

The world economy has experienced its most significant slowdown since the early 1990s (Box 1.1 and Figure 3.1).

Much public discussion has focused on how the current downturn differs from other recessions in recent history, and some have argued that the current downturn is much more akin to those in the late nineteenth century. Specifically:

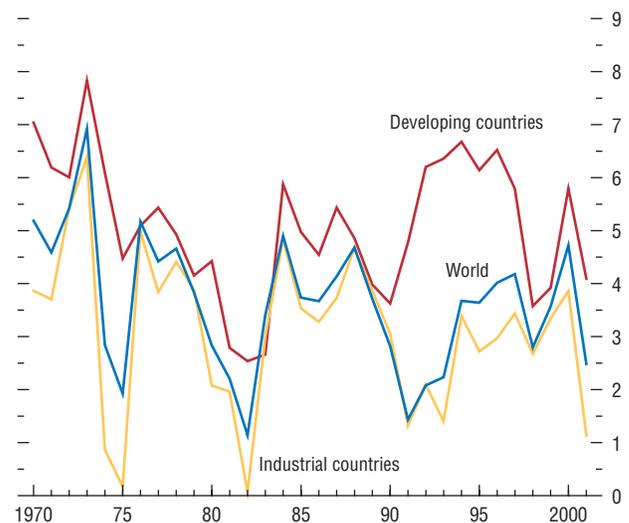
- The synchronization of the current slowdowns appears to be greater than that in the early 1990s. How common are synchronized recessions and what are the implications for the synchronization of the recoveries?
- The global collapse of high-tech investment has prompted comparisons with recessions in the late nineteenth century. If investment remains weak for a long time, will the recovery of output be anemic?
- Following the long and strong bull market of the 1990s, stock prices have fallen sharply in all major countries. Do these large contractions imply that the recessions will be especially deep? How soon will stock prices recover?
- Monetary policy in all three major currency areas was tightened prior to the downturn, and has since been loosened. How does the behavior of monetary policy during this cycle compare to previous cycles?

Business cycles are persistent features of market-oriented economies. More than 50 years ago, Arthur Burns (1947) wrote: “For well over a century, business cycles have run an unceasing round. They have persisted through vast economic and social changes; they have withstood countless experiments in industry, agriculture, banking, industrial relations, and public policy; they have confounded forecasters without num-

The main authors of this chapter are James Morsink (lead), Thomas Helbling, and Stephen Tokarick. Emily Conover provided research assistance.

**Figure 3.1. Real Output Growth (Percent)**

The world economy has experienced its most significant slowdown since the early 1990s. The global business cycle is driven mainly by fluctuations in industrial countries.



ber, belied repeated prophecies of a ‘new era of prosperity’ and outlived repeated forebodings of ‘chronic depression.’” The same observations could be made today.

While every business cycle is different, business cycles share common elements that make them interesting for analysis. This chapter puts the current business cycles in industrial countries into perspective by describing the key features of previous recessions and recoveries. The focus of the chapter is on industrial countries, as global fluctuations in recent decades have been most closely associated with the business cycle in these countries. This is clear both from the coincidence of peaks and troughs in activity between the global economy and industrial countries and from formal work on synchronization.

Business cycles are defined here as recurrent sequences of expansions and contractions in the level of economic activity (Box 3.1). An alternative definition is that of cyclical fluctuations in economic activity around a trend—the growth cycle, which is more useful if underlying growth rates are high and level recessions relatively rare. However, the primary focus of this chapter is on business cycles in industrial countries after 1973, when growth rates were generally lower and level recessions were not uncommon. Also, growth cycles depend on an arbitrary distinction between trend and cycle, and key cyclical characteristics depend crucially on which detrending method is used. Another possibility is to consider level cycles using output per capita, which is a better measure of welfare and explicitly recognizes that high growth rates of output sometimes reflect rapid population growth. In practice, output per capita recessions in industrial countries after 1973 were similar to output recessions, as population growth rates were generally low.

The chapter contributes to the study of business cycles by describing the main empirical regularities of recessions and recoveries across industrial countries and across time, though it does not directly address their fundamental

causes. This analysis complements the vast country-specific literature on business cycles, with the work on the United States alone being huge. The few studies of the international and historical evidence generally do not treat recessions and recoveries as events, but rather focus on the average properties of macroeconomic series over time. The very few studies that do identify expansions and contractions mostly look at growth cycles.

The key features of business cycles in industrial countries from the late nineteenth century to the present are discussed first. To anticipate some of the results: recessions are getting milder and expansions are getting longer; synchronized recessions are a common feature of the international and historical experience; and investment is playing a larger role in recessions now than in the late nineteenth century. The deeper examination of business cycles since 1973 that follows confirms these results. In addition, this analysis indicates that investment contractions and stock price declines are more synchronized than recessions; that investment contractions make important contributions to recessions but upturns in consumption tend to drive recoveries; and that cycles in interest rates and output in G-7 countries are closely related.

### Were Business Cycles in the Late Nineteenth Century Different from Modern Cycles?

Business cycles have run an “unceasing round” since at least the late nineteenth century. This section compares and contrasts the amplitude, duration, and other key characteristics of recessions and recoveries across historical periods using annual data for 1881–2000 for 16 industrial countries (Appendix 3.1).<sup>1</sup> The choice of countries is determined mainly by the availability of data; the quality of the available historical data—especially for the earlier periods—is distinctly mixed. The sample is split into four

<sup>1</sup>The countries are Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, Norway, the Netherlands, Portugal, Spain, Sweden, Switzerland, United Kingdom, and the United States.

### Box 3.1. Measuring Business Cycles

How should business cycles be defined? The classic definition of the business cycle is attributable to Burns and Mitchell (1946), who—along with other researchers at the National Bureau of Economic Research (NBER) in the United States—pioneered concepts and methodology in business cycle analysis: “A cycle consists of expansions occurring at about the same time in many economic activities, followed by similar general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration, business cycles vary from more than one year to ten or twelve years.” In other words, a recession is a significant decline in the level of aggregate economic activity that lasts for more than a few months and an expansion is a sustained increase in the level of activity.<sup>1</sup> The NBER determines peaks and troughs in aggregate economic activity on the basis of turning points in a number of indicators, including aggregate employment, industrial production, and the volume of sales. An NBER business cycle dating committee identifies the turning points in the individual series, reconciles the conflicting dates among individual series, and, on this basis, determines peaks and troughs in aggregate economic activity.

For meaningful cross-country comparisons of business cycles in industrial countries since 1973, chronologies based on a consistent definition are needed. Such chronologies exist for some, but not all, industrial countries.<sup>2</sup>

The main author is Thomas Helbling.

<sup>1</sup>While the essence of this definition has remained unchanged, it has been revised slightly over time. For the latest definition, see the recent announcements by the NBER Business Cycle Dating Committee (available on the Internet at <http://cycles-www.nber.org/cycles/november2001/recessnov.html>).

<sup>2</sup>The Organization for Economic Cooperation and Development (OECD) and the Economic Cycle Research Institute (ECRI) in New York provide chronologies for only some industrial countries. Their chronologies are available on the Internet at <http://www.oecd.org/oecd/pages/home/displaygeneral/0,3380,EN-countrylist-509-15-no-no-287-509,FF.html> and <http://www.businesscycle.com/research/intl/cycledates.asp>.

Chapter III proposes business cycle turning points based on the behavior of real gross domestic product, which is the best available measure of aggregate economic activity.<sup>3</sup> (See Appendix 3.1.) This advantage is especially relevant for modern cycles in industrial countries, where manufacturing accounts for a small share of output. Recent studies have shown that NBER peaks and troughs can be closely approximated by applying a well-known business cycle dating algorithm to real GDP.<sup>4</sup> The algorithm looks for peaks and troughs in overlapping five-quarter periods and then picks those pairs that result in cycles that are at least five quarters long and phases that are at least two quarters long.

An alternative concept of business cycle fluctuations is that of growth cycles—fluctuations in economic activity around a long-run trend (Moore, 1983, and Zarnowitz, 1992). The growth cycle concept has some advantages, but also disadvantages, relative to the conventional business cycle concept (Stock and Watson, 1999).<sup>5</sup>

- Growth cycles are better suited for business cycle analysis in countries with high trend growth rates, including many emerging market economies, which tend to experience sharp contractions and expansions in rates of growth

<sup>3</sup>Stock and Watson (1999) say that GDP is “the core of the business cycle.”

<sup>4</sup>Harding and Pagan (2001 and forthcoming). See also King and Plosser (1994) on business cycle dating algorithms. The algorithms detect peaks and troughs on the basis of maxima and minima in the series that have been subjected to censoring rules to ensure that standard conditions for the minimal duration of cycles and phases are met.

<sup>5</sup>Another advantage of growth cycles is that standard statistical methods can be applied, since these cycles are less asymmetric in duration or amplitude of fluctuations during phases than classical cycles. Analyzing the latter often requires the application of cumbersome nonlinear statistical methods (e.g., Diebold and Rudebusch, 1999). However, recent advances in econometrics and information technology have greatly facilitated the use of nonlinear models in empirical economic research.

rather than in levels. However, level recessions are more relevant for industrial countries, which have generally experienced low average growth rates since 1973.

- Growth cycles are often more helpful in understanding the relationships between output, inflation, and unemployment.<sup>6</sup> However, growth cycles depend on an arbitrary distinction between trend and cycle, on which there is no professional consensus.<sup>7</sup> Moreover, key growth cycle characteristics vary considerably depending on the detrending method used (Canova, 1998).
- Growth recessions are sometimes minor in size, while level recessions are usually associated with major adverse macroeconomic events, which usually makes them more relevant from a policy perspective.<sup>8</sup>

Another possibility is to consider level cycles using real GDP divided by working age population (“per capita”), which is a better measure of welfare. In practice, in industrial countries after 1973, cycles based on output per capita closely matched those based on output. The total number of cycles was similar on the two measures, as a slightly higher number of shallow per capita recessions (compared to level recessions) was offset by the merging of a few double-dip level recessions into single, longer per capita recessions. Per capita recessions lasted on average

<sup>6</sup>See, for example, Boone and others (2002).

<sup>7</sup>In some macroeconomic models, the same shock may affect both long-run growth and business cycle fluctuations. See King and others (1991), among others.

<sup>8</sup>Classical recessions typically overlap with growth recessions, while the converse is not true.

time periods, divided by major world events: the prewar period before World War I (1881–1913); the interwar period between the World Wars (1919–38); the Bretton Woods period between World War II and the productivity slowdown, the oil shocks, and the move to generalized floating of exchange rates in the early 1970s (1950–

### Level Versus Per Capita Recessions

	Level	Per Capita <sup>1</sup>
<i>Quarters</i>		
Average duration of recessions	3.8	4.4
<i>Percent of peak GDP</i>		
Average depth of recessions	–2.7	–3.2
1970s	–3.8	–3.7
1980s	–2.1	–3.5
1990s	–2.2	–2.4
<i>Percent</i>		
Share in total		
Length		
2 quarters	32.0	24.0
3–4 quarters	42.0	39.0
5–6 quarters	14.0	13.0
More than 7 quarters	12.0	24.0
Contractions of		
0–2 percent	48.0	40.0
2–4 percent	37.0	35.0
More than 4 percent	15.0	25.0

Source: IMF staff calculations.

<sup>1</sup>Working age population.

about one-half of a quarter longer than level recessions, and were about ½ percent of GDP deeper (see the table). Across decades, the most striking difference in depths was during the early 1980s, when working age population growth rates accelerated in many countries, thus increasing the severity of per capita recessions.<sup>9</sup> As per capita cycles are similar to level cycles, this chapter focuses on the latter because they match more closely existing business cycle chronologies, including the NBER’s.

<sup>9</sup>Looking forward, as the working age population in many industrial countries starts to decline, level recessions will no longer be so severe in per capita terms.

1972); and the post–Bretton Woods period (1973–2000).

For the analysis, a recession is defined as one or more consecutive years of negative real GDP growth, while an expansion consists of a year or more of positive growth. The resulting business cycle turning points broadly match the dates in

**Table 3.1. Recessions and Expansions: 1881–2000**

	Prewar 1881–1913	Interwar 1919–1938	Bretton Woods 1950–1972	Post–Bretton Woods 1973–2000
<b>Recessions</b>				
Decline in output				
Average decline in output (percent)	–4.3	–8.1	–2.1	–2.5
Proportion with a decline in output of:				
0–2 percent	29.4	23.5	50.0	57.5
2–4 percent	33.3	17.6	44.4	30.0
> 4 percent	37.3	58.8	5.6	12.5
Length of recessions				
Average length of recessions (years)	1.3	1.8	1.1	1.5
Proportion that were:				
One year in length	79.4	60.8	94.4	60.0
Two years in length	16.7	15.7	5.6	32.5
Three years or more in length	3.9	23.5	0.0	7.5
Proportion of years in recession	24.7	29.4	5.2	13.4
Proportion associated with a decline in investment	58.9	77.4	63.6	96.2
<b>Expansions</b>				
Increase in output				
Average increase in output (percent)	19.8	34.6	102.9	26.9
Length of expansions				
Average length of expansions (years)	3.6	3.7	10.3	6.9
Proportion of years in expansion	75.3	70.6	94.8	86.6
Average number of years until previous peak is reached	2.0	2.7	1.1	1.7
<b>Memorandum</b>				
Average growth rate (percent)	2.8	3.8	5.3	2.6

Source: IMF staff calculations.

the National Bureau of Economic Research (NBER) chronologies for the United States, the United Kingdom, France, and Germany (available in Glasner, 1997). The differences reflect the use by the NBER of higher frequency (monthly) data and a broader variety of indicators, such as employment, bank clearings, and department store sales. Also, since the analysis in this section uses annual data, differences might arise regarding the dating of business cycles, compared to the following section, which uses quarterly data.

