CHAPTER 5

THE CHANGING DYNAMICS OF THE GLOBAL BUSINESS CYCLE

World growth in recent years has been much more rapid than at any time since the oil price surges of the 1970s. This growth is being shared across countries to an unprecedented degree. Moreover, output volatility in most countries and regions has significantly declined. This chapter analyzes these changes in business cycle characteristics and finds that the increasing stability and the associated increase in the durability of expansions largely reflect sources that are likely to prove persistent. In particular, improvements in the conduct of monetary and fiscal policy, as well as in broader institutional quality, have all reduced output volatility. The prospects for future stability should, however, not be taken for granted. Low average volatility does not mean that the business cycle is dead. The abrupt end to the period of strong and sustained growth in the 1960s and early 1970s provides a useful cautionary lesson about what can happen if policies do not adjust to tackle emerging risks in a timely manner.

From 2004 to the present, the world economy has enjoyed its strongest period of sustained growth since the late 1960s and early 1970s, while inflation has remained at low levels. Not only has recent global growth been high but the expansion has also been broadly shared across countries. The volatility of growth has fallen, which may seem especially surprising because the more volatile emerging market and developing countries account for a rising share of the global economy.

How much of the recent performance of the global economy is a result of good policies, solid institutions, and structural changes, and how much is pure "good luck"? Can policymakers be confident that output volatility will remain low and that the current global expansion will continue for a long time? Or is the recent stability likely to come to an end?

This chapter aims to shed light on these questions in two separate ways. First, it compares the current global growth cycle with earlier periods, including the 1960s—a previous era of strong growth and low volatility. Second, the chapter analyzes the sources of differences, both across countries and over time, in business cycle characteristics such as output volatility and the length of expansions. It follows the recent literature on the "Great Moderation" in the U.S. economy, but extends the analysis to a global context. Further, it focuses on determining to what extent policy actions have helped to bring about an enduring reduction in volatility so as to make expansions more durable.

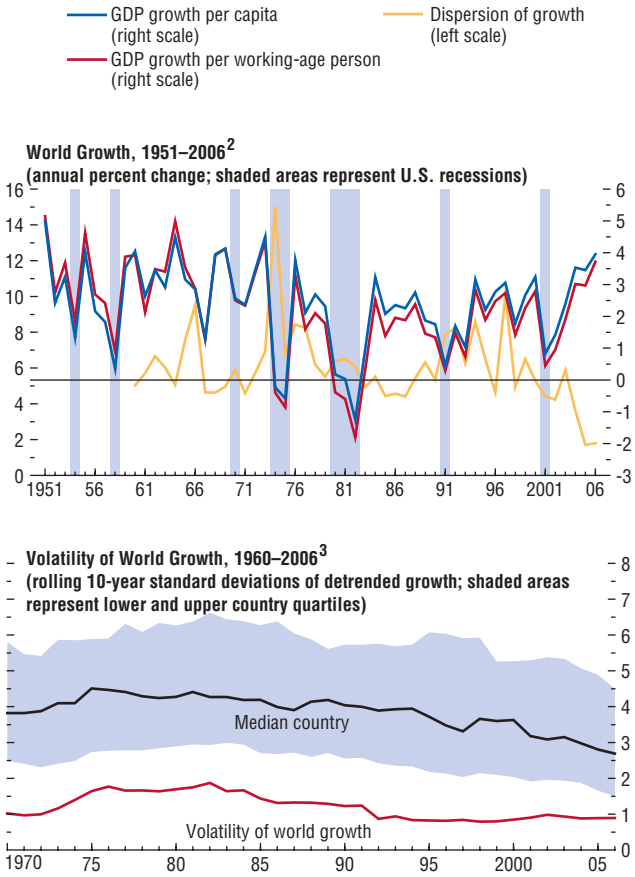
This chapter finds that, in important ways, the global economy has recently displayed greater stability than observed even in the 1960s. In particular, the volatility of output has declined in most countries, and growth is more broadly shared across countries than previously observed. Further, the chapter suggests that the increase in the durability of expansions largely reflects sources that are likely to prove persistent, including improvements in the conduct of monetary and fiscal policy, as well as in broader institutional quality.

The prospects for future stability, however, should not be taken for granted. Low average volatility does not rule out occasional recessions. More broadly, the abrupt end to the period of strong and stable growth in the 1960s and early 1970s provides a cautionary tale of what can happen if policies do not respond to risks and new challenges in the global economic system as they arise. The Bretton Woods system of fixed exchange rate parities worked well for an extended period. In the end, however, it did not prove sufficiently resilient as imbalances from

Note: The main authors of this chapter are Martin Sommer and Nikola Spatafora, with support from Angela Espiritu and Allen Stack. Massimiliano Marcellino provided consultancy support.

Figure 5.1. World Growth Has Been Strong and Stable[1]

World growth is very high compared with the past three decades. However, the strength of the current expansion does not appear unusual compared with the 1950s and 1960s. That said, the low dispersion of detrended growth across countries is unprecedented. World output volatility has been falling since its peak during the 1970s and, for a median country, output volatility is now one-third lower than in the 1960s.



Sources: Heston, Summers, and Aten (2006); Maddison (2007); United Nations, Population Prospects: The 2004 Revision Population database; World Bank, World Development Indicators database (2007); and IMF staff calculations.

[1] See Appendix 5.1 for information on country group composition.

[2] Growth of world real GDP per capita and working-age person aggregated using purchasing-power-parity weights. Dispersion of growth is measured as the standard deviation of detrended GDP growth across countries. Shading represents U.S. recessions identified from annual real GDP per capita series. See Appendix 5.1 for details.

[3] Volatility in 1970 is calculated as the standard deviation of detrended growth over 1961–70, and so on.

expansionary fiscal and monetary policies in the United States led to overheating and eventual inflation—even before the first oil price shock of 1973–74. The 1970s subsequently turned out to be the decade of weakest growth in the post–World War II period.

Global Business Cycles: A Historical Perspective

The global economy is now in its fifth year of strong expansion. As noted above, the world growth rate is very high compared with the past three decades. Compared with earlier post–World War II cycles, however, the strength of the current expansion is not unusual. During the 1960s, world growth (expressed as growth in purchasing power parity (PPP)-weighted GDP per working-age person, to account for demographic shifts) averaged 3.4 percent, slightly above the 3.2 percent outcome over the past three years.[1] That said, one feature of the current expansion is clearly unique, even compared with the 1960s—strong growth is being shared by most countries, as evidenced by the unusually low dispersion of growth (relative to trend) across countries (Figure 5.1). In other words, virtually all countries are doing well.

As with growth rates, the length of the current expansion has not reached historical highs. The present world cycle is only half the length of those in the 1980s and 1990s. Similarly, in the United States, the current cyclical expansion has not matched the long expansions of the previous two decades (Figure 5.2). In the major European economies and Japan, the length of the current expansion stacks up well against those

[1] Expressed in per capita terms, current world growth is actually higher than in the 1960s—over the past three years, average world per capita growth was 3.6 percent, compared with 3.3 percent during the 1960s. The comparison of per capita growth rates between the two periods is influenced, however, by particularly strong population growth in the 1960s and slowing population growth thereafter. Since demographic shifts are typically very slow, the distinction between calculations using per capita and per working-age-person terms is unimportant for the chapter's analysis of business cycle duration and volatility.

of the recent decades, although the expansions were on average much longer in the 1950s and 1960s, supported by high trend growth.[2]

A comparison of business cycles over the past century points to a secular increase in the length of expansions and a decrease in the amount of time economies spend in recessions.[3] In advanced economies, deep recessions have virtually disappeared in the post–World War II period. That said, the 1970s represented a temporary break from the trend of ever-longer expansions in moderately growing advanced economies. In part, this reflected unprecedented oil supply disruptions and the productivity slowdown, but in part also monetary policy mistakes.[4]

[2]In this chapter, expansions are defined as periods of nonnegative growth of real GDP per capita. Analogously, recessions are defined as periods of falling real GDP per capita. Most analysis in this chapter therefore adopts the concept of the "classical" business cycle as discussed in, for example, Artis, Marcellino, and Proietti (2004) and Harding and Pagan (2001)—see Appendix 5.1 for details. Expansions are identified using annual data and in per capita terms to allow for broad comparisons across countries and over time. Expansions based on quarterly data would likely be shorter for many countries. There are also notable differences in cyclical behavior within regions: for example, the United Kingdom has not experienced a recession since 1991 based on this chapter's definition of business cycles.

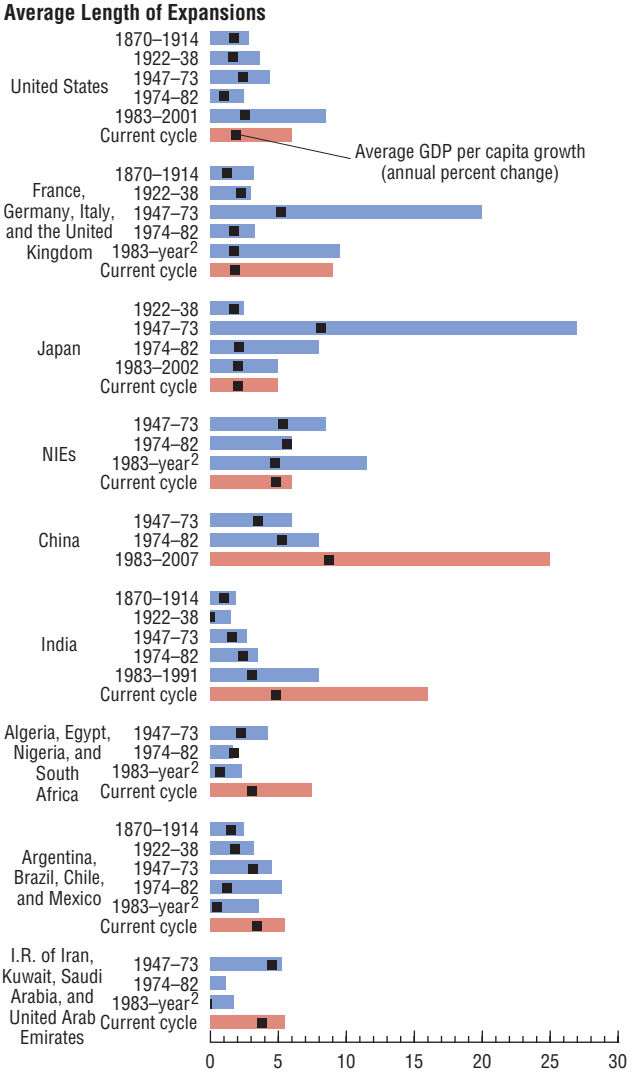
[3]The stabilization of post–World War II business cycles relative to the pre-war period has been attributed to a number of factors, including higher average growth rates; lower share of commodity-linked sectors; introduction of deposit insurance, which reduced the number of banking panics; and the pursuit of macroeconomic stabilization policies—although at times policy mistakes destabilized output (Romer, 1999). In the academic literature, there is a vigorous debate about the quality of pre-war GDP data and the nature of pre-war cycles; see Balke and Gordon (1989); Diebold and Rudebusch (1992); and Romer (1989) for a detailed discussion.

[4]See Romer and Romer (2002) and DeLong (1997) for a discussion of U.S. monetary policy during the 1970s. Broadly, monetary policy was too accommodative during the period, partly reflecting unrealistically low estimates of the natural rate of unemployment. The eventual tightening of monetary policy in response to double-digit inflation caused a recession in the early 1980s. Orphanides (2003b) suggests that incomplete real-time information about the economy may have increased the likelihood of policy mistakes in the 1970s, especially in the period of difficult-to-observe productivity slowdown.

Figure 5.2. Expansions in Historical Perspective[1]

(Years; current cycle includes expected outcome for 2007)

As in the case of growth, the length of the current expansion has generally not yet reached historical highs. In China and India, long expansions driven by rapid growth are comparable with the post–World War II experience of some European economies, Japan, and the newly industrialized Asian economies (NIEs). In the key economies of Africa, Latin America, and the Middle East, performance was mixed during the 1980s and 1990s, but the current expansions of these economies are the longest in three decades.



Sources: Heston, Summers, and Aten (2006); Maddison (2007); World Bank, World Development Indicators database (2007); and IMF staff estimates.

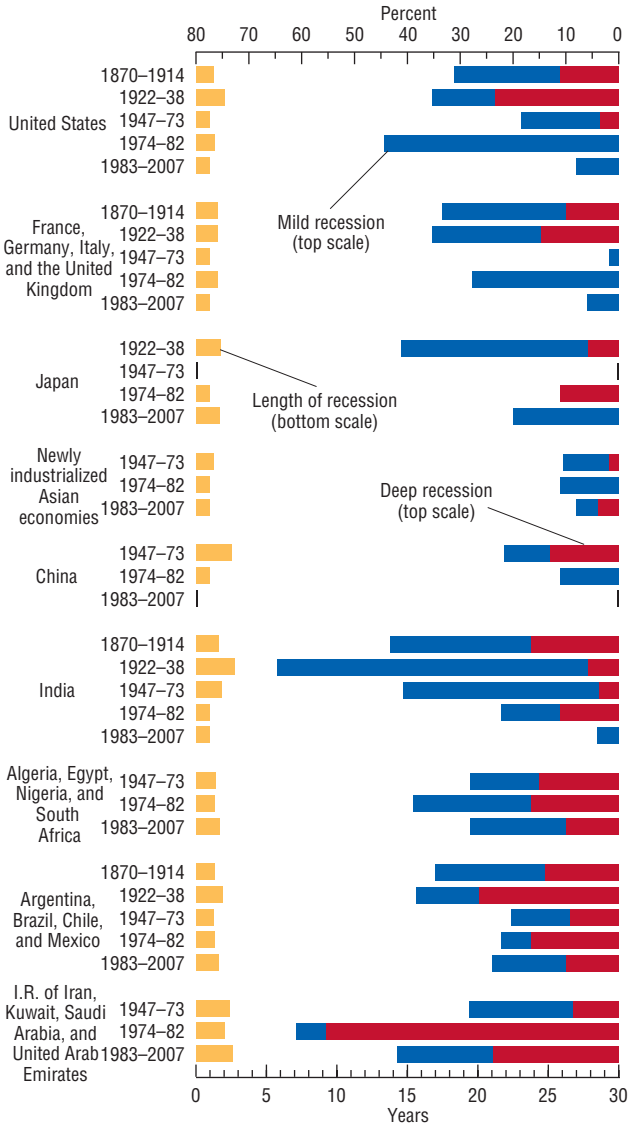
[1]Expansions are defined as periods with nonnegative annual real GDP per capita growth. See Appendix 5.1 for details. Data for country groups refer to group medians. The current cycle includes the expected outcome for 2007.

