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Asset Price Levels and Volatility: Causes and Implications

The variability of real activity and inflation in the United States has declined substantially since the mid-1980s--a development often termed the Great Moderation. During roughly the same period, equity valuations have risen, and term premiums for fixed-income assets have fallen. The obvious question is whether these real economy and financial market phenomena are measurably related. Put differently, has less-variable real activity helped increase the value of financial assets, as some have claimed? It is certainly possible to see how such a link might occur. If perceived to be persistent over sufficiently long periods of time, greater economic stability could support higher asset prices by reducing risk premiums on financial assets. It is also plausible that more stability in output and inflation could lead to lower volatility in financial asset prices.

In my remarks today, I want to discuss what researchers are uncovering about the links between the volatility of real activity and asset prices. As a monetary policy maker, I am interested in these links because the prices of financial assets affect the spending decisions of firms and households and because these prices may reveal forward-looking information relevant for setting policy. In addition, I want to discuss changes in financial markets themselves that may contribute to asset price volatility. Before proceeding, I must indicate that the views I am about to express are my own and do not necessarily reflect the views of other members of the Board of Governors or the Federal Open Market Committee.

The volatility of GDP has fallen while equity prices have risen

A number of researchers have documented that the volatility of economic activity has moderated since the mid-1980s (Kim and Nelson, 1999; McConnell and Perez-Quiros, 2000). Moreover, the decline does not appear to be the result of a long-term downward trend but appears to conform more to a structural break around the mid-1980s. The moderation is substantial: The standard deviation of the quarterly growth rate of real gross domestic product from 1985 to 2004--about 2.1 percent--is only about one-half its standard deviation from 1960 to 1984. Similar-sized declines in volatility have been evident in many of the components of GDP, including consumption and residential investment, and also in inflation. Declines have also occurred in the volatility of business investment and corporate profits, but these declines have been more modest.

A variety of explanations for this Great Moderation have been put forth, and each has garnered some empirical support. First, the U.S. economy might have been lucky, and the shocks to the economy have been milder than in the past (Stock and Watson, 2002; Ahmed, Levin and Wilson, 2004). Another explanation is that firms may have adopted information technologies that allow them to more efficiently manage their inventories (Kahn, McConnell, and Perez-Quiros, 2002), thus limiting destabilizing imbalances and rectifying them more quickly when they arise. Better conduct of monetary policy could also lead to lower inflation and economic volatility (see, for example, Clarida, Gali, and Gertler, 2000;

and Romer and Romer, 2002). Finally, financial innovations, such as risk-based loan pricing and expanded securitization, may have enhanced the ability of households to borrow, which would make them less sensitive to fluctuations in income (Dynan, Elmendorf, and Sichel, 2005).

Importantly, equity valuation, as measured by the price-earnings ratio of the S&P 500, has been higher in the past two decades than in the two decades before that. The price-earnings ratio averaged 14 from 1960 to 1984 and rose to an average of 19 over 1985-2004. The average since 1984 falls only slightly, to 18, if we exclude the late 1990s and 2000, when valuations reached record levels. The rise in equity valuations at the same time that macroeconomic volatility fell is circumstantial evidence of a link between the two.

Interest rates also could potentially have been affected by the Great Moderation. Investors in Treasury bonds require a risk (or term) premium to compensate them for the risk of loss on longer-maturity bonds resulting from movements in interest rates. Term premiums could be lower when inflation expectations are well anchored or the macroeconomy is less volatile. Ongoing research by Board staff suggests a notable downward trend in term premiums since 1990 (Kim and Wright, 2005). This secular decline in term premiums since 1990 appears to be correlated with the decline in long-run inflation uncertainty and in short-term interest rate uncertainty.

Does volatility of real activity affect the level of asset prices?

