zero, otherwise ξ would also be determined by the forecast.

Rational expectations imposes a series of restrictions on the properties of the forecast error (ξ) that are derived from the following optimization problem. The problem is stated in terms of minimizing the sum of squared forecast errors by choice of parameters α and β in equation (4),

$$\underset{\alpha,\beta}{\text{Min}} \sum_{j=1}^{T} (\alpha + \beta \cdot F_j + v_{+1,j})^2, \tag{4}$$

where $\xi_{+1} = \alpha + \beta \cdot F + v$. The model is therefore consistent with the standard statistical criterion of minimizing the sum of squared errors. A comparison of equations (3) and (4) implies that $\beta = \gamma - 1$. The optimality conditions of this problem are given by equations (5) and (6),

$$\alpha: \qquad E(\xi_{+1}) = 0 \tag{5}$$

$$\beta: \qquad E(\xi_{+1} \cdot F) = 0. \tag{6}$$

Equation (5) implies that the forecast is unbiased if its average error is zero; Holden and Peel (1990) show that this is necessary and sufficient. They also

[3]Fama (1976) introduces the concept of weak information sets which consist of current and past values of a random process. All variables are denoted in the current period, unless stated otherwise.

[4]See also Theil (1971), Levich (1978), and Urich and Wachtel (1984).

[5]See, for example, Artis (1988).

[6]See Murfin and Ormerod (1984) for a discussion of this issue.

show that the standard criterion for unbiasedness is necessary but not sufficient. In the same fashion as in the theory of finance,[7] a forecast is efficient if it reflects all the information that is available at the time the forecast is made. Thus, condition stated in equation (6) implies that a forecast is efficient if the error term is uncorrelated with the forecast itself. Applying $E(A \cdot B) = E(A) \cdot E(B) + \text{cov}(A,B)$ to equation (6), yields

$$E(\xi_{+1} \cdot F) = E(\xi_{+1}) \cdot E(F) + \text{cov}(\xi_{+1}, F). \quad (7)$$

Thus, the optimality condition in equation (6) can be characterized in terms of the average forecast error, the average projection, and the covariance between the forecast error and the forecast itself. Hence, even if the covariance between the forecast error and the forecast itself is zero, the condition in equation (6) would be satisfied only if the average forecast error were zero. By contrast, the conventional criterion implies that $E(v_{+1} \cdot F) = \text{cov}(v_{+1}, F)$, since by construction the average residual is zero. This characterizes the importance that unbiasedness has for the efficiency of a projection (equation (6)), unlike the standard criterion that fails to distinguish between these two concepts. It is shown below that the distinction between these two conditions yields the appropriate adjustment factor to improve the accuracy of a forecast. It also illustrates the relevance of the distinction between the regression error (v) and the forecast error (ξ). Substituting equations (5) and (6) into equation (7), and dividing by the variance of the forecast (σ_F^2) yields

$$\beta = \frac{\text{cov}(\xi_{+1}, F)}{\sigma_F^2} = 0. \quad (8)$$

Equation (8) states that the comovement between the forecast error and the forecast itself, relative to the variance of the forecast, should be zero. Note that equation (8) allows a least-squares representation of the relation between the forecast error and the projection. Hence, the optimization problem yields a version of the standard efficiency conditions in which both the average forecast error and $\beta = \gamma - 1$ are zero.

To demonstrate that $\beta = 0$ is not sufficient for efficiency, define $F = g(\phi)$, where g: $\phi -> F$ and $\phi = \phi_{-1} + \xi$. Replacing $F = g(\phi)$ by $g(\phi_{-1}) + \xi$ in equation (7) yields

$$\text{cov}[\xi_{+1}, g(\phi_{-1})] + \text{cov}(\xi_{+1}, \xi) = 0. \quad (9)$$

Rational expectations imposes the restriction that $\text{cov}[\xi_{+1}, \xi) = \text{cov}[\xi_{+1}, g(\phi_{-1})] = 0$.[8] Dividing this restriction by the variance of the forecast error (σ_ξ^2) yields

$$\rho = \frac{\text{cov}(\xi_{+1}, \xi)}{\sigma_\xi^2} = 0. \quad (10)$$

Equation (10) implies that the current period forecast error should not be significantly related to last period's forecast error. It is important to note that if $\text{cov}(\xi_{+1}, \xi) = -\text{cov}[\xi_{+1}, g(\phi_{-1})] \neq 0$ in equation (9), β would be zero even though the forecast errors are serially correlated and, hence, the projection is inefficient. It follows that $\beta = 0$ is a necessary, yet not sufficient condition for efficiency. Thus, from equations (8), (9), and (10) the necessary and sufficient conditions for efficiency are that the average forecast error and both β and ρ be zero.

Unlike the standard criterion, this method provides a useful distinction between different forms of inefficiency, and yields insight into the relation between them. For instance, from equations (7) and (8), if ρ is different from zero and β is zero, the forecast is inefficient because the errors of the past are repeated in the present, and hence forecasts could be improved by adjusting them by ρ. If β and ρ are both not equal to zero, the inefficiency is again partly due to the way in which new information is incorporated into projected values. Finally, if ρ is zero and β is different from zero, the inefficiency arises because the model used to derive the forecast is not the minimum variance model, and, thus, the projections could be improved by adjusting them by β.[9] If the nature of the relation between different kinds of inefficiency could be established, an adjustment method that would reduce the effect of specific disturbances and, hence, improve the accuracy of a forecast could be produced.

This criterion suggests defining an accurate forecast as one that is both unbiased and efficient. A forecast is unbiased if its average error is zero (equation (5)) and is efficient if the forecast error is not related to information available at the time the projections were made (equations (7) and (9)). Of the two characteristics, unbiasedness is generally regarded as more important because it means that, on average, forecasts are identical to outturns. In addition, unbiasedness is also important because it is a necessary condition for efficiency.

The approach used in this paper fully implements the optimality conditions to assess the accuracy of a

[7]See Fama (1976).

[8]The model is consistent with linear rational expectations. It could, however, also accommodate nonlinear specifications by choosing a different g function.

[9]Note that if the average forecast error is not zero, the projection is inefficient even if both β and ρ are zero.

forecast and the nature of an inefficiency. To implement this approach, a least-squares regression of the forecast error on a constant is used to test whether the average forecast error is statistically different from zero. The efficiency of a projection can be tested by measuring the statistical significance of the comovement between the forecast error and the forecast itself (the β test), and the comovement between the current period's forecast error and the previous period's forecast error (the ρ test). If both of these comovements are not statistically different from zero, a forecast is said to be efficient.[10]

Forecasting Accuracy of the *World Economic Outlook*

This section applies the optimality criterion introduced in the previous section to examine the accuracy of the World Economic Outlook projections of output growth and inflation for each of the 7 major industrial countries; the group of 7 largest industrial countries; the group of 14 smaller industrial countries;[11] the average of these industrial country groups; each of the groups of developing countries in Africa, Asia, the Middle East, and the Western Hemisphere;[12] the average of these developing country groups; and 36 nonprogram developing countries.[13]

The data are from the published versions of the *World Economic Outlook* and from earlier unpublished IMF documents. Two sets of projections are examined: the current year forecasts prepared in the spring of the same year, and year ahead forecasts made in the fall for the following year. For the current year forecasts, the outcome is taken to be the figure reported in the *World Economic Outlook* published in the following spring; and for the year ahead forecasts, the outcome is the estimate published two years later. The sample period is 1971–91 for industrial countries, 1977–91 for developing countries, and 1988–91 for nonprogram developing countries. The smaller industrial countries and the developing countries include several countries for which projections are prepared only once a year. Therefore, for these countries the current year and year ahead forecasts may be similar.

The Seven Major Industrial Countries

Tables 1 and 2 present the results for each of the seven major industrial countries, and for the pooled projections for the seven countries in 1971–91.[14] The top panels of Tables 1 and 2 indicate that forecast errors of output growth (real GDP/GNP) and inflation (GDP/GNP deflator) in the current year are all small and not significantly different from zero.[15] In addition, the current year growth and inflation forecasts are efficient, except for growth projections for Canada and the pooled, and inflation projections for the United Kingdom. Furthermore, one third of the variation of the forecast error is captured by the predicted variation of the projections for these economies.[16] For the remaining countries the fraction of the variation explained by the model ranges from 1 percent for France to 9½ percent for the United States. For the pool, this figure is 5⅘ percent.