[2]The period starting in 1983 ends as follows: Europe: France (1993), Germany (2003), Italy (2005), and the United Kingdom (1991); NIEs: Hong Kong SAR (2001), Korea (1998), Singapore (2003), and Taiwan Province of China (2001); Africa: Algeria (2002), Egypt (1997), Nigeria (2004), and South Africa (1992); Latin America: Argentina, Brazil, Mexico (2002), and Chile (1999); and Middle East: I.R. of Iran (2001), Kuwait (2002), Saudi Arabia (2002), and the United Arab Emirates (1998).

Figure 5.3. Recessions in Historical Perspective[1]

In advanced economies, deep recessions have almost disappeared in the post–World War II period, although advanced economies spent a considerable amount of time in recessions during 1974–82 owing to supply shocks, productivity slowdowns, and policy swings. In moderately growing emerging market and developing countries, the frequency of recessions has been significantly higher than in the advanced economies, despite some improvements over the past couple of decades.

Average Length and Share of Time Spent in Recessions



Sources: Heston, Summers, and Aten (2006); Maddison (2007); World Bank, World Development Indicators database (2007); and IMF staff estimates.

[1]Recessions are defined as periods with negative annual real GDP per capita growth. See Appendix 5.1 for details. Deep recessions are defined as recessions with a cumulative output loss greater than 3 percent. Data for country groups refer to group medians.

In emerging market and developing countries, the long-term trend toward improved business cycle dynamics has been more mixed. In Asia, the current long expansions in China and India are strikingly similar to the sustained post-war expansions in western Europe, Japan, and the newly industrialized Asian economies (NIEs). By contrast, the four largest Latin American economies have not seen an increase in the durability of expansions since the 1970s, owing to recurrent fiscal and currency crises. Likewise, the share of time these economies have spent in recessions has not declined (Figure 5.3). Average improvements among the four largest African and Middle Eastern economies have until recently been fairly modest. On the upside, the current expansions in developing regions are the longest in three decades.

At the country level, past expansions have ended for a variety of reasons, including unsustainable fiscal or external imbalances, monetary policy tightening in the face of rising inflation, cross-country spillovers, commodity and asset price swings, and associated financial squeezes.[5] Many of the same factors also tended to slow down world growth, especially when causing a recession in the United States or reducing growth in a broad group of countries. It is important to recognize that some of the factors triggering recessions were at times considered "new." For instance, the currency crises in some Asian economies (for example, in Indonesia and Korea in 1997) were linked to financial and external vulnerabilities that were not well identified beforehand and whose importance was not well understood.[6] Clearly, the task of maintaining expansions requires policymakers to adapt because the process of trade and financial globalization may have generated new risks and

[5]See Chapter 3 in the April 2002 *World Economic Outlook;* Dell'Ariccia, Detragiache, and Rajan (2005); and Fuhrer and Schuh (1998).

[6]Policymakers later responded to these crises through major improvements in financial sector surveillance, including through the IMF–World Bank Financial Sector Assessment Programs. See Ito (2007) for a discussion of the Asian currency crisis.

vulnerabilities—for example, the losses associated with highly leveraged investments in the U.S. subprime mortgage market have created distress in the banking sector in many advanced economies, raising concerns about a possible credit crunch (see Chapter 1). Looking beyond the most recent market developments, the policy debate has also focused on the potential risks arising from global imbalances or the linkages between monetary and prudential policies and sustained asset price booms. For example, White (2006) suggests that successful inflation targeting may have led to increased vulnerability of economies to an excessive buildup of asset prices.

Has the World Economy Become More Stable?

One important business cycle characteristic is output volatility. Together with the trend growth rate, volatility determines the amount of time that economies spend in expansions or recessions. The volatility of global growth, as measured by the rolling 10-year standard deviation of world GDP growth (PPP weighted), has fallen progressively since its 1970s peak.[7] The standard deviation of world output growth over the past 10 years has been 0.9 percent, which is only slightly lower than during the 1960s—another period of strong and sustained growth. This outcome at the aggregate level, however, masks a more substantial, one-third reduction in volatility at the country level between the 1960s and the present—the standard deviation of median country growth declined from 3.8 percent to 2.7 percent (see Figure 5.1). The different degrees of volatility moderation at the world and country levels arise because growth outcomes were less correlated across countries in the 1960s owing to more limited trade and financial linkages. Output fluctuations of individual countries therefore tended to offset one another to a greater degree during the 1960s.[8]

The evolution of output volatility over time can be broken down into several phases. In advanced economies, volatility was high in the 1950s, partly as a result of the boom-and-bust cycle associated with the Korean War and the rapid, but volatile, post-war reconstruction phase in Europe and Japan (Figure 5.4; output volatility during the 1950s is captured by the data point for 1960). Volatility declined during the 1960s, but it rose again in the 1970s as a result of oil supply disruptions and stop-go macroeconomic policies. After the disinflation of the early 1980s, volatility in advanced economies began to fall in a sustained way and is currently only about one-half of that seen during the 1960s.

Volatility has also fallen over time in emerging market and developing countries, although this decline occurred much later than in advanced economies. Looking at the performance of developing regions by decades, output volatility varied greatly during the 1960s,[9] with some countries, such as those in Latin America, experiencing a relatively stable period, while others, notably China, experienced high volatility.[10] Oil shocks, increases in other commodity prices, and spillovers from advanced economies increased output volatility in most emerging market and developing countries during the 1970s. Unlike in the advanced economies, however, volatility stayed high or increased further during the 1980s and much of the 1990s as

[7]The 10-year window was chosen because the length of a typical cycle in advanced economies increased to about 10 years during the 1980s and 1990s.

[8]See Box 4.3 in the April 2007 *World Economic Outlook*.

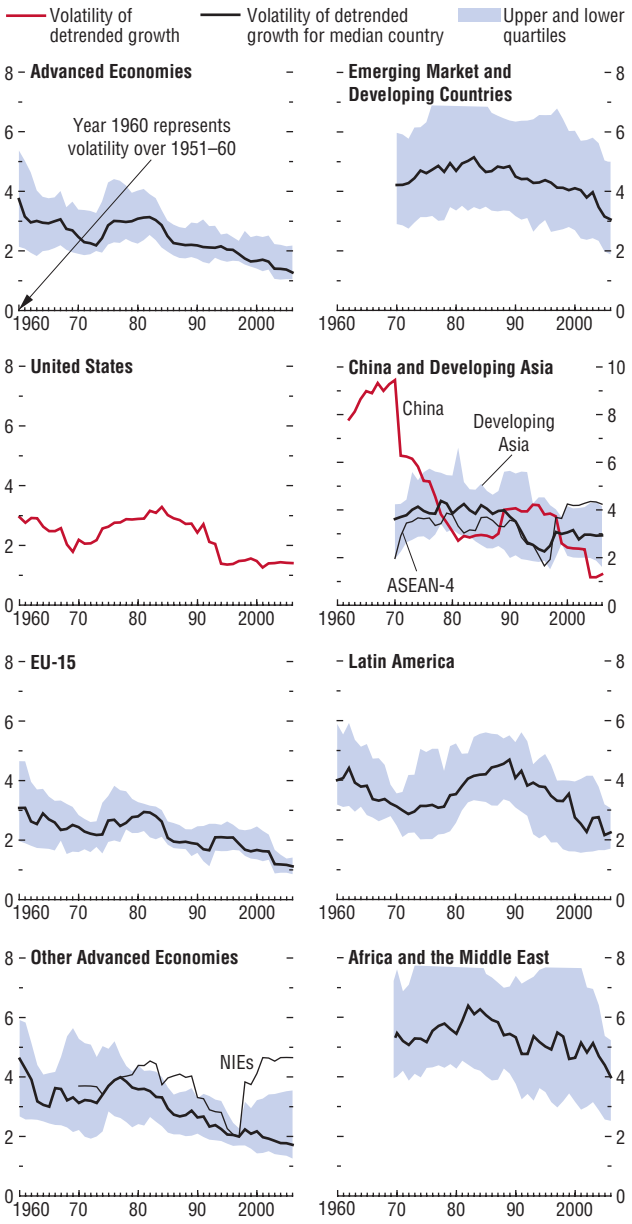
[9]Data limitations do not allow a comprehensive analysis of volatility in developing countries in the 1950s. Specifically, volatility of growth cannot be reliably calculated for many countries in Africa, Asia, and the Middle East because the available GDP data are often interpolations among infrequent benchmark estimates and, therefore, annual growth rates tend to be smoothed. In Latin America (for which more accurate data are available), output volatility was higher than in advanced economies during the decade (see Figure 5.4).

[10]The extremely high volatility of the Chinese economy was, to a large extent, caused by the Great Leap Forward economic plan and the Cultural Revolution (launched in 1958 and 1966, respectively).

Figure 5.4. Volatility of Growth in the Main World Regions[1]

(Rolling 10-year standard deviations of detrended growth—year 1960 represents volatility over 1951–60)

Advanced economies quickly stabilized after the oil shocks of the 1970s. Their volatility is now about one-half of their levels in the 1960s. Output stabilization was more gradual and modest in emerging market and developing countries, as many economies experienced debt, currency, and banking crises.



Sources: Heston, Summers, and Aten (2006); Maddison (2007); World Bank, World Development Indicators database (2007); and IMF staff calculations.

[1]Volatility in 1960 is calculated as the standard deviation of detrended growth over 1951–60, and so on. For some regions, volatility measures covering the 1950s are not shown due to the lack of accurate data on annual growth. See Appendix 5.1 for information on country group composition.

countries were buffeted by debt crises (especially in Latin America and Africa) and banking and currency crises (in Asia, central and eastern Europe, and Latin America). Some countries also experienced high volatility during their transition from centrally planned to market economies.[11] Despite a big decline in recent years, the output volatility in developing economies continues to be significantly higher than in advanced economies, partly as a result of structural differences, such as the greater weight of agriculture or commodity-related sectors. The median standard deviation of annual growth is currently 3 percent in emerging market and developing countries compared with 1¼ percent in advanced economies.

Volatility decompositions suggest that most of the past changes in the volatility of world growth can be attributed to advanced economies, especially the United States (Figure 5.5).[12] That said, falling output volatility in China contributed noticeably to the lower volatility of world growth during 1996–2006 compared with 1983–95.

[11]In central and eastern Europe, deep recessions associated with the transition from centrally planned to market economies generated very large output volatility during the 1990s. Countries of the former Soviet Union are not included in the analysis because many variables for these countries are not readily available for the period prior to the 1990s. See Chapter 2 in the April 2005 *World Economic Outlook* for a detailed discussion of output volatility in developing countries.

[12]Decompositions of volatility in this section are carried out using the volatility of aggregate world growth, given the computational difficulties of decomposing changes in median values. As a result, the decompositions cannot fully reflect the decline in country-specific volatility between the 1960s and today. Volatility is calculated over four periods (1960–73, 1974–82, 1983–95, and 1996–2006), with years 1973 and 1983 broadly representing the main breaks in the volatility of world growth since 1960. Owing to data limitations, world volatility is not calculated for the 1950s. The contribution of the United States to the changes in world output volatility appears larger than the contribution of the EU-15, because the EU-15 aggregate removes some of the country-specific volatility. In the past, U.S. output volatility was similar to the EU-15 median (see Figure 5.4). To simplify the analysis, the volatility decompositions are calculated using headline rather than per capita growth. However, volatilities of headline and per capita growth tend to be similar for most countries.

Despite the fact that emerging market and developing countries tend to be more volatile than advanced economies, their growing weight has so far not pushed world output volatility higher, mostly because output volatility in China is now as low as in advanced economies.[13]

Figure 5.5 also suggests that the comovement (covariance) of growth across countries is an important factor affecting volatility of world output. The simultaneity of growth decelerations after the oil price shocks of the 1970s illustrates how rising covariance can at times magnify the impact of country volatility on the volatility of world growth. Growing trade and financial integration of economies, especially within regions, has also tended to strengthen cross-country output spillovers (Box 5.1).[14] In particular, the lower volatility of output in the United States contributed a significant portion of the decline in world volatility between the 1960–73 and 1996–2006 periods, but the greater stability of the United States and most other advanced economies was offset largely by the increasing correlation between country growth rates. This increasing correlation can also be seen as reflecting the regional nature of currency crises in emerging markets in the late 1990s and the global slowdown following the bursting of the information technology bubble in 2000.

