

# FRBSF ECONOMIC LETTER

Number 2008-06, February 15, 2008

## Recent Trends in Economic Volatility: Conference Summary

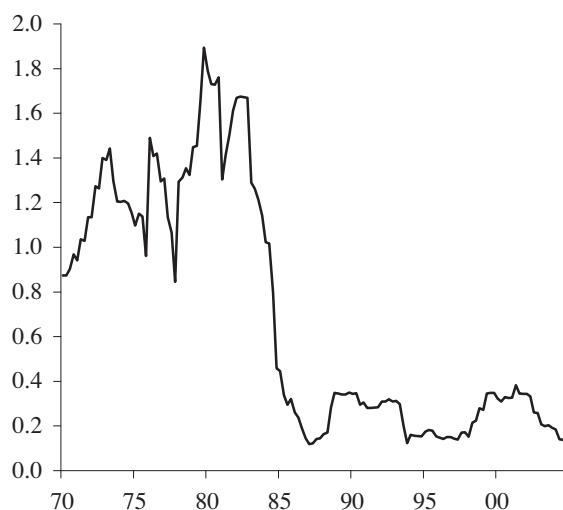
*This Economic Letter summarizes the papers presented at a conference on “Recent Trends in Economic Volatility” held at the Federal Reserve Bank of San Francisco by the Bank’s Center for the Study of Innovation and Productivity on November 2 and 3, 2007. The papers are listed at the end and are available at <http://www.frbsf.org/economics/conferences/0711/>*

Over the last 25 years, the U.S. economy has become much less volatile; that is, the swings from boom to bust have been greatly reduced, as has the pain typically associated with such cycles. As Figure 1 illustrates, the volatility of GDP growth has fallen by more than half since 1985. Many observers refer to this phenomenon as the “Great Moderation.” To what can we credit this improved environment? Researchers have uncovered several potential drivers, including improved technology (especially related to inventory and supply chain management), better monetary policy, and simple good luck, but to date they have found little consensus on which factor is most important. Also in dispute is the extent to which the decline in aggregate volatility has been mirrored in the microeconomic data on income and employment. In other words, have households and businesses also experienced a decline in volatility? The seven papers presented at the Center for the Study of Innovation and Productivity’s conference on “Recent Trends in Economic Volatility” investigate these questions. Although the debate is not over, the papers have moved the research forward and highlighted key questions for future work.

### Structural change vs. good luck in explaining the Great Moderation

The first paper of the conference, by Galí and Gambetti, begins with a useful summary of the various explanations for the Great Moderation, placing them into two broad categories: structural changes and “good luck.” Structural changes in-

**Figure 1**  
**Variance of quarterly real GDP growth**  
(Five-year moving variance)



Source: Bureau of Economic Analysis.

clude changes in the way monetary policy is conducted and technology-driven changes that affect the way firms operate. “Good luck” essentially means smaller and fewer economic shocks. Galí and Gambetti go on to use a standard empirical model known as a structural vector autoregression in order to characterize the correlations in post-World War II data among key U.S. macroeconomic variables. They posit that if declining volatility is merely the result of “good luck,” then the data should show no change in the correlations between them. Their model, however, finds that this is not the case, as correlations between output, labor hours, and productivity have indeed changed since the early 1980s. Having eliminated good luck as an explanation, they attribute most of the decline in volatility to a decline in nontechnology shocks, which have come about due to a change in the Federal Reserve’s monetary policy “rules” (specifically, an increased emphasis on fostering low



**CSIP NOTES**

CSIP Notes appears on an occasional basis. It is prepared under the auspices of the Center for the Study of Innovation and Productivity within the FRBSF’s Economic Research Department.

and stable inflation in addition to strong economic growth) as well as a reduction in labor adjustment costs. It is worth noting that the authors' finding that reduced labor adjustment costs may have played an important role in the Great Moderation is consistent with evidence, discussed below, provided by the paper of Davis et al., which explores the secular decline in labor market volatility.

### **The role of technological change**

Several papers ascribe a key role to technological progress in explaining declining volatility. The first of these papers, by Koren and Tenreyro, looks at how development of new technologies affects both the rate of growth and the volatility of growth in an economy. Their model posits that, just as households benefit from investing in a diversified portfolio of stocks (smoothing their returns and minimizing losses stemming from shocks to specific assets), having a larger and more diverse "menu" of technologies available to firms in a country means that each specific technology plays less of a role in production. The diversification of technologies in an economy makes it easier for firms to offset price or supply shocks to specific inputs (oil, for example) by substituting with other technologies that rely less on those inputs. In this way, technological advances reduce firm-level volatility, which consequently reduces overall volatility. Technological change also boosts the level of growth, since it allows firms to move to a new technology before reaching the point of diminishing returns in their old technology. While sensible and consistent with data that Koren and Tenreyro bring to bear, this finding contrasts sharply with the conclusions of previous research, which point to an explicit trade-off between risk (volatility) and return (fast growth).