As one would expect, the current year projections are more accurate than the year ahead projections, which are nonetheless unbiased when evaluated on an individual country basis, with the exception of the inflation projections for the United Kingdom. It is noteworthy that for the pooled sample, year ahead forecasts of growth in 1971–91 overestimated actual growth by ½ of 1 percentage point, while the year ahead forecasts of inflation underestimated actual inflation by the same magnitude. By comparison, Artis found that the average output and inflation forecast errors for 1973–85 were about ¾ of 1 percentage point. The updated results therefore suggest that the bias in the *World Economic Outlook*'s forecasts was reduced after 1985. For the pooled projections, the results show that the *World Economic Outlook*'s year ahead forecast of inflation and both current year and year ahead forecasts of output growth are inefficient.[17]

Comparison of Business Cycles and Recession Years

Charts 1 and 2 show the pooled growth and inflation forecast errors for the seven major industrial

[10]Least-squares regressions are used to estimate β and ρ.

[11]These countries are Australia, Austria, Belgium, Denmark, Finland, Greece, Ireland, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, and Switzerland.

[12]Eastern European countries and the states of the former U.S.S.R. are not included in the developing country group.

[13]Nonprogram countries are those that were not engaged in Fund-supported stabilization and structural adjustment programs in 1988–91. The requisite data are available for 36 of these countries.

[14]This period was chosen because growth and inflation projections start in 1971. The pooled time-series/cross-section sample for the current year forecasts have 147 (= 7 × 21) observations, while the year ahead forecasts have 140.

[15]For the pooled projections, the average forecast error is only 3½ percent of actual average output growth (0.1 of 1 percentage point compared with average growth of 2.7 percent) and about 2¾ percent of the actual average inflation (0.2 of 1 percentage point compared with average inflation of 7.1 percent).

[16]The predicted variation is $\beta^2 \cdot \sigma_F^2$, where σ_F^2 is the variance of the forecast.

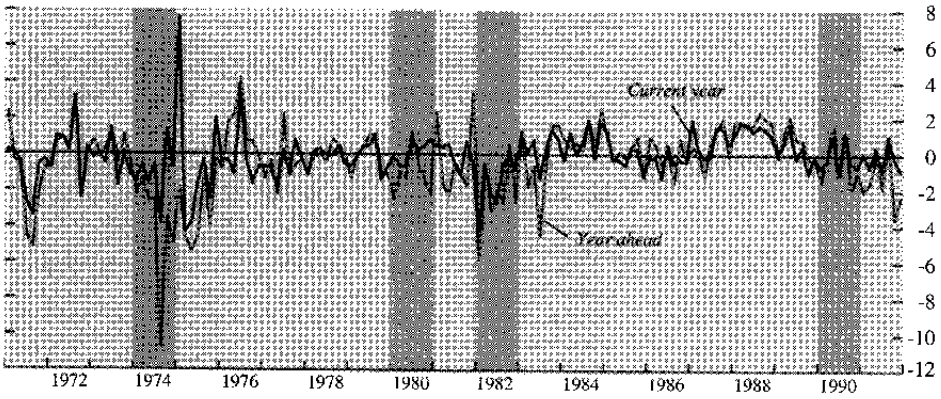
[17]This implies, for example, that if ρ is significant the projection could be improved by adjusting for last period's error.

Table 1. Forecast Error Statistics for Output Growth in the Seven Major Industrial Countries[1]
(In percent)

	United States	Japan	Germany[2]	France	Italy	United Kingdom	Canada	Seven Major Industrial Countries: Average	Seven Major Industrial Countries: Pooled
					(Current year forecast)				
Average growth	2.5	4.8	2.4	2.6	2.2	1.6	2.9	2.9	2.7
AFE[3]	−0.1	—	−0.3	−0.1	−0.1	−0.1	0.1	−0.1	−0.1
	(0.2)	(0.4)	(0.3)	(0.3)	(0.3)	(0.3)	(0.5)	(0.2)	(0.1)
RMSE[4]	0.9	1.4	1.4	1.1	1.4	1.1	2.1	0.7	1.4
β[5]	0.1	−0.2	—	—	0.2	−0.1	−0.4*	—	−0.1*
	(0.1)	(0.2)	(0.2)	(0.2)	(0.1)	(0.2)	(0.1)	(0.1)	—
ρ[6]	−0.1	−0.1	0.3	0.2	—	—	−0.2	0.1	—
	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.1)
					(Year ahead forecast)				
Average growth	2.6	4.8	2.4	2.7	2.3	1.7	2.9	2.9	2.8
AFE[3]	−0.4	−0.5	−0.5	−0.4	−0.4	−0.6	−0.5	−0.4	−0.5*
	(0.3)	(0.6)	(0.4)	(0.3)	(0.5)	(0.4)	(0.4)	(0.3)	(0.2)
RMSE[4]	1.8	3.0	1.9	1.4	2.3	1.9	1.5	1.5	2.1
β[5]	—	−0.7	0.1	−0.1	−0.5	—	0.1	—	−0.2*
	(0.2)	(0.2)	(0.4)	(0.2)	(0.3)	(0.3)	(0.3)	(0.2)	(0.1)
ρ[6]	−0.2	—	0.1	—	0.1	0.4	−0.2	0.1	—
	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.1)

[1]The sample period is 1971–91. The number of observations for the individual country tests is 21, except for the estimates of ρ, which are 20. In the pooled tests there are 147 observations, but 140 for estimation of ρ. The figures in parentheses are standard errors and an * indicates that the error is significantly different from zero at the 5 percent level of significance.
[2]Prior to unification.
[3]Average forecast error is defined as the realization less the forecast.
[4]Root mean squared error.
[5]β is the estimated coefficent from a least-squares regression of the forecast error on the forecast.
[6]ρ is the estimated coefficient from a least-squares estimate of the current period forecast error in the forecast error of the previous period.

Chart 1. Forecast Errors in World Economic Outlook Projections for Output Growth[1]
(In percent)



[1]Forecast error—defined as realized minus projected—of pooled projections for the seven major industrial countries. Each year consists of seven forecast errors for each of the country. The shaded areas indicate years in which the United States was in recession for two or more quarters, as defined by the National Bureau of Economic Research (NBER).

Table 2. Forecast Error Statistics for Inflation in the Seven Major Industrial Countries[1]
(In percent)

	United States	Japan	Germany[2]	France	Italy	United Kingdom	Canada	Seven Major Industrial Countries	
								Average	Pooled
				(Current year forecast)					
Average inflation	5.5	4.2	4.2	7.4	12.1	9.9	6.6	2.9	7.1
AFE[3]	—	−0.5	—	−0.3	0.6	0.5	0.3	—	0.2
	(0.1)	(0.5)	(0.2)	(0.3)	(0.4)	(0.4)	(0.3)	(0.1)	(0.2)
RMSE[4]	0.6	2.1	0.8	1.2	1.7	2.0	1.4	0.6	1.5
β[5]	—	−0.1	—	—	−0.1	0.1	0.1	—	—
	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(—)
ρ[6]	0.1	0.1	−0.2	—	0.2	−0.4*	0.2	0.3	—
	(0.2)	(0.1)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.1)
				(Year ahead forecast)					
Average inflation	5.6	4.1	4.2	7.7	12.0	10.0	6.6	6.0	7.2
AFE[3]	0.2	−0.3	0.2	0.7*	1.1	1.4*	0.6	−0.2	0.5*
	(0.3)	(0.7)	(0.2)	(0.3)	(0.7)	(0.6)	(0.5)	(0.3)	(0.2)
RMSE[4]	1.4	3.3	0.9	1.6	2.9	2.9	2.3	1.4	2.2
β[5]	—	−0.1	0.1	—	−0.1	0.2	0.2	0.1	—
	(0.2)	(0.2)	(0.1)	(0.1)	(0.1)	(0.2)	(0.2)	(0.2)	(—)
ρ[6]	0.3	—	0.1	0.4*	0.4*	0.3	0.3	0.3	0.3*
	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.1)

[1]The sample period is 1971–91. The number of observations for the individual country tests is 21, except for the estimates of ρ, which are 20. In the pooled tests there are 147 observations, but 140 for estimation of ρ. The figures in parentheses are standard errors and an * indicates that the error is significantly different from zero at the 5 percent level of significance.

