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The 'Great Moderation' in Output and Employment Volatility: An Update

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The reduced aggregate volatility that began in 1984 has continued into the new millenium.

Volatility can wreak havoc on economies. Sudden, sharp ups and downs in business activity can make it difficult for consumers to plan their spending, workers to feel secure in their jobs and companies to determine their future investments. Because of their impact on expectations and business and consumer confidence, swings in the economy can become self-reinforcing. Volatility can also spill over into real and financial asset markets, where severe price movements can produce seemingly arbitrary redistributions of wealth.

It's good news, then, that the U.S. economy has become much more stable. On average, the five recessions from 1959 to 1983 were 47 months apart, lingered 12 months and were associated with a 2.17 percent peak-to-trough decline in real gross domestic product. By contrast, the 1990 downturn came after

92 months of expansion, lasted eight months and involved a 1.26 percent decline in GDP. The 2001 slump ended a record 120 months of uninterrupted growth, lasted eight months and entailed a GDP decline of only 0.35 percent. More generally, quarterly growth in both real GDP and jobs became markedly less volatile after 1983.[1]

Explanations for this "Great Moderation," as it's called, include structural changes in the economy, improved monetary policy and simple good luck.

Potentially important structural changes include the elimination of ceilings on deposit interest rates, broader access to credit markets through financial innovations like home equity loans, tighter inventory controls facilitated by technology, and the globalization of output and labor markets.

By improved monetary policy, analysts typically have in mind central bank actions that respond more quickly and forcefully to emerging inflation pressures, so that medium- to long-term price expectations remain contained.

As for good luck, analysts cite the reduced frequency of economic shocks comparable to the 1973 Arab oil embargo and 1979 oil price spike.[2]

We've accumulated eight years of additional data since completion of the early work on the Great Moderation, and the U.S. economy has experienced another recession and recovery. The new data allow us to examine whether the moderation has continued and detect changes in different sectors' contributions to volatility.

Our results are interesting because of the light they shed on the debate over the causes of the Great Moderation, but they're also useful in their own right. Breaking volatility down by sector, for example, can pinpoint which industries and expenditure categories are currently the most important sources of fluctuations in GDP and employment. It's in these areas that monitoring efforts ought to be focused.

What we've found in studying the new data is that the reduced aggregate volatility that began in 1984 has continued into the new millennium. The economy's volatility hasn't, however, dropped much further.

In the case of GDP growth, most of the initial volatility decline can be attributed to greater stability in investment and consumer durables expenditures. Volatility from consumer spending has fallen further in recent years, but this decline has been completely offset by increased volatility from international trade.

In the case of jobs growth, most of the 1984 volatility decline can be attributed to manufacturing. The sector's volatility contribution has held steady since then, even though its employment