### Recessions Are Becoming Milder and Less Frequent

Recessions have become less severe and less frequent over time (Table 3.1). During the prewar period, the average decline in real GDP from peak to trough was 4.3 percent, and recessions

in the United States were on average deeper than in the United Kingdom, owing in part to greater financial instability in the United States, which did not have a central bank. Recessions were exceptionally deep (–8.1 percent on average) during the interwar period, mainly reflecting the Great Depression (Box 3.2). The severity of recessions moderated significantly after World War II, with the proportion of recessions in which output declined by just 0–2 percent almost doubling. Recessions were somewhat milder in the Bretton Woods period compared to the post–Bretton Woods period, partly reflecting the oil price shocks of the later period.<sup>2</sup> It is striking that recessions were considerably more severe in the prewar period compared to the post–Bretton Woods period, even though average growth rates were similar.

While recessions were shallower in the post–Bretton Woods period compared to the

<sup>2</sup>Hamilton (1983, 1996) has demonstrated a close relationship between oil price shocks and recessions in the United States.

prewar period, they were not shorter.<sup>3</sup> The proportion of recessions that lasted just one year fell from four-fifths in the earlier period to three-fifths in the later period. The interwar period was—once again—unusual, with recessions lasting longer than in any other period. The Bretton Woods period was characterized by short recessions, with about 95 percent lasting just one year. The increase in recession duration from the Bretton Woods period to the post-Bretton Woods period may partly reflect the fall in the underlying growth rate as well as the decline in labor-market flexibility in many countries, which would tend to slow the recovery of output following an adverse shock.<sup>4</sup>

Unlike recessions, expansions clearly became longer after World War II. During the Bretton Woods period, expansions were especially long, lasting about 10 years on average. Some expansions lasted 20 years, and several countries did not experience a year of negative output growth at all. The long expansions reflected in part the technological catch-up in many countries following World War II. One consequence of longer expansions was that countries spent less time in recession.<sup>5</sup> The Bretton Woods period had the lowest share of recession years, just 5 percent, compared to 30 percent in the interwar period. It is interesting that, even though average growth rates were similar in the prewar and post-Bretton

Woods periods, recession years were less common in the later period, because expansions were on average almost twice as long.<sup>6</sup>

The findings that expansions have become longer and recessions shallower in the post-World War II period are consistent with much of the literature on U.S. business cycles.<sup>7</sup> Using the NBER chronology of U.S. business cycles, Zarnowitz (1992) shows that expansions were 1½ times as long as recessions between the mid-nineteenth and mid-twentieth centuries, and 4 times as long since then. Zarnowitz also shows that, on several measures, output variability in the United States was highest during the interwar period, intermediate during the prewar period, and lowest during the post-World War II period.

The mainstream view of the post-World War II cyclical dampening in the United States has been challenged, mainly on grounds of data reliability. Romer (1989) created a new GDP series for the pre-World War II period, rather than using the series developed by Kuznets (1961), and showed that the volatility of real GDP was similar in the pre-World War II and post-World War II periods.<sup>8</sup> In response, Balke and Gordon (1989) challenged Romer's findings and demonstrated that output was about twice as volatile in the earlier period, in line with the original results.<sup>9</sup> Several studies, including

<sup>3</sup>The duration of a recession is defined as the number of consecutive years of negative output growth. The duration of an expansion is defined analogously.

<sup>4</sup>Blanchard and Wolfers (2000) present evidence that the interaction of shocks and labor market institutions does a good job of explaining the evolution of unemployment in Europe since 1960.

<sup>5</sup>The share of recession years is simply the number of country-years of negative output growth divided by the total number of country-years in each of the four sample periods.

<sup>6</sup>Since countries were expanding when they were not in recession, the share of expansion years is simply one minus the share of recession years. Thus, the share of expansion years was higher after World War II than before.

<sup>7</sup>Our findings support the view—held by Mitchell (1927) and Keynes (1936), among others—that contractions and expansions are asymmetric in their duration. Other business cycle asymmetries in the United States are the differences in the statistical properties of output growth across business cycle phases (Hamilton, 1989) and between the early and late stages of expansion (Sichel, 1994). DeLong and Summers (1986) have challenged this view, arguing that business cycles were symmetric, if detrended data were used. Using detrended data for many countries over a long time period, Bergmann, Bordo, and Jonung (1998) have found evidence that generally favors asymmetry.

<sup>8</sup>Romer found that the new series was 27 percent less volatile than the traditional Kuznets series. A related argument, posited by Romer (1994), Watson (1994), and Diebold and Rudebusch (1992), was that the NBER business cycle dates for the prewar period were based on inferior measurement techniques and fewer and weaker data sources. When the dates were corrected by these authors, the duration of recessions became more similar in the prewar and postwar periods.

<sup>9</sup>Separately, Zarnowitz (1992) has criticized Romer for ignoring structural changes.

### Box 3.2. The Great Depression

The Great Depression of the early 1930s is the most severe recession on record (see the table). Most countries entered recession in 1929–30 and began their recoveries in 1932–33; in France, the contraction occurred somewhat later (1932–35). Output losses in the United States, Germany, France, Italy, Japan, Canada, Sweden, and Australia exceeded 10 percent of GNP, and were also sizable in many other countries. As the U.S. economy was at the time by far the largest, and experienced just about the deepest contraction, the Great Depression in the United States accounted for much of the decline in global output.

Most economic historians concur that the Great Depression—at least the first stage—was caused primarily by monetary policy in the United States, propagated mostly by a series of banking panics, and then spread to the rest of the world via the international gold exchange standard.<sup>1</sup> The U.S. Federal Reserve tightened monetary policy in early 1928, in response to the stock market boom that began in 1926 and the belief that banks should confine their lending strictly to commercial bills and not finance stock market speculation (the “real bills doctrine”). The contractions in central bank credit and the monetary base, along with a rise in the discount rate, precipitated a downturn in the U.S. economy starting in August 1929 (before the stock market crash of October 1929).

A series of banking panics beginning in October 1930 turned an otherwise serious recession into a depression. These panics, which resulted in the suspension of 9,000 banks (more than one-third of the total), exacerbated the economic contraction because they reduced broad money (Friedman and Schwartz, 1963). The U.S. Federal Reserve was insufficiently aggressive in trying to counter the collapse in broad money, for example via open market pur-

The main author is Michael Bordo.

<sup>1</sup>Many other causes of the Great Depression have been proposed, from more restrictive trade policy (Meltzer, 1976) to the stock market crash of 1929 (Galbraith, 1961).

### The Great Depression

Country	Share of World Output, 1931 (percent)	Economic Activity		Output Loss (percent) <sup>1</sup>
		Peak	Trough	
United States	42.4	1929	1933	-29.4
United Kingdom	13.1	1930	1931	-0.5
Germany	9.5	1928	1932	-26.3
France	7.9	1932	1935	-10.4
Italy	5.4	1928	1933	-13.7
Japan	5.1	1930	1933	-14.9
Spain	4.2	1929	1931	-6.3
Canada	2.5	1929	1933	-29.7
Netherlands	2.1	1930	1934	-14.2
Switzerland	2.0	1930	1932	-6.5
Sweden	1.6	1930	1933	-12.1
Australia	1.4	1926	1931	-24.9
Denmark	1.1	1930	1932	-4.4
Norway	0.9	1930	1931	-8.0
Finland	0.5	1928	1931	-7.2
Portugal	0.4	1935	1936	-0.7

<sup>1</sup>Cumulative loss in output from peak to trough (based on annual data). The peak is defined as the year before real growth turned negative. The trough is defined as the year before real growth turned positive.

chases.<sup>2</sup> The collapse of broad money reduced output through several channels: (1) lower aggregate demand, which—in the face of nominal wage rigidity—decreased real output (Bernanke and Carey, 1996; Bordo, Erceg, and Evans, 2000); (2) disruption of financial intermediation from the bank failures (Bernanke, 1983); (3) asset price deflation, whereby declining asset prices reduced the value of collateral for bank loans, inducing weakened banks to engage in a fire sale

<sup>2</sup>The reason for this policy failure is still being debated. Friedman and Schwartz (1963) attributed it to a breakdown in governance at the U.S. Federal Reserve, following the death in 1928 of Benjamin Strong, Governor of the Federal Reserve Bank of New York, who they argued would have acted correctly to offset the banking panics, based on his record in the 1920s. Alternatively, Wheelock (1991) and Meltzer (forthcoming) argued that the policy failure stemmed from the adherence to two beliefs: (1) the “real bills doctrine,” which posited that the low interest rates observed in the early 1930s were a sign of expansionary monetary policy and that even looser monetary policy would rekindle speculation; and (2) the liquidationist view, which posited that recessions were a necessary purge to the excesses of the previous booms.

of their loans and securities, leading to further asset price deflation (Bernanke and Gertler, 1989); and (4) debt deflation, in which falling goods prices led to rising debt burdens in an environment where contracts were not fully indexed (Fisher, 1933) and rising ex ante real interest rates (Cecchetti, 1992).

The fall in broad money in the United States raised interest rates, leading to a capital inflow from the rest of the world, and reduced output, lowering U.S. demand for the rest of the world's output. The United States ran persistent balance of payments surpluses with its main trading partners during 1929–31. In the rest of the world, the combination of the gold outflow and the fall in exports to the United States caused aggregate demand to decline. This was exacerbated by a loss of confidence in the currencies of the reserve countries, leading central banks to convert their holdings of foreign exchange into gold, which caused a contraction in the world money supply. Countries that did not adhere to the gold exchange standard, such as Spain, experienced milder contractions (Choudhri and Kochin, 1980).

The gold exchange standard also exacerbated the contractions in other countries by preventing central banks from responding aggressively to the banking panics prompted by weakened bank balance sheets. Central banks were reluctant to extend liquidity support to banks, fearing a speculative attack that would force them off the gold standard—they were confined by “golden fetters” (Bernanke and James, 1991; Eichengreen, 1992). At the same time, foreign depositors' fears of either devaluation or the imposition of exchange controls (or both) fueled the spread of banking crises from Austria in May 1931 to Germany and other central European countries, and then to France and Belgium. Finally, the banking crises on the continent led to a speculative attack on the Bank of England's gold reserves, leading the United Kingdom to suspend gold convertibility in September 1931. The contagion even reached the United States, leading the central bank to raise its discount rate in order to protect its gold reserves—thereby aggravating the banking crisis already under way.

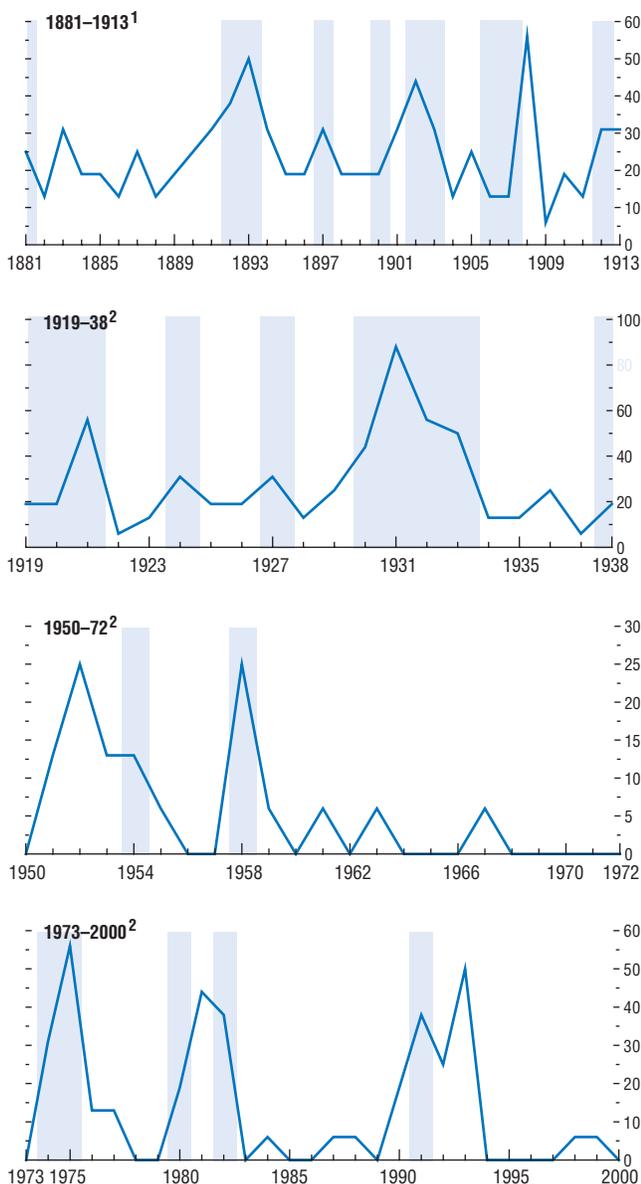
The Great Depression generally ended once countries left the gold exchange standard and adopted policies that restored confidence in the financial system and stimulated aggregate demand, including expansionary fiscal and monetary policies. The United Kingdom and other countries in the sterling bloc, including Australia, Denmark, Finland, Norway, and Sweden, left gold in 1931 and started to recover. The United States ended its link to gold in 1933 and effectively devalued by raising the price of gold, which in turn revalued the monetary gold stock and expanded the monetary base. The principal remaining gold standard adherents were France, Belgium, the Netherlands, and Switzerland (the “gold bloc” countries), which had returned to gold in the late 1920s.<sup>3</sup> After the United Kingdom, the United States, and much of the rest of the world devalued, France and the gold bloc countries were placed at an ever deteriorating competitive disadvantage. To preserve their gold reserves, they followed increasingly contractionary macroeconomic policies, which served to exacerbate the Depression. In the end, Belgium left gold in 1935 and France in 1936, followed by the Netherlands and Switzerland.