[2]Prior to unification.

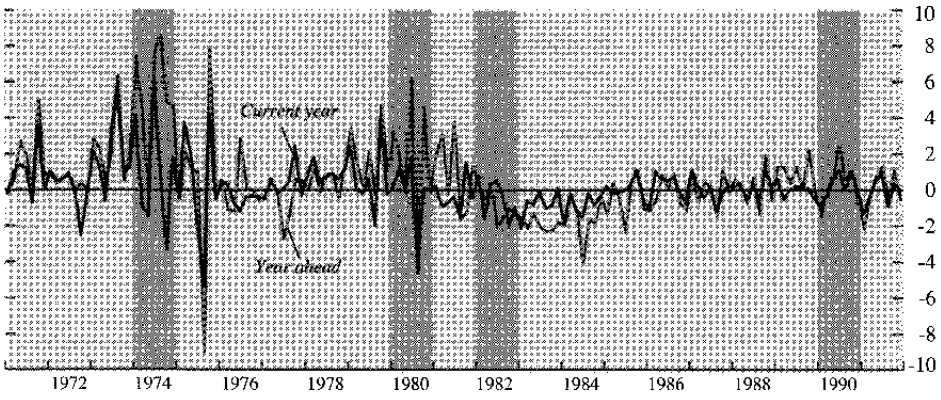
[3]Average forecast error is defined as the realization less the forecast.

[4]Root mean squared error.

[5]β is the estimated coefficent from a least-squares regression of the forecast error on the forecast.

[6]ρ is the estimated coefficient from a least-squares estimate of the current period forecast error in the forecast error of the previous period.

Chart 2. Forecast Errors in World Economic Outlook Projections for Inflation[1]
(In percent)



[1]Forecast error—defined as realized minus projected—of pooled projections for the seven major industrial countries. Each year consists of seven forecast errors for each of the country. The shaded areas indicate years in which the United States was in recession for two or more quarters, as defined by the National Bureau of Economic Research (NBER).

Table 3. Pooled Forecast Error Statistics for Output Growth Over the Business Cycles in the Seven Major Industrial Countries[1]

(In percent)

	1974	1980	1982	1990	1991	1971–82	1983–91	1986–91
				(Current year forecast)				
Average growth	1.1	1.3	−0.4	2.5	0.9	2.6	2.9	2.8
AFE[2]	−1.1*	0.2	−1.5*	−0.2	−0.2	−0.4*	0.3*	0.3*
	(0.5)	(0.3)	(0.6)	(0.4)	(0.3)	(0.2)	(0.1)	(0.1)
RMSE[3]	1.8	0.6	2.1	0.8	0.7	1.7	1.0	1.0
Theil statistic[4]	0.3	0.3	0.6	0.6	0.4	0.4	0.5	0.7
β[5]	−0.2	−0.1	0.3	0.5*	−0.1	−0.1*	0.1	0.1
	(0.2)	(0.1)	(0.4)	(0.2)	(0.1)	(—)	(0.1)	(0.1)
ρ[6]	0.9*	−0.1	−0.5	0.8	0.7	−0.1	0.1	0.3
	(0.5)	(0.4)	(1.0)	(0.4)	(0.2)	(0.1)	(0.1)	(0.1)
				(Year ahead forecast)				
Average growth	0.9	1.4	−0.3	2.5	0.9	2.6	3.0	2.8
AFE[2]	−4.0*	−1.1*	−2.3*	−0.5	−1.5*	−0.9*	0.1	0.1
	(1.0)	(0.5)	(0.7)	(0.5)	(0.6)	(0.2)	(0.2)	(0.2)
RMSE[3]	4.9	1.4	2.8	1.3	2.0	1.4	1.4	1.4
Theil statistic[4]	0.7	0.6	0.9	0.9	1.2	0.7	0.7	1.1
β[5]	−1.0*	0.2	−0.1	1.0*	1.2*	−0.2*	0.2	0.4
	(0.5)	(0.3)	(0.5)	(0.5)	(0.3)	(0.1)	(0.2)	(0.3)
ρ[6]	1.5	1.0*	−0.5	1.2	1.1	−0.1	0.2*	0.6*
	(1.6)	(0.3)	(0.3)	(0.3)	(0.2)	(0.1)	(0.1)	(0.2)

[1]The number of observations for individual years is seven; the number of observations for the longer time periods is seven times the number of years. The figures in parentheses are standard errors and an * indicates that the error is significantly different from zero at the 5 percent level of significance.

[2]Average forecast error is defined as the realization less the forecast.

[3]Root mean squared error.

[4]Theil inequality statistic, defined as the ratio of the *RMSE* of the World Economic Outlook forecast to the *RMSE* of the random walk (last period realization) forecast. A ratio value of less than one indicates the World Economic Outlook forecast is better; a value greater than one implies the random walk forecast is better.

[5]β is the estimated coefficent from a least-squares regression of the forecast error on the forecast.

[6]ρ is the estimated coefficient from a least-squares estimate of the current period forecast error in the forecast error of the previous period.

countries during the 1971–91 period. A positive (negative) error implies that the actual value was higher (lower) than projected. These charts indicate that prior to 1982 the forecast errors are consistently negative across the group of seven major industrial countries, and are positive thereafter. Tables 3 and 4 suggest that the World Economic Outlook generally overestimated growth and underestimated inflation in 1971–82.[18] By comparison, in 1983–91, only output growth in the current year was slightly underestimated, while the year ahead projection of growth and both current year and year ahead projections of inflation showed large reductions in the average error (both absolutely and relative to average growth and inflation) and were unbiased. Furthermore, the average error of the inflation and growth forecasts was only 16 percent of the mean error derived over the entire 1971–91 period. Thus, the accuracy of the World Economic Outlook forecasts improved after 1982. This improvement may partly reflect a more stable economic environment in the 1980s compared with the repeated supply and demand shocks and high inflation in the 1970s.

In 1986–91, the year ahead pooled projections of growth and both current year and year ahead projections of inflation were unbiased; however, the pooled projections underestimated growth in the current year by about ⅓ of 1 percentage point. Based on either the β or ρ statistics, the pooled projections for 1986–91 were inefficient, although the Theil statistics indicate that current year forecasts were generally superior to random walk forecasts.[19] Moreover, the root mean square errors

[18]Although 1971–82 is somewhat longer than the 1974–82 business cycles, the earlier years were included because the forecast errors in 1971–73 were similar to those in 1974–82 (cf. Charts 1 and 2).

[19]The Theil inequality statistic is defined as the ratio of the root mean squared error of the World Economic Outlook forecast to the root mean squared error of the random walk forecast. If this ratio is less than one, it indicates that the World Economic Outlook forecast is better; that is, it has a lower average error than the random walk forecast. The random walk forecast for next period is the current period's realization. These statistics are provided for comparison with Artis (1988).

Table 4. Pooled Forecast Error Statistics for Inflation Over the Business Cycles in the Seven Major Industrial Countries[1]

(In percent)

	1974	1980	1982	1990	1991	1971–82	1983–91	1986–91
				(Current year forecast)				
Average growth	12.8	11.2	8.7	4.2	4.2	9.0	4.0	3.9
AFE[2]	1.0	−0.2	−0.5	0.2	−0.1	0.4*	−0.1	0.1
	(1.0)	(0.8)	(0.4)	(0.3)	(0.3)	(—)	(0.1)	(0.1)
RMSE[3]	3.2	1.9	1.1	0.7	0.7	1.7	0.7	0.6
Theil statistic[4]	0.6	0.7	0.5	0.7	1.2	0.4	0.5	0.6
β[5]	−0.2	0.2	—	0.3	0.3	—	—	0.1
	(0.3)	(0.2)	(0.1)	(0.2)	(0.2)	(—)	(—)	(0.1)
ρ[6]								
				(Year ahead forecast)				
Average growth	13.2	11.2	8.7	4.2	4.2	9.1	4.0	3.9
AFE[2]	5.3*	1.6	−0.1*	0.4	—	1.2*	−0.3	0.2
	(1.1)	(1.3)	(—)	(0.5)	(0.5)	(0.3)	(0.2)	(0.2)
RMSE[3]	5.9	3.6	1.1	1.0	1.0	2.8	1.3	1.0
Theil statistic[4]	1.1	1.3	0.5	1.1	2.2	0.7	0.9	1.0
β[5]	0.7	0.7*	−0.1	0.1	0.2	0.3	−0.2*	0.1
	(0.5)	(0.3)	(0.1)	(0.3)	(0.4)	(0.7)	(0.1)	(0.1)
ρ[6]	1.1*	1.6*	—	0.3	0.9	0.1	0.6	0.4*
	(0.5)	(0.6)	(0.2)	(0.7)	(0.2)	(0.1)	(0.1)	(0.1)

[1]The number of observations for individual years is seven; the number of observations for the longer time periods is seven times the number of years. The figures in parentheses are standard errors and an * indicates that the error is significantly different from zero at the 5 percent level of significance.