Further decompositions of world output volatility by expenditure components show that consumption and investment volatility have both shifted significantly over time (Figure 5.6). The rise in overall volatility during 1974–82 was to a large extent due to the rise in investment volatility. This finding is intuitively appealing because

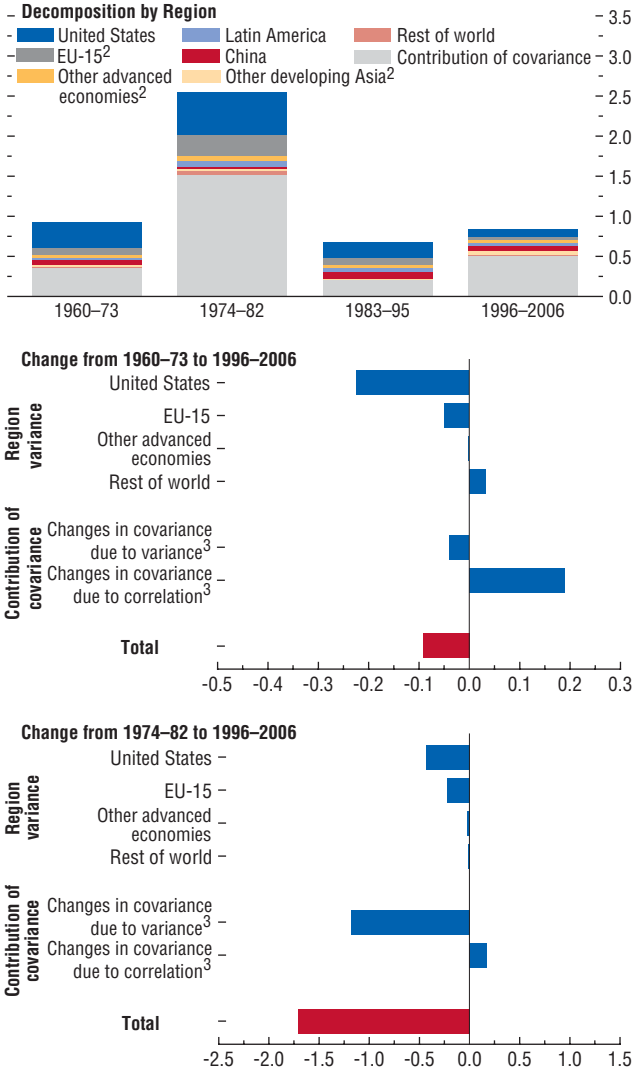
[13]If the current world volatility were recalculated using country weights from the 1960s, it would be almost the same as the world volatility calculated using the current weights. However, if the country volatility from the 1960s were combined with the current country weights, the standard deviation of world growth would increase from 0.9 percent (the actual outcome for 1996–2006) to 1.5 percent. This result reflects mostly the significant decline of volatility in China and, to a more limited extent, in other developing economies since the 1960s.

[14]See also Chapter 4 in the April 2007 *World Economic Outlook*.

Figure 5.5. Decomposition of Changes in World Output Volatility by Region[1]

(Variance of real GDP growth)

Volatility of world growth was particularly high during 1974–82, a period characterized by oil supply disruptions and policy swings. At the aggregate level, the moderation of world volatility has been fairly small compared with 1960–73, although since then many countries have experienced significant reductions in volatility (see Figure 5.4). Greater trade and financial integration have increased the correlation of growth across countries, and this has largely offset the decline of volatility at the country level. Most of the past changes in world output volatility can be attributed to advanced economies, especially the United States.



Sources: Heston, Summers, and Aten (2006); Maddison (2007); World Bank, World Development Indicators database (2007); and IMF staff calculations.

[1]Volatility is measured as the variance of real purchasing-power-parity-weighted GDP growth over a period. Given data limitations, world output volatility cannot be reliably calculated for the 1950s.

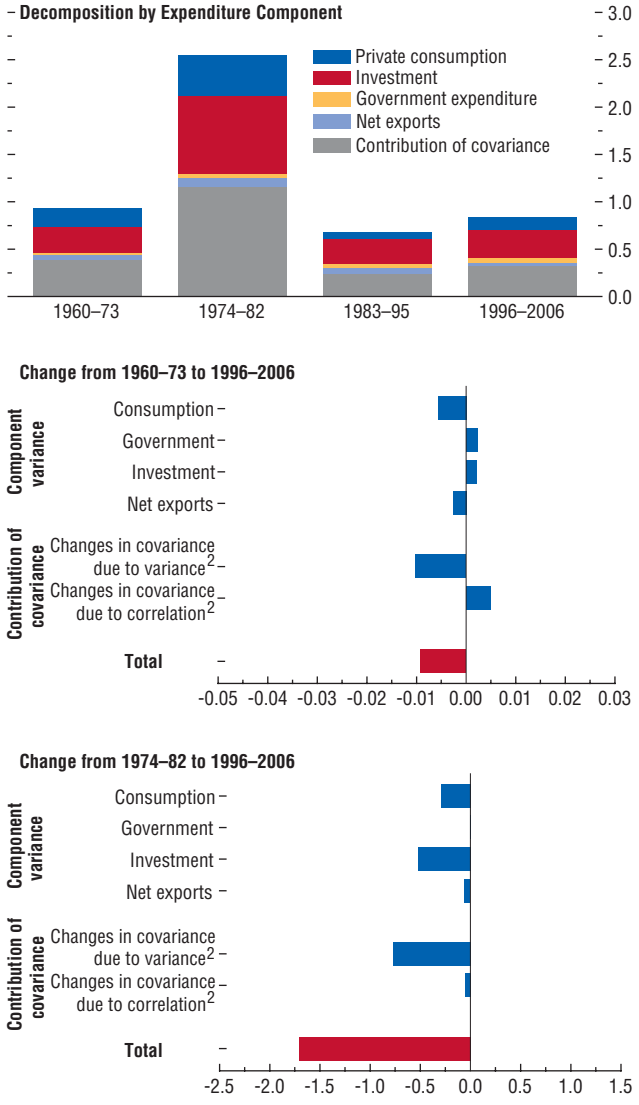
[2]See Appendix 5.1 for details on country groupings.

[3]Contributions of covariance to the changes in output volatility were decomposed into contributions due to changes in the variance of regions and changes in the correlation among them. See Appendix 5.1 for details.

Figure 5.6. Decomposition of Changes in World Output Volatility by Expenditure Component[1]

(Variance of real GDP growth)

Consumption and investment volatility have both shifted significantly over time. The rise in overall volatility during 1974–82 was, to a large extent, due to the rise in investment volatility, as supply disruptions, shifts in productivity trends, and policy swings induced volatility in investment plans. The mild decline in world output volatility from the 1960s to the present is mostly attributable to the lower volatility of consumption.



Sources: Heston, Summers, and Aten (2006); World Bank, World Development Indicators database (2007); and IMF staff calculations.

[1]Volatility is measured as the variance of real purchasing-power-parity-weighted GDP growth over a period. Given data limitations, world output volatility cannot be reliably calculated for the 1950s.

[2]Contributions of covariance to the changes in output volatility were decomposed into contributions due to changes in the variance of expenditure components and changes in the correlation among them. See Appendix 5.1 for details.

the period was characterized by repeated supply disruptions, shifts in productivity trends, and policy swings, all of which induced volatility in the expected profitability of investment plans. Nevertheless, the decline in world output volatility from the 1960s to the present is attributable mostly to lower volatility of consumption rather than investment. Some of this latter result is certainly driven by the nature of events unfolding over the past decade, including a significant reduction of investment in post-crisis and post-bubble economies. Indeed, volatility of investment was somewhat lower during 1983–95 compared with the past decade. The finding, however, suggests that any explanations for the current output stability need to include factors that affect consumer behavior, such as the rising availability of financing to smooth consumption over time.[15]

Looking in more detail at the United States (Figure 5.7), the decline in output volatility since the 1960s has indeed been driven largely by consumer behavior (through a variety of channels, including lower volatility of consumer spending, residential investment, and lower correlation between consumption and investment) and by the government.[16] The role of inventory investment in explaining the reduction in U.S. output volatility between 1960–73 and 1996–2006 is surprisingly limited,[17]

[15]Dynan, Elmendorf, and Sichel (2006) make a similar point about consumption volatility in the context of U.S. data. While the aggregate world data do not identify government expenditures as the major source of output volatility, fiscal policy in the form of, for instance, procyclical spending or excessive debt accumulation has been a significant driver of output volatility in many countries (see the next section). These country-specific effects, however, disappear in the aggregate world data.

[16]During the 1960s, government expenditures increased U.S. output volatility through volatile defense spending associated with the Vietnam War.

[17]Several studies have highlighted the contribution of improved inventory management techniques and lower volatility of inventory investment to the reduction of *quarterly* output volatility in the United States since the 1980s (McConnell and Perez-Quiros, 2000; and Kahn, McConnell, and Perez-Quiros, 2002). However, the role of inventories is greatly diminished in the annual data, especially when considering volatility changes between

although—for the same reasons as at the world level—the lower volatilities of inventories and business fixed investment have contributed to the moderation of U.S. output volatility relative to the 1970s.

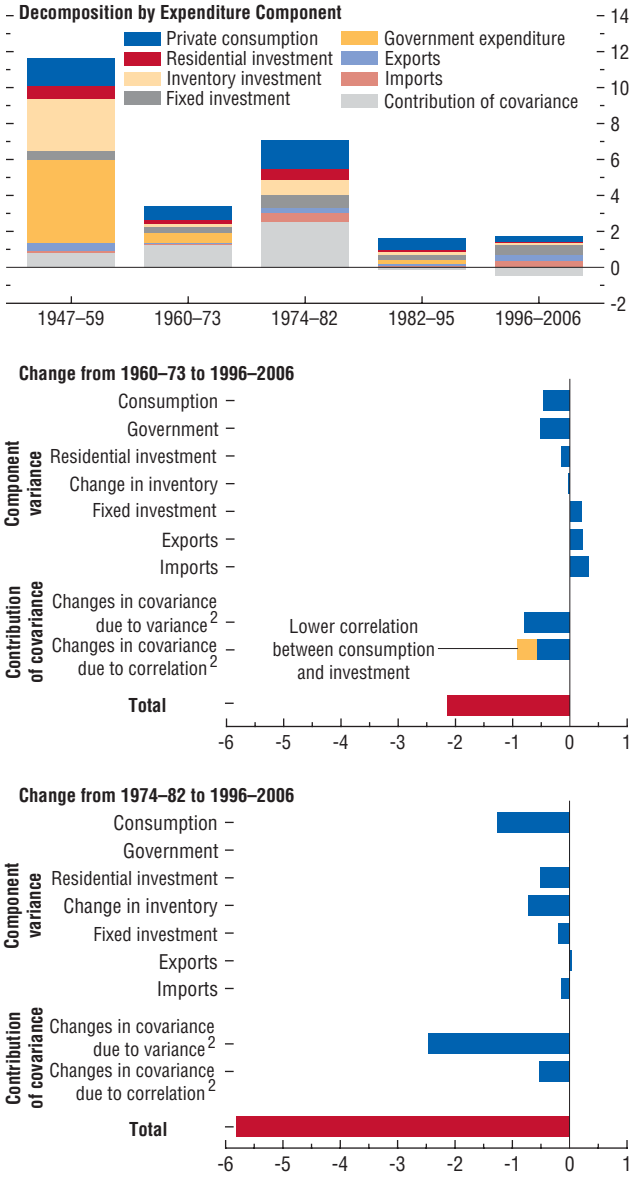
Looking forward, the performance of emerging market and developing countries will be increasingly important for the stability of the world economy. In 2006, these economies accounted for over 40 percent of global GDP, two-thirds of world GDP growth (using PPP weights), and about one-third of world trade (at market exchange rates). China and India alone now account for one-fifth of the world PPP-adjusted GDP, up from 10 percent in 1990. The output paths of China and India have broadly followed the output paths of other economies that experienced rapid expansions earlier, although China has been able to maintain extremely high growth for a longer period of time than Japan and the NIEs (including Korea), the previous best performers during the growth takeoff episodes (Figure 5.8). Interestingly, the volatility trajectories of rapidly growing economies have also been similar. Initially, these economies tended to exhibit much higher volatility than world growth. As the economies diversified away from volatile sectors such as agriculture and the policy frameworks improved, their output volatility started to converge to the world average. But these historical comparisons also offer some cautionary tales. Brazil and Mexico were not able to sustain high growth as structural rigidities became binding, and fiscal and currency crises increased volatility in these economies for an extended period. Although the NIEs managed to sustain rapid

the 1960s and today. From a policy perspective, changes in the quarterly fluctuations of inventory investment may not have important welfare implications unless these have a significant longer-lived impact on, for example, consumption growth—which appears unlikely. Another aspect influencing the interpretation of any volatility studies based on quarterly data is that components of quarterly national accounts tend to suffer from much greater measurement error than annual data; for example, Sommer (2007) documents that measurement errors make up a nontrivial fraction of quarterly consumption growth.

Figure 5.7. Decomposition of Changes in U.S. Output Volatility[1]

(Variance of real GDP growth)

The decline in U.S. output volatility since the 1960s has been driven largely by consumer behavior, including through lower volatility of consumer spending, residential investment, and the lower correlation between consumption and investment. Lower volatility of government spending also explains some of the volatility moderation between 1960–73 and 1996–2006.

