

Box 1.3. How Does Uncertainty Affect Economic Performance?

Bouts of elevated uncertainty have been one of the defining features of the sluggish recovery from the global financial crisis. In recent quarters, high uncertainty has once again coincided with weakness in the global recovery. Many commentators argue that uncertainty is a major cause of escalating financial stress and recession in the euro area, stalling labor markets in the United States, and slowing growth in emerging market and developing economies.

This box explores the role of uncertainty in driving macroeconomic outcomes. Specifically, it addresses three major questions: How is uncertainty measured? How does it evolve over the business cycle? And what is the impact of uncertainty on growth and business cycles? To address these questions, the box briefly analyzes the main features of various measures of uncertainty and their association with growth and business cycles in advanced economies, and it interprets the evidence in light of findings from recent research.

Uncertainty is shown to have a harmful impact on economic activity. First, the adverse effects are transmitted through multiple channels, with financial market imperfections and institutional constraints often magnifying them, so the effects of uncertainty are likely to vary across sectors and countries. Second, as experienced acutely since the global financial crisis, uncertainty is highly countercyclical. Third, cross-country evidence indicates that high uncertainty is often associated with deeper recessions and weaker recoveries.

How Is Uncertainty Measured?

Economic uncertainty frequently refers to an environment in which little or nothing is known about the future state of the economy. Shocks that lead to economic uncertainty can stem from a variety of sources, including changes in economic and financial policies, dispersion in future growth prospects, productivity movements, wars, acts of terrorism, and natural disasters (Bloom, 2009). Although uncertainty is difficult to quantify because of its latent nature, it can be measured

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indirectly in a number of ways. These measures emphasize distinct aspects of uncertainty facing an economy over time. Some of the measures focus on macroeconomic uncertainty, including the volatility of stock returns, variation in aggregate productivity, dispersion in unemployment forecasts, and the prevalence of terms such as “economic uncertainty” in the media. Others consider uncertainty at the microeconomic level, which is often measured by various indicators of dispersion across sectoral output, firm sales, and stock returns.

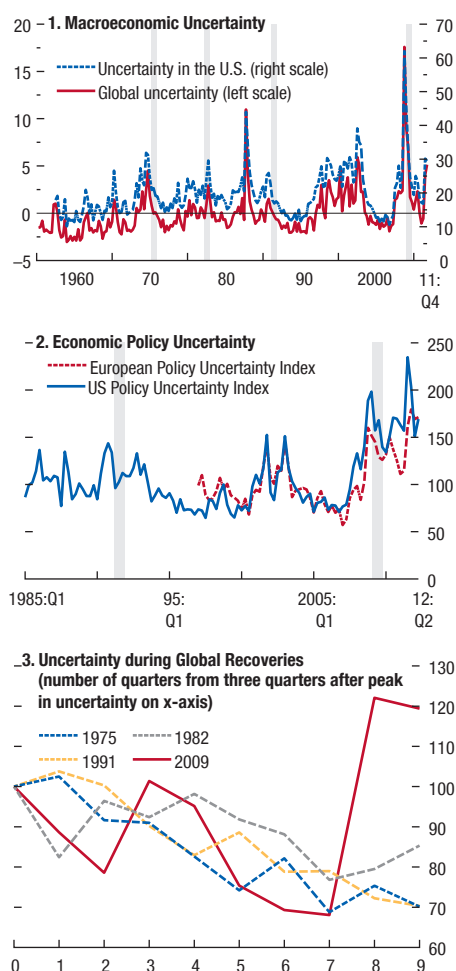
Because we are concerned primarily with macroeconomic uncertainty, we concentrate on four measures based on the volatility of stock returns and economic policy. The first is the monthly standard deviation of daily stock returns in each advanced economy in our sample.

The second is the Chicago Board Options Exchange Volatility Index (VIX), which is an indicator of the implied volatility of equity prices calculated from S&P 100 options. The third refers to uncertainty surrounding economic policies.¹ The fourth, which represents uncertainty at the global level, is the estimated dynamic common factor of the first measure using the series of the six major advanced economies with the longest available data.

How Does Uncertainty Evolve?