Now, I would like to explore some of the research that might explain whether and, if so, how the Great Moderation affected the level of asset prices. Structural models of asset prices provide a consistent framework for understanding both equity prices and interest rates. In these models, each asset price contains a risk premium that represents the additional return demanded by risk-averse investors for bearing risk. A reduction in macroeconomic volatility that reduces uncertainty about earnings or dividends could reduce the equity risk premium and, as a result, lead to higher equity prices. Less uncertainty about future inflation could lower the risk premiums on nominal Treasury bonds, lowering the risk-free interest rate. There is, however, a potential offset as well. Lower volatility may reduce the motive for precautionary savings and thus put upward pressure on interest rates and, all else equal, downward pressure on equities.

One recent paper has directly examined whether the recent decline in economic volatility contributed to a lower long-run equity premium and the steep run-up in stock prices in the late 1990s (Lettau, Ludvigson, and Wachter, 2005). This model supposes that investors learn about the new, low-volatility regime only gradually. The researchers estimate that investors revised up the probability of being in a low-volatility regime starting in the early 1990s. This revision, if perceived to be persistent, could explain the magnitude of the decline in the long-run equity premium in the late 1990s. However, one concern that has been raised about this model is that it does not also address the behavior of interest rates over the past decade.

Some other studies address the effect of macroeconomic volatility on both stock prices and the risk-free interest rate. However, the focus of these papers is not explicitly on a downward shift in volatility, as implied by the Great Moderation, but instead on a temporary drop in volatility that is eventually reversed. These papers find that lower volatility leads to higher interest rates and a lower equity premium, but the net effect on stock prices depends on how the researchers choose to model investors' risk and savings preferences (see, for example, Bansal and Yaron, 2004; Bekaert, Engstrom, and Xing 2005). Ongoing research by Board staff members (Bekaert, Engstrom and Xing 2005) suggests that when a more flexible

specification for investor preferences is adopted, macro volatility has little net effect on stock prices. That is, this research finds that the downward pressure of the higher interest rates on equity prices roughly offsets the upward pressure of a lower equity premium.

The effect of a reduction in the variability of inflation, rather than output, on equity premiums has also been examined. Against the backdrop of a long-term downward trend in the equity premium, from unusually high levels in the late 1930s and 1940s, Blanchard (1993) shows that year-to-year moves in the equity premium are correlated with changes in inflation. In particular, lower deviations of inflation from past trends are correlated with lower-than-average equity premiums, an indication that the decline in the volatility of inflation is a factor behind the observed decline in the equity premium in the 1980s.

In short, although the data are suggestive, tests based on asset pricing models have not firmly established an empirical link between reduced macroeconomic volatility and higher asset prices. The ability to establish such a link is limited, in part because many of the fundamental concepts underlying asset prices, such as risk aversion and expected volatility of growth, are difficult to measure and the model outcomes depend greatly on assumptions regarding these key variables.

Does volatility of real activity affect the volatility of asset prices?

I would like to turn now from the level of asset prices to their volatility. In brief, evidence of a decline in this volatility is scarce. For S&P 500 returns, the annualized standard deviation was 13.2 percent over 1985-2004, about matching the 12.9 percent figure over 1960-84. For the ten-year Treasury bond, the annualized standard deviation of interest rate changes was 1.1 percentage points over 1985-2004, down only slightly from 1.4 percentage points over 1960-84. These data indicate clearly that the Great Moderation of volatility in GDP and many of its components has not carried over to the volatility of asset prices.

To better understand what could appear to be an anomaly, a theoretical framework is helpful. Asset price volatility can be decomposed into two pieces--one that depends on the volatility of future cash flows and one that depends on the volatility of the discount rate applied to those cash flows. For the stock market, the relevant cash flows might be thought of as dividends or earnings, and the discount rate would be the sum of the real risk-free interest rate and the equity risk premium. Research has suggested that the variation in dividends or earnings accounts for no more than one-fourth of stock market volatility, whereas variation in the discount rate accounts for the bulk of the volatility.