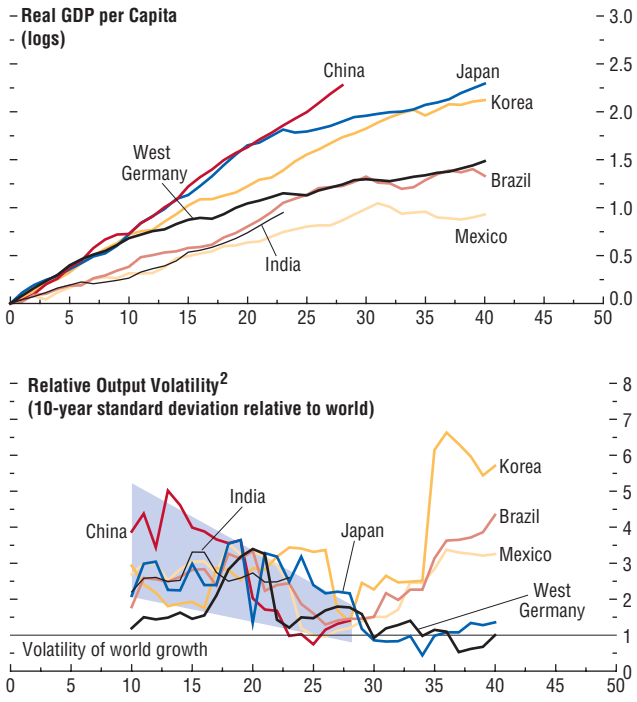


Sources: U.S. Bureau of Economic Analysis; and IMF staff calculations.
[1]Volatility is measured as the variance of real GDP growth over a period.
[2]Contributions of covariance to the changes in output volatility were decomposed into contributions due to changes in the variance of expenditure components and changes in the correlation among them. See Appendix 5.1 for details.

Figure 5.8. Volatility Patterns in Rapidly Growing Economies[1]

(Growth takeoff begins in time t = 0 *on the x-axis)*

The growth paths of China and India have broadly followed the patterns of earlier rapid expansions, although China has been able to sustain strong growth for the longest period of time. Volatility of rapidly growing economies has tended to converge gradually to the world average. However, unaddressed vulnerabilities can trigger recessions or outright crises associated with large increases in volatility, such as in Brazil, Mexico, and Korea.



Sources: Heston, Summers, and Aten (2006); Maddison (2007); World Bank, World Development Indicators database (2007); and IMF staff calculations.

[1]Growth takeoff is dated as follows: 1950 for Brazil, 1979 for China, 1984 for India, 1950 for Japan, 1963 for Korea, 1950 for Mexico, and 1950 for West Germany. See Appendix 5.1 for details.

[2]Relative output volatility is defined as the ratio of the rolling 10-year standard deviation of detrended country growth divided by the 10-year standard deviation of detrended world growth over the same period.

growth, expansions in most NIEs did not prove resilient to the Asian crisis and volatility sharply increased. All these experiences suggest that policymakers cannot take the good times for granted and need to continuously identify and address vulnerabilities.

What Is Driving the Moderation of the Global Business Cycle?

What underlying factors explain the differences, both across countries and over time, in output volatility and in the duration of expansions? And are they likely to persist? There has been considerable analysis of the decline in output volatility in the United States since the 1970s (the Great Moderation debate),[18] but work on other advanced economies and on emerging market and developing countries is more limited.[19] Given the growing importance of developing countries in the global economy, this section looks at the broader canvas.

Specifically, the analysis considers a sample of nearly 80 countries, including both advanced and developing economies over the period 1970–2005, and employs a variety of econometric techniques. It examines the determinants of the volatility of detrended output as well as of four other closely related business cycle characteristics: the share of output lost to recessions and slowdowns, the average length of expansions, the share of time spent in recessions, and the probability of economic expansion for a given country in any given year.[20]

In line with the existing literature, the analysis encompasses a broad range of variables that

[18]See, for instance, Kim and Nelson (1999); Blanchard and Simon (2001); and Arias, Hansen, and Ohanian (2006). Bernanke (2004) provides an overview.

[19]See Dijk, Osborn, and Sensier (2002); Artis, Krolzig, and Toro (2004); and Cecchetti, Flores-Lagunes, and Krause (2006a). Summers (2005) provides an overview.

[20]See Appendix 5.1 for further details. Berg, Ostry, and Zettelmeyer (2006), focusing on trend growth rather than on cyclical fluctuations, use a probability model to analyze the determinants of a different but complementary concept: the length of "growth spells" (that is, periods of significantly higher growth than previously observed).

Box 5.1. Major Economies and Fluctuations in Global Growth

Over the past five years, the world economy has enjoyed the highest growth since the early 1970s, despite a significant slowing of the U.S. economy since 2006 and, earlier, a sluggish recovery in the euro area and Japan. Some observers have argued that the apparently reduced spillovers could mean that the world economy has become more robust to disturbances in major economies, partly because, with new poles such as China and India, there are more sources of growth to pick up the slack.

At the same time, however, the scope for cross-country spillovers from disturbances in major economies has increased with rapidly rising cross-border trade and financial linkages, which could at least partly offset these economies' declining share of global trade growth. Against this background, this box compares recent patterns of business cycle comovement for China and India with those of major industrial countries and analyzes the impact of disturbances in major economies on global growth in a general framework.[1]

Turning first to the experience with international business cycle comovement, the first table reports the extent of output correlations between major economies and different regions for 1960–73 (a period with limited cross-border linkages and, unlike the 1970s and early 1980s, no large global disturbances) and 1996–2006, a period with rapidly rising cross-border linkages.[2] Three findings stand out.

- Business cycle comovement with the new poles indeed increased in the second period compared with the first one. The rise is particularly evident for China. Increased comovement with the new poles is particularly noticeable for countries in Latin America and emerging Asia.
- In industrial countries, comovement with the United States and Germany increased sharply between 1960–73 and 1996–2006, whereas it decreased with Japan.
- In other emerging market and developing countries, and particularly in Latin America, comovement with the United States and Japan increased.

Using the correlations as rough approximations for cross-border spillover effects of disturbances, the results suggest that a disturbance to growth in China could now have substantial spillover effects on some emerging market and developing countries, although the effects on industrial countries would be considerably smaller.

Overall, the picture that emerges is one of increasing business cycle comovement, first, among industrial countries and, second, among China and emerging market economies in Latin America and Asia. In contrast, business cycle comovement between industrial countries and other emerging market and developing countries has risen by less.

Output Comovement with Major Economies, by Region[1]

(Averages by region)

	United States	Germany	Japan	India	China
All countries					
1960–73	0.00	0.07	0.03	0.03	0.07
1996–2006	0.24	0.23	0.23	0.06	0.20
Industrial countries					
1960–73	0.07	0.35	0.25	0.08	0.05
1996–2006	0.54	0.74	0.03	0.04	0.14
Latin America					
1960–73	0.02	0.09	0.05	0.02	0.13
1996–2006	0.26	0.28	0.44	0.15	0.43
Emerging Asia					
1960–73	–0.04	0.08	0.05	–0.07	0.16
1996–2006	0.17	0.06	0.49	0.06	0.25
Africa					
1960–73	–0.05	0.04	–0.02	0.05	0.03
1996–2006	0.11	0.03	0.16	0.05	0.16

Source: IMF staff calculations.

[1]The table reports regional averages of bilateral correlation coefficients with the major economy indicated. Correlations are based on annual growth rates. The regional classification of countries follows that used in Chapter 2.

Note: The main author of this box is Thomas Helbling.

[1]The box draws on Chapter 4 of the April 2007 *World Economic Outlook*.

[2]See Box 4.3 in the April 2007 *World Economic Outlook* on the measurement of international business cycle synchronization. The comparison between the 1960s and more recent periods follows Kose, Otrok, and Whiteman (2005).

Box 5.1 *(concluded)*

What are the main factors determining the impact of disturbances in a major economy on international business cycles and ultimately global growth? Three seem particularly relevant.[3] First, the size of a country's GDP matters, both directly, through its own impact on global growth, and indirectly, through the impact on other countries. For given trade shares, a larger importer will have a greater effect on other countries' external demand (or, in other words, export exposure) as a percent of GDP. In this regard, China has now surpassed most major industrial countries in terms of its share in global GDP and global imports, whereas India's economic size is still relatively small. More generally, the total share of the largest 10 economies has remained broadly unchanged since the early 1970s, in terms of both global GDP and world imports.[4] From this perspective, the scope for other major economies to pick up the slack from another one has thus not changed significantly.

A second factor is the extent of a country's cross-border trade and financial linkages. Numerous empirical studies have found that business cycle comovement tends to rise in tandem with trade and financial linkages.[5] The generally higher comovement among industrial economies, for example, is partly related to more intensive linkages among them, with other variables, such as similarity in stages of development or per capita income, also playing a role. Regarding the new poles, China's trade linkages with other emerging market and developing countries have risen rapidly (see second table), especially in Asia but also elsewhere, which partly explains the rising cyclical comovement reported in the first table.[6] With their rising trade linkages with the new poles, other emerging market and developing countries now trade relatively less with the major industrial countries, suggesting that emerging markets have become *relatively* less dependent on advanced economies. As a share of GDP, however, the total trade of emerging market and developing countries with major industrial countries has increased, partly driving the rising output correlations between these two groups.

The depth of financial linkages among emerging market and developing economies, and between these economies and industrial countries, remains well below the levels found among industrial countries. This helps explains why, on average, business cycle comovement among advanced economies still exceeds the correlations for the other pairings (see first table). Limited financial linkages notwithstanding, emerging market countries have faced common fluctuations in general external financing

Exports to Major Economies, by Region
(In percent of total exports; averages by region)

	Exports to				
	United States	Germany	Japan	India	China
Exports from					
All countries[1]					
1973	17.5	7.4	6.1	0.5	0.8
2006	16.0	5.3	3.8	2.3	6.0
Industrial countries					
1973	12.5	11.6	4.3	0.3	0.5
2006	11.9	12.6	2.9	0.8	2.9
Latin America					
1973	37.8	7.4	4.0	0.1	0.3
2006	27.6	1.7	1.6	0.4	2.6
Emerging Asia					
1973	15.1	3.5	15.0	0.7	1.3
2006	11.9	4.1	6.9	5.9	8.6
Africa					
1973	11.1	7.1	3.5	0.6	1.1
2006	10.3	3.4	2.7	3.3	8.7

Sources: IMF, *Direction of Trade Statistics;* and IMF staff calculations.

[1]90 countries.

[3]See Canova and Dellas (1993); and Baxter and King (1999).

[4]Although the composition of this group has remained unchanged, relative sizes within the group have changed substantially, with those of China and India increasing and those of major industrial countries decreasing.

[5]See, among others, Frankel and Rose (1998); Imbs (2004, 2006); and Baxter and Kouparitsas (2005).

[6]See Moneta and Rüffer (2006).

conditions. Indeed, financial contagion and the attendant financial crises during the late 1990s may be one factor behind the increased business cycle comovement among emerging market countries.[7]

Third, the nature of disturbances plays an important role. Disturbances in a major economy tend to have limited cross-border spillover effects if they are specific to the country or if they are transmitted primarily through trade channels.

- Regarding the reach of disturbances, past episodes with large declines in growth across countries at the same time were characterized by common disturbances that were either truly global in nature (e.g., abrupt oil price changes) or were correlated across countries (e.g., disinflationary policies during the early 1980s).[8]
- As for the limited effects of disturbances transmitted through trade channels, the main reason is that, except for countries in the same region, the effects on external demand are usually small in terms of overall demand. In contrast, spillovers tend to be larger if asset price and/or confidence channels are involved. In this respect, with the continued dominant role of the United States in global financial markets, cross-border spillovers from financial shocks in the United States remain a particular concern.[9]

[7]See also Kose, Otrok, and Prasad (forthcoming).
[8]See the April 2007 *World Economic Outlook*.
[9]See, among others, Bayoumi and Swiston (2007); and Ehrmann, Fratzscher, and Rigobon (2005).

Against this backdrop, the broad decoupling of Japan from other industrial countries in the late 1990s is not surprising because developments in the Japanese economy at the time were country specific—protracted adjustment after a major asset price boom-bust cycle—with limited apparent global financial market impact.[10] Similarly, because the current U.S. slowdown has been driven by sector-specific developments—primarily in housing but also in manufacturing—with limited impact on broader asset markets until very recently, the spillover effects on growth in other countries outside the region have generally remained small so far.

In sum, the seemingly limited impact of disturbances in major economies on global growth in the current episode to date reflects a number of factors, including the nature of the slowdown in the United States. The new poles likely have played a role as well, primarily through the direct impact of their high growth rates on global growth and their impact on commodity prices (which has benefited many emerging market and developing countries), but also through their impact on growth in emerging Asia and Latin America. Nevertheless, with financial markets around the world now being affected by the fallout from U.S. subprime mortgage difficulties, a broader growth slowdown cannot be ruled out.

[10]See, for example, Helbling and Bayoumi (2003); and Stock and Watson (2005).

could explain changes in business cycle characteristics (see Appendix 5.1 for details). The variables include the following:

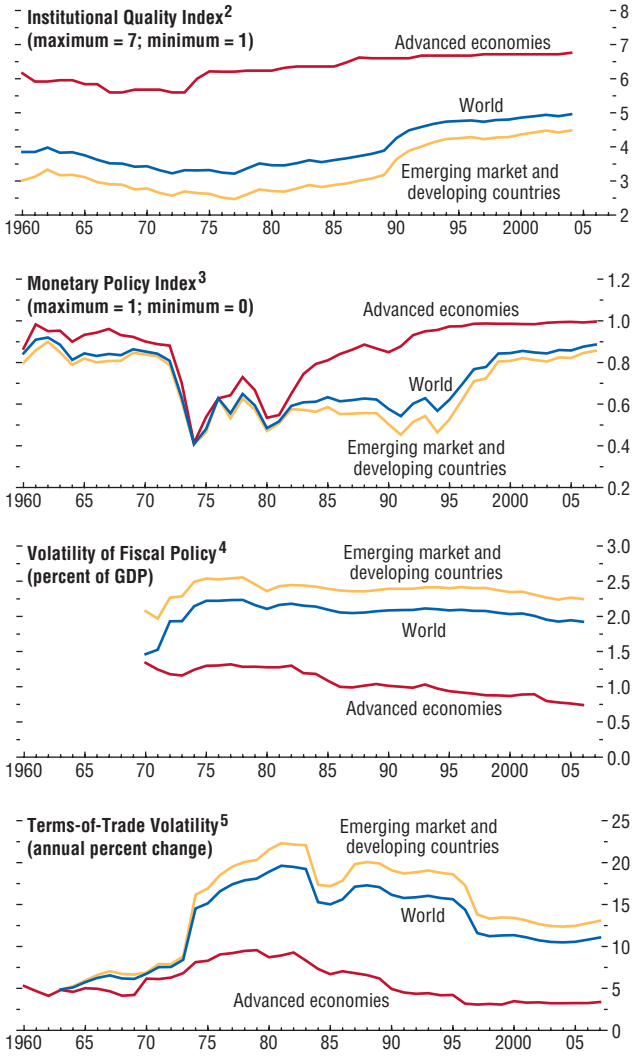
- *Institutional quality*. Broadly understood, this can increase a country's capacity to reconcile internal political differences. In turn, greater political stability and continuity in policymaking may foster economic stability and sustainability. More specifically, weak institutions may render adjustment to major economic shocks more difficult and, in the extreme, may encourage coups and revolutions.[21]

[21]Institutional quality is captured here by a measure of constraints on the political executive. Among other advantages, this variable is available for a broad sample of countries and for extended periods; it also seems less prone to endogeneity problems than other indicators, such as the ICRG risk measures. See Acemoglu and others (2003); and Satyanath and Subramanian (2004) for a fuller discussion of this variable and of how institutions in general may affect volatility.