Both macroeconomic and policy measures of uncertainty tend to rise during global recessions (Figure 1.3.1). Policy uncertainty in the United States and the euro area has remained high since the global financial crisis and the recent sovereign debt problems in the euro area. Moreover, during the lethargic global recovery, uncertainty has been unusually high and volatile. This contrasts with the recoveries following the other three global recessions.

¹The economic policy uncertainty measure employed here is from Baker, Bloom, and Davis (2012), who use a weighted average of the following three indicators: the frequency with which terms like “economic policy” and “uncertainty” appear together in the media, the number of tax provisions that will expire in coming years, and the dispersion of forecasts of future government outlays and inflation. Because most of this information refers to outcomes it does not distinguish between uncertainty about policy goals and uncertainty about policy instruments.

Box 1.3. (continued)**Figure 1.3.1. Evolution of Uncertainty (Indices)**

Sources: IMF staff calculations; and Baker, Bloom, and Davis (2012).

Note: In panels 1 and 2, shaded areas denote the periods of global recession. These global recessions (1975, 1982, 1991, 2009) are identified following Kose, Loungani, and Terrones (2009). In panel 2, economic policy uncertainty in the United States and the euro area is from Baker, Bloom, and Davis (2012). Since these indicators are based on different measures, their levels are not strictly comparable. In panel 3, each line presents the evolution of uncertainty in the United States starting three quarters after uncertainty reached its peak during the respective global recession.

sions shown in Figure 1.3.1, which were accompanied by steady declines in uncertainty.

Uncertainty is highly countercyclical. Macroeconomic uncertainty varies over different phases of the business cycle: during expansions in advanced economies uncertainty is, on average, much lower than during recessions, regardless of the measure (Table 1.3.1). Microeconomic uncertainty, measured by the volatility of movements in plant-level productivity in the United States, also behaves countercyclically and reached a post-1970 high during the Great Recession (Bloom and others, 2012).

Causality between uncertainty and the business cycle is difficult to establish—does uncertainty drive recessions or do recessions lead to uncertainty? Empirical findings on this question are mixed.² However, economic theory, as discussed next, points to clear channels through which uncertainty can have a negative impact on growth. Some uncertainty is likely to be an intrinsic feature of the business cycle: firms and households will learn only over time which sectors of the economy will do better and which will do worse—and for how long—in response to the shocks that cause recessions.

What Is the Impact of Uncertainty on Growth and Business Cycles?

Economic theory suggests that macroeconomic uncertainty can have an adverse impact on output through a variety of channels. On the demand side, for example, when faced with high uncertainty, firms reduce investment demand and delay their projects as they gather new information, because investment is often costly to reverse (Bernanke, 1983; Dixit and Pindyck, 1994). Households' response to high uncertainty is similar to that of

²Bachmann and Moscarini (2011) find that the direction of causality runs from recessions to uncertainty. In contrast, Baker and Bloom (2011) offer evidence, using disaster data as instruments, that the causality runs from uncertainty to recessions, and Bloom and others (2012) report that growth does not cause uncertainty. Predictions of theory and findings from empirical studies collectively indicate that uncertainty can play a dual role over the business cycle: it can be an impulse as well as a propagation mechanism.

Box 1.3. (continued)**Table 1.3.1. Uncertainty over the Business Cycle**

	Country-Specific Uncertainty	Uncertainty in the United States	Economic Policy Uncertainty	Global Uncertainty
Recession	1.29*** (0.08)	24.12*** (0.50)	134.59*** (2.78)	1.61*** (0.18)
Expansion	0.93*** (0.03)	19.03*** (0.06)	100.56*** (0.51)	-0.24** (0.02)
Number of Observations	3,138	4,158	2,268	4,347
Number of Economies	21	21	21	21
R ² Adjusted	0.77	0.89	0.92	0.07
Test (<i>p</i> Values)				
h0: Recession Coefficient = Expansion Coefficient	0.00	0.00	0.00	0.00

Source: IMF staff calculations.