[2]Average forecast error is defined as the realization less the forecast.

[3]Root mean squared error.

[4]Theil inequality statistic, defined as the ratio of the *RMSE* of the World Economic Outlok forecast to the *RMSE* of the random walk (last period realization) forecast. A ratio value of less than one indicates the World Economic Outlook forecast is better; a value greater than one implies the random walk forecast is better.

[5]β is the estimated coefficent from a least-squares regression of the forecast error on the forecast.

[6]ρ is the estimated coefficient from a least-squares estimate of the current period forecast error in the forecast error of the previous period.

(RMSE) of the World Economic Outlook and the random walk projections for 1983–91 and 1986–91 were about half of those in 1971–82, except for the year ahead projections of growth.[20]

In the 1990–91 recession, the World Economic Outlook projections have been reasonably accurate, and in general they compare favorably with the forecasting record in past recessions. All of the growth and inflation projections in 1990 and 1991 were unbiased, with average projection errors not significantly different from zero, except for the year ahead projection for growth in 1991, which was overstated by a large margin. The error reflects the difficulty of predicting major turning points in economic activity; however, even this projection was better than the comparable estimates in the 1974 and 1982 recessions. Moreover, for current year growth and year ahead inflation, the unbiasedness of the 1991 projection was also a significant improvement over the projections for the 1974 and 1982 recessions. In general, the forecast errors are of broadly similar orders of magnitude for the current and the 1980 recessions, on the one hand, and the 1974 and 1982 recessions, on the other. This suggests that forecast errors may be related to the depth of the recession—with larger errors associated with the more severe recessions.

Industrial Country Groups

Table 5 presents the results for each group of industrial countries.[21] It shows that deviations between the outcomes and both the current year and year ahead forecasts of output growth and inflation were small and not significantly different from zero. Although both were unbiased, forecasts for the current year were, not surprisingly, more accurate than for the year ahead.

For all industrial countries, year ahead forecasts

[20]Because growth and inflation are likely to be stationary; that is, they tend to revert to a fixed mean. It should not be difficult for a judgmental projection to outperform a random walk that does not have this property.

[21]The outcomes for the seven major countries are taken from the *World Economic Outlook, May 1992* (Washington: International Monetary Fund, May 1992), Annex VIII, pp. 88–93.

Table 5. Industrial Countries: Deviations of Outcomes from Projections[1]
(In percent)

	Output Growth			Inflation		
	Seven major countries	Fourteen smaller countries	All countries	Seven major countries	Fourteen smaller countries	All countries
			(Current year forecast)			
Average outcome	2.9	2.2	2.7	2.9	7.1	6.1
AFE[2]	−0.1	−0.2	−0.1	—	0.5	0.1
RMSE[3]	0.7	0.9	1.2	0.6	1.0	0.5
Theil statistic[4]	0.3	0.5	0.3	0.4	0.8	0.3
β[5]	—	0.1	—	—	−0.2	—
ρ[6]	0.1	0.3	0.2	0.3	−0.2	0.4*
			(Year ahead forecast)			
Average outcome	2.9	2.4	2.9	6.0	7.1	6.1
AFE[2]	−0.4	−0.4	−0.4	−0.2	0.8	0.3
RMSE[3]	1.5	1.5	1.4	1.4	1.5	1.3
Theil statistic[4]	0.5	0.8	0.6	0.8	1.1	1.5
β[5]	—	−0.4	—	0.1	−0.3*	1.1
ρ[6]	0.1	0.2	0.1	0.3	0.3	0.4*

[1]The sample period is 1971–91 giving 21 observations, where, except for the estimates of ρ, the sample size is 20. An * indicates that the projection error is significantly different from zero at the 5 percent level of significance.

[2]Average forecast error. The error is defined as the realization less the forecast.

[3]Root mean squared error.

[4]The Theil inequality statistic is defined as the ratio of the World Economic Outlook *RMSE* to the *RMSE* of the random walk forecast, which is its last period's realization. A Theil inequality statistic less than unity implies that the World Economic Outlook projections are better than the random walk forecasts.

[5]The symbol β is the estimated coefficient from a least-squares regression of the forecast error on the forecast.

[6]The symbol ρ is the estimated coefficient from a least-squares estimate of the current period forecast error on the forecast error of the previous period.

of growth in 1971–91 overestimated actual growth by 0.4 percentage point on average, whereas the year ahead forecasts of inflation underestimated actual inflation by 0.3 percentage point. Artis found that the average forecast errors for output and inflation for 1973–85 were 0.5 percentage point. This suggests that the bias in the World Economic Outlook's forecasts for industrial countries was reduced after 1985, probably because of the relative stability of output growth and inflation since 1985. In particular, there were enormous projection errors associated with the first oil price shock in 1973–74. The absolute average projection error for the group of 14 smaller industrial countries was higher than that for the major industrial countries, except for the average year ahead growth projection, which was the same for both groups.

The current year and year ahead projections of growth were efficient for the industrial countries. Current year inflation forecasts were efficient for the seven large countries and for the small countries.[22] Year ahead inflation forecasts were efficient for the large countries but not for the small countries.[23] The Theil statistics indicate that World Economic Outlook projections of growth and inflation for industrial countries were superior to random walk forecasts, except for inflation projections for the smaller countries.

Developing Countries

The conditionality of output and inflation projections is far more important for developing countries than for industrial countries, because many developing countries have adopted Fund-supported stabilization and structural adjustment programs. The World Economic Outlook projections of growth and inflation assumed the full implementation of the policies stipulated in the programs. The deviations between the conditional projections and outcomes are therefore partly a measure of the extent to which the policies specified in the programs were not fully implemented, or partly a reflection of assumptions about the international economic environment that

[22]These forecasts barely fail the efficiency tests for the industrial countries as a group, the statistic is 1.82 and the critical value is 1.80.

[23]For example, since ρ is significant in the case of the inflation forecasts of the group of industrial countries, the projection could be improved by adjusting for last period's error.

have not always been explicitly realized. Moreover, the economic situation of program countries has tended to be, on balance, worse than that of nonprogram countries, making forecasting more difficult for the former group.

Table 6 presents the results of the statistical tests for the developing country groups as well as for 36 developing countries that were not engaged in Fund-supported programs. The tests performed for the nonprogram countries correspond more closely to the evaluation of unconditional growth and inflation forecasts and, hence, are more comparable with those for industrial countries. The results show that in many cases there have been significant deviations between projections and outcomes for growth and inflation, both on average across all developing countries and for individual groups. In particular, actual growth fell short of the projections, while inflation tended to exceed projected price increases. For the sample of nonprogram developing countries, both inflation and real output growth projections were unbiased in the 1988–91 period.

Table 7 reports the same tests for the subperiods 1977–85 and 1986–89. In the earlier period, real output growth fell short of the current year projections by 1.1 percentage points for the average of all developing countries, whereas growth exceeded the current year projections by 0.3 percentage point in the later subperiod for this group. For the year ahead projections, output growth fell short of the projections in both subperiods, but the average shortfall declined from 1.4 percentage points to 0.5 percentage point. The RMSE also fell substantially between the subperiods: for the current year forecasts, it fell from 1.5 percentage points to 0.5 percentage point; for the year ahead forecasts, from 2.0 percentage points to 0.9 percentage point. In view of the important assumption of policy implementation, this reduction may suggest improvement in the record of meeting program objectives after 1985, perhaps because of the recent progress toward strengthened policies in many developing countries.[24] In addition, the economic environment has been more stable in recent years than in the late 1970s and early 1980s. In contrast, the average deviation between the outcome and the projection for inflation for the developing countries as a whole rose significantly between the periods. Although this result suggests a substantial departure from policy objectives, it must be interpreted with care, because the picture for inflation in 1986–91 was dominated by only a few countries.