Figure 5.9. Some Determinants of Differences in Business Cycle Characteristics[1]

(Unweighted averages)

Monetary policy improved substantially in advanced economies after the 1970s; more recently, significant improvements have occurred in emerging market and developing countries as well. Since the 1980s, the volatility of fiscal policy has declined in most advanced economies, institutional quality has increased in most emerging market and developing countries, and terms-of-trade volatility has declined sharply in both advanced economies and developing countries. For all these variables, advanced economies score more favorably than emerging market and developing countries.



Sources: Heston, Summers, and Aten (2006); Marshall, Jaggers, and Gurr (2004); World Bank, World Development Indicators database (2007); and IMF staff calculations.

[1]See Appendix 5.1 for information on country group composition.

[2]Measured using the "executive constraint" variable from Marshall, Jaggers, and Gurr's Polity IV data set.

[3]Defined as $\exp[-0.005 * (\text{inflation} - 2\%)^2]$.

[4]Defined as the rolling 10-year standard deviation of cyclically adjusted government consumption as a percent of GDP.

[5]Defined as the rolling 10-year standard deviation of the annual percent change in the terms of trade.

- *The quality of macroeconomic policies.* In part, this is assessed through an index measuring the success of the monetary framework in maintaining low inflation (see Box 5.2 for an assessment of the extent to which better monetary policies and more flexible markets have muted the business cycle in the United States).[22] In addition, more stable fiscal policy can help dampen, or at least not amplify, output fluctuations; in this context, the analysis focuses on the volatility of cyclically adjusted government expenditures.[23] As mentioned above, external vulnerabilities have in the past also brought expansions to a premature end. Therefore, the impact of large current account deficits (defined here as a deficit exceeding 5 percent of GDP) is also analyzed.
- *Structural features.* For instance, a better-developed financial infrastructure (measured using the ratio of private sector credit to GDP) may enable greater smoothing of both consumption and investment plans.[24] Other structural factors, including changes in the sectoral composition of output, improved inventory management techniques in the wake of the information technology revolution, more flexible labor and product markets, and a general opening up to international trade, may have smoothed fluctuations and reduced inflationary bottlenecks.[25] Clearly, many of the above factors are not just reducing susceptibility to

[22]The role of monetary policy is emphasized in Clarida, Galí, and Gertler (2000); and Cecchetti, Flores-Lagunes, and Krause (2006b). Importantly, globalization may have strengthened policymakers' incentives to maintain low inflation, especially in developing economies—see Box 3.1 in the April 2006 *World Economic Outlook*.

[23]See Fatás and Mihov (2003); and Chapter 2 in the April 2005 *World Economic Outlook*.

[24]See Easterly, Islam, and Stiglitz (2000); Kose, Prasad, and Terrones (2003); Barrell and Gottschalk (2004); and Dynan, Elmendorf, and Sichel (2006).

[25]On the impact of sectoral changes, see Dalsgaard, Elmeskov, and Park (2002); of inventory management, see footnote 17; of product-market regulation, see Kent, Smith, and Holloway (2005); and of globalization, see Chapter 3 in the April 2006 *World Economic Outlook*. Neither inventory management techniques nor labor and product-market flexibility are captured in this analysis, owing to data limitations.

Table 5.1. Cross-Sectional Regressions

	Output Volatility	Lost Output	Length of Expansion	Time in Recessions
Broad institutions	**–0.18***	–0.02	0.19	**–1.08***
Financial development[1]	**–1.99***	**–0.18***	**0.39****	**–3.30****
Monetary policy quality	0.07	–0.70	**3.33***	**–18.27****
Fiscal policy volatility	**0.58***	**0.30****	–0.72	0.58
Current account deficit	0.39	–0.03	**–1.49*****	**12.24*****
R^2	0.49	0.50	0.49	0.65

Source: IMF staff calculations.

Note: number of countries = 78. Sample covers the period 1970–2005. Statistically significant coefficients are in boldface; *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively. Other controls include trade openness, terms-of-trade volatility, exchange rate flexibility, and share of agriculture in GDP.

[1]To allow for nonlinearities, regressions employ both the level and the square of financial development; the joint coefficient presented represents the marginal value, evaluated at the sample mean.

Table 5.2. Panel and Probit Regressions

	Output Volatility	Probability of Being in an Expansion
Broad institutions	–0.07	–0.00
Financial development[1]	0.22	–0.11
Monetary policy quality	**–2.39*****	**0.22*****
Fiscal policy volatility	**0.61***	**–0.04****
Current account deficit	–0.17	0.01
Trade openness	–0.61	**0.11*****
Terms-of-trade volatility	0.05	–0.00
R^2	0.27	0.08
Number of countries	78	78
Number of observations	299	1,824

Source: IMF staff calculations.

Note: Results for "output volatility" are based on a panel fixed-effects regression, estimated using decade-average values over 1960–2005. Results for "probability of being in an expansion" are based on a probit regression, estimated using annual data over 1960–2005. Statistically significant coefficients are in boldface; *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively. Other controls include exchange rate flexibility and share of agriculture in GDP.

[1]To allow for nonlinearities, regressions employ both the level and the square of financial development; the joint coefficient presented represents the marginal value, evaluated at the sample mean.

both demand and supply shocks but are also raising trend productivity growth rates, which will also reduce the risk of an output decline.

- *Supply shocks*, including in particular oil-supply disruptions. These are widely understood to have played an important role in driving previous business cycles.[26] They are represented here by the volatility of the external terms of trade.

As shown in Figure 5.9, the combination of a more challenging environment and inadequacies in monetary policy frameworks helped bring about poor inflationary performance in the 1970s (see Box 5.2). However, monetary policy improved substantially in advanced economies starting in the 1980s. More recently, significant improvements have also occurred in emerging market and developing countries. Also, since the 1980s, the volatility of fiscal policy has declined in most advanced economies, broad institutional quality has increased in most emerging market and developing countries, and terms-of-trade volatility has declined sharply in both advanced and developing economies. For all these variables, advanced economies score more favorably than emerging market and developing countries.

More formally, both cross-sectional analysis (Table 5.1) and panel and probit regressions (Table 5.2) suggest the following broad findings:[27]

- Greater *institutional quality* is associated with lower volatility and less time spent in recessions. This effect is statistically significant in the cross section.
- *Financial deepening* significantly dampens all aspects of business cycle volatility in the cross-sectional analysis. However, there is strong evidence that this impact diminishes once a country attains a certain level of financial development. The influence of this variable, just as with institutional quality, is more

[26]For instance, Stock and Watson (2005), using a structural vector autoregression methodology, conclude that "the widespread reduction in volatility [since the 1970s] is in large part associated with a reduction in the magnitude of the common international shocks." Similarly, Ahmed, Levin, and Wilson (2004) emphasize the role of "good luck" in driving recent U.S. macroeconomic stability. See also Stock and Watson (2003).

[27]In the absence of a structural econometric model of the business cycle, care should be taken in interpreting these correlations as indicating causality, even though instruments are employed for both institutional quality and fiscal policy volatility.

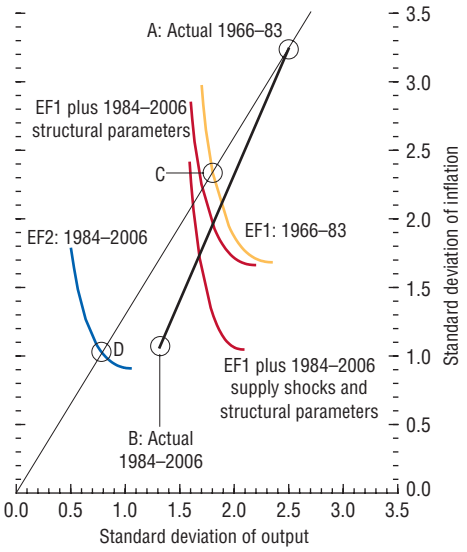
Box 5.2. Improved Macroeconomic Performance—Good Luck or Good Policies?

As discussed in the main text, output volatility has declined significantly in recent years across the main advanced economies. This box discusses how much of the lower volatility in the United States can be attributed to, respectively, better monetary policies, structural changes to the economy, and smaller shocks (potentially reflecting "good luck"). To do so, it uses a structural model of the U.S. economy that can statistically identify macroeconomic shocks and structural changes, and can simulate counterfactual monetary policies that would have been more effective at stabilizing the economy than actual policies. This analysis also provides some perspective on the important policy question of whether output volatility is likely to remain low in the future.

The main result is that sustainable improvements in monetary policy account for about one-third of the reduction in the volatility of U.S. output and inflation between the pre-1984 and the post-1984 period. This contrasts sharply with a study by Stock and Watson (2003), who find that monetary policy has not played a significant role in reducing output variability.

U.S. Inflation and Output Volatility: Data and Model-Based Results

(Percent)



Sources: Haver Analytics; and IMF staff calculations.

Performance of Monetary Policy Has Improved Considerably

The figure plots the actual volatility of U.S. inflation and detrended output during 1966–83 (point A) and 1984–2006 (point B).[1] This experience can be compared with what model-based estimates suggest could have been achieved by following an optimal monetary policy rule, represented by the efficiency frontiers EF1 and EF2.[2] Specifically, the efficiency frontier EF1 represents the best possible combinations of inflation and output volatility that could have been achieved by the Federal Reserve during 1966–83, had it followed a monetary policy rule that adjusted interest rates sufficiently to stabilize inflation and output outcomes. Note

Note: The authors of this box are Michael Kumhof and Douglas Laxton, with support from Susanna Mursula.

[1]The volatility of the output gap and of inflation are defined in this box as the standard deviation of, respectively, the output gap and the year-on-year percent change in the CPI. All estimates are based on quarterly data.

[2]The efficiency frontiers are constructed in two steps. First, a structural monetary model of the U.S. economy is used to estimate the distribution of a set of eight macroeconomic shocks over the period 1966–83 (EF1) or 1984–2006 (EF2); the model is documented in Juillard and others (2006). Second, the estimated coefficients of the model's interest rate reaction function are replaced by optimal coefficients that minimize a weighted sum of standard deviations of inflation and output; the functional form of this monetary policy rule is adopted from Orphanides (2003a). This procedure is repeated for a variety of different relative weights of inflation and output, and in each case the realized standard deviations are recorded as one point on the efficiency frontier.

that this model-based frontier is downward sloping—policymakers face a trade-off between inflation volatility and output volatility. This trade-off arises because when the economy is hit by, for instance, an oil-price shock, the Federal Reserve must decide whether to tighten monetary policy to keep inflation within a narrow range while temporarily tolerating a decline in output or to accept higher inflation so as to achieve more stable output. Similarly, the efficiency frontier EF2 represents the best possible combinations of inflation and output volatility that could have been achieved by the Federal Reserve during 1984–2006. It has shifted inward considerably relative to EF1 (mostly reflecting smaller shocks, as discussed below).

Crucially, the model suggests that there is a significant difference between actual performance at point A and what could have been achieved during 1966–83, as represented by the set of points along EF1. This indicates that suboptimal monetary policy played a major role during that period in increasing both inflation and output volatility. In contrast, over 1984–2006, U.S. monetary policy became much more credible, adjusting the policy rate more aggressively in response to underlying inflationary pressures.[3] This achieved outcomes closer to the efficiency frontier.

The figure examines the role of monetary policy and other factors in reducing output and inflation volatility. The contribution of monetary policy to better performance of the U.S. economy is calculated as $(AB - CD)/AB$, where AB represents the total decline in volatility between 1966–83 and 1984–2006 and CD reflects the portion of this change unrelated to monetary policy. This calculation suggests that around one-third of the reduction in output volatility was a result of better monetary policies.

[3]For empirical evidence on the role of monetary policy credibility in changing the persistence of the inflation process in OECD countries, see Laxton and N'Diaye (2002).