Comin and Mulani also examine the effects of technological change on economic growth and volatility and, similarly, find that technological change leads to both faster growth and lower volatility. But in contrast to the previous paper, Comin and Mulani argue that this good result holds only for the national, or macro, measures. Indeed, predictions from their model suggest that firm-level, or micro, volatility should increase as the pace of technological innovation increases. To get this result, they consider an economy with two types of technologies: general innovations (GIs), which are not patentable and are used by all firms in the economy, and research and development innovations (RDI), which are patentable and used by a limited number of firms. They then assume

that GIs are produced by large, stable firms and RDIs are produced by smaller, more volatile firms. Under these conditions, they show that increases in RDIs (for example, due to government research and development (R&D) subsidies) lead to market "shake-up," whereby smaller firms gain market share and perhaps even leapfrog ahead of the previous market leaders. Since GI activity relies on the presence of stable market leaders, this shake-up creates both firm-level volatility and lower GI activity. The decline in GIs, which by definition help all firms, reduces the comovement between firms in the economy, ultimately reducing the volatility of aggregate outcomes. Said more simply, if the increase in the innovative activity comes from small firms jockeying for position in the industry, aggregate volatility will go down, as winners and losers will offset each other, but microvolatility will rise, as losing firms compete to get back on top. Comin and Mulani provide empirical evidence showing that increased R&D activity in the U.S. has coincided with increased volatility in sales and market shares for publicly traded firms, reduced comovement across industries, and reduced volatility in aggregate economic growth.

Turning to the purely micro data, Brynjolfsson et al. analyze the impact of information technology (IT) on industry volatility or turbulence. Use of IT allows an innovation to diffuse rapidly throughout a firm, increasing productivity and market share faster than was previously possible. Although first movers on an innovation are able to gain market share quickly creating the opportunity for concentration, the speed of diffusion that IT affords also enables new entrants to leapfrog ahead of leaders in a given sector, thus increasing sectoral turnover rates (turbulence). Empirically, IT-intensive industries have indeed experienced both greater concentration and turbulence. This evidence is consistent with the findings of Comin and Mulani that firms in more R&D-intensive industries tend to have more volatile sales and market shares, since there is a strong correlation between an industry's R&D intensity and its IT intensity.

### **Supply chain management**

The role of supply chain management in the Great Moderation is the subject of a paper by Davis and Kahn as well as one by Irvine and Schuh. Davis and Kahn argue that dramatic technology-driven improvements in supply chain management in the durable goods sector, combined with a secular shift away from domestic durable goods

manufacturing and toward services, is the explanation for the decline in aggregate volatility. They suggest that changes in monetary policy, on the other hand, played a minimal role. Their model of the firm's inventory decision process mirrors observed declines in output and sales volatility, as well as the sales-to-output ratio, and the authors suggest that a shorter lead time for materials orders (more precise inventory control) is the key mechanism through which this change has occurred.

Irvine and Schuh also find that improvement in supply chain management likely played the predominant role in reduced aggregate volatility. Using a multi-sector, vector-autoregression empirical model, they find that a decline in the comovement of output among inventory-holding industries (for example, manufacturing and wholesale trade) can explain a substantial share of the decline in aggregate output volatility. Their model suggests that a change in structural relationships between inventory-holding industries seems to be the cause of this decline, and industries in which firms share supply and distribution chains exhibited the largest decline in covariance in volatility. As in Davis and Kahn, Irvine and Schuh find little evidence that changes in monetary policy or "good luck" are major factors behind the Great Moderation.

### **Volatility in the labor market**

In the final paper of the conference, Davis et al. establish and attempt to explain two interesting facts from the data. The first fact is that volatility of employment levels within firms, particularly those not publicly traded, has declined over the past 25 years. The second fact is that the flows of individuals into unemployment have fallen over time. In the early 1980s about 4% of employed persons fell into unemployment (either voluntarily or involuntarily) in the average month; by the early 1990s, this figure had dropped to just 2%. The focus of their paper, then, is to investigate whether the decline in volatility in employment demand by businesses is responsible for the decline in unemployment inflows. Using industry-level data, they find a strong statistical association between an industry's volatility in employment demand, as measured by the variance in its job

destruction rate, and the industry's unemployment inflow rate (the rate at which workers in the industry go into unemployment in a given period). They conclude that the decline in firm level employment volatility likely has reduced flows into unemployment.