The pace of recovery from the Great Depression varied widely across countries, depending in part on macroeconomic and structural policies. In the United Kingdom, which left gold early, it took only a year for output to exceed its peak level before the recession began. In the United States, recovery began in 1933 but was sluggish compared with the strength of the monetary expansion under way, and it took about three years for output to return to its previous peak level. Recent research suggests that the weak recovery and the following second stage of the Depression partly reflected New Deal policies that enhanced the monopoly power of firms and labor unions, which strongly reduced aggregate supply, especially in manufacturing (Bordo, Erceg, and Evans, 2000; Cole and Ohanian, 1999).

<sup>3</sup>In France, the monetary authorities were reluctant to abandon gold, because of the intense political struggle that had preceded stabilization of high inflation in the 1920s and the return to the gold standard in 1928.

**Figure 3.2. Synchronization of Recessions, 1881–2000**  
*(Percent of countries in recession at the same time, 16 countries = 100)*

Recessions have always been synchronized and, if anything, have become more so over time. Recessions in the largest economy have either led or coincided with the peaks.



Source: IMF staff estimates.

<sup>1</sup>The shaded areas indicate the years when the United Kingdom was in recession.

<sup>2</sup>The shaded areas indicate the years when the United States was in recession.

Backus and Kehoe (1992) and Bergman, Bordo, and Jonung (1998), examined output volatility in other countries and generally found a decrease in volatility after World War II, corroborating the mainstream view.

The lower amplitude of business cycles in the United States after World War II reflects several factors, including structural changes and more active stabilization policy. In a survey of the evidence, Zarnowitz (1992) attributes the decline in amplitude to the structural shifts from the volatile agricultural sector and the cyclically sensitive manufacturing sector toward the less cyclical service and government sectors; the advent of automatic fiscal stabilizers; and greater financial stability fostered by both the development of financial markets and the institution of effective lender-of-last-resort policies and deposit insurance—though recent international evidence does not suggest that financial crises are becoming less frequent or less severe (Box 3.3).

### Synchronization, Investment, and Deflation

Contrary to the impression one gets from much of the public discussion, the tendency of recessions in one country to occur at the same time as recessions in other countries—synchronization—has been a persistent feature of the historical record (Figure 3.2).<sup>10</sup> Since the late nineteenth century, most recessions have been synchronized: before World War I, there were the global downturns in the early 1890s, the early 1900s, and 1907–08; in the interwar period, there was the worldwide recession of 1920–21 and the Great Depression of 1929–33; and in recent decades, there were the widespread slowdowns of the mid-1970s, the early 1980s, and the early 1990s. Even in the Bretton Woods period, the few recessions that occurred were highly synchronized.<sup>11</sup> The “background” (or ongoing)

<sup>10</sup>The measure of synchronization is the number of countries in recession at the same time.

<sup>11</sup>Zarnowitz (1992) shows that growth cycles in major industrial countries were highly synchronized throughout 1948–80.

### Box 3.3. Historical Evidence on Financial Crises

Financial crises can exacerbate recessions for several reasons, as recognized in the early business cycle literature, including Mitchell (1941), Cagan (1965), and Zarnowitz (1992). A banking panic, like those that prevailed in industrial countries before World War II, reduces output by forcing a contraction in the money supply and thus aggregate demand, and by disrupting financial intermediation. Although classic banking panics are now rare, major banking insolvencies still occur and still disrupt financial intermediation (Honohan and Klingebiel, 2000). Currency crises exacerbate recessions because substantial depreciations are typically associated with sharp current account reversals, requiring the economy to quickly adjust the balance between domestic saving and investment (Milesi-Ferretti and Razin, 1998), and worsen financial distress, as many firms have net foreign exchange exposures. Twin crises—the simultaneous occurrence of a banking and a currency crisis—combine the negative effects of both types of crises (Kaminsky and Reinhart, 1998).

Does the association of severe recessions with financial crises still hold? A recent paper by Bordo and others (2001) looks at the experience of 21 industrial and emerging countries with both banking and currency crises over the

four historical episodes described in the main text (the prewar period, the interwar period, the Bretton Woods period, and the post-Bretton Woods period).<sup>1</sup> The frequency of financial crises has changed significantly over time (see the table). Banking crises—defined as either a banking panic or major banking insolvencies—were especially prevalent during the interwar period and completely absent during the Bretton Woods period. Their declining frequency after World War II reflects in part the adoption in many countries of deposit insurance and effective lenders of last resort, which effectively eliminated classic banking panics (but not major banking insolvencies). Currency crises—defined as a successful speculative attack on a pegged exchange rate arrangement—were least frequent during the prewar period, reflecting the stability of the gold standard, and most frequent during the Bretton Woods period of fixed but adjustable exchange rates. Interestingly, the increase in the number of currency crises between the prewar and post-Bretton Woods periods (the two periods of relatively greater globalization) accounts for the higher incidence of finan-

<sup>1</sup>The 21 countries are Argentina, Australia, Belgium, Brazil, Canada, Chile, Denmark, Finland, France, Germany, Greece, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

The main author is Michael Bordo.

#### Financial Crises and Recessions

	Prewar	Interwar	Bretton Woods	Post-Bretton Woods
Frequency of financial crises (percent a year) <sup>1</sup>	4.9	13.2	7.0	9.7
Banking crises	2.3	4.8	0.0	2.0
Currency crises	1.2	4.3	6.9	5.2
Twin crises	1.4	4.0	0.2	2.5
Severity of recessions (percent of GDP) <sup>2</sup>				
Without financial crises	10.7	8.5	6.7	14.3
Industrial economies	9.7	8.5	8.1	14.1
Emerging economies	11.0	8.5	4.2	15.1
With financial crises	19.6	29.3	14.6	19.9
Industrial economies	7.8	25.0	12.3	18.1
Emerging economies	24.5	39.0	18.1	27.8

Note: This table is based on Bordo and others (2001). For details, please consult that paper.

<sup>1</sup>Frequency is defined as the number of crises divided by the number of country-years.

<sup>2</sup>Severity is defined as the cumulative difference between actual growth and previous trend growth.

**Box 3.3 (concluded)**

cial crises in the later period. Like banking crises, twin crises were most frequent during the interwar period.

While it is difficult to disentangle the effects of financial crises on recessions from other factors, there is evidence that crises make recessions worse.<sup>2</sup> Bordo and others (2001) examine this relationship after controlling for other characteristics (such as a preceding credit boom and whether a country is industrial or emerging) and after taking account of possible simultane-

<sup>2</sup>Mulder and Rocha (2001) show that the measurement of output losses is also difficult.

ity. The implication of these empirical tests is that the relationship between financial crises and recessions is probably causal (i.e., crises make recessions worse) rather than associative (i.e., other factors account for both crises and severe recessions). The general result is that financial crises—in both industrial and emerging market countries and across historical periods—make recessions more severe than they would be otherwise.<sup>3</sup>

<sup>3</sup>Using a different approach, Gupta, Mishra, and Sahay (2002) examine the factors that affect the impact of currency crises on output in developing countries.

level of recessions fell sharply after World War II, so that the peaks in synchronization account for virtually all recessions since then—suggesting that, if anything, synchronization has in fact increased over time. Finally, recessions in the largest economy (the United Kingdom before World War I and the United States thereafter) tended to either lead or coincide with the peaks in synchronization.

The results are consistent with the international and historical evidence. Thorp (1926) describes the coincidence of business cycles across countries in the prewar period. Moore and Zarnowitz (1986) show a substantial degree of conformity across the business cycles between 1880 and 1920 in France, Germany, and the United Kingdom. More recently, Backus and Kehoe (1992) and Bergmann, Bordo, and Jonung (1998) find that output movements across countries were least synchronized during the prewar period, most synchronized during

the interwar period, and fairly synchronized after World War II.<sup>12</sup>

The role of investment in recessions has, if anything, increased over time, contrary to the view that the current investment-driven downturn represents a return to the recessions of the late nineteenth century.<sup>13</sup> Virtually all recessions in the post-Bretton Woods period were accompanied by investment contractions, compared with only about 60 percent of recessions in the prewar period, when the share of investment in output was much smaller.<sup>14</sup> However, it should be noted that our sample does not cover the railroad investment booms and busts of the mid-nineteenth century. While recognizing the data limitations, these results do not suggest that investment played a bigger role in recessions in the prewar period compared to recent decades.

About 40 percent of recessions before World War II were accompanied by deflation, but only one—Japan in the late 1990s—since then. The

<sup>12</sup>Backus and Kehoe (1992) attribute the higher correlation in the post-World War II period compared to the prewar period to greater measurement error in the earlier period.

<sup>13</sup>The important role of investment in recessions is consistent with most theories of the business cycle, including Austrian, Keynesian, and neoclassical views.

<sup>14</sup>Data on real investment are available for 10 countries: Australia, Denmark, Finland, Germany, Italy, Japan, Norway, Sweden, United Kingdom, and the United States. A recession was deemed to be associated with a decline in real investment if real investment fell in the year prior to, or in the year of the trough of, a recession. The average investment share in output in Denmark, Norway, Italy, Sweden, and the United Kingdom increased from 13 percent in the prewar period to 21 percent in the post-Bretton Woods period.

more common association of deflation with recessions prior to World War II reflected in part less activist monetary policy under the gold standard. Not all episodes of deflation were associated with recessions—in fact, France from 1929 to 1931, Germany from 1884 to 1886 and again from 1892 to 1896, and the United Kingdom from 1884 to 1887 were characterized by rapid growth—underlining that some deflations were driven by rapid productivity growth and others by declines in aggregate demand. That said, the combination of deflation and recession is a serious concern, not only because deflation increases the real burden of debt, but also because deflation makes it impossible for the central bank to engineer negative real interest rates.

Fluctuations in interest rates have long been recognized as an integral aspect of business cycles. Other things being equal, interest rates might be expected to fall during recessions and rise during expansions, reflecting either changes in the demand for credit or countercyclical monetary policy (or both). Indeed, there is a large literature that argues that, at least in the United States, the central bank has played a significant role in causing many of the recessions of the past century, partly reflecting its objective (before World War II) of maintaining gold convertibility or (after World War II) long-run price stability (Friedman and Schwartz, 1963, and Romer and Romer, 1989). Others have pointed to the role of monetary policy as one of the factors behind the diminution in the amplitude of business cycles after World War II. However, real short-term interest rates were not found to be related to the phase of the business cycle in the sample under consideration.<sup>15</sup> Clearly, a more rigorous analysis of this issue is needed.

Overall, the historical record suggests four broad lessons.

- Recessions have become less severe and less frequent.
- Synchronization has been a common feature of recessions throughout history.
- The role of investment in recessions has if anything increased over time.
- Since World War II, deflation has rarely been a feature of recessions.

### Modern Business Cycles in Industrial Countries—A Tale of 93 Cycles

Building on the previous historical analysis, this section takes a closer look at the key empirical regularities of business cycles in recent decades. For the purpose of this section, the modern period begins in 1973, when three important developments occurred. First, the exchange rates between the major currencies began to float, marking a significant change in the international monetary regime. Second, long-term average growth rates in industrial countries decreased, reflecting a slowdown in productivity growth. Third, for the first time since World War II, a wave of level recessions started, reflecting in part the first oil shock.

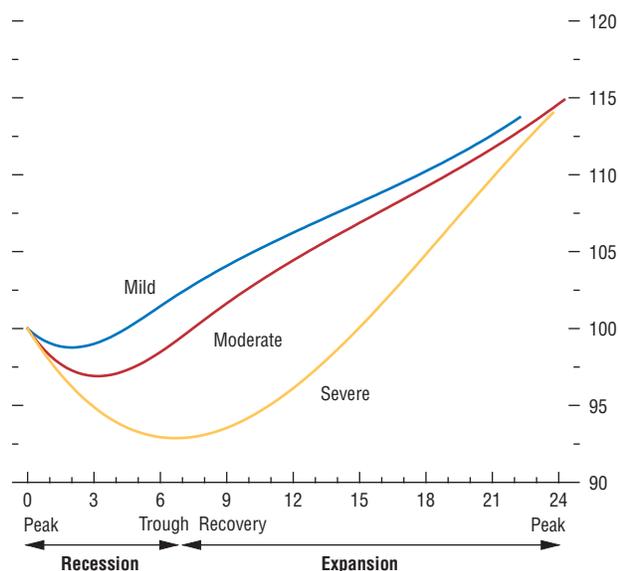
The analysis focuses on business cycles in 21 industrial countries over the period 1973–2000.<sup>16</sup> During this period, 93 cycles were identified on the basis of turning points in the level of aggregate economic activity in each country (Appendix 3.1). The turning points define the two main phases of each cycle, recession and expansion: a recession is the period between a peak and a trough in activity, and an expansion is the period between a trough and a peak. The entire period from peak to peak determines the length of the cycle. Using quarterly real GDP as a proxy measure for aggregate economic activity, consistent dates for business cycle peaks and troughs in the 21 industrial countries during the

<sup>15</sup>Data on real short-term interest rates are available for seven countries: France, Germany, Japan, Netherlands, Switzerland, the United Kingdom, and the United States.