Role of Structural Changes and Shocks

The inward shift of the efficiency frontier since 1984 reflects a combination of changed structural characteristics of the economy and smaller shocks. To illustrate this, the figure shows two alternative frontiers for the 1966–83 period that are generated by the model under two different sets of assumptions. First, the pre-1984 estimates of structural parameters of the economy are replaced with post-1984 estimates. Clearly, changes in the structural characteristics of the economy can account for only a small part of the estimated inward shift of the efficiency frontier. Second, the pre-1984 model is modified using post-1984 values for both structural parameters and the distributions of supply shocks (e.g., productivity shocks and oil price hikes). Unsurprisingly, the frontier EF1 shifts mainly downward because, in the short run, supply shocks have a stronger effect on inflation than on output. The difference between this frontier and the post-1984 frontier EF2 represents the contribution of demand shocks (for instance, smaller shocks to private consumption and investment demand, and/or greater stability in the conduct of fiscal policy). The role of demand factors in explaining reduced output volatility since 1984 is much larger than the role of supply shocks. This finding is consistent with the traditional interpretation of business cycles as being mostly demand driven.[4]

Conclusions

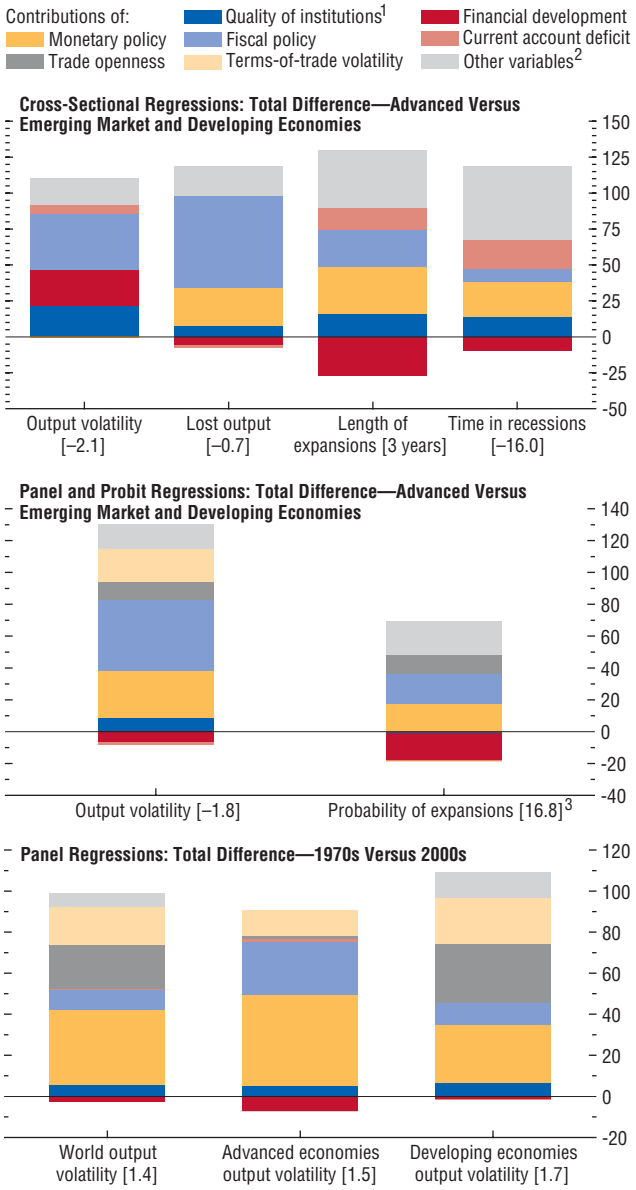
Monetary policy has clearly improved the economy's performance by keeping it closer to the efficiency frontier, and this gain is not likely to disappear. What is less certain is whether the frontier itself will stay where it is, that is, whether supply and demand shocks will continue to be small. As discussed in Chapter 1, there are a number of important risks facing the global economy that could increase volatility going forward.

[4]See Juillard and others (2006) and the references cited therein.

Figure 5.10. Contribution to Outcome Differences

(Dependent variable and total difference in percentage points on the x-axis, and percent of total difference on the y-axis unless otherwise indicated)

More stable monetary and fiscal policies in advanced economies than in emerging market and developing countries play a large part in explaining their lower volatility and longer expansions. Much of the remaining difference reflects advanced economies' better institutional quality. Improvements in monetary policy and lower terms-of-trade volatility account for much of the reduction in output volatility over time.



Sources: Beck, Demirgüç-Kunt, and Levine (2007); Heston, Summers, and Aten (2006); Maddison (2007); Marshall, Jaggers, and Gurr (2004); Reinhart and Rogoff (2004); Wacziarg and Welch (2003); World Bank, World Development Indicators database (2007); and IMF staff calculations (see Appendix 5.1 for details).

[1]Initial values for the cross-sectional and panel regressions.

[2]See Tables 5.1 and 5.2 for the list of "other variables."

[3]The y-axis indicates the probability of an expansion in percentage points.

difficult to detect in the panel regressions, because financial development tends to be a relatively slow-moving variable.

- The impact of the quality of *monetary and fiscal policy* is sometimes difficult to disentangle. That said, in the cross section, better monetary policy is associated with longer expansions, whereas volatility in fiscal policy is associated with output volatility. Better monetary and fiscal policies are both associated in the panel with smaller output fluctuations. Further, they are also associated with a higher probability of being in an expansion.
- There is some evidence that large *external deficits* can bring expansions to a premature end (in the cross section), and that periods with lower *terms-of-trade volatility* tend to have lower output volatility (in the panel).

The results imply that more stable monetary and fiscal policies in advanced economies play a large part in explaining lower volatility and longer expansions in advanced economies, when compared with emerging market and developing countries (Figure 5.10). Part of the remaining difference reflects advanced economies' better institutional quality. Their lower terms-of-trade volatility also plays a role. In a similar vein, better monetary policy, more stable fiscal policy, and greater trade openness in advanced economies all help to increase their probability of being and remaining in an expansion, relative to emerging market and developing countries (see Figure 5.10).

The results can also be applied to explain the large reduction in average volatility between the 1970s and the current decade, both for the world as a whole and for advanced and developing economies separately. Improvements in monetary policy account for much of the reduction in volatility over time (see Figure 5.10). A significant portion of the remainder reflects improved fiscal policy (in advanced economies), and trade liberalization and institutional improvements (in emerging market and developing countries). Lower terms-of-trade volatility than observed in the 1970s does have an important, but certainly not a dominant, role to play.

This is consistent with the finding, expressed in Box 5.2, that policy mistakes were an important contributor to the volatility observed in the 1970s.[28]

Conclusions

The current global expansion certainly stands out in comparison with the experience of the past three decades, but it is not unprecedented. In recent years, output growth has been much more rapid than observed at any time since the oil shocks of the 1970s. Compared with the 1960s, however, neither the strength nor the length of the current expansion appears exceptional. That said, rapid growth has been shared across countries more broadly than in the past, and output volatility in most countries and regions has been significantly lower than during the 1960s.

Advanced economies in particular have improved their performance since the 1970s, and they have typically experienced long expansions. Output stabilization in emerging market and developing countries has been more gradual and modest, with certain regions experiencing deep and sometimes recurrent crises. Over time, greater trade and financial integration have increased the covariance of growth across countries, and therefore at the world level output volatility is only slightly lower than in the 1960s.

This chapter finds that the increasing stability of economies and the associated increase in the durability of expansions largely reflect sources that are likely to prove persistent. In particular, improvements in the conduct of monetary and fiscal policy, as well as in broader institutional quality, are all robustly associated with smaller fluctuations in output, both over time and across countries. Reductions in terms-of-trade volatility have played an important, but not dominant, role.

The prospects for future stability should nevertheless not be overstated. The process of globalization continues to present policymakers with new challenges, as reflected in the difficulties in managing volatile capital flows, increasing exposure of investors to developments in overseas financial markets, and the uncertainties associated with large global current account imbalances. The recent return of interest rates to more neutral levels in most major advanced economies, the corrections of asset prices in some countries, and the current rise in risk premiums and tightening of credit market conditions may also test the strength of the current expansion. Overconfidence in the ability of the current policy framework to deliver stability indefinitely would certainly not be warranted. Although the business cycle has changed for the better, policymakers must remember that it has not disappeared.

Appendix 5.1. Data and Methods

The main authors of this appendix are Martin Sommer and Nikola Spatafora, with support from Angela Espiritu and Allen Stack. Massimiliano Marcellino provided consultancy support.

Expansions are defined as periods of nonnegative growth of real GDP per capita. Analogously, *recessions* are defined as periods of negative growth. Most of the analysis in this chapter therefore adopts the concept of "classical" business cycles as discussed in, for example, Artis, Marcellino, and Proietti (2004) and Harding and Pagan (2001).[29] Expansions are identi-

[28]Caution is needed in interpreting these results as indicating a small role for "good luck" in recent years. The panel regressions involve relatively large error terms, which may partly reflect temporary shocks. That said, the estimated equations do a very good job in matching the average business cycle characteristics for broad country groups.

[29]Harding and Pagan (2001) review various alternative business cycle definitions and their implications for business cycle properties. Business cycle research on advanced economies has typically used headline GDP series to determine the timing of expansions and recessions. This chapter, however, also analyzes many emerging market and developing countries with high population growth rates. To ease cross-country comparisons, the chapter therefore defines business cycles using per capita output growth.

fied using annual data and in per capita terms to allow for broad comparisons across countries and over time. Expansions based on quarterly data would likely be shorter for many countries. For the United States, the identified recessions broadly match those reported by the National Bureau of Economic Research, with the exception of the 1960 recession, which cannot be identified from annual data.

Volatility Decompositions

For the purposes of volatility decompositions, GDP growth at time t, y_t, is first expressed as the sum of growth contributions by regions or expenditure component, *Cont:*

$$y_t = (GDP_t/GDP_{t-1} - 1) * 100 = \sum_{i=1}^{n} Cont_{t,i},$$

where $n = 4$ in the case of decomposition of world volatility by expenditure components and $n = 7$ in the cases of decomposition of world growth by regions and decomposition of U.S. output volatility by expenditure components. The contributions to world growth are calculated from the data sources described below. For the United States, the contributions to growth are reported directly by the Bureau of Economic Analysis. To simplify analysis, the volatility decompositions are not calculated on a per capita basis—however, volatilities of headline and per capita growth tend to be similar for most countries.

Volatility decompositions in the top panels of Figures 5.5, 5.6, and 5.7 are calculated using the standard formula:

$$var\ y_t = \sum_{i=1}^{n} var(Cont_{t,i}) + \sum_{\substack{i=1,j=1 \\ \text{and } t \neq j}}^{n} cov(Cont_{t,i}, Cont_{t,j}),$$

where *var* and *cov* denote the variance and covariance operators. The volatility decompositions are computed over four periods (1960–73, 1974–82, 1983–95, and 1996–2006), with years 1973 and 1983 broadly representing the main breaks in the volatility of world growth since 1960. Given data limitations, world volatility is not calculated for the 1950s. The year 1996 was selected as an additional breakpoint to facilitate analysis of volatility over the past decade (in advanced economies, the length of the typical cycle increased to about 10 years during the 1980s and 1990s).

The change in output volatility from period B to period A is decomposed as follows:

$$\begin{aligned} var^A y_t - var^B y_t = & \sum_{i=1}^{n} \{var^A(Cont_{t,i}) - var^B(Cont_{t,i})\} \\ & + \sum_{\substack{i=1,j=1 \\ \text{and } t \neq j}}^{n} \{std^A(Cont_{t,i})\, std^A(Cont_{t,j}) \\ & - std^B(Cont_{t,i})\, std^B(Cont_{t,j})\} corr^B(Cont_{t,i}, Cont_{t,j}) \\ & + \sum_{\substack{i=1,j=1 \\ \text{and } t \neq j}}^{n} std^A(Cont_{t,i})\, std^A(Cont_{t,j}) \{corr^A(Cont_{t,i}, Cont_{t,j}) \\ & - corr^B(Cont_{t,i}, Cont_{t,j})\}, \end{aligned}$$

where *std* and *corr* are the standard deviation and correlation operators. The first term in the equation above is the change in the volatility of regions or expenditure components and corresponds to "region variance" and "component variance" in the middle and bottom panels of Figures 5.5, 5.6, and 5.7. The second and third terms in the equation reflect the "contribution of covariance" in the figures. Specifically, the second term is the contribution of covariance to the decline in output volatility because of the lower standard deviations of growth contributions (note that these standard deviations enter as pairs and therefore cannot be assigned to individual regions or expenditure components). The third term is the contribution of covariance to the change in output volatility that occurred as a result of the change in the correlation of growth contributions among regions or expenditure components. The contribution of covariance is split into these two terms because changes in the volatility of components do not necessarily have the same sign as the changes in the correlation among components—see, for example, the middle and bottom panels of Figure 5.5—with interesting economic implications, as discussed in the main text.

In Figure 5.8 ("Volatility Patterns in Rapidly Growing Economies"), the beginning of the rapid growth period is identified as follows: initially, the first available year is identified in

which the five-year moving average of real GDP growth (1) exceeds 5 percent, and (2) remains above 5 percent for at least two years. Subsequently, the beginning of the takeoff is identified within the five-year window before this year.

Econometric Analysis

The econometric analysis (Tables 5.1 and 5.2) considers the following dependent variables:

- *output volatility:* defined as the standard deviation of detrended GDP growth per capita. Detrending is carried out using the Hodrick-Prescott (HP) filter;
- *share of output that is lost to recessions and slowdowns:* defined as the cumulative sum of all below-trend outputs, divided by the cumulative sum of all outputs. Detrending is again carried out using the HP filter; and
- *average length of expansions; share of time spent in recessions; whether a country is in an expansion in any given year:* expansions and recessions are defined as described at the start of this appendix.