The growth projections for the full sample and for both subsamples were generally efficient for the developing countries. In contrast, neither the current year nor year ahead inflation projections satisfied the efficiency tests. According to the Theil statistics, random walk forecasts were superior to the World Economic Outlook projections of both growth and inflation, although the statistics are somewhat lower for the 1986–91 period. The Theil statistics for the pooled sample of nonprogram countries, however, are well below unity, implying that the projections for these countries were superior to random walk forecasts. The difference in the Theil statistics between program and nonprogram countries may reflect unrealized policy objectives in the former.

Chart 3 shows the deviations between outcomes and projections for growth and inflation for the average of industrial countries and the average for developing countries. For output growth, the deviations tended to move in the same direction for both groups, although the magnitude was larger for the developing country group. Chart 3 also shows that the magnitude of the underprediction of inflation for developing countries increased significantly in the last four years of the 1980s due to sharply increasing inflation in a few countries, notably Brazil and Argentina.

Time-Series Forecasts

The World Economic Outlook makes judgmental projections that are based on an implicit view of how economic variables are mutually related. Alternatively, projections of the future values of a particular variable can be obtained from its past values. This method does not use any economic knowledge that may be available about a variable. Rather, a model is constructed for the stochastic process that generated the data. Time-series models that replicate output growth and inflation data for the seven major industrial economies are constructed below. The accuracy of the predictions of these models is evaluated using the rational expectations criterion presented earlier and then compared with the World Economic Outlook projections.

The processes generating output growth and inflation can often be represented in a form involving autoregressive (AR) and moving average (MA) components represented as follows,

$$\theta(L) \cdot y = \alpha(L) \cdot v, \qquad (11)$$

where y is an economic variable and v is white noise.[25] The AR and MA representations of the pro-

[24]See Chapter IV of the *World Economic Outlook, October 1992* (Washington: International Monetary Fund, 1992).

[25]$\theta(L) = (1-\theta_1 \cdot L-\theta_2 \cdot L^2- \ldots -\theta_p \cdot L^p)$ and $\alpha(L) = (1-\alpha_1 \cdot L-\alpha_2 \cdot L^2- \ldots -\alpha_q \cdot L^q)$, where p and q are the orders of the AR and MA processes.

Table 6. Developing Countries: Deviations of Outcomes from Projections[1]

(In percent)

	Output Growth						Inflation					
	Average	Africa	Asia	Middle East	Western Hemisphere	Nonprogram pooled	Average	Africa	Asia	Middle East	Western Hemisphere	Nonprogram Pooled
						(Current year forecast)						
Average outcome	3.5	2.1	5.7	2.9	2.2	4.9	45.5	19.1	8.9	22.4	179.3	11.1
AFE[2]	−0.5*	−1.0*	—	−0.3	−0.7	−0.2	11.1*	2.5*	1.7*	0.2	77.7*	—
RMSE[3]	1.2	1.3	1.3	2.4	2.3	3.6	18.0	5.4	2.4	8.9	156.0	5.7
Theil statistic[4]	1.0	1.0	0.7	0.9	0.9	0.8	0.9	1.4	0.9	1.0	0.8	0.4
β[5]	−0.3	—	−0.5	−0.3	−0.3	−0.6*	0.9*	−0.9*	0.1	−0.4*	1.7*	−0.2*
ρ[6]	0.5	−0.1	—	−0.2	0.3	0.1	0.6*	−0.2	0.2	0.1	0.5*	—
						(Year ahead forecast)						
Average outcome	3.7	2.3	6.1	3.1	2.3	4.7	46.9	18.8	9.2	22.6	200.2	13.7
AFE[2]	−1.0*	−0.8*	0.2	−1.3	−1.7*	−0.6	21.7*	2.8*	2.6*	−1.1	141.8*	2.4
RMSE[3]	1.6	1.4	1.7	2.5	2.9	4.2	30.3	5.8	3.7	16.3	237.0	7.1
Theil statistic[4]	1.2	1.1	0.9	1.3	1.1	0.9	1.1	1.1	1.4	1.7	1.1	0.7
β[5]	−0.4	−0.7*	−1.5	−0.3	0.1	−0.7*	1.9	−0.9*	−0.8*	0.8*	5.9*	−0.4*
ρ[6]	0.3	−0.1	0.3	0.4	0.4	—	0.5*	−0.1*	−0.1	0.3	0.5*	—

[1]The sample period is 1977–91, except for the year ahead projections of inflation (1979–91) and for the nonprogram countries, for which pooled observations for 36 countries in 1988–91 (144 = 36 × 4 observations) are used. (Nonprogram countries are developing countries without arrangements with the IMF in 1988–91.)

[2]Average forecast error. The error is defined as the realization less the forecast; an * indicates that the projection error is significantly different from zero at the 5 percent level of significance.

[3]Root mean squared error.

[4]The Theil inequality statistic is defined as the ratio of the World Economic Outlook *RMSE* to the *RMSE* of the random walk forecast, which is its last period's realization. A Theil inequality statistic less than unity implies that the World Economic Outlook projections are better than the random walk forecasts.

[5]The symbol β is the estimated coefficient from a least-squares regression of the forecast error on the forecast; an * indicates that the estimated coefficient is significantly different from zero at the 5 percent level of significance; that is, that the error is correlated with the forecast.

[6]The symbol ρ is the estimated coefficient from a least-squares estimate of the current period forecast error on the forecast error of the previous period. The sample period is 1977–91, except for the year-ahead projections of inflation (1979–91) and for the nonprogram countries, for which pooled observations for 36 countries in 1988–91 (144 = 36×4 observations) are used. (Nonprogram countries are developing countries without arrangements with the IMF in 1988–91).

Table 7. Developing Countries: Deviations of Outcomes from Projections by Subperiod[1]

(In percent)

	Output Growth					Inflation				
	Average	Africa	Asia	Middle East	Western Hemisphere	Average	Africa	Asia	Middle East	Western Hemisphere
1977–85					*(Current year forecast)*					
Average outcome	3.5	2.3	5.4	4.2	2.5	33.6	19.7	8.2	27.5	81.5
AFE[2]	−1.1*	−1.1*	−0.3	−0.7	−1.2*	4.1*	2.1	1.3*	−0.8	16.7*
RMSE[3]	1.5	1.4	1.3	2.3	2.6	4.7	6.3	1.6	11.3	19.6
Theil statistic[4]	1.0	1.0	0.8	1.1	1.0	1.5	1.6	0.8	1.0	1.1
β[5]	0.2	0.3	−0.9	0.1	−0.5	−0.2	−1.4*	−0.2	−0.5	−0.3*
ρ[6]	0.2	−0.2	−0.2	—	−0.2	−0.2	−0.5	−0.5	0.5	0.8*
					(Year ahead forecast)					
Average outcome	3.8	2.5	6.0	4.1	2.6	34.1	19.6	8.4	29.6	89.7
AFE[2]	−1.4*	−0.8*	−0.2	−1.7*	−1.8*	8.6*	2.5	2.0*	−3.6	40.0*
RMSE[3]	2.0	1.5	1.7	2.9	3.3	8.4	3.3	2.4	19.5	41.4
Theil statistic[4]	1.2	1.0	0.9	1.8	1.1	4.5	0.6	1.3	1.8	2.6
β[5]	0.1	−0.4	−1.4	−0.2	0.4	−1.0	−0.7*	−0.2	−1.0*	2.5*
ρ[6]	0.2	—	0.4	0.6	0.5	−2.0*	−0.4	0.4	0.3	1.1
1986–91					*(Current year forecast)*					
Average outcome	3.5	2.8	5.0	5.5	3.2	63.3	18.0	9.7	14.9	326.1
AFE[2]	0.3	−0.8*	0.5	0.5	−0.1	21.5*	3.2	2.2*	1.6	169.2*
RMSE[3]	0.5	1.0	1.2	2.5	1.7	27.7	3.8	3.3	3.6	245.6
Theil statistic[4]	0.7	0.8	0.9	1.2	1.2	0.9	1.8	0.7	0.6	1.3
β[5]	−0.4	−0.1	−0.6	−1.6	1.8	0.9*	−2.0*	−0.2	0.1	—
ρ[6]	−0.6	−0.4	−0.5	0.8	0.6	0.2	—	−1.4*	−0.2	−1.1*
					(Year ahead forecast)					
Average outcome	3.6	2.9	5.4	5.5	3.3	61.9	17.9	10.1	14.5	329.1
AFE[2]	−0.5	−0.8	0.7	−0.9	−1.8	37.0*	3.2*	3.4*	1.9	260.5*
RMSE[3]	0.9	1.3	1.3	1.9	2.4	46.8	7.6	4.7	3.3	345.3
Theil statistic[4]	0.9	1.0	0.9	1.7	1.2	1.1	0.7	1.3	1.0	2.3
β[5]	−0.7	−1.0	0.7	−1.5*	2.0	2.3	−0.4	—	−1.2	−1.5*
ρ[6]	0.4	—	—	1.3	1.0	0.1	−0.8	0.4	−0.5	0.8*