<sup>16</sup>The countries included in the sample are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

**Figure 3.3. Recession Depth and Cyclical Path of Output<sup>1</sup>**  
*(Initial peak = 100; x-axis in quarters)*

Business cycles usually last about six years, during which cumulative output growth is about 14 percent. Mild recessions tend to be short as well.



Source: IMF staff estimates.  
<sup>1</sup>Stylistic representation of business cycles, based on averages associated with mild, moderate, and severe recessions in the sample.

sample period were computed with a business cycle dating algorithm that closely matches the NBER chronology for the United States.

### What Do Modern Cycles Look Like?

The typical or average cycle lasts about six years (Figure 3.3). It begins with a recession of about one year, during which output falls by slightly less than 3 percent (the depth of a recession), followed by a five-year expansion, during which output grows by a little more than 3 percent a year.<sup>17</sup> Hence, despite the initial recession, the level of output at the end of a cycle is about 14 percent higher than at the beginning. Strikingly, almost three-fourths of recessions were of mild to moderate depth and short to medium duration, while less than 10 percent of recessions were long and severe or worse (Figure 3.4). Short and medium-length recessions were more likely to be of mild to moderate depth. Although the relationship between depth and duration was generally less clear-cut for severe recessions, the most severe recessions were typically long or even protracted.

In line with the broad historical trends, business cycles have become longer and recessions shallower since 1973. The average length of business cycles increased from about four years during the 1970s to about six years during the 1980s and 1990s, reflecting mainly longer expansions (Figure 3.5).<sup>18</sup> Recessions became milder in the 1980s and 1990s, even though average growth rates were lower than in the 1970s. These results are in line with recent empirical work on declining output volatility in industrial countries (McConnell and Perez-Quiros, 2000; Blanchard and Simon, 2001; and Dalsgaard, Elmeskov, and

<sup>17</sup>This result—that the durations of level recessions and expansions in industrial countries in recent decades are asymmetric—was noted by Artis, Kontolemis, and Osborn (1997).

<sup>18</sup>Roughly 40 percent of all cycles during the 1980s and 1990s lasted more than eight years, suggesting that the usual range of business cycle frequencies of 6–32 quarters may need to be revisited. Among other things, this frequency range is used in the estimation of the so-called cyclical components of economic time series.

Park, 2002). By contrast, the magnitude of output fluctuations in developing countries has not declined (Box 3.4).

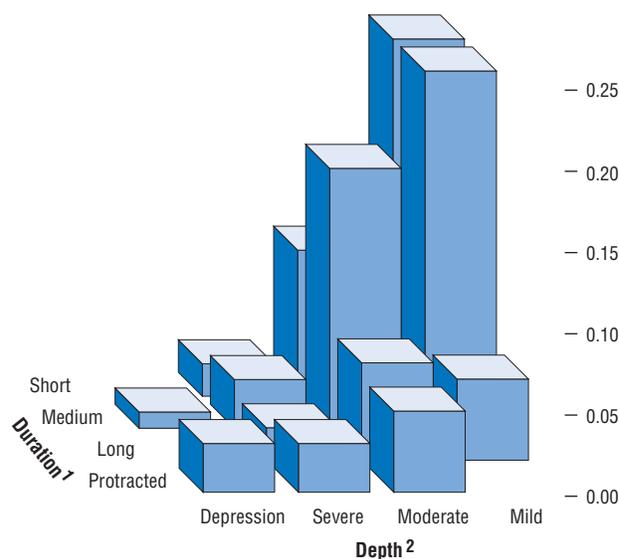
The duration of recoveries—the time it takes for output to return to its previous peak—is not significantly related to either recession depth or duration, except for severe recessions. In other words, output does not on average recover significantly more quickly after a short and mild recession than after a medium-length and moderate recession. Recoveries lasted on average about 30 percent longer than recessions, indicating that output fell faster in recessions than it grew during the initial phase of the expansion. This result is consistent with that of Artis, Kontolemis, and Osborn (1997), who show that industrial production declined more quickly during recessions than it rose during expansions.

Sequences of short cycles could be related to structural rigidities that impede adjustment to adverse shocks. While most countries recorded three to five cycles after 1973, a few countries—Austria, Denmark, Greece, New Zealand, Norway, and Switzerland—registered more cycles. The higher number of cycles does not reflect generally shorter cycles throughout the sample period, but rather clusters of short cycles during a 5–10 year period. For example, four of Switzerland’s seven recessions occurred during the early to the mid-1990s. The clusters of short cycles generally occurred in the context of relatively high labor and product market rigidity.<sup>19</sup> Against this background, it is not surprising that Japan—with its structural rigidities—is now in its third recession since 1993.

Most severe and long recessions could reflect the combination of structural problems and adverse shocks. The systemic banking crises in Finland and Sweden in the early 1990s showed how financial sector problems can amplify the output effects of adverse external shocks. Similarly, the combination of terms of trade shocks and structural rigidities led to large out-

**Figure 3.4. Recession Depth and Duration**  
(Share of total number of recessions)

Almost three-fourths of recessions were of mild to moderate depth and short to medium duration, while less than 10 percent were long and severe or worse.

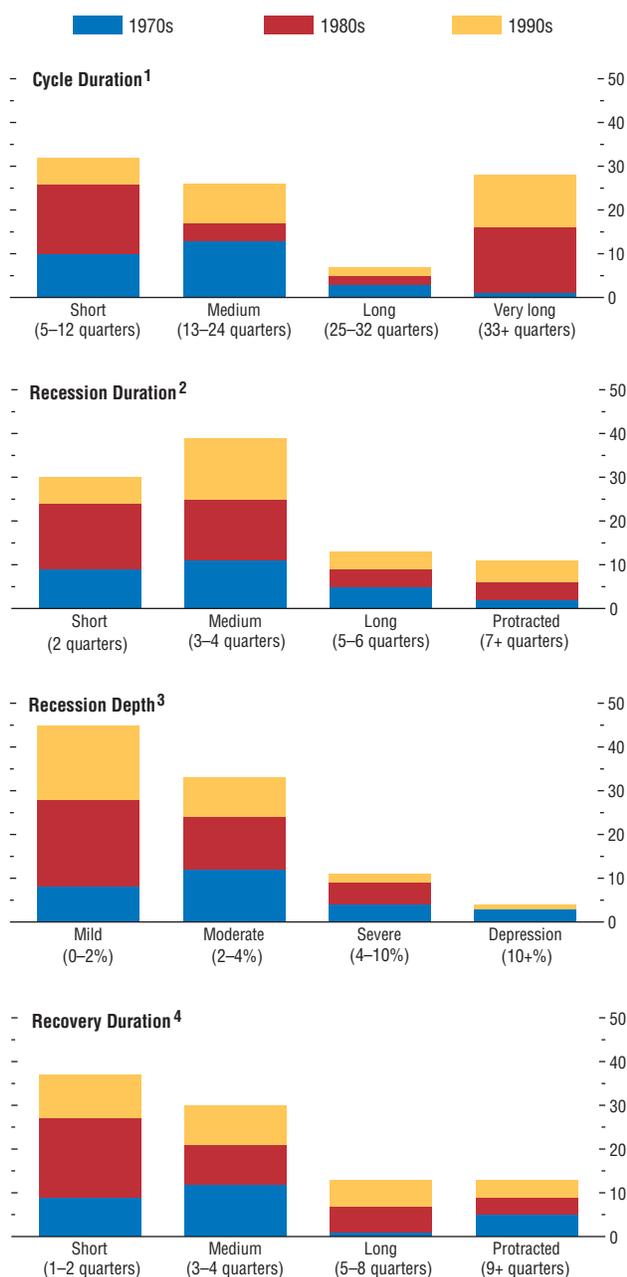


Source: IMF staff estimates.  
<sup>1</sup>Time from peak to trough.  
<sup>2</sup>Output contraction from peak to trough.

<sup>19</sup>For cross-country comparisons of structural policies, see Nicoletti, Scarpetta, and Boylaud (1999) and Edwards and Schanz (2001).

**Figure 3.5. Key Business Cycle Characteristics**  
(Number of observations, 93 total)

Business cycles have become longer and recessions shallower since 1973.



Source: IMF staff estimates.

<sup>1</sup> Cycle duration measured from peak to peak.

<sup>2</sup> Number of quarters from peak to trough (excluding peak quarter).

<sup>3</sup> Output contraction from peak to trough in percent of peak GDP.

<sup>4</sup> Number of quarters from trough for output to reach previous peak level.

put losses in New Zealand in the 1970s. Other deep recessions reflected the combination of oil shocks and especially aggressive disinflationary policy, as in Switzerland during 1974–75 and the United Kingdom during 1979–81.

### Synchronization

Recessions tend to be synchronized, as manifested in their clustering in four periods during 1973–2000 (Figure 3.6). The first wave of recessions came in the mid-1970s, shortly after the first oil shock; the next two waves hit in the early 1980s, at the time of the second oil shock and the tightening of monetary policy in most countries; and the last wave occurred in the early 1990s. In the early 1990s, recessions clustered around two peaks rather than one, reflecting asymmetric shocks across the major currency areas.<sup>20</sup> As a result, business cycle peaks occurred at different times across countries, so that aggregate industrial country output did not go through a recession.

About half of all recessions in the modern period were synchronized, defining a recession in any one country as synchronized if at least one-half of the other countries (appropriately weighted) are in recession also.<sup>21</sup> Using this criterion, synchronized recessions were deeper but not longer than unsynchronized recessions. In particular, recessions that were concurrent with those in the G-7 countries were significantly deeper.

The results from our event-based analysis are consistent with those based on methods that effectively ignore the business cycle (i.e., the distinction between recession and expansion). Empirical studies of pairwise correlations, including Backus, Kehoe, and Kydland (1995) and Baxter (1995), document the high degree of comovement in output across industrial countries

<sup>20</sup>See Chapter II of the October 2001 *World Economic Outlook* and Helbling and Bayoumi (2002) for details.

<sup>21</sup>If the threshold is lowered to one-third, which then includes many recessions in Europe during 1992–93, then about three-fourths of all recessions were synchronized.

in recent decades. Among studies of the common components in macroeconomic fluctuations across countries, Lumsdaine and Prasad (1999) find that fluctuations were strongly and positively correlated with an estimated common component, and that these correlations increased in the post-Bretton Woods period. Kose, Otrok, and Whiteman (2001) also find a significant world component in output fluctuations, which accounted for a substantial fraction of fluctuations in advanced economies but a smaller fraction in developing countries. Helbling and Bayoumi (2002) indicate that, among G-7 countries, the U.S. component led the world factor.

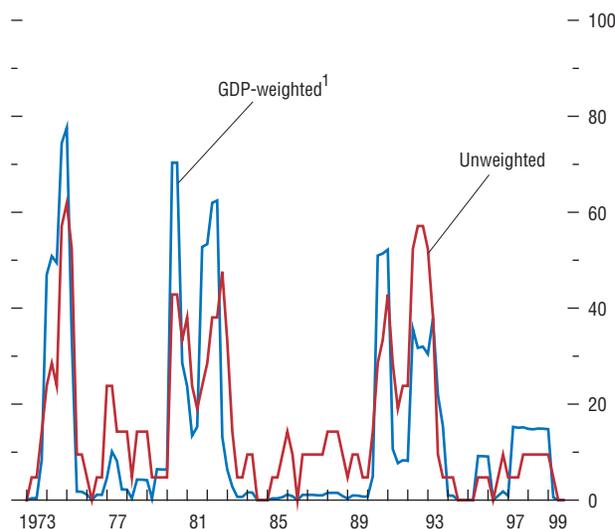
### What Happens to Components of Aggregate Demand?

Virtually all recessions in the modern period were accompanied by contractions in private fixed investment, based on an analysis of turning points in the components of aggregate demand.<sup>22</sup> In these recessions, investment peaked on average almost two quarters earlier than output and rebounded one quarter later, implying that the average duration of an investment contraction exceeded that of GDP (Figure 3.7). The average percentage contraction in private fixed investment was about six times larger than that of real GDP, while cumulative investment growth during the first four quarters after the trough was only about twice as large as that of real GDP. Not surprisingly, the depth of investment contraction and GDP contraction are positively correlated. Compared with aggregate economic activity, there are more cycles in private fixed investment, as minor investment contractions also occur during expansions. The most striking feature about private fixed investment contractions is their strong synchronization across countries, even for minor contractions (Figure 3.8). In periods with synchronized recessions, the number of countries experiencing investment

<sup>22</sup>In turn, virtually all recessions with no investment contractions were mild.

**Figure 3.6. Synchronization of Recessions**  
(Share of countries in recession, percent)

Recessions tend to be synchronized, as manifested by their clustering in a few peaks.

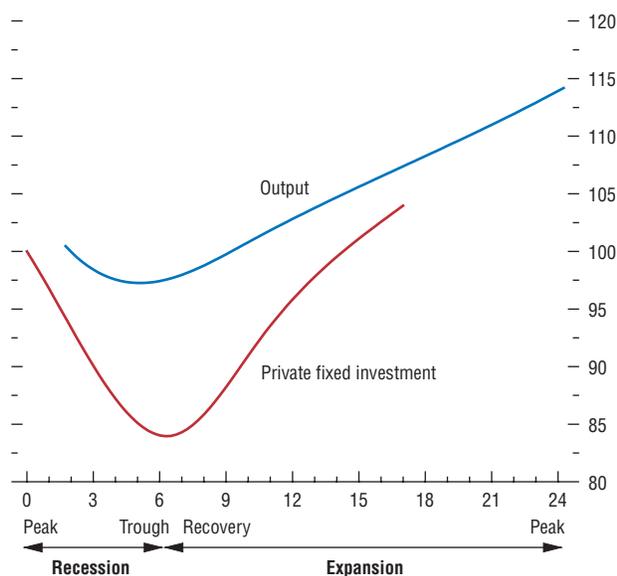


Source: IMF staff estimates.