Note: The dependent variable is the level of uncertainty. Recessions and expansions in regressions refer to dummy variables taking the values of 1 and zero when the economy is in recession and expansion, respectively. The periods of recession and expansion are defined following Claessens, Kose, and Terrones (2012). Country-specific uncertainty refers to the monthly standard deviation of daily stock returns in each country. Daily returns are calculated using each country's stock price index. Data series cover the period 1960–2011, but coverage varies across economies. Uncertainty in the United States refers to the Chicago Board Options Exchange VXO index, which is calculated from S&P 100 options. Prior to 1986, this series has been extended following Bloom (2009). The policy uncertainty measure is an index of economic policy uncertainty for the United States from Baker, Bloom, and Davis (2012). It refers to the weighted average of three indicators, including the frequency of the appearance of terms like “economic policy” and “uncertainty” in the media, the number of tax provisions that will expire in coming years, and the dispersion of forecasts of future government outlays and inflation. Global uncertainty is the estimated dynamic common factor of the first measure using the series of France, Italy, Germany, Japan, the United Kingdom, and the United States. (These countries have the longest series of stock market indices.) *** denotes that the coefficients are statistically significant at the 1 percent level. Standard errors are in parentheses.

firms: they reduce their consumption of durable goods as they wait for less uncertain times. On the supply side, firms' hiring plans are also negatively affected by higher uncertainty, reflecting costly adjustment of personnel (Bentolila and Bertola, 1990).

Financial market imperfections can amplify the negative impact of uncertainty on growth. In theory, uncertainty leads to a decline in expected returns on projects financed with debt and makes it harder to assess the value of collateral. Thus, creditors charge higher interest rates and limit lending during uncertain times, which reduces firms' ability to borrow. The decline in borrowing causes investment to contract, especially for credit-constrained firms, and results in slower productivity growth because of reduced spending on research and development. These factors together can translate into a significant reduction in output growth (Gilchrist, Sim, and Zakrajsek, 2010).

The impact of uncertainty differs across sectors and countries. The sectors that produce durable goods—including machinery and equipment, automobiles, houses, and furniture—are often the most affected by increases in uncertainty. The impact of an uncertainty shock on consumption and investment is larger in emerging market economies than in advanced economies, probably because the

former group tends to have less developed financial markets and institutions (Carrière-Swallow and Céspedes, 2011).

Empirical evidence suggests that uncertainty tends to be detrimental to economic growth. The growth rate of output is negatively correlated with macroeconomic uncertainty (Table 1.3.2). A 1 standard deviation increase in uncertainty is associated with a decline in output growth of between 0.4 and 1.25 percentage points depending on the measure of macroeconomic uncertainty. There were indeed multiple episodes during which uncertainty rose by 1 standard deviation or more, including at the onset of the Great Recession and during the recent debt crisis in the euro area. High uncertainty tends to be associated with a larger drop in investment than in output and consumption growth. These findings lend support to the validity of different theoretical channels through which uncertainty adversely affects economic activity. They are also consistent with recent studies documenting a negative relationship between growth and uncertainty.³

³Empirical evidence based on vector autoregression (VAR) models points to a significant negative impact of uncertainty shocks on output and employment (Bloom, 2009; Hirata and others, 2012). These results also echo the findings in a broader area of research on the negative impact of macroeconomic and policy volatility on economic growth (Ramey and

Box 1.3. (continued)**Table 1.3.2. Uncertainty and Growth**

	Output				Consumption				Investment			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Country-Specific Uncertainty	-0.65*				-0.23				-1.18			
	(0.37)				(0.38)				(0.99)			
Uncertainty in the U.S.		-0.18***				-0.12***				-0.41***		
		(0.01)				(0.01)				(0.06)		
Economic Policy Uncertainty			-0.01***				-0.01				-0.02**	
			(0.00)				(0.00)				(0.01)	
Global Uncertainty				-0.46***				-0.31***				-0.87***
				(0.03)				(0.04)				(0.164)
Number of Observations	3,117	4,157	2,267	4,283	3,115	4,155	2,265	4,281	3,111	4,041	2,265	4,123
Number of Countries	21	21	21	21	21	21	21	21	21	21	21	21
R ² Adjusted	0.42	0.38	0.44	0.38	0.09	0.13	0.06	0.13	0.31	0.25	0.35	0.25

Source: IMF staff calculations.

Note: Dependent variable is the year-over-year growth of the respective macroeconomic aggregate. All specifications include country fixed and time effects. See notes to Table 1.3.1 for explanations of uncertainty measures. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively. Standard errors are in parentheses.