### **Conclusion**

While there is broad agreement that aggregate economic volatility has declined over the last 25 years, the relative roles of economywide factors, such as changes in monetary policy and technological change, remain topics of dispute. Also in dispute is the extent to which this decline in aggregate volatility is mirrored in microeconomic variables, such as income and employment. Reductions in aggregate and firm-level volatility do not necessarily translate into a reduction in volatility at the individual level. Rather, some studies argue that household consumption and individual earnings have become more volatile in recent decades, not less. The linkages between the disparate trends in volatility at the aggregate level and at the individual level remain important areas of economic research.

**Charles Notzon**  
Research Associate

**Dan Wilson**  
Senior Economist

### **Conference papers**

- Brynjolfsson, Erik, Andrew McAfee, Michael Sorell, and Feng Zhu. "Scale without Mass: Business Process Replication and Industry Dynamics."
- Comin, Diego, and Sunil Mulani. "A Theory of Growth and Volatility at the Aggregate and Firm Level."
- Davis, Steven J., and James A. Kahn. "Changes in the Volatility of Economic Activity at the Macro and Micro Levels."
- Davis, Steven J., R. Jason Faberman, John Haltiwanger, Ron Jarmin, and Javier Miranda. "Business Volatility, Job Destruction, and Unemployment."
- Galí, Jordi, and Luca Gambetti. "On the Sources of the Great Moderation."
- Irvine, Owen, and Scott Schuh. "The Roles of Comovement and Inventory Investment in the Reduction of Output Volatility."
- Koren, Miklós, and Silvana Tenreyro. "Technological Diversification."

# ECONOMIC RESEARCH FEDERAL RESERVE BANK OF SAN FRANCISCO

P.O. Box 7702  
San Francisco, CA 94120

PRESORTED  
STANDARD MAIL  
U.S. POSTAGE  
PAID  
PERMIT NO. 752  
San Francisco, Calif.

Address Service Requested

Printed on recycled paper  
with soybean inks



## Index to Recent Issues of *FRBSF Economic Letter*

DATE	NUMBER	TITLE	AUTHOR
7/20	07-21	What We Do and Don't Know about the Term Premium	Swanson
7/27	07-22	Regional Economic Conditions and Community Bank Performance	Furlong/Krainer
8/3	07-23	Trends in Bay Area IT Employment	Hsueh
8/10	07-24	Are Global Prices Converging or Diverging?	Glick
8/31	07-25	Changing Productivity Trends	Trehan
9/14	07-26-27	Recent Financial Developments and the U.S. Economic Outlook	Yellen
9/21	07-28	Changes in Income Inequality across the U.S.	Regev/Wilson
9/28	07-29	Internal Risk Models and the Estimation of Default Probabilities	Christensen
10/5	07-30	Relative Comparisons and Economics: Empirical Evidence	Daly/Wilson
10/19	07-31	Corporate Access to External Financing	Lopez
10/26	07-32	Asset Price Bubbles	Lansing
11/2	07-33	Labor Force Participation and the Prospects for U.S. Growth	Daly/Regev
11/23	07-34	Financial Globalization and Monetary Policy	Spiegel
11/30	07-35	Fixing the New Keynesian Phillips Curve	Dennis
12/7	07-36-37	The U.S. Economy and Monetary Policy	Yellen
12/14	07-38	Sovereign Wealth Funds: Stumbling Blocks or Stepping Stones...?	Aizenman/Glick
1/18	08-01	Publishing FOMC Economic Forecasts	Rudebusch
1/25	08-02	Publishing Central Bank Interest Rate Forecasts	Rudebusch
2/1	08-03	2007 Annual Pacific Basin Conference: Summary	Glick
2/8	08-04-05	Prospects for the Economy in 2008	Yellen

Opinions expressed in the *Economic Letter* do not necessarily reflect the views of the management of the Federal Reserve Bank of San Francisco or of the Board of Governors of the Federal Reserve System. This publication is edited by Judith Goff, with the assistance of Anita Todd. Permission to reprint portions of articles or whole articles must be obtained in writing. Permission to photocopy is unrestricted. Please send editorial comments and requests for subscriptions, back copies, address changes, and reprint permission to: Public Information Department, Federal Reserve Bank of San Francisco, P.O. Box 7702, San Francisco, CA 94120, phone (415) 974-2163, fax (415) 974-3341, e-mail [sf.pubs@sf.frb.org](mailto:sf.pubs@sf.frb.org). **The *Economic Letter* and other publications and information are available on our website, <http://www.frbsf.org>.**