<sup>1</sup> Countries are weighted by GDP at purchasing-power-parity exchange rates.

**Figure 3.7. Cyclical Paths of Output and Investment<sup>1</sup>**  
*(Initial peak = 100; x-axis in quarters)*

Contractions in private fixed investment begin earlier, last longer, and are deeper than output contractions.



Source: IMF staff estimates.

<sup>1</sup>Stylistic representation of a business and an investment cycle, based on averages in the sample. The figure shows the average of investment cycles that coincide with output cycles. See text for details.

contractions exceeds that of those going through a recession, suggesting that global investment busts may be stronger than other linkages during downturns.

Cyclical peaks in private consumption, as well as the average duration and average depth of contractions, coincided more closely with those in output. However, consumption contracted in only about half of all recessions, mostly during moderate and more severe recessions. As a result, consumption contractions were less synchronized across countries than either fixed investment or output. This difference in the degree of synchronization between consumption and fixed investment matches the results of Kose, Otrok, and Whiteman (2001), who find that country-specific and idiosyncratic factors played a more important role in explaining consumption fluctuations, consistent with imperfect consumption risk-sharing across countries.

Shifting from the turning points in the components of aggregate demand to their contributions to growth, we find that—during a typical recession—declines in inventory changes and private fixed investment more than fully accounted for the contraction in output (Figure 3.9).<sup>23</sup> Private consumption contracted somewhat, while government spending and net exports were countercyclical. Short and mild recessions were mostly inventory-driven, with private consumption playing an even smaller role (Table 3.2). In unsynchronized recessions, which usually occurred in small, open economies, net exports tended to be procyclical, reflecting the greater vulnerability of such economies to adverse external shocks. Procyclical net exports were also an important factor in the severe recessions in emerging market countries associated with capital account crises (Box 3.5).

Over time, inventories have been contributing less to recessions, while fixed investment and

<sup>23</sup>In countries where GDP data are chain-weighted, contributions to growth are based on the cumulative sums of quarterly contributions that are corrected for changes in relative prices.

consumption have contributed more. The decline in the contribution of inventory changes from the 1970s and 1980s to the 1990s is consistent with the idea that improved inventory management, partly reflecting the increased use of information technology, has reduced the variability of inventories.<sup>24</sup> The increase in the contribution of fixed investment reflects the exceptionally large investment contractions after banking crises (Finland, Sweden) and the impact of sharp asset price falls (Japan, United Kingdom) in the 1990s.<sup>25</sup> The increase in the contribution of private consumption is consistent with the combination in the 1990s of especially large falls in asset prices and larger wealth effects (as discussed in Chapter II).

During a typical recovery, private consumption was the single largest contributor to the growth in output (Table 3.3).<sup>26</sup> Private consumption was the most important contributor to growth during the recovery, even if it did not contract during the recession. The smaller contribution of fixed investment to the recovery is consistent with the longer duration of investment contractions discussed above. As in the case of recessions, inventories contributed less to recoveries in the 1990s than in the 1970s, while private fixed investment contributed more.

While the contributions to growth of consumption and fixed investment are asymmetric between recessions and recoveries, the *changes* in their contributions to growth during the *transition* from recessions to recoveries are more symmetric. For fixed investment, a large rate of decline during the recession switches to a small

<sup>24</sup>See Box 3.4 in Chapter 3 of the October 2001 *World Economic Outlook*. The declining role of inventories may also reflect the increasing share of services in the economy, which reduces the ratio of inventories to output.

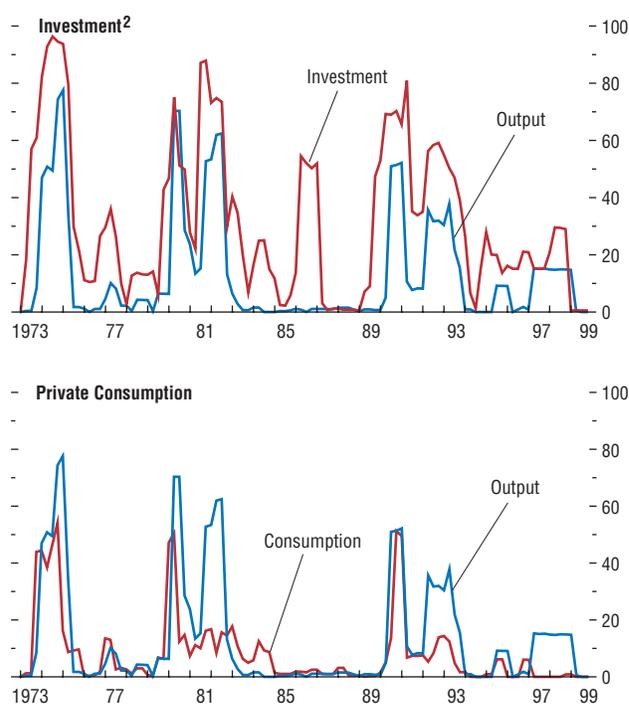
<sup>25</sup>Contractions in private fixed investment actually became somewhat milder in the 1990s, but by less than the corresponding moderation of output contractions.

<sup>26</sup>Surprisingly, net exports also contribute more than 10 percent to the recovery, although this appears to reflect the relatively large number of recoveries in smaller industrial economies after nonsynchronized recessions in the sample. If demand contributions are weighted by country size, the average contribution of net exports is zero.

**Figure 3.8. Synchronization of Contractions in Output, Investment, and Consumption**

(Share of countries experiencing contractions, percent)<sup>1</sup>

Contractions in investment are more synchronized than those in output or private consumption.



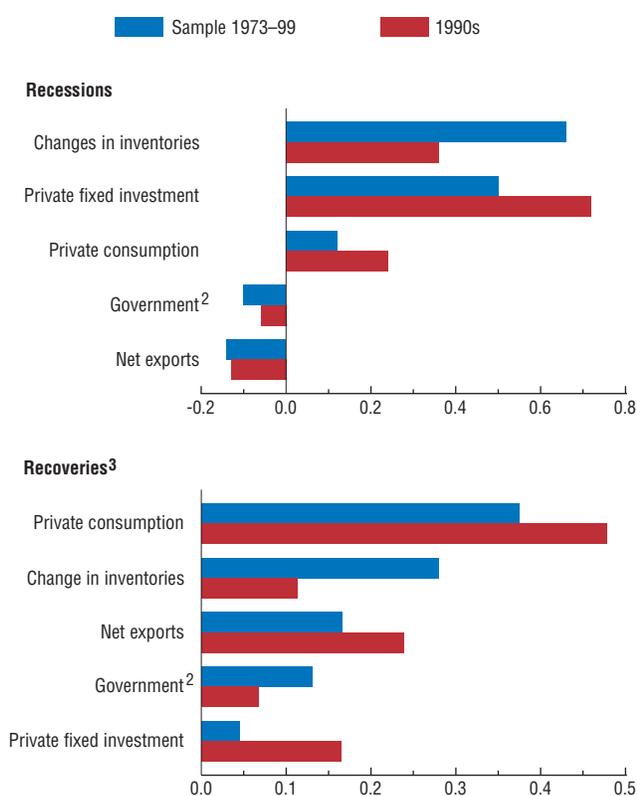
Source: IMF staff estimates.

<sup>1</sup>Countries are weighted by GDP at purchasing-power-parity exchange rates.

<sup>2</sup>Private gross fixed capital formation.

**Figure 3.9. Contributions to Growth**  
(Ratio of change in component to change in output)<sup>1</sup>

Declines in inventories and private fixed investment largely account for output declines during recessions, while increases in private consumption are the most important driving force during recoveries.



Source: IMF staff estimates.

<sup>1</sup>Unweighted average.

<sup>2</sup>Includes government fixed capital formation and government final consumption.

<sup>3</sup>Cumulative change during first four quarters after the trough.

growth rate during the recovery. For private consumption, a small rate of decline changes to a substantial rate of growth. The differences in the (weighted) rates of change for the two components are rather similar, indicating that both of them are important for the turnaround in output growth from recession to recovery. Similarly, the changes in the contributions of consumption and fixed investment to growth during the transition from expansion to recession are symmetric. The growth of fixed investment changes from slightly positive to strongly negative, while the growth of consumption changes from strongly positive to slightly negative.

The results from our event-based analysis are consistent with those in the broader literature. There is widespread agreement that investment spending is more volatile than output and highly procyclical.<sup>27</sup> Backus and Kehoe (1992), using more than a century of data on 10 industrial countries, show that investment was consistently two to four times as variable as output, while consumption was about as variable. They also show that both investment and consumption were strongly procyclical, while the trade balance was generally countercyclical, exhibiting larger deficits during booms than recessions.<sup>28</sup> Similar results are obtained by Basu and Taylor (1999) on the basis of a somewhat broader sample of countries and longer time period. They also find that investment was more highly correlated with output than consumption during the post-Bretton Woods period, but not in earlier eras.

<sup>27</sup>Using the bandpass filter to remove the high- and low-frequency components of U.S. macroeconomic time series and focusing on business cycle frequencies only, Stock and Watson (1999) have found that consumption, inventory investment, fixed investment, and imports have significant, positive contemporaneous correlations with output (i.e. they are strongly procyclical). As exports do not vary strongly with output, the trade balance is countercyclical. For other studies, see Gordon (1986), Fuhrer and Schuh (1998), or Diebold and Rudebusch (1999).

<sup>28</sup>Similarly, Prasad and Gable (1998) find little evidence that variations in the trade balance have contributed significantly to cyclical recoveries in industrial countries since the 1970s.

**Table 3.2. Relative Contributions to Recessions**

	Full Sample	Decade			Type of Recession			G-7 Countries
		1970s	1980s	1990s	Mild	Severe	Short	
<i>Ratio of peak-to-trough change in component to peak-to-trough change in GDP; percent</i>								
Change in inventories	66	78	77	36	122	56	107	52
Private investment	50	47	36	72	41	47	-4	67
Private consumption	12	2	14	24	-14	16	8	22
Net exports	-21	-16	-21	-30	-29	-5	-4	-27
Government <sup>1</sup>	-10	-13	-9	-6	-22	-17	-12	-5
<i>Peak-to-trough change; percent of peak</i>								
<i>Memorandum</i>								
GDP	-2.7	-3.8	-2.1	-2.2	-1.0	-7.1	-1.8	-2.4

Source: IMF staff calculations.

<sup>1</sup>Includes government final consumption and fixed investment.

**Table 3.3. Relative Contributions to Recoveries**

	Full Sample	Decade			Type of Previous Recession			G-7 Countries
		1970s	1980s	1990s	Mild	Severe	Short	
<i>Ratio of change in component to change in GDP during first four quarters after trough</i>								
Change in inventories	25	38	25	-6	20	50	30	21
Private investment	5	6	9	—	—	—	10	18
Private consumption	45	44	38	63	50	30	40	52
Net exports	6	-2	11	18	30	10	10	-1
Government <sup>1</sup>	19	14	17	32	10	10	10	10
<i>Change during first four quarters after trough; percent of trough</i>								
<i>Memorandum</i>								
GDP	3.5	5.6	3.0	2.2	2.7	6.2	4.0	3.4

Source: IMF staff calculations.

<sup>1</sup>Includes government final consumption and fixed investment.

### Cycles in Asset Prices and Monetary Policy

The behavior of asset prices is closely related to that of aggregate economic activity.<sup>29</sup> Expectations of future changes in macroeconomic conditions can have important effects on current asset prices, so changes in asset prices usually lead economic activity. To examine the behavior of stock prices over the business cycle,

we identified turning points in real stock price indices using the same methodology as for aggregate economic activity.<sup>30</sup>

Virtually all recessions were preceded by sharp contractions in stock prices.<sup>31</sup> On average between 1973 and 2000, stock price contractions were about 40 percent deep and lasted about nine quarters, much longer than the average re-

<sup>29</sup>For a review of the transmission mechanisms through which asset price and monetary policy shocks affect output, and vice versa, see Chapter III, "Asset Prices and the Business Cycle," in the May 2000 *World Economic Outlook*.

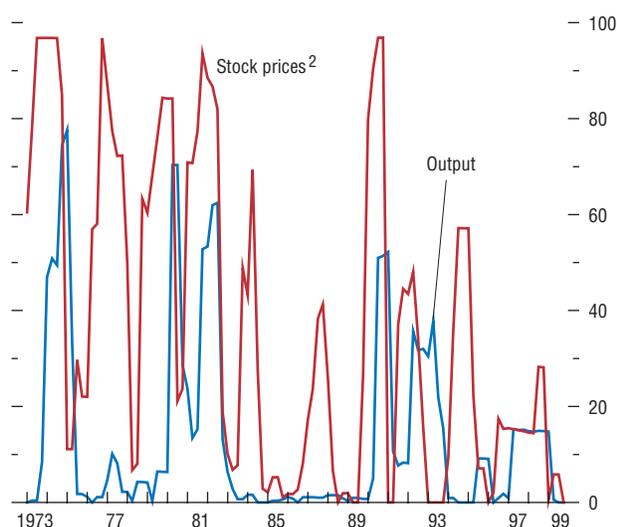
<sup>30</sup>Consistent data going back to 1970 were available for 15 countries. These countries account for 65 of the 93 recessions in the full sample.