Explanatory variables employed in the analysis include the following:

- *Broad institutions:* measured using the "executive constraint" variable from Marshall, Jaggers, and Gurr's Polity IV data set (2004).[30] This variable is instrumented using country- and period-specific initial values. The variable follows a seven-category scale, with higher values denoting better checks and balances in place on the executive branch of the government. A score of one indicates that the executive branch has unlimited authority in decision making; a score of seven represents the highest possible degree of accountability to another group of at least equal power, such as a legislature.
- *Financial development:* measured using the ratio of private sector credit by banks and other financial institutions to GDP. Data are from Beck, Demirgüç-Kunt, and Levine's Financial Development and Structure database (2007).[31] To allow for nonlinearities, regressions employ both the level and the square of this variable; the joint coefficient presented represents the marginal value, evaluated at the sample mean.
- *Quality of monetary policy:* the index is defined as $\exp[-0.005 * (\text{inflation} - 2 \text{ percent})^2]$. This measure of price stability rapidly deteriorates once inflation rises above 10 percent. For instance, the index equals 1 when inflation equals 2 percent, roughly ¾ when inflation equals 10 percent, and 0.2 when inflation equals 20 percent. The index moves only slightly in response to short-term inflation fluctuations, such as those stemming from oil price changes, so long as the initial inflation level is low. Although this variable is clearly influenced by factors other than the quality of monetary policy, it is nevertheless correlated with other proxies for the quality of the institutional setup behind monetary policy, over the more limited sample for which the latter are available.[32]
- *Volatility of fiscal policy:* measured as the rolling 10-year standard deviation of cyclically adjusted government expenditure to GDP, following the country-specific, instrumental-variable estimation procedure set out in Fatás and Mihov (2003).[33] The government expenditure data are from the World Bank's World

[30]For more details on the Polity IV database, see www.cidcm.umd.edu/polity.

[31]For more details on the Financial Development and Structure database, see www.worldbank.org.

[32]For instance, a cross-sectional regression of the monetary policy index on a measure of the turnover of central bank governors yields a t-statistic of 5.5 and an R^2 of 0.24. The analogous fixed-effects panel regression yields a t-statistic of 4.0 and an R^2 of 0.10.

[33]Using government expenditures, rather than the government balance, minimizes endogeneity concerns that stem from difficulties in cyclical adjustment. As discussed in Fatás and Mihov (2003, p. 11), "There are both theoretical considerations and empirical estimates that support the idea that spending (excluding transfers) does not react contemporaneously to the cycle. On the other hand, there is plenty of evidence that the budget deficit is automatically affected by changes in macroeconomic conditions and therefore more subject to endogeneity problems."

Development Indicators database (2007)[34] when available and the IMF's World Economic Outlook database otherwise.

- *Large current account deficit:* this indicator equals 1 when the current account deficit exceeds 5 percent of GDP; the indicator equals zero otherwise. Data are from the IMF's World Economic Outlook database when available and the World Bank's World Development Indicators database (2007) otherwise.
- *Trade openness:* the Wacziarg and Welch (2003) index is based on average tariff rates, average nontariff barriers, the average parallel market premium for foreign exchange, the presence of export marketing boards, and the presence of a socialist economic system. The variable is equal to zero prior to liberalization and 1 from the beginning of liberalization.[35]
- *Exchange rate flexibility:* measured based on the Reinhart-Rogoff coarse index of de facto exchange rate flexibility, collapsed to a three-value indicator (where 1 denotes a fixed or pegged exchange rate regime, 2 denotes an intermediate regime, and 3 denotes a free float). The Reinhart-Rogoff classification takes into account the existence in some economies of dual rates or parallel markets, and it uses the volatility of market-determined exchange rates to statistically classify an exchange rate regime.[36]
- *Share of agriculture in GDP:* the data are from the World Bank's, World Development Indicators database (2007).

All cross-sectional regressions are estimated using average values over the period 1970–2003.[37] Panel regressions are estimated using all available decade-average observations, starting in 1960, and use fixed effects. Probit regressions are estimated using annual data, starting in 1960.

Figure 5.10 is constructed as follows. First, each regression is estimated using the whole sample. Then the sample is split into advanced economies versus emerging market and developing countries, and mean values of the dependent and explanatory variables are calculated for each subsample. For each explanatory variable, the difference in its mean value across subsamples is multiplied by the relevant coefficient (estimated using the whole sample). This yields the contribution of the relevant explanatory variable to the (mean) difference of the dependent variable between advanced and other economies. Finally, and analogously, the above procedure is repeated, but with the sample split by decade (rather than into advanced versus other economies). This yields the contribution of each explanatory variable to the (mean) difference of the dependent variable between decades.

Other Data Sources

- *Real GDP and its components.* Data on an aggregate and per capita basis are from (1) Heston, Summers, and Aten's Penn World Tables Version 6.2 (2006);[38] (2) the World Bank's World Development Indicators database (2007); (3) the IMF's World Economic Outlook database; and (4) Maddison (2007).[39] Data from these sources are spliced multiplicatively together in the order in which they are numbered to produce the longest time series possible. Most of the data, however, are from the Penn World Tables, with data for 2007 based on projections from the IMF's World Economic Outlook database. Data from Maddison are available only for total GDP and GDP per capita.[40] Given the ongoing discussion about the accuracy of pre–World War II data (see Box 5.3), the analysis of pre-war data is con-

[34]For more details on the World Development Indicators data, see www.worldbank.org.

[35]For more details on the openness variable, see www.papers.nber.org/papers/w10152.pdf.

[36]For more details on the Reinhart-Rogoff index, see www.wam.umd.edu/~creinhar/Links.html.

[37]The robustness of the conclusions was also checked by estimating the regressions separately over the subperiods 1970–83 and 1984–2003.

[38]For more details on the Penn World Tables Version 6.2, see www.pwt.econ.upenn.edu.

[39]For more details, see www.ggdc.net/Maddison.

[40]See Johnson and others (2007) for a discussion of how GDP data vary across data sets, including across different versions of the Penn World Tables.

Box 5.3. New Business Cycle Indices for Latin America: A Historical Reconstruction

Important insights into the roots of business cycle volatility can be gained from long-run data spanning a variety of policy regimes and institutional settings. Yet there is a striking dearth of systematic work along these lines for most countries outside North America and western Europe.

A main obstacle to this line of research has been limited or patently unreliable historical GDP data for developing countries. Although the work of Maddison (1995, 2003) has been useful in making long-run data more easily accessible to macroeconomists, important deficiencies remain in the pre–World War II data reported by Maddison. For most developing countries, these data are either provided only for sparse benchmark years or compiled directly from secondary sources relying on a very limited set of macroeconomic variables and often using disparate methodologies to build up GDP estimates. As discussed below, this procedure can be misleading.

This box summarizes a new methodology for real GDP reconstruction laid out in Aiolfi, Catão, and Timmerman (2006; ACT henceforth), and compares the estimates for four Latin American countries (Argentina, Brazil, Chile, and Mexico) with those reported by Maddison (2007). Underpinning this new methodology is the idea that a cross section of economic variables shares a common factor structure. That is, fluctuations in any individual economic variables (such as industrial production, investment, and so on) stem from the combination of a common factor that affects all individual economic variables in an economy (that is, "a tide that raises all boats") plus an idiosyncratic (that is, sector- or variable-specific) component. Recent time-series techniques allow a sounder formalization of this classical factor approach, and recent studies have used it for forecasting purposes. ACT argue that such dynamic factor models can be also suitable for "backcasting" purposes, notably in the reconstruction of aggregate indices of economic activity. A critical requirement is the availability of a broad set of variables that is both heterogeneous enough and comprises individual series that bear a close relation to aggregate cyclical behavior. Natural candidates include investment, government revenues and expenditures, and sectoral output, as well as external trade and a host of financial variables for which there are data stretching far back in time. A main advantage of such a methodology is its relative robustness to errors in the measurement of individual variables—a problem deemed particularly severe in developing country statistics. Provided that such measurement errors are largely idiosyncratic, the resulting estimates will be far less sensitive to the effects of such errors than the usual procedure of adding up sectoral output indices to estimate an aggregate GDP, where each of these individual indices is measured with substantial idiosyncratic error.

The ACT backcasting methodology consists of three steps. First, all individual series are made stationary by detrending—a standard procedure in factor model estimation. Second, common factors are extracted from the cross section of stationary series. The third step consists of projecting the extracted factors on real GDP by an ordinary least squares regression confined to the period for which real GDP data are judged to be sufficiently reliable (usually sometime after World War II). Although the resulting indices track actual GDP very closely over this latter "in-sample" period (yielding very high R^2s and t-ratios), the methodology's reliance on coefficient stability over a period spanning several decades could potentially be criticized. However, Stock and Watson (2002) show that such common factor estimates are consistent even under temporal instability in the individual time series, provided this instability averages out in the construction

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

Box 5.3 *(concluded)*

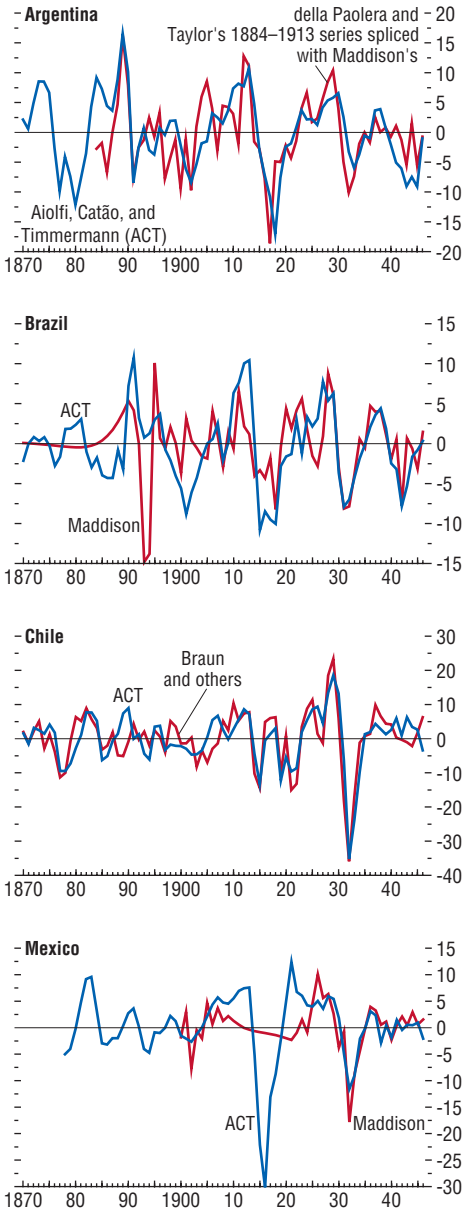
of the factors. In addition, ACT postulate a variety of structural stability tests and find that the respective backcasting estimates are remarkably robust to those tests. As a further robustness check, ACT also apply this backcasting method to U.S. data, comparing the resulting estimates with those of Romer (1989) and Balke and Gordon (1989), which are viewed as reasonably reliable gauges of U.S. pre–World War II GDP. ACT find that the proposed backcasting method gauges well the timing and magnitude of U.S. pre–World War II cycles, particularly when compared with the Balke and Gordon series.

How do these estimates differ from those previously found in the literature, including those reported in Maddison (1995, 2003)? Although the average volatility of output gaps over the time periods used in the main text is fairly comparable across data sets, the differences can be very dramatic at other times. Indeed, ACT show that some differences in the interpretation of historical episodes are startling. For instance, the Maddison-compiled index for Brazil shows a much deeper downturn in the wake of the 1891 Barings crisis (see figure), but this is very likely an artifact, arising because the index relies almost exclusively on foreign trade information and ignores indicators more tightly related to domestic production. Conversely, Maddison's (2003) real GDP figures for Mexico portray a remarkable output stability for the revolution years 1911–20, when it is well known from a variety of other indicators and historical narratives that output plunged during at least the height of the revolutionary disruptions in 1914–17.

Overall, these results indicate that extending this reconstruction methodology to other developing countries should prove worthwhile. Such an extension should enable us to better answer key questions about the historical evolution of world business cycles and the role of institutions and policy regimes therein.

Historical Output Gap Estimates: Differences Between Previous and New Estimates

(Percent)



Sources: Aiolfi, Catão, and Timmermann (2006); Braun and others (2000); della Paolera and Taylor (2003); and Maddison (1995, 2003).

fined to the average length of expansions and recessions for a selected group of countries (Figures 5.2 and 5.3).

- *Working-age population.* Interpolated five-year working-age population data are from the United Nations' Population Prospects: The 2004 Revision Population database.[41] Working-age population is defined as people between ages 15 and 64.

Country Coverage

The chapter covers 133 advanced economies and emerging market and developing countries. The countries are presented in the chapter as part of the following economic and regional groupings (the number of countries is in parentheses):

- *advanced economies* (28): Japan and the United States plus the following countries:
  - *EU-15:* Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom;
  - *newly industrialized Asian economies* (4): Hong Kong SAR, Korea, Singapore, and Taiwan Province of China; and
  - *other advanced economies* (7): Australia, Canada, Iceland, Israel, New Zealand, Norway, and Switzerland; and
- *emerging market and developing countries* (105): China and India plus the following countries:
  - *Africa* (49): Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Republic of Congo, Côte d'Ivoire, Djibouti, Egypt, Equatorial Guinea, Ethiopia, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, São Tomé and Príncipe, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Tunisia, Uganda, Zambia, and Zimbabwe;
  - *central and eastern Europe* (8): Albania, Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovak Republic, and Turkey (countries of the former Soviet Union are not included in the analysis because many variables for these countries are not readily available for the period prior to the 1990s);
  - *developing Asia* (13): Bangladesh, Cambodia, Indonesia, Kiribati, Lao People's Democratic Republic, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, Tonga, and Vietnam;
  - *Latin America* (21): Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, and Venezuela; and
  - *Middle East* (12): Bahrain, Islamic Republic of Iran, Jordan, Kuwait, Lebanon, Libya, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, United Arab Emirates, and Republic of Yemen.

[41]For more details, see esa.un.org/unpp.