Recent research by Board staff members (Campbell, 2005) has shown that the volatility of investors' forecasts of future corporate earnings or dividends has declined substantially, which would tend to lower the volatility of stock prices. However, this paper also showed that the volatility of the discount rate, which historically has been the main driver of stock market volatility, has not declined. This result could arise if the volatility of investors' risk aversion is independent of macroeconomic volatility, as would be consistent with asset pricing models that are based on habit formation (Campbell and Cochrane, 1999). Other researchers (Bekaert, Engstrom, and Xing, 2005) also find evidence consistent with this hypothesis. Another reason why the volatility of discount rates may not have fallen is that investors learn only gradually about changes in macro volatility and thus have greater uncertainty about the current volatility regime. Alternatively, investors may fear that volatility will revert back to a higher level in the future. The bottom line is that some big questions remain unanswered and that this topic remains very much an active area of research.

Volatility of asset prices may also be affected by changes in financial markets

So far I have focused on how macroeconomic volatility can affect asset prices. I have argued that observable macroeconomic variables, such as the volatility of news about future earnings or the volatility of macroeconomic factors, such as consumption, can explain only a fraction of the asset price volatility that we observe. At this point, it seems sensible to look elsewhere to try to explain asset price volatility. Microeconomic factors seem like the logical next place to look.

The microeconomic factor I want to focus on is the greater effect of market liquidity on asset prices. The liquidity of financial markets has expanded significantly in recent years, to the great benefit of many segments of our economy. As liquidity has grown, some of the volatility we have seen in asset prices may be related to shifts in market liquidity. Some believe that liquidity may now be a more significant factor in three particular areas: financial innovations that enable a wider range of risks to be traded, the trading behavior of large investors, and the growing role of hedge funds.

Financial engineering has produced many innovations that enable risks to be unbundled and dispersed throughout the financial system. For example, the new technologies of securitization and credit derivatives help banks better manage their exposure to credit risk by offloading some of their risk to institutional investors who appear to be more willing and able to bear it. Dispersing risk widely creates a more resilient financial system, which in turn allows the economy to better weather disruptions. High-profile defaults in recent years, such as those of Enron, WorldCom, Parmalat, and Delphi, have not caused financial distress among large financial institutions or disrupted the supply of credit to the nonfinancial sector in any noticeable way.

Some people have argued, however, that because these financial innovations rely on market liquidity, they impose costs by increasing asset price volatility when demands for liquidity are unusually high. For example, some blame the stock market crash of 1987, either wholly or in part, on portfolio insurance strategies practiced by some market participants at that time. Likewise, some have blamed past bouts of volatility in fixed-income markets partly on investors who dynamically hedge the prepayment risk of mortgage-backed securities.

It seems clear that large and sudden changes in asset prices can occur when market participants do not sufficiently consider liquidity. Fortunately, however, recent episodes have served as painful lessons for some market participants of the need to actively manage market liquidity risk. For example, swaps dealers now routinely estimate mortgage-related hedging flows to try to anticipate the changes in liquidity that could accompany swings in mortgage prepayment risk.

Effectively managing market liquidity risk can limit the effects on asset price volatility. Market participants have learned that lesson and have strong incentives to manage liquidity risk by means that include the stress-testing of their portfolios with scenarios such as a sudden absence of liquidity in key markets. It is, in my judgment, important for supervisors to reinforce that incentive and encourage more institutions to conduct such stress tests.

Recent research at the Federal Reserve Board sheds some light on how liquidity conditions can be influenced by the trading behavior of large investors and can, in turn, affect asset price volatility (Pritsker, 2005). The research shows that the presence of large investors can affect market price dynamics if they become forced sellers. Specifically, forced sales by large investors can temporarily cause assets to be mispriced, no longer reflecting long-run

fundamentals, past pricing relationships to break down, and liquidity factors to take on importance for asset pricing. The results of this research would appear to be relevant to our thinking about markets dominated by large investors. However, this finding merely reinforces the earlier comment that all investors need to consider liquidity risk carefully, and it puts a special focus on the class of large investors that has emerged in the last decade as the financial sector has undergone a period of consolidation and growth.