<sup>31</sup>Typically, cycles in real stock price have been shorter, so that there were periods of prolonged stock price contractions during expansions in output. As noted by Samuelson (1966): "The stock market has predicted nine out of the last five recessions." To focus on stock price behavior during recessions and recoveries, turning points in real stock prices that were close enough to those in aggregate economic activity to be considered related were selected. To be considered "close," periods of contractions in real stock prices and aggregate economic activity had to be at least adjacent, that is, the trough quarter in stock prices had to be the same as the peak quarter in activity. If contractions in real stock prices with troughs up to 4 quarters prior to the peak in activity were considered, 58 out of the 65 recessions would have been accompanied by contractions and recoveries in real stock prices.

**Figure 3.10. Synchronization of Contractions in Output and Stock Prices**

(Share of countries experiencing contractions, percent)<sup>1</sup>

Stock price contractions are highly synchronized, reflecting global asset market linkages.



Source: IMF staff estimates.

<sup>1</sup>Countries are weighted by GDP at purchasing-power-parity exchange rates.

<sup>2</sup>Stock prices deflated by consumer prices.

**Table 3.4. Real Stock Price Contractions and Recoveries in Industrial Countries<sup>1</sup>**

(Percent)

	Sample	1970s	1980s	1990s
<b>Contractions</b>				
Average	-39.2	-56.1	-35.5	-25.4
Standard deviation	20.9	17.5	20.0	11.6
Median	-34.1	-54.0	-31.7	-27.1
<b>Recoveries<sup>2</sup></b>				
Average	28.6	22.8	31.7	31.2
Standard deviation	21.0	23.5	21.9	16.8
Median	25.1	19.7	27.4	31.9
<b>Memorandum</b>				
<b>Contractions in G-7 countries</b>				
Average	-36.4	-59.6	-30.2	-25.0
Standard deviation	20.1	14.0	14.3	15.2
Median	-37.7	-59.7	-31.7	-18.7
<b>Recoveries in G-7 countries<sup>2</sup></b>				
Average	26.5	33.3	28.5	31.6
Standard deviation	22.0	33.6	17.1	18.6
Median	30.5	23.2	34.4	32.1

Source: Morgan Stanley Capital International (MSCI); IMF, *International Financial Statistics*; and IMF staff calculations.

<sup>1</sup>Real stock price indices were computed using MSCI indices and consumer prices for Australia, Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, the United Kingdom, and the United States. For details on selection of peaks and troughs in real stock prices, see text.

<sup>2</sup>Cumulative growth in real stock prices in the first four quarters after trough.

cession (Table 3.4). The magnitudes of the stock price contractions were related to the depths of the associated recessions. Since stock prices peaked about five quarters before economic activity, the trough in stock prices usually coincided with the trough in activity.<sup>32</sup> Stock prices did not recover to their previous peaks within two years after the trough. However, in the 1990s, stock price contractions were shallower and stock prices regained their previous peaks within four quarters. Stock price contractions were highly synchronized across countries, as was the case with fixed investment (Figure 3.10). During periods of synchronized recessions, the number of countries experiencing stock price contractions exceeded the number of countries going through a recession, underlining the strength of global asset market linkages.

<sup>32</sup>Stock and Watson (1999) have found that in the case of the United States, stock prices are moderately procyclical and lead output.

### Box 3.4. Economic Fluctuations in Developing Countries

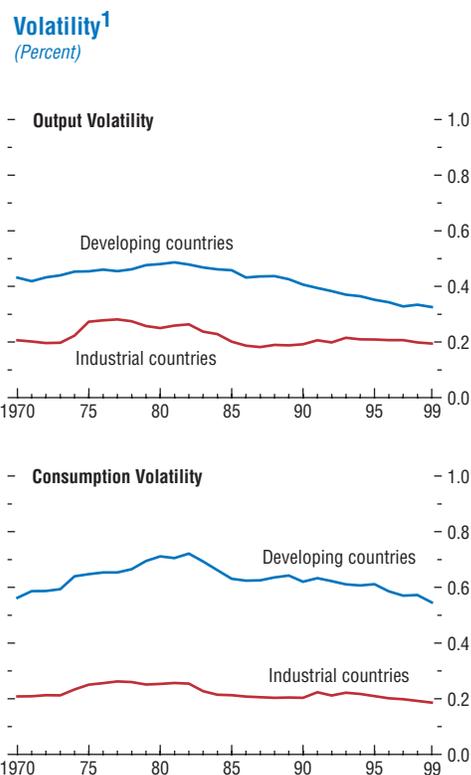
Economic fluctuations in developing countries are more severe and have more serious consequences than those in industrial countries. As shown in the figure, the volatility of real GDP growth in developing countries is higher than that in industrial countries, and the volatility of consumption growth is much higher. Consumption in developing countries fluctuates much more than output, while consumption in industrial countries fluctuates about the same as output, indicating that households in industrial countries can maintain consumption levels even in bad times by running down assets accumulated in good times.<sup>1</sup> The harmful effects of output volatility on growth are well documented (Ramey and Ramey, 1995). A recent study finds that the welfare cost of consumption volatility in a typical developing country is much higher than that in the United States (Pallage and Robe, 2001).

Several factors account for the higher volatility in developing countries. First, emerging market countries are more vulnerable to commodity price shocks, both because many of them remain highly specialized in commodity exports and because many are more dependent on commodity imports, especially oil. As a result, the fluctuations in the terms of trade (the ratio of export prices to import prices) are larger in emerging market countries than in industrial countries and have remained high (Cashin and McDermott, 2002). In part, this reflects the high degree of competition among suppliers of commodities, who respond aggressively to changes in prices, thus generating large fluctuations.

Second, financial systems in emerging market countries are generally less developed than those in industrial countries. Financial systems can help smooth economic fluctuations by facilitating diversification and by making it easier to lend and borrow. However, sometimes financial

The main author is Ashoka Mody.

<sup>1</sup>Blanchard and Simon (2001) show that in industrial countries except Japan volatility has declined steadily, but De Ferranti and others (2000) find that the experience in developing countries is more mixed.



Source: Kose, Prasad, and Terrones (2002).

<sup>1</sup>Averages of standard deviations of growth rates of output and consumption across 21 industrial and 56 developing countries calculated over rolling 10-year windows using data for 1960–99.

systems are large because they are engaged in unproductive activities, resulting in so-called “lending booms,” which tend to increase volatility (Eichengreen and Mody, 2000). Others have argued that volatile external capital flows can amplify the fragility of domestic financial systems (Caballero, 2000). Greater transparency and opportunities for diversification are therefore key to achieving the financial system’s stabilizing function.

Third, developing countries face higher asset price fluctuations (Du and Wei, 2002) and their consequences are more severe. In industrial countries, exchange rates remain highly variable, though their effects do not appear to feed into

**Box 3.4 (concluded)**

consumption volatility (Rogoff, 2001). While stock price volatility feeds into consumption volatility through wealth effects, households in industrial countries have a wider scope for financial diversification than those in emerging market countries. For example, in the United States, an increasing share of equity market volatility is due to movements in the stock prices of individual companies, implying that—for the most part—individuals can diversify across relatively uncorrelated risks (Campbell and others, 2001). By contrast, in many emerging market countries, a very large fraction of stock market movement reflects overall market risk rather than individual company risk (Morck, Yeung, and Yu, 2000), implying less opportunity to diversify.

Finally, macroeconomic policies in emerging market countries may also help to explain some of the higher volatility of macroeconomic outcomes. In industrial countries, central banks have helped to create a more predictable macro-

economic environment and reduce output volatility by bringing inflation under control (see the essay on low inflation in Chapter II). By contrast, macroeconomic policies in many developing countries are often procyclical—that is, they tend to amplify macroeconomic disturbances (see the essay on Latin America in Chapter II). While this difference is important, it should be recognized that the policymaking environment in developing countries is typically more volatile than that in industrial countries, partly reflecting larger external shocks, such as commodity price shocks. Moreover, policymaking in developing countries occurs in an environment of weak institutions of conflict management, which are a source of volatility and which limit the ability to deal with the adverse consequences of macroeconomic fluctuations (Rodrik, 1999). As such, stronger institutions are necessary not just for growth, but also for dampening fluctuations.

Deliberate monetary tightening in major industrial countries is widely regarded as among the factors behind the recessions.<sup>33</sup> In the modern period, monetary tightening generally followed the acceleration in inflation that began in the late 1960s and was exacerbated by the collapse of the Bretton Woods system of pegged exchange rates and the oil price shocks. Attempts to fight inflation began in the early 1970s but weakened during the course of the 1973–75 recessions. Sustained efforts to implement disinflationary monetary policies in most countries be-

gan only in 1979 and continued through the early to mid-1980s. Another episode of widespread monetary tightening began in 1988–89, when major central banks started to reverse the large liquidity injections that followed the 1987 stock market crash.

While a rigorous assessment of the relationship between monetary policy and output is beyond the scope of this chapter, the focus here is on whether turning points in monetary policy were consistent with the idea that monetary policy had an impact on output.<sup>34</sup> In general, mon-

<sup>33</sup>A forceful expression of the role of monetary policy is due to Dornbusch (1997): “None of the U.S. expansions of the past 40 years died in bed of old age; every one was murdered by the Federal Reserve.” Other important factors include oil and technology shocks; there is much less of a consensus on the role of fiscal policy in precipitating or mitigating the severity of recessions. Cochrane (1994) has concluded: “None of the popular candidates for observable shocks robustly accounts for the bulk of business-cycle fluctuations in output.”

<sup>34</sup>The magnitude of the impact of monetary policy on output remains subject to considerable debate, as the results vary with the specification and identification of monetary policy shocks, as well as the estimation techniques used to remove the biases arising from the simultaneity between monetary policy and output. Romer and Romer (1989) argue that, in the United States, output fell substantially in every episode in which the Federal Reserve deliberately attempted to induce a recession to reduce inflation. By contrast, in a survey of the empirical literature, Christiano, Eichenbaum, and Evans (1999) argue that unanticipated changes in monetary policy in general have smaller output effects and account for only about 20 percent of the variation in output.

etary policy might be expected to tighten during the late stage of an expansion, and to loosen during a recession, reflecting the central bank's objectives of stabilizing inflation and output. As a result, turning points in the monetary policy stance might be expected to either lead or be coincident with those in output. The relationship between cycles in monetary policy and output were examined using nominal and real short-term interest rates as indicators of the monetary policy stance.<sup>35</sup>

The expected pattern of turning points in interest rates and output was more evident in larger than in smaller economies, and in synchronized than in unsynchronized recessions. In the full sample, interest rates peaked just before recessions about one-third of the time and during recessions about another one-third of the time, while in G-7 countries interest rates peaked prior to or during all recessions.<sup>36</sup> The weaker results for smaller countries could reflect the greater prominence of exchange rate considerations in these countries. In other words, interest rate changes may have been constrained by explicit or implicit exchange rate targets, which on occasion may have called for procyclical interest rates before and during recessions.

The cyclical behavior of monetary policy was also more evident in synchronized recessions than in unsynchronized ones, suggesting that many central banks pursued disinflationary policies at the same time. This also indicates that factors other than monetary policy cycles are more important in unsynchronized recessions (mostly in smaller countries), consistent with the earlier finding that these recessions were often accompanied by contractions in net exports. In these cases, accelerating inflation may either be absent, so that there would be no reason for a monetary policy tightening prior to a recession, or may be among the reasons for exchange rate

**Table 3.5. Changes in Short-Term Interest Rates<sup>1</sup>**  
(Percentage points)

	Sample	1970s	1980s	1990s
<b>All countries</b>				
Increases during 4 quarters to peak				
Nominal interest rates				
Average	3.8	5.1	4.0	2.6
Standard deviation	2.7	2.6	3.0	1.6
Real interest rates				
Average	3.8	5.6	3.3	3.2
Standard deviation	3.5	4.9	3.2	2.5
Decreases from peak to trough				
Nominal interest rates				
Average	-6.8	-6.6	-6.7	-7.1
Standard deviation	2.7	2.2	3.0	2.8
Real interest rates				
Average	-6.2	-9.5	-5.2	-4.9
Standard deviation	4.2	6.1	2.5	2.7
<b>G-7 countries</b>				
Increases during 4 quarters to peak				
Nominal interest rates				
Average	4.8	6.2	5.5	2.2
Standard deviation	2.8	2.8	2.6	1.4
Real interest rates				
Average	3.3	3.2	4.3	2.1
Standard deviation	3.4	4.7	3.5	1.8
Decreases from peak to trough				
Nominal interest rates				
Average	-7.4	-7.8	-7.0	-7.6
Standard deviation	2.6	1.6	3.8	2.1
Real interest rates				
Average	-6.6	-11.3	-4.8	-4.6
Standard deviation	5.0	7.4	2.0	1.9

Source: IMF staff calculations.

<sup>1</sup>Only recessions during which interest rate behavior was consistent with the monetary policy cycle hypothesis are included. See text for details of the calculations.

overvaluation and falling net exports, so that the recessions could actually be related to the lack of appropriate monetary tightening.

In recession episodes when interest rates peaked before output, the magnitudes of the interest rate increases were related to the depths of recessions (Table 3.5). This suggests that the degree of monetary policy tightening may be one factor behind the magnitude of output contractions. In turn, the degree of monetary tightening was related to both the inflation rate at

<sup>35</sup>As above, the analysis involves a comparison of peaks and troughs in interest rates with peaks and troughs in aggregate economic activity. Interest rate peaks up to six quarters prior to the beginning of a recession were considered consistent with the monetary tightening hypothesis, provided that interest rate troughs occurred during the recessions.