[1]The sample period is 1971–91 giving 21 observations, where, except for ρ, the sample size is 20.

[2]Average forecast error. The error is defined as the realization less the forecast. An * indicates that the projection error is significantly different from zero at the 5 percent level of significance.

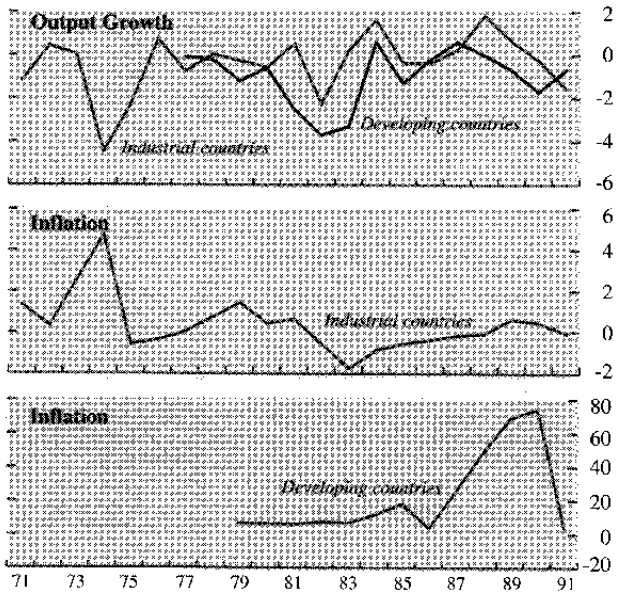
[3]Root mean squared error.

[4]The Theil inequality statistic is defined as the ratio of the World Economic Outlook *RMSE* to the *RMSE* of the random walk forecast, which is its last period's realization. A Theil inequality statistic less than unity implies that the World Economic Outlook projections are better than the random walk forecasts.

[5]The symbol β is the estimated coefficient from a least-squares regression of the forecast error on the forecast.

[6]The symbol ρ is the estimated coefficient from a least-squares estimate of the current period forecast error on the forecast error of the previous period.

Chart 3. Difference Between Outcomes and Projections in the World Economic Outlook Projections[1]
(In percent)



[1]Outcome minus year ahead projection.

cess characterize the systematic effect of past values of y and past errors, respectively, on the current value of y. Unit root tests suggest that output growth and inflation are stationary across the seven major industrial countries at a 5 percent significance level.[26] Thus, among AR and MA representations that satisfied the stationarity and invertibility conditions,[27] the process that minimized the Akaike (1974) and (1976) and Schwarz (1978) criteria was chosen as the data-generating process.[28]

Tables 8 and 9 present nonlinear least-squares estimates of the time-series representations of output growth and inflation for each of the seven major industrial economies in 1950–70.[29] Table 5 suggests that both past values of growth and past errors were significant determinants of growth in the current period. Indeed, the second lag of output growth was an important determinant of the processes generating growth across the seven major industrial economies, except for Germany (prior to unification). Last period's growth was the only relevant part of past growth determining current growth in Germany and in the pooled sample. For most of these seven countries, the errors made one and two periods earlier also affect significantly present growth. Campbell and Mankiw (1987) characterize the univariate time-series model of the United States in terms of an AR and MA representation (2, 1) for 1969–84. Table 8, however, indicates that the forecast error made two periods ago is also a significant determinant of current growth in the United States and of the average of the seven major industrial economies.

Table 9 suggests that last period's inflation accurately characterizes the current inflation rate across most of the major seven industrial countries.[30] Inflation in France and Canada was also described by the previous period's unanticipated inflation. The univariate time-series models of inflation presented in Table 9 are similar to the first-order models that Nelson and Schwert (1977), Pearce (1978), and Fama and Gibbons (1982) estimate on monthly data for the United States in the 1953–71, 1959–76, and 1953–77 periods, respectively.

Forecasting Accuracy of the Time-Series Models

Table 10 presents statistics that measure the accuracy of within-sample forecasts generated by time-series models for each of the seven major industrial countries, for the GDP-weighted average of the seven countries, and for the pooled projections for the seven countries. Time-series forecasts were generated by using the models identified and estimated prior to the forecast sample 1971–91. The models were re-estimated recursively until the end of the sample.[31] Table 10 indicates that the forecast errors of output growth (real GDP/GNP) and infla-

[26]Unit roots tests were performed using the augmented Dickey-Fuller and the augmented Phillips-Perron for the 1950–91 period. The number of lags included in each of these tests was chosen following Campbell and Perron (1991).

[27]Stationarity requires that $\theta_1 + \theta_2 + \ldots + \theta_p < 1$, while invertibility requires that the roots of the characteristic equation $\alpha(L) = 1 - \alpha_1 \cdot L - \alpha_2 \cdot L^2 - \ldots - \alpha_q \cdot L^q = 0$ must all lie outside the unit circle.

[28]Under this, the lag length is selected by minimizing the functions $(RSS + 2 \cdot K \cdot SEESQ)/T$ (Akaike) and $[RSS + K \cdot (\log T) \cdot SEESQ]/T$, where K and T are the number of regressors and observations, respectively, and RSS is the residual sum of squares and $SEESQ$ is the standard error of the estimate squared.

[29]Nonlinear least-squares estimations were performed using the Gauss-Newton algorithm with numerical partial derivatives and annual data. The data prior to 1971 were obtained from the International Finance Statistics tape of the International Monetary Fund. For Germany and Italy, data for 1950–55 were obtained from the OECD National Accounts. The data for developing countries were not available prior to 1965.

[30]Interestingly enough, the model for inflation not only describes essentially the same process across the seven countries, but the parameters estimates are also fairly close to each other.

[31]Models estimated over the entire 1950–91 period were also consistent with these specifications.

Table 8. Time-Series Models of Output Growth[1]

	United States	Japan	Germany[2]	France	Italy	United Kingdom	Canada	Seven Major Industrial Countries	
								Average	Pooled
ARMA (p,q)	(2,2)	(2,1)	(1,0)	(2,2)	(2,2)	(2,0)	(2,2)	(2,2)	(1,1)
p lags	2	1,2	1	2	1,2	1,2	1,2	2	1
q lags	1,2	1	—	1,2	1,2	—	1,2	1,2	1
Constant[3]	1.9	6.4	1.8	9.3	4.6	4.3	2.7	9.2	—
	(0.6)	(1.5)	(1.3)	(0.6)	(1.7)	(0.8)	(1.6)	(0.8)	
AR lag:[4]									
1	—	0.8	0.7	—	0.7	0.1	0.7	—	−0.3
		(0.3)	(0.2)		(0.2)	(0.2)	(0.3)		(0.1)
2	0.4	−0.4	—	−0.6	−0.5	−0.6	−0.3	−0.8	—
	(0.1)	(0.2)		(0.1)	(0.2)	(0.2)	(0.3)	(0.1)	
MA lag:[5]									
1	1.2	−0.9	—	−0.1	−0.3	—	−1.0	−0.5	0.6
	(0.1)	(0.3)		(0.1)	(0.1)		(0.6)	(0.2)	(0.1)
2	−0.8	—	—	0.9	0.8	—	−0.7	0.6	—
	(0.4)			(0.2)	(0.1)		(0.3)	(0.2)	
Prob Q-statistic[6]	18.0	11.5	61.0	5.0	5.0	38.0	24.9	7.0	10.3

[1]The sample period is 1950–70. In the pooled tests there are 147 observations.
[2]Prior to unification.
[3]Constant estimates and standard errors are in percent; standard errors are in parentheses.
[4]AR is the autoregressive process of the ARMA model.
[5]MA is the moving average process of the ARMA model.
[6]Prob Q-statistic is the probability that a χ^2 random variate will exceed the computed value. The hypothesis that the residuals are random noise is rejected if the marginal significance level is smaller than 5 percent. Figures are in percent. The lag length is selected by minimizing the Akaike and Schwarz criteria. The Akaike and Schwarz criterion statistics are 0.0 for each process.