No discussion of liquidity and volatility would be complete without a mention of hedge funds. Hedge funds have grown rapidly in recent years: Assets under management are estimated to have grown from \$50 billion in 1993 to \$600 billion in 2003 and close to \$1 trillion today. However, with 8,000 hedge funds in existence, according to industry estimates, the average size of a hedge fund is less than \$120 million. Therefore, few, if any, hedge funds seem to be of systemic scale. Hedge funds provide valuable liquidity and reduce the mispricing of financial assets that might occur across markets, making markets more efficient. They appear to have an advantage over other market participants in the provision of these services because they have more-flexible investment strategies and can adapt quickly to changing market opportunities.

Some observers are concerned that the features of hedge funds that promote liquidity and efficient pricing might also contribute to higher asset price volatility. One concern along these lines is that sudden withdrawals by investors could force hedge funds to sell into a falling market. Of course, this is a risk that hedge fund managers have an incentive to manage by taking into account the liquidity of both their assets and their liabilities. One tool that hedge funds appear to actively use when managing this risk is lock-up periods on investors' capital. Therefore, this concern seems misplaced, in my assessment.

A second concern is that excessive leverage at hedge funds could lead their counterparties to close out their positions in the event of an adverse shock, again potentially increasing volatility. Sound credit-risk management by hedge fund counterparties is important for effectively addressing this risk, and supervisors are promoting such techniques among the institutions they oversee. Although these institutions have made progress at improving their management of hedge fund credit risk, some work remains to be done, but the counterparties of hedge funds are undertaking that work.

Finally, some hedge funds do appear at times to crowd into niche markets to exploit mispricings, and their actions have occasionally caused price volatility in those niches to rise. However, this behavior would be expected to self-correct as the overcrowded trades produce low returns that disappoint hedge fund investors. In any case, price volatility in niche markets poses little danger of systemic risk as long as other market participants manage their exposure to such events prudently.

Summary and lessons for policymakers

To sum up, macroeconomic volatility has declined over the past two decades. Some of this decline appears to have fed through to financial markets in the form of lower risk premiums and higher asset valuations. To some extent, the lack of a clear link between macroeconomic volatility and the level of asset prices in existing research and models should not be a surprise. Explaining asset prices is difficult because they are determined by many complex factors, such as risk aversion, expected future earnings, and expected earnings volatility, which are inherently difficult to measure.

A more concrete finding is that the decline in macroeconomic volatility has not led to a decline in asset price volatility. News about corporate earnings appears to have become less

volatile, but this factor explains only a small part of the reduction in the volatility of asset prices. Rather, existing research suggests that asset price volatility remains largely a reflection of variation in investors' discount rates rather than of changes in forecasts of fundamentals. On a micro level, financial innovations and new types of market participants appear to have led to greater market efficiency and liquidity. Still, growing pains in the markets are inevitable, and policymakers need to watch financial markets carefully for any warning signs that may appear. It certainly feels like market liquidity, investor behavior, and asset price volatility are more important considerations for policymakers now than they were decades ago. That said, the benefits of a more efficient financial system seem to me and most others to outweigh the costs.

From my perspective as a policymaker, the lesson I take from these developments is that the best course of action is good preparation for potential problems. First and foremost is maintaining low and stable inflation. Inflation expectations that are well anchored provide policymakers much greater flexibility to respond as unexpected events unfold in financial markets. Second, policymakers need to encourage sound risk management by private market participants because that is the primary line of defense against financial instability. Supervisors should create incentives for sound risk management at supervised institutions, and central banks should ensure that the infrastructure of financial markets, especially arrangements to clear and settle financial market transactions, is subject to robust risk management.

In conclusion, a policymaker today probably has a different perspective on the world compared with that of a policymaker forty years ago, long before the Great Moderation. Without targeting asset prices, we need to be more attentive now to financial markets because asset prices affect spending to a greater degree than before and because asset prices provide us with a greater amount of timely information to guide policy. Moreover, we have become an even more receptive audience for research that enables us to better understand the links between the real economy and financial asset prices. It is for that reason that I wish to thank the Banco de Mexico for giving me an opportunity to participate in this conference.

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