<sup>36</sup>Stock and Watson (1999) have found that nominal interest rates in the United States are procyclical and in fact lead output.

**Box 3.5. Capital Account Crises in Emerging Market Countries**

Capital account crises in emerging market countries—characterized by a sudden cessation or reversal of capital inflows that forces a large and abrupt current account adjustment together with a large depreciation in the exchange rate—have been associated with severe output contractions (Ghosh and others, 2002). As illustrated in the table, the severity of the output collapses in such crises in emerging market countries in the 1990s has varied. On average, the swing in real GDP growth in these crises was almost 10 percentage points, compared with less than 2 percentage points in more typical IMF-supported program countries. Growth in most cases rebounded rapidly in the year following the crisis.

What underlies these steep output declines? From one perspective, they are the counterpart to the massive capital outflows experienced by these countries, which in some cases amounted to as much as 15–20 percent of GDP (at annualized rates). To the extent that these capital outflows could not be met from existing reserves or official support, they required corresponding adjustments of the current account. With only limited scope to increase exports in the short run, this adjustment took place mainly through import compression and a corresponding slump in domestic demand. The figure shows the average behavior of real GDP growth, the current account, and private capital flows during capital account crises.

The output losses in turn reflected a combination of demand- and supply-side factors. On the demand side, the salient event in all these crises was a collapse in private domestic consumption and investment spending. Net exports provided a significant positive contribution, mitigating the downturn—but as noted, this typically reflected a contraction of imports more than a large expansion of exports.<sup>1</sup> The recoveries, in

The main authors are Atish R. Ghosh and Timothy Lane.

<sup>1</sup>The high level of imports prior to the crisis reflected in part the private sector's assessment that the exchange rate policy was unsustainable, causing people to shift their demand for imports from the future to the present, when imports were relatively cheap (Calvo, 1998).

**Real GDP Growth***(Percent)*

Country	Crisis year	Real GDP Growth		
		Previous year	Crisis year	Following year
Argentina	1995	5.8	-2.8	5.5
Brazil	1999	0.2	0.8	4.2
Indonesia	1998	4.5	-13.1	0.8
Korea	1998	5.0	-6.7	10.9
Mexico	1995	4.4	-6.2	5.2
Philippines	1998	5.2	-0.6	3.3
Thailand	1998	-1.4	-10.8	4.2
Turkey	1994	7.7	-4.7	8.1

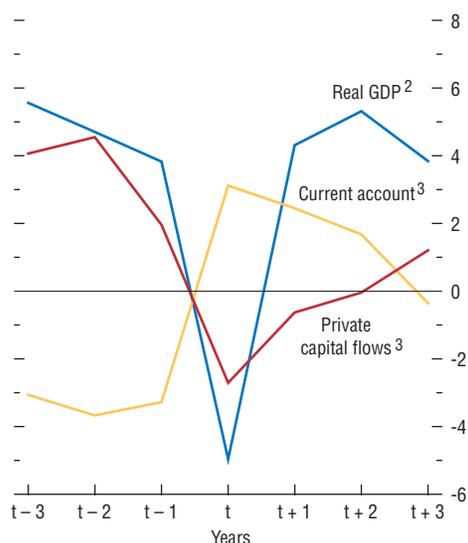
Sources: WEO database; IMF staff estimates.

turn, were driven mainly by a pickup in private consumption and investment, with export expansion playing only a supportive role.

Adverse shocks to aggregate supply also appear to have played a major part in the crises. Although the relative effects of supply and demand shocks are very difficult to disentangle, the behavior of inventories as well as some econometric evidence suggests that the initial sharp decline in output mostly reflected a supply shock. This may in large part have reflected high import content of domestic production and severe balance sheet effects stemming from corporate and financial sector exposures to exchange rate and interest rate changes. The large exchange rate depreciations and temporarily high interest rates forced many firms into bankruptcy and disrupted supply and credit channels. These initial supply shocks were accompanied by negative aggregate demand shocks, because the same balance sheet and credit market effects also dampened investment and consumption spending; such spending was depressed further as the initial output contractions resulted in layoffs and mounting uncertainties.

The pattern of the downturns and recoveries varied considerably across countries. In Brazil, for instance, the downturn was comparatively mild, in large part reflecting low corporate leverage and the fact that the private sector was able to hedge itself against exchange rate move-

### Macroeconomic Indicators During Capital Account Crises<sup>1</sup>



Source: Ghosh and others (2002).

<sup>1</sup>Median values for Argentina (1995), Brazil (1998), Indonesia (1998), Korea (1998), Mexico (1995), the Philippines (1998), Thailand (1998), and Turkey (1994). The year in parentheses refers to year 't' in the chart.

<sup>2</sup>Percent of GDP.

<sup>3</sup>Percent per year.

ments through holdings of dollar- and inflation-indexed public debt. At the other end of the spectrum, Indonesia experienced a relatively severe and protracted downturn: the balance sheet effects of the currency depreciation were massive, owing to the corporate sector's large unhedged foreign currency exposures, and, in the absence of a framework for resolving corporate debt problems, took a long time to resolve. Indonesia's crisis was also compounded by other structural weaknesses and by political turmoil and regional fragmentation.

Macroeconomic policies played a broadly supportive or neutral role in these crises after the initial shocks (Ghosh and others, 2002). Except in Mexico and Turkey, where the fiscal contraction was substantial, fiscal impulses were either positive or modestly negative. The credit crunches that occurred appear to have reflected primarily the withdrawal of foreign financing and the heightened riskiness of lending; the timing and magnitude of changes in monetary aggregates suggest that they were not a major factor accounting for the output declines. Real interest rates typically rose to high levels temporarily, but then came down rapidly as confidence returned, contributing to the recovery.

the interest rate peaks and the increases in inflation prior to that peak. Interestingly, the magnitude of the interest rate declines during recessions remained similar across decades and does not appear related to either peak interest rate levels or recession depth. There is some evidence suggesting that more aggressive easing is associated with higher output growth during the recovery but not with the recovery duration.

### Main Points About Modern Business Cycles

Overall, the analysis of modern business cycles suggests the following main points.

- In line with the broad historical trend, recessions in industrial countries were shallower in

the 1990s than in the 1970s or 1980s. The duration of recoveries was not significantly related to the duration or the severity of the preceding recession. Repeated recessions and deep recessions were unusual, and reflected mostly structural problems.

- As in previous historical episodes, synchronized recessions were fairly common after 1973—most recessions occurred when other countries were in recession too. The downturn of the early 1990s was different because the major advanced economies went into recession at somewhat different times, reflecting asymmetric shocks. Synchronized recessions were on average deeper, though not longer, than unsynchronized ones.

- In contrast to the late nineteenth century, virtually all recessions in recent decades were accompanied by contractions in private fixed investment. The investment contractions were more synchronized across countries than were the recessions, suggesting that investment busts may be stronger than other international linkages during downturns.
- While investment contractions made important contributions to recessions, upturns in consumption tended to drive recoveries. During both recessions and recoveries, the role of inventories has been falling over time, consistent with the idea that inventory management has improved, partly in response to the increased use of information technology.
- Peaks in stock prices preceded peaks in output, usually by about one year, and troughs roughly coincided. In the 1990s, stock prices fell by about 25 percent on average during recessions and usually took less than one year to regain their previous peak. Like investment contractions, stock price declines were more synchronized than recessions, underlining the role of global asset market linkages.
- Peaks in interest rates usually just preceded or just followed peaks in output, especially in larger economies where exchange rate considerations were relatively less important. The interest rate increases prior to the peaks were positively related to inflation, and also to the depths of the subsequent recessions.

### The Current Cycle

The current downturn in industrial countries has so far been fairly typical of other downturns in recent decades. The synchronization of the current recessions is not unusual, though it is greater than in the early 1990s and appears to have caught some policymakers by surprise. In line with the long-term trend toward milder recessions, the output losses in the United States and Germany are proving to be smaller than usual; Italy and Canada appear to be skirting recession; and France and the United Kingdom are likely to avoid output losses altogether.

Historically, the length of mild recessions does not vary much, suggesting that the coming upturns in activity will be about as synchronized as the downturns. The forecast that the initial upturn will be sharper in the United States than in Europe is consistent with the milder downturn in Europe and the fact that—historically—it takes roughly the same amount of time for output to regain its previous peak following mild recessions, regardless of the depth of the downturn.

Japan is rather different. Its recession is deeper than the recent downturns in other major industrial countries, though still only about average compared to recessions in recent decades. Japan provides the only case of deflation in industrial countries since World War II, likely reflecting inadequate aggregate demand rather than exceptional productivity growth. And it is now in its third recession since 1993, which resembles the experience of other countries with deep structural problems that saw sequences of short cycles in recent decades. The combination of deflation and structural problems is a serious concern, underlining the urgency of additional monetary easing and aggressive structural reform.

The main drivers of the current cycle also seem to be fairly typical. Declines in fixed investment and inventories have played the largest roles in the downturns, consistent with industrial country experience after 1973, though in contrast to the more limited role of investment in the late nineteenth century. The expectation that inventories and a moderate pickup in final domestic demand will play the largest roles in the recovery is also in line with previous upturns. Even the continued growth of private consumption—indeed, it appears to be helping some European countries to avoid recession entirely—is consistent with past mild recessions. However, as discussed in Chapter I, the exceptional strength of consumption during the current downturn raises questions about its sustainability, especially in the United States, given the already low personal saving rate and relatively high levels of corporate and household debt.

The behavior of stock prices in the current downturn looks fairly typical compared to recent history, though the extraordinary stock market boom during the previous expansion was not typical. As in the past, stock price declines have been highly synchronized, underlining the importance of global asset market linkages. In the current downturn, stock prices in the United States and Germany peaked about four quarters before output did, compared with an average of five quarters in the 1990s, and stock prices fell by 25–30 percent, like in the 1990s. However, the stock market boom that preceded the current downturn has left stock prices richly valued by historical standards. The best historical parallel for the stock market boom of the late 1990s is probably that of the 1920s, which was associated in part with the introduction of electricity and other new technologies. It is difficult to make inferences about the current cycle, because the recession that followed the 1920s boom—the Great Depression—was exacerbated by serious monetary policy mistakes.

As in previous business cycles, monetary policy in G-7 countries was tightened prior to the recent downturn. Given that inflation was relatively low toward the end of the previous expansion, central banks had to raise interest rates by less than usual, which is one factor behind the relatively mild recessions. Relatively low inflation going into the downturn also allowed central banks—especially in the United States, the United Kingdom, and Canada—to cut interest rates aggressively over the past year, helping to set the stage for recovery.

### Appendix 3.1. Business Cycle Turning Points

This appendix reports the business cycle turning points identified using annual data over 1881–2000 and quarterly data over 1973–2000.

#### Annual Data, 1881–2000

Business cycle turning points were determined using annual real GDP data for 16 industrial

countries. The data sources were Bergman, Bordo, and Jonung (1998) for 1881–1950 and the WEO database, the *International Financial Statistics*, and the Penn World Tables for 1950–2000. The overall period was divided into four subperiods: 1881–1913, 1919–38, 1950–72, and 1973–2000. The years 1914–18 and 1939–49 were excluded because of the two World Wars. Data on GDP were not available for all 16 countries for all years: data for France were not available for 1919–22; data for Germany were not available for 1919–24; and data for Japan began in 1887. A year was designated as a trough (*T*) if growth in the year in question was negative and growth in the following year was positive. Similarly, a year was designated as a peak (*P*) if growth in the year in question was positive and growth in the following year was negative. In cases where a business cycle phase extended beyond the end of a subperiod, the phase was truncated at the end of that subperiod. As a result, troughs did not always follow peaks and vice versa. The turning points in each country were as follows.

Australia: *P*: 1882, *T*: 1883, *P*: 1889, *T*: 1893, *P*: 1898, *T*: 1899, *P*: 1901, *T*: 1902, *P*: 1906, *T*: 1907, *P*: 1910, *T*: 1911, *P*: 1913, *T*: 1919, *P*: 1924, *T*: 1925, *P*: 1926, *T*: 1931, *P*: 1937, *T*: 1938, *P*: 1951, *T*: 1952, *P*: 1960, *T*: 1961, *P*: 1972, *P*: 1981, *T*: 1982, *P*: 1989, *T*: 1990, *P*: 2000.

Canada: *P*: 1882, *T*: 1883, *P*: 1884, *T*: 1885, *P*: 1891, *T*: 1893, *P*: 1895, *T*: 1896, *P*: 1907, *T*: 1908, *P*: 1913, *T*: 1919, *P*: 1920, *T*: 1921, *P*: 1929, *T*: 1933, *P*: 1937, *T*: 1938, *P*: 1953, *T*: 1954, *P*: 1972, *P*: 1981, *T*: 1982, *P*: 1989, *T*: 1991, *P*: 2000.

Denmark: *T*: 1881, *P*: 1883, *T*: 1884, *P*: 1890, *T*: 1891, *P*: 1907, *T*: 1908, *P*: 1911, *T*: 1912, *P*: 1913, *P*: 1920, *T*: 1921, *P*: 1924, *T*: 1925, *P*: 1926, *T*: 1927, *P*: 1930, *T*: 1932, *P*: 1938, *P*: 1950, *T*: 1951, *P*: 1954, *T*: 1955, *P*: 1962, *T*: 1963, *P*: 1972, *P*: 1973, *T*: 1975, *P*: 1979, *T*: 1981, *P*: 1986, *T*: 1987, *P*: 2000.

Finland: *T*: 1881, *P*: 1883, *T*: 1884, *P*: 1890, *T*: 1892, *P*: 1898, *T*: 1899, *P*: 1900, *T*: 1902, *P*: 1907, *T*: 1908, *P*: 1913, *P*: 1920, *T*: 1921, *P*: 1928, *T*:

1931, *P*: 1938, *P*: 1952, *T*: 1953, *P*: 1957, *T*: 1958, *P*: 1972, *P*: 1975, *T*: 1977, *P*: 1989, *T*: 1993, *P*: 2000.

France: *P*: 1884, *T*: 1886, *P*: 1892, *T*: 1893, *P*: 1894, *T*: 1895, *P*: 1898, *T*: 1902, *P*: 1904, *T*: 1905, *P*: 1907, *T*: 1908, *P*: 1912, *T*: 1913, *P*: 1922, *T*: 1923, *P*: 1924, *T*: 1925, *P*: 1932, *T*: 1935, *P*: 1938, *P*: 1972, *P*: 1974, *T*: 1975, *P*: 1992, *T*: 1993, *P*: 2000.

Germany: *P*: 1890, *T*: 1891, *P*: 1900, *T*: 1901, *P*: 1905, *T*: 1906, *P*: 1907, *T*: 1908, *P*: 1913, *P*: 1925, *T*: 1926, *P*: 1928, *T*: 1932, *P*: 1938, *P*: 1966, *T*: 1967, *P*: 1972, *P*: 1973, *T*: 1975, *P*: 1980, *T*: 1982, *P*: 1992, *T*: 1993, *P*: 2000.

Italy: *T*: 1881, *P*: 1882, *T*: 1883, *P*: 1886, *T*: 1888, *P*: 1891, *T*: 1892, *P*: 1893, *T*: 1894, *P*: 1896, *T*: 1897, *P*: 1901, *T*: 1902, *P*: 1903, *T*: 1904, *P*: 1907, *T*: 1908, *P*: 1909, *T*: 1910, *P*: 1913, *P*: 1920, *T*: 1921, *P*: 1925, *T*: 1927, *P*: 1928, *T*: 1933, *P*: 1935, *T*: 1936, *P*: 1938, *P*: 1972, *P*: 1974, *T*: 1975, *P*: 1980, *T*: 1981, *P*: 1992, *T*: 1993, *P*: 2000.

Japan: *T*: 1887, *P*: 1892, *T*: 1893, *P*: 1896, *T*: 1897, *P*: 1902, *T*: 1903, *P*: 1904, *T*: 1905, *P*: 1909, *T*: 1910, *P*: 1913, *P*: 1923, *T*: 1924, *P*: 1930, *T*: 1933, *P*: 1936, *T*: 1937, *P*: 1938, *P*: 1972, *P*: 1973, *T*: 1974, *P*: 1997, *T*: 1999, *P*: 2000.

Netherlands: *P*: 1887, *T*: 1888, *P*: 1889, *T*: 1890, *P*: 1892, *T*: 1894, *P*: 1895, *T*: 1898, *P*: 1899, *T*: 1900, *P*: 1904, *T*: 1905, *P*: 1908, *T*: 1909, *P*: 1911, *T*: 1913, *P*: 1930, *T*: 1934, *P*: 1938, *P*: 1950, *T*: 1952, *P*: 1957, *T*: 1958, *P*: 1972, *P*: 1974, *T*: 1975, *P*: 1980, *T*: 1982, *P*: 2000.

Norway: *P*: 1882, *T*: 1883, *P*: 1902, *T*: 1903, *P*: 1913, *P*: 1920, *T*: 1921, *P*: 1923, *T*: 1924, *P*: 1930, *T*: 1931, *P*: 1938, *P*: 1972, *P*: 1987, *T*: 1988, *P*: 2000.

Portugal: *P*: 1888, *T*: 1890, *P*: 1892, *T*: 1894, *P*: 1896, *T*: 1898, *P*: 1900, *T*: 1901, *P*: 1902, *T*: 1904, *P*: 1910, *T*: 1911, *P*: 1912, *T*: 1913, *P*: 1919, *T*: 1921, *P*: 1923, *T*: 1924, *P*: 1926, *T*: 1927, *P*: 1935, *T*: 1936, *P*: 1938, *P*: 1972, *P*: 1974, *T*: 1975, *P*: 1983, *T*: 1984, *P*: 1992, *T*: 1993, *P*: 2000.

Spain: *P*: 1886, *T*: 1887, *P*: 1888, *T*: 1890, *P*: 1891, *T*: 1892, *P*: 1894, *T*: 1895, *P*: 1896, *T*: 1898,

*P*: 1901, *T*: 1902, *P*: 1904, *T*: 1905, *P*: 1909, *T*: 1910, *P*: 1911, *T*: 1912, *P*: 1913, *P*: 1922, *T*: 1924, *P*: 1927, *T*: 1928, *P*: 1929, *T*: 1931, *P*: 1932, *T*: 1933, *P*: 1934, *T*: 1937, *P*: 1938, *P*: 1952, *T*: 1953, *P*: 1958, *T*: 1959, *P*: 1972, *P*: 1980, *T*: 1981, *P*: 1992, *T*: 1993, *P*: 2000.

Sweden: *P*: 1881, *T*: 1882, *P*: 1885, *T*: 1886, *P*: 1894, *T*: 1895, *P*: 1901, *T*: 1902, *P*: 1907, *T*: 1908, *P*: 1911, *T*: 1912, *P*: 1913, *P*: 1920, *T*: 1922, *P*: 1930, *T*: 1933, *P*: 1938, *P*: 1972, *P*: 1976, *T*: 1977, *P*: 1980, *T*: 1981, *P*: 1990, *T*: 1993, *P*: 2000.

Switzerland: *P*: 1881, *T*: 1882, *P*: 1886, *T*: 1887, *P*: 1888, *T*: 1889, *P*: 1890, *T*: 1891, *P*: 1893, *T*: 1894, *P*: 1900, *T*: 1901, *P*: 1902, *T*: 1903, *P*: 1907, *T*: 1908, *P*: 1912, *T*: 1913, *P*: 1930, *T*: 1932, *P*: 1935, *T*: 1936, *P*: 1938, *P*: 1951, *T*: 1952, *P*: 1957, *T*: 1958, *P*: 1972, *P*: 1974, *T*: 1976, *P*: 1981, *T*: 1982, *P*: 1990, *T*: 1993, *P*: 2000.

United Kingdom: *T*: 1881, *P*: 1891, *T*: 1893, *P*: 1896, *T*: 1897, *P*: 1899, *T*: 1900, *P*: 1901, *T*: 1903, *P*: 1905, *T*: 1907, *P*: 1911, *T*: 1912, *P*: 1913, *P*: 1919, *T*: 1921, *P*: 1925, *T*: 1926, *P*: 1930, *T*: 1931, *P*: 1938, *P*: 1951, *T*: 1952, *P*: 1972, *P*: 1973, *T*: 1975, *P*: 1979, *T*: 1981, *P*: 1990, *T*: 1992, *P*: 2000.

United States: *P*: 1882, *T*: 1885, *P*: 1892, *T*: 1894, *P*: 1895, *T*: 1896, *P*: 1907, *T*: 1908, *P*: 1912, *T*: 1913, *T*: 1921, *P*: 1923, *T*: 1924, *P*: 1926, *T*: 1927, *P*: 1929, *T*: 1933, *P*: 1937, *T*: 1938, *P*: 1953, *T*: 1954, *P*: 1957, *T*: 1958, *P*: 1972, *P*: 1973, *T*: 1975, *P*: 1979, *T*: 1980, *P*: 1981, *T*: 1982, *P*: 1990, *T*: 1991, *P*: 2000.

### Quarterly Data, 1973–2000

Business cycle turning points were determined using quarterly real GDP data for 21 industrial countries. The primary data source was the OECD Analytical Database. In some cases, more up-to-date data were provided by IMF country desks based on official national data sources. Turning points in the log-level of real GDP that were identified using a simplified Bry-Boschan (1971) dating algorithm, which determines peaks (*P*) and troughs (*T*) by first searching the input data for maxima and minima in

five-quarter data windows and then picking pairs of adjacent, locally absolute maxima and minima that meet the rules for the minimal duration of cycles (five quarters) and phases (two quarters). The turning points in each country are as follows:

Australia: *P*: 1973Q4, *T*: 1974Q2, *P*: 1981Q3, *T*: 1983Q2, *P*: 1990Q2, *T*: 1991Q2.

Austria: *P*: 1974Q3, *T*: 1975Q2, *P*: 1980Q1, *T*: 1981Q1, *P*: 1982Q2, *T*: 1982Q4, *P*: 1983Q4, *T*: 1984Q2, *P*: 1992Q2, *T*: 1993Q1, *P*: 1996Q3, *T*: 1997Q1.

Belgium: *P*: 1974Q3, *T*: 1975Q2, *P*: 1976Q4, *T*: 1977Q2, *P*: 1980Q4, *T*: 1981Q3, *P*: 1982Q3, *T*: 1983Q1, *P*: 1992Q2, *T*: 1993Q2.

Canada: *P*: 1980Q1, *T*: 1980Q3, *P*: 1981Q2, *T*: 1982Q4, *P*: 1990Q1, *T*: 1991Q1.

Denmark: *P*: 1973Q3, *T*: 1975Q1, *P*: 1977Q3, *T*: 1978Q1, *P*: 1980Q1, *T*: 1980Q3, *P*: 1987Q2, *T*: 1988Q3, *P*: 1989Q1, *T*: 1989Q3, *P*: 1990Q3, *T*: 1991Q1, *P*: 1991Q3, *T*: 1992Q2, *P*: 1992Q4, *T*: 1993Q2.

Finland: *P*: 1975Q1, *T*: 1975Q4, *P*: 1976Q4, *T*: 1977Q2, *P*: 1980Q3, *T*: 1981Q1, *P*: 1990Q1, *T*: 1993Q1.

France: *P*: 1974Q3, *T*: 1975Q1, *P*: 1980Q1, *T*: 1980Q4, *P*: 1992Q1, *T*: 1993Q3.

Germany: *P*: 1974Q1, *T*: 1975Q2, *P*: 1980Q1, *T*: 1982Q3, *P*: 1992Q1, *T*: 1993Q2, *P*: 1995Q2, *T*: 1996Q1.

Greece: *P*: 1973Q3, *T*: 1974Q2, *P*: 1980Q4, *T*: 1981Q2, *P*: 1982Q3, *T*: 1983Q1, *P*: 1986Q3, *T*: 1987Q2, *P*: 1989Q3, *T*: 1990Q2, *P*: 1992Q1, *T*: 1993Q2.

Ireland: *P*: 1982Q3, *T*: 1983Q2, *P*: 1985Q3, *T*: 1986Q2.

Italy: *P*: 1974Q3, *T*: 1975Q2, *P*: 1977Q1, *T*: 1977Q3, *P*: 1982Q1, *T*: 1982Q3, *P*: 1992Q1, *T*: 1993Q1.

Japan: *P*: 1993Q1, *T*: 1993Q4, *P*: 1997Q1, *T*: 1999Q1.

Netherlands: *P*: 1974Q3, *T*: 1975Q2, *P*: 1980Q1, *T*: 1980Q3, *P*: 1982Q1, *T*: 1982Q4.

New Zealand: *P*: 1974Q3, *T*: 1975Q2, *P*: 1976Q4, *T*: 1979Q2, *P*: 1982Q3, *T*: 1983Q1, *P*: 1985Q1, *T*: 1986Q1, *P*: 1986Q3, *T*: 1989Q3, *P*: 1990Q4, *T*: 1992Q3, *P*: 1997Q3, *T*: 1998Q2.

Norway: *P*: 1978Q2, *T*: 1979Q1, *P*: 1981Q1, *T*: 1982Q2, *P*: 1985Q4, *T*: 1986Q2, *P*: 1987Q4, *T*: 1988Q4, *P*: 1992Q2, *T*: 1993Q1, *P*: 1998Q2, *T*: 1999Q2.

Portugal: *P*: 1974Q1, *T*: 1975Q2, *P*: 1982Q4, *T*: 1984Q2, *P*: 1992Q3, *T*: 1993Q2.

Spain: *P*: 1974Q4, *T*: 1975Q2, *P*: 1978Q2, *T*: 1979Q1, *P*: 1980Q1, *T*: 1981Q1, *P*: 1992Q1, *T*: 1993Q2.

Sweden: *P*: 1976Q2, *T*: 1977Q1, *P*: 1980Q3, *T*: 1981Q2, *P*: 1982Q3, *T*: 1983Q1, *P*: 1990Q2, *T*: 1992Q4.

Switzerland: *P*: 1974Q2, *T*: 1976Q1, *P*: 1976Q4, *T*: 1978Q1, *P*: 1981Q4, *T*: 1982Q4, *P*: 1990Q4, *T*: 1991Q2, *P*: 1992Q1, *T*: 1992Q4, *P*: 1993Q4, *T*: 1994Q2, *P*: 1996Q2, *T*: 1996Q4.

United Kingdom: *P*: 1973Q3, *T*: 1974Q1, *P*: 1974Q3, *T*: 1975Q2, *P*: 1979Q2, *T*: 1981Q1, *P*: 1990Q2, *T*: 1992Q2.

United States: *P*: 1973Q4, *T*: 1975Q1, *P*: 1980Q1, *T*: 1980Q3, *P*: 1981Q3, *T*: 1982Q3, *P*: 1990Q2, *T*: 1991Q1.

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