Table 9. Time-Series Models of Inflation[1]

	United States	Japan	Germany[2]	France	Italy	United Kingdom	Canada	Seven Major Industrial Countries	
								Average	Pooled
ARMA (p,q)	(1,0)	(1,0)	(1,0)	(1,1)	(1,0)	(1,0)	(1,1)	(1,0)	(1,1)
p lags	1	1	1	1	1	1	1	1	1
q lags	—	—	—	1	—	—	1	—	1
Constant[3]	1.1	2.8	1.6	2.1	1.9	1.8	3.4	1.6	1.2
	(0.6)	(1.0)	(0.9)	(1.2)	(1.0)	(0.9)	(0.8)	(0.6)	(0.4)
AR lag[4]									
1	0.6	0.4	0.4	0.6	0.5	0.5	−0.4	0.5	0.6
	(0.2)	(0.2)	(0.2)	(0.3)	(0.2)	(0.2)	(0.2)	(0.2)	(0.1)
MA lag[5]									
1	—	—	—	−0.8	—	—	0.8	—	−0.3
				(0.2)			(0.2)		(0.1)
Prob Q-statistic[6]	50.9	57.3	28.0	31.0	67.2	65.0	14.2	62.2	13.7

[1]The sample period is 1950-70. In the pooled tests there are 147 observations.
[2]Prior to unification.
[3]Constant estimates and standard errors are in percent; standard errors are in parentheses.
[4]AR is the autoregressive process of the ARMA model.
[5]MA is the moving average process of the ARMA model.
[6]Prob Q-statistic is the probability that a χ^2 random variate will exceed the computed value. The hypothesis that the residuals are random noise is rejected if the marginal significance level is smaller than 5 percent. Figures are in percent. The lag length is selected by minimizing the Akaike and Schwarz criteria. The Akaike and Schwarz criterion statistics are 0.0 for each process.

tion (GDP/GNP deflator) are all small and not significantly different from zero. Moreover, the ratio of the average forecast error to average growth across the seven major industrial economies is, on average, 15 percent, while for inflation, it is only 5 percent.

Year ahead growth and inflation forecasts are efficient, except for growth projections for France, the United Kingdom, and Canada, and inflation projections for France and Italy. The ρ and β tests suggest that the forecast error of inflation in these countries is correlated with the error lagged one period and

Table 10. Forecast Error Statistics for Time-Series Models[1]
(In percent)

	United States	Japan	Germany[2]	France	Italy	United Kingdom	Canada	Seven Major Industrial Countries: Average	Seven Major Industrial Countries: Pooled
					(Output growth)				
Average growth	2.6	4.8	2.4	2.7	2.3	1.7	2.9	2.9	2.8
AFE[3]	−0.6	−0.1	−0.5	0.3	−0.7	−0.5	−0.3	−0.1	−0.2
	(0.7)	(0.6)	(0.5)	(0.5)	(0.7)	(0.4)	(0.5)	(0.4)	(0.3)
RMSE[4]	1.8	1.5	2.3	2.2	1.8	2.0	2.5	1.3	1.9
β[5]	−0.9	−0.8	−0.7	−0.7*	−0.9	−0.6	−0.9*	−0.4	−0.6
	(0.6)	(0.5)	(0.7)	(0.4)	(0.6)	(0.5)	(0.5)	(0.6)	(0.4)
ρ[6]	—	0.3	−0.2	0.3	−0.3	0.5*	0.2	0.3	0.2
	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.3)	(0.3)	(0.2)	(0.2)
					(Inflation)				
Average growth	5.6	4.1	4.2	7.7	12.0	10.0	6.6	6.0	7.2
AFE[3]	−0.1	−0.6	—	−0.6	−0.2	−0.9	−0.4	−0.1	−0.3
	(0.4)	(0.9)	(0.3)	(0.6)	(0.7)	(1.1)	(0.6)	(0.4)	(0.3)
RMSE[4]	1.7	2.8	1.3	1.8	2.7	2.1	2.1	1.8	2.0
β[5]	0.3	0.3	0.1	−0.2	−0.1	−0.5	−0.3	−0.3	−0.1
	(0.2)	(0.4)	(0.3)	(0.2)	(0.2)	(0.3)	(0.2)	(0.2)	(0.1)
ρ[6]	0.2	0.1	0.2	0.5*	0.5*	−0.3	0.8	0.3	0.2
	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.3)	(0.2)	(0.1)

[1]The sample period is 1971–91. The number of observations for the individual country tests is 21, except for the estimates of ρ, which are 20. In the pooled tests there are 147 observations, but 140 for estimation of ρ. The figures in parentheses are standard errors. An * indicates the error is significantly different from zero at the 5 percent level of significance.
[2]Prior to unification.
[3]Average forecast error is defined as the realization less the forecast.
[4]Root mean squared error.
[5]β is the estimated coefficent from a least-squares regression of the forecast error on the forecast.
[6]ρ is the estimated coefficient from a least-squares estimate of the current period forecast error in the forecast error of the previous period.

with the forecast itself. It was suggested earlier that the significance of β is related to the failure to incorporate last period's unexpected inflation into the inflation projected for the current period. These inefficiencies arise because in this exercise the Q-statistic test evaluates the serial correlation of the residuals lagged one through five periods, thereby reducing the significance of the correlation of lags closer to the current period. The tests for inflation in France and Italy provide an example of the care that should be exercised in drawing conclusions from the β statistic alone: the β statistic suggests that the pooled projections are efficient, but the ρ statistic shows that they are not.

Comparison of Forecasts

A comparison of the year ahead forecast statistics in Tables 1 and 2 with those in Table 10 indicates that the absolute average forecast error of growth and inflation generated by the time-series models is two thirds of the absolute average forecast error of the World Economic Outlook for most of the seven major industrial countries. The pooled growth projections of the time-series model are efficient, while those of the World Economic Outlook are not. Nonetheless, World Economic Outlook and time-series projections of growth for most individual countries and for the average of the seven major industrial economies are efficient. The efficiency restrictions are satisfied less often for pooled projections of the World Economic Outlook than those of the time-series models.

For comparison with time-series models and Artis (1988), the *TS* Theil and *RW* Theil statistics are used to compare the projections of the World Economic Outlook with those of time-series models and a random walk, respectively. The *RW* Theil statistics in Table 11 indicate that World Economic Outlook projections are superior to random walk forecasts. Not surprisingly, 17 out of 18 statistics are below unity. Theil statistics for the pooled projections show that the root mean squared error of the current year projections for growth and inflation are about half those of the random walk projections, while the year ahead projections are about 30 percent better than those of a random walk.

The *TS* Theil statistics suggest that time-series forecasts of growth and inflation between 1971 and 1991 were superior to World Economic Outlook projections, except for growth projections for Germany, France, and Canada and inflation forecasts

Table 11. Comparison of Forecast Errors[1]
(In percent)

	United States	Japan	Germany[2]	France	Italy	United Kingdom	Canada	Seven Major Industrial Countries: Average	Seven Major Industrial Countries: Pooled
					(Output growth)				
Theil statistic *TS*[3]	1.0	2.0	0.8	0.6	1.3	1.0	0.6	1.2	1.1
Theil statistic *RW*[4]	0.5	0.9	0.7	0.7	0.7	0.8	0.6	0.5	0.7
					(Inflation)				
Theil statistic *TS*[3]	0.8	1.2	0.7	0.9	1.1	1.4	1.1	0.8	1.1
Theil statistic *RW*[4]	0.7	0.8	0.6	0.8	1.0	0.5	0.9	0.8	0.7

[1]The sample period is 1971–91. The number of observations for the individual country tests is 21. In the pooled tests there are 147 observations.