Table 1.3.3. Uncertainty and Business Cycles

	Recessions		Recoveries	
	With High Uncertainty	Others	With High Uncertainty	Others
Output				
Duration	4.00	3.89	4.81	4.54
Amplitude	-3.66**	-1.85	2.31*	3.06
Slope	-0.78*	-0.49	0.66*	0.77
Cumulative Loss	-5.81*	-2.99
Consumption	-0.46	-0.37	1.53	2.21
Investment	-9.44	-5.22	-0.48**	3.28
Number of Episodes	28	83	28	82

Source: IMF staff calculations.

Note: A recession is associated with high uncertainty if the level of uncertainty at its trough falls in the top quartile of uncertainty measured at the troughs of all recessions. A recovery is associated with high uncertainty if the average uncertainty during the recovery is in the top quartile of average uncertainty of all recovery episodes. The periods of recession and recovery are defined following Claessens, Kose, and Terrones (2012). All statistics except "Duration" correspond to sample median. For duration, means are shown. For recessions, duration is the number of quarters between peak and trough. Duration for recoveries is the time it takes to attain the level at the previous peak after the trough. The amplitude for recessions is calculated based on the decline in output during the recession and expressed in percent. The amplitude for the recoveries is calculated based on the one-year change in output after the trough and expressed in percent. The slope of the recessions is the amplitude from peak to trough divided by the duration. The slope of recoveries is the amplitude from the trough to the period where output has reached the level at its last peak divided by the duration. Cumulative loss combines information about duration and amplitude to measure the overall cost of a recession and is expressed in percent. ** and * denote that features of recessions (recoveries) with high uncertainty differ significantly from those of other recessions (recoveries) at the 5 percent and 10 percent levels, respectively.

Policy-induced uncertainty is also negatively associated with growth. The adverse impact of policy uncertainty on economic growth works mainly through two channels. First, it directly affects the behavior of households and firms as they postpone investment and consumption decisions when uncertainty about future policies is elevated. Second, it breeds macroeconomic uncertainty, which in turn reduces growth. As noted, policy

uncertainty has increased to record levels since the Great Recession. Specifically, the increase in policy uncertainty between 2006 and 2011 was about 5 standard deviations. This sharp increase in policy uncertainty may have stymied growth in advanced economies by 2½ percentage points during this period.⁴

⁴This finding is consistent with results from a recent study by Baker, Bloom, and Davis (2012). They employ a VAR model and report that a jump in policy uncertainty, such as the one observed between 2006 and 2011 in the United

Ramey, 1995; Kose, Prasad, and Terrones, 2006; Fatas and Mihov, forthcoming).

Box 1.3. (continued)

The degree of economic uncertainty also appears to be related to the depth of recessions and strength of recoveries. In particular, recessions accompanied by high uncertainty are often deeper, longer, and more severe than other recessions. Moreover, recessions in highly uncertain environments are associated with cumulative output losses roughly two times larger than those during other recessions (Table 1.3.3). Similarly, recoveries coinciding with periods of elevated uncertainty are weaker and slower than other recoveries.⁵ Both consumption

States, is associated with about a 3 percent decline in real GDP and a 16 percent contraction in private investment.

⁵The unusually high levels of uncertainty the global economy experienced since the 2007–09 financial crisis and the associated episodes of deep recessions and weak recoveries play an important role in explaining these findings. Uncertainty shocks account for about one-third of business cycle variation in advanced economies and up to half of cyclical volatility in emerging market and developing economies, implying that these shocks play a sizable role in driving the dynamics of recessions and expansions (Bloom and others,

and investment tend to grow at a slower pace during recoveries associated with high uncertainty.

Global Recovery in Times of Manifold Uncertainty

Elevated uncertainty historically coincides with periods of lower growth, and the recent pickup in uncertainty raises the specter of another global recession. Policymakers can do little to alleviate the intrinsic uncertainty economies typically face over the business cycle. However, policy uncertainty is unusually high, and it contributes significantly to macroeconomic uncertainty. By implementing bold and timely measures, policymakers can reduce policy-induced uncertainty and help kick-start economic growth. What precisely policymakers need to do is discussed in the main text of Chapter 1.

2012; Baker and Bloom, 2011). Other relevant research concludes that shocks associated with uncertainty and financial disruptions were the primary factors that led to the Great Recession (Stock and Watson, forthcoming).