References

Acemoglu, Daron, Simon Johnson, James Robinson, and Yunyong Thaicharoen, 2003, "Institutional Causes, Macroeconomic Symptoms: Volatility, Crises and Growth," *Journal of Monetary Economics*, Vol. 50, No. 1, pp. 49–123.

Ahmed, Shaghil, Andrew Levin, and Beth Anne Wilson, 2004, "Recent U.S. Macroeconomic Stability: Good Policies, Good Practices, or Good Luck?" *The Review of Economics and Statistics*, Vol. 86, No. 3, pp. 824–32.

Aiolfi, Marco, Luis Catão, and Allan Timmermann, 2006, "Common Factors in Latin America's Business Cycles," IMF Working Paper 06/49 (Washington: International Monetary Fund).

Arias, Andres, Gary D. Hansen, and Lee E. Ohanian, 2006, "Why Have Business Cycle Fluctuations Become Less Volatile?" NBER Working Paper No. 12079 (Cambridge, Massachusetts: National Bureau of Economic Research).

Artis, Michael, Hans-Martin Krolzig, and Juan Toro, 2004, "The European Business Cycle," *Oxford Economic Papers*, Vol. 56 (January), pp. 1–44.

Artis, Michael, Massimiliano Marcellino, and Tommaso Proietti, 2004, "Dating Business Cycles: A Methodological Contribution with an Application to the Euro Area," *Oxford Bulletin of Economics and Statistics*, Vol. 66, No. 4, pp. 537–65.

Balke, Nathan S., and Robert J. Gordon, 1989, "The Estimation of Prewar Gross National Product: Methodology and New Evidence," *Journal of Political Economy*, Vol. 97, No. 1, pp. 38–92.

Barrell, Ray, and Sylvia Gottschalk, 2004, "The Volatility of the Output Gap in the G7," *National Institute Economic Review*, Vol. 188 (April), pp. 100–107.

Baxter, Marianne, and Robert G. King, 1999, "Measuring Business Cycles: Approximate Band-Pass Filters for Economic Time Series," *Review of Economics and Statistics*, Vol. 81 (November), pp. 575–93.

Baxter, Marianne, and Michael A. Kouparitsas, 2005, "Determinants of Business Cycle Comovement: A Robust Analysis," *Journal of Monetary Economics*, Vol. 52 (January), pp. 113–57.

Bayoumi, Tamim, and Andrew Swiston, 2007, "The Ties That Bind: Measuring International Bond Spillovers Using the Inflation-Indexed Bond Yields," IMF Working Paper 07/128 (Washington: International Monetary Fund).

Beck, Thorsten, Asli Demirgüç-Kunt, and Ross Levine, 2000 (revised: March 21, 2007), "A New Database on Financial Development and Structure," *World Bank Economic Review*, Vol. 14 (September), pp. 597–605. Available via the Internet: www.econ.worldbank.org/staff/tbeck.

Berg, Andy, Jonathan D. Ostry, and Jeromin Zettelmeyer, 2006, "What Makes Growth Sustained?" (unpublished; Washington: International Monetary Fund).

Bernanke, Ben S., 2004, "The Great Moderation," remarks at the meetings of the Eastern Economic Association, Washington, February 20.

Blanchard, Olivier, and John Simon, 2001, "The Long and Large Decline in U.S. Output Volatility," *Brookings Papers on Economic Activity: 1*, pp. 135–64.

Braun, Juan, Matías Braun, Ignacio Briones, José Diaz, Rolf Lüders, and Gert Wagner, 2000, "Economia Chilena 1810–1995: Estadistícas Históricas," Working Paper No. 187 (Santiago: Catholic University of Chile, Instituto de Economía).

Canova, Fabio, and Harris Dellas, 1993, "Trade Interdependence and the International Business Cycle," *Journal of International Economics*, Vol. 34 (February), pp. 23–47.

Cecchetti, Stephen G., Alfonso Flores-Lagunes, and Stefan Krause, 2006a, "Assessing the Sources of Changes in the Volatility of Real Growth," NBER Working Paper No. 11946 (Cambridge, Massachusetts: National Bureau of Economic Research).

———, 2006b, "Has Monetary Policy Become More Efficient? A Cross-Country Analysis," *The Economic Journal*, Vol. 116 (April), pp. 408–33.

Clarida, Richard, Jordi Galí, and Mark Gertler, 2000, "Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory," *Quarterly Journal of Economics*, Vol. 115, No. 1, pp. 147–80.

Dalsgaard, Thomas, Jørgen Elmeskov, and Cyn-Young Park, 2002, "Ongoing Changes in the Business Cycle—Evidence and Causes," SUERF Studies No. 20 (Vienna: Société Universitaire Européenne de Recherches Financières).

Dell'Ariccia, Giovanni, Enrica Detragiache, and Raghuram Rajan, 2005, "The Real Effect of Banking Crises," IMF Working Paper 05/63 (Washington: International Monetary Fund).

della Paolera, Gerardo, and Alan Taylor, 2003, *A New Economic History of Argentina* (New York: Cambridge University Press).

DeLong, J. Bradford, 1997, "America's Peacetime Inflation: The 1970s," in *Reducing Inflation: Motivation and Strategy*, ed. by Christina D. Romer and David H. Romer (Chicago: University of Chicago Press), pp. 247–76.

Diebold, Francis X., and Glenn D. Rudebusch, 1992, "Have Postwar Economic Fluctuations Been Stabilized?" *The American Economic Review*, Vol. 82, No. 4, pp. 993–1005.

Dijk, Dick van, Denise R. Osborn, and Marianne Sensier, 2002, "Changes in Variability of the Business Cycle in the G7 Countries," Econometric Institute Report EI 282 (Rotterdam: Erasmus University, Econometric Institute).

Dynan, Karen E., Douglas W. Elmendorf, and Daniel E. Sichel, 2006, "Can Financial Innovation Help to Explain the Reduced Volatility of Economic Activity?" *Journal of Monetary Economics*, Vol. 53 (January), pp. 123–50.

Easterly, William, Roumeen Islam, and Joseph Stiglitz, 2000, "Shaken and Stirred: Explaining Growth Volatility," in *Annual Bank Conference on Development Economics* (Washington: World Bank).

Ehrmann, Michael, Marcel Fratzscher, and Roberto Rigobon, 2005, "Stocks, Bonds, Money Markets, and

Exchange Rates: Measuring International Financial Transmission," NBER Working Paper No. 11166 (Cambridge, Massachusetts: National Bureau of Economic Research).

Fatás, Antonio, and Ilian Mihov, 2003, "The Case for Restricting Fiscal Policy Discretion," *Quarterly Journal of Economics*, Vol. 118, No. 4, pp. 1419–47.

Frankel, Jeffrey A., and Andrew K. Rose, 1998, "The Endogeneity of the Optimum Currency Area Criteria," *Economic Journal*, Vol. 108 (July), pp. 1009–25.

Fuhrer, Jeffrey, and Scott Schuh, 1998, "Beyond Shocks: What Causes Business Cycles? An Overview," *New England Economic Review* (November/December), pp. 3–24.

Harding, Don, and Adrian Pagan, 2001, "Extracting, Analysing and Using Cyclical Information," MPRA Paper No. 15 (Munich: University Library of Munich).

Helbling, Thomas, and Tamim Bayoumi, 2003, "Are They All in the Same Boat? The 2000–2001 Growth Slowdown and the G-7 Business Cycle Linkages," IMF Working Paper 03/46 (Washington: International Monetary Fund).

Heston, Alan, Robert Summers, and Bettina Aten, 2006, Penn World Table Version 6.2, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania (September).

Imbs, Jean, 2004, "Trade, Finance, Specialization, and Synchronization," *The Review of Economics and Statistics*, Vol. 86 (August), pp. 723–34.

———, 2006, "The Real Effects of Financial Integration," *Journal of International Economics*, Vol. 68 (March), pp. 296–324.

Ito, Takatoshi, 2007, "Asian Currency Crisis and the International Monetary Fund, 10 Years Later: Overview," *Asian Economic Policy Review*, Vol. 2, pp. 16–49.

Johnson, Simon, Will Larson, Chris Papageorgiou, and Arvind Subramanian, 2007, "When the Facts Change: Shifting GDP Data and Their Implications" (unpublished; Washington: International Monetary Fund).

Juillard, Michel, Philippe Karam, Douglas Laxton, and Paolo Pesenti, 2006, "Welfare-Based Monetary Policy Rules in an Estimated DSGE Model of the US Economy," ECB Working Paper No. 613 (Frankfurt: European Central Bank).

Kahn, James A., Margaret M. McConnell, and Gabriel Perez-Quiros, 2002, "On the Causes of the Increased Stability of the U.S. Economy," *Economic Policy Review*, Vol. 8, No. 1, pp. 183–202.

Kent, Christopher, Kylie Smith, and James Holloway, 2005, "Declining Output Volatility: What Role for Structural Change?" Research Discussion Paper No. 2005-08 (Sydney: Reserve Bank of Australia, Economic Group).

Kim, Chang-Jin, and Charles R. Nelson, 1999, "Has the U.S. Economy Become More Stable? A Bayesian Approach Based on a Markov-Switching Model of the Business Cycle," *The Review of Economics and Statistics*, Vol. 81 (November), pp. 608–16.

Kose, M. Ayhan, Christopher Otrok, and Eswar Prasad, forthcoming, "Twin Peaks in Global Business Cycle Convergence," IMF Working Paper (Washington: International Monetary Fund).

Kose, M. Ayhan, Christopher Otrok, and Charles Whiteman, 2005, "Understanding the Evolution of World Business Cycles," IMF Working Paper 05/211 (Washington: International Monetary Fund).

Kose, M. Ayhan, Eswar Prasad, and Marco Terrones, 2003, "Financial Integration and Macroeconomic Volatility," IMF Working Paper 03/50 (Washington: International Monetary Fund).

Laxton, Douglas, and Papa N'Diaye, 2002, "Monetary Policy Credibility and the Unemployment-Inflation Trade-Off: Some Evidence from 17 Industrial Countries," IMF Working Paper 02/220 (Washington: International Monetary Fund).

Maddison, Angus, 1995, *Monitoring the World Economy* (Paris: Organization for Economic Cooperation and Development).

———, 2003, *The World Economy: Historical Statistics* (Paris: Organization for Economic Cooperation and Development).

———, 2007, World Population, GDP and Per Capita GDP, 1–2003 AD data set. Available via the Internet: www.ggdc.net/Maddison.

Marshall, Monty, Keith Jaggers, and Ted Robert Gurr, 2004, Polity IV data set. Available via the Internet: www.cidcm.umd.edu/polity.

McConnell, Margaret M., and Gabriel Perez-Quiros, 2000, "Output Fluctuations in the United States: What Has Changed Since the Early 1980s?" *American Economic Review*, Vol. 90, No. 5, pp. 1464–76.

Moneta, Fabio, and Rasmus Rüffer, 2006, "Business Cycle Synchronisation in East Asia," ECB Working Paper No. 671 (Frankfurt: European Central Bank).

Orphanides, Athanasios, 2003a, "Historical Monetary Policy Analysis and the Taylor Rule," *Journal of Monetary Economics*, Vol. 50 (July), pp. 983–1022.

———, 2003b, "Monetary Policy Evaluation with Noisy Information," *Journal of Monetary Economics,* Vol. 50 (April), pp. 605–31.

Reinhart, Carmen, and Kenneth Rogoff, 2004, "The Modern History of Exchange Rate Arrangements: A Reinterpretation," *Quarterly Journal of Economics,* Vol. 119 (February), pp. 1–48.

Romer, Christina D., 1989, "The Prewar Business Cycle Reconsidered: New Estimates of Gross National Product, 1869–1908," *Journal of Political Economy*, Vol. 97 (February), pp. 1–37.

———, 1999, "Changes in Business Cycles: Evidence and Explanations," *Journal of Economic Perspectives*, Vol. 13, No. 2, pp. 23–44.

———, and David H. Romer, 2002, "The Evolution of Economic Understanding and Postwar Stabilization Policy," in *Rethinking Stabilization Policy* (Federal Reserve Bank of Kansas City), pp. 11–78.

Satyanath, Shanker, and Arvind Subramanian, 2004, "What Determines Long-Run Macroeconomic Stability? Democratic Institutions," IMF Working Paper 04/215 (Washington: International Monetary Fund).

Sommer, Martin, 2007, "Habit Formation and Aggregate Consumption Dynamics," *The B.E. Journal of Macroeconomics—Advances*, Vol. 7, No. 1, Article 21. Available via the Internet: www.bepress.com/bejm/vol7/iss1/art21.

Stock, James H., and Mark W. Watson, 2002, "Macroeconomic Forecasting Using Diffusion Indexes," *Journal of Business and Economic Statistics*, Vol. 20, pp. 147–62.

———, 2003, "Has the Business Cycle Changed and Why?" in *NBER Macroeconomics Annual 2002* (Cambridge, Massachusetts: MIT Press), pp. 159–218.

———, 2005, "Understanding Changes in International Business Cycle Dynamics," *Journal of the European Economic Association*, Vol. 3 (September), pp. 968–1006.

Summers, Peter M., 2005, "What Caused the Great Moderation? Some Cross-Country Evidence," *Economic Review* (Third Quarter) (Federal Reserve Bank of Kansas City), pp. 5–32.

Wacziarg, Romain, and Karen Horn Welch, 2003, "Trade Liberalization and Growth: New Evidence," NBER Working Paper No. 10152 (Cambridge, Massachusetts: National Bureau of Economic Research).

White, William R., 2006, "Procyclicality in the Financial System: Do We Need a New Macrofinancial Stabilisation Framework?" BIS Working Paper No. 193 (Basel: Bank for International Settlements).

World Bank, 2007, *World Development Indicators* (Washington: World Bank).