[2]Prior to unification.

[3]The Theil inequality statistic *TS* is defined as the ratio of the *RMSE* of the World Economic Outlook forecast to the *RMSE* of the time-series forecast. A ratio value of less than one indicates that the World Economic Outlook forecast is better; a value of greater than one implies that the time series forecast is better.

[4]The Theil inequality statistic *RW* is defined as the ratio of the *RMSE* of the World Economic Outlook forecast to the *RMSE* of the random walk forecast. A ratio value of less than one indicates that the World Economic Outlook forecast is better; a value of greater than one implies that the random walk forecast is better.

for Germany, France, the United States and the average of the seven major industrial countries. The efficiency of growth projections for the United States and the United Kingdom was the same for both forecasts. These results suggest that time-series forecasts provide a more accurate description of growth and inflation than the projections of the World Economic Outlook. Judgmental projections can be improved, however, if they are adjusted by β and ρ. It is shown next that this adjustment roughly corresponds to the error-correction mechanism present in time-series models.

An Adjustment Method

To examine the relevance of shocks in generating forecasts in time-series models, it is useful to calculate the fraction of unexpected growth and inflation for the previous year(s) that is incorporated into the growth and inflation projected for the current year. This exercise illustrates how time-series models incorporate previous errors to generate current forecasts. In the same fashion, a judgmental projection could be adjusted by ρ to improve the accuracy of the forecast. The time-series model that characterizes the process generating growth for the United States and the average of the seven major industrial countries is given by

$$y = \theta_2 \cdot y_{-2} + \upsilon - \alpha_1 \cdot \upsilon_{-1} - \alpha_2 \cdot \upsilon_{-2}. \quad (12)$$

This process can be described by its expected and unexpected components,

$$y = E(y) + \upsilon, \quad (13)$$

where $E(y)$ is expected growth for the current year assessed four periods earlier, and the unexpected growth (υ) is serially uncorrelated white noise. Equations (12) and (13) imply

$$E(y) = \theta_2 \cdot y_{-2} - \alpha_1 \cdot \upsilon_{-1} - \alpha_2 \cdot \upsilon_{-2}. \quad (14)$$

Thus, rewriting y_{-2} in terms of its expected and unexpected components, $E_{-2}(y_{-2})$ and υ_{-2}, yields

$$E(y) = \theta_2 \cdot E_{-2}(y_{-2}) + (\theta_2 - \alpha_2) \cdot \upsilon_{-2} - \alpha_1 \cdot \upsilon_{-1}. \quad (15)$$

The estimates of the parameters α and θ in Table 8 for equation (15) indicate that the unexpected growth one and two years earlier are fully incorporated into the expected growth for the current year in the United States. Similar calculations for the time-series process of the average of the seven major industrial countries suggest that one half of the unexpected growth one period earlier is incorporated into the projection of growth in the current year. The time-series model for Germany incorporates two thirds of unexpected growth for the previous year, while France and Italy fully include last period's unanticipated growth into current expected growth.

The time-series model that characterizes the process generating the inflation rate for most of the seven major industrial economies is given by

$$\pi = \theta_1 \cdot \pi_{-1} + \eta, \quad (16)$$

where the unexpected component of inflation is rep-

resented by η. Rewriting π_{-1} in terms of its expected and unexpected components, $E_{-1}(\pi_{-1})$ and η_{-1}, yields

$$E(\pi) = \theta_1 \cdot E_{-1}(\pi_{-1}) + \theta_1 \cdot \eta_{-1}. \qquad (17)$$

The estimates of the parameters α and θ in Table 9 indicate that the variance of expected inflation is small relative to the variance of unexpected inflation across most of the seven major industrial economies. Equation (17) then suggests that only three fifths of the unexpected inflation rate for the previous year is incorporated into the expected inflation for the current year in the United States. For Japan and Germany only two fifths of last period's unexpected inflation is included in the projection of inflation in the current period. This figure is about one half for Italy, the United Kingdom, and the average of the seven major industrial economies. Thus, a failure to make adjustments for large errors reduces significantly the accuracy of a projection.

Concluding Remarks

This paper presents a simple criterion to evaluate the accuracy of a forecast. The criterion is derived from a simple optimization problem under rational expectations. The optimality conditions of this problem imply that the standard efficiency conditions are necessary, but not sufficient. A key feature of the method is the characterization of how different kinds of inefficiency are mutually related. The forecasting accuracy of the World Economic Outlook and time-series models are examined according to this criterion. The results of a number of empirical tests for industrial countries support the following conclusions.

- The World Economic Outlook current year forecasts of growth and inflation for the seven major industrial countries are unbiased for 1971–91. The current year forecasts of growth reflect an important structural change between 1971–82 and 1983–91. In particular, the 1971–82 forecasts of growth are biased upward, whereas those for 1983–91 are biased downward.
- The World Economic Outlook year ahead projections overstate growth and understate inflation by ½ of 1 percentage point. This bias occurs because year ahead forecasts overstated growth and understated inflation in 1971–82. After 1982, however, year ahead projections of both growth and inflation are unbiased across the seven major industrial economies.
- Only current year forecasts of inflation are efficient. Current and year ahead forecasts of growth and year ahead projections of inflation are inefficient in the sense that the projections could be improved by adjusting them by a forecast error correlation factor (ρ) or a projection factor (β), or both.
- The accuracy of the World Economic Outlook projections for growth and inflation improved after 1985, the last year fully analyzed in the earlier study by Artis. This improvement may partly reflect a more stable environment in the 1980s than in the more volatile 1970s.
- In the 1990–91 recession, the World Economic Outlook projection errors are lower than in the two previous cyclical downturns, and the projections were generally unbiased, which is a distinct improvement over the forecasts for 1974 and 1982. Possible reasons for this difference are that supply shocks did not play a central role in the current recession and that the current recession has been relatively shallow compared with the other two. Nevertheless, the World Economic Outlook projections failed to anticipate the full extent of the current downturn.
- Time-series forecasts for 1971–91 are unbiased and efficient, with the exception of inflation forecasts for three countries. The absolute value of the average growth and inflation errors generated by time-series models were half of those derived for the World Economic Outlook.
- The analysis suggests that a fraction of the unexpected inflation rate and growth are included in the time-series projections for the current year across the seven major industrial countries.

Time-series forecasts outperform the projections of the World Economic Outlook. This suggests that the accuracy of the World Economic Outlook could be improved by the use of such model-based methods. By contrast, the criterion presented in this paper allows a constructive analysis of the projection error that may improve forecast performance over time. Indeed, judgmental projections could be improved significantly if the β and ρ adjustments are included in the projections. Moreover, the model could readily be extended to include assumption-based adjustments. These kinds of adjustments resemble the error-correction mechanism present in time-series models and, thus, provide a more accurate description of future economic activity.

The tests performed for developing countries suggest the following conclusions.

- There were significant deviations between outcomes and projections of growth and inflation before 1985, but they were small for growth projections in the 1986–91 period. Although the economic environment has been more stable, the improvement in forecast accuracy suggests that policy assumptions have been more frequently met in recent years.
- The average deviation between the outcome and

the projection of inflation for the developing countries as a whole rose significantly between 1977–85 and 1986–91. Only a few countries, however, dominated this result.

- For the sample of nonprogram developing countries, both inflation and real output growth projections were unbiased in the 1988–91 period.
- The growth projections were generally efficient for the developing countries. In contrast, neither the current year nor year ahead inflation projections were efficient.
- Theil statistics suggest that random walk forecasts were superior to the World Economic Outlook projections of both growth and inflation for the groups of developing countries that include program countries. The Theil statistics for the pooled sample of nonprogram countries, however, suggest that the projections for these countries were superior to random walk forecasts. This suggests that there were unrealized policy objectives for some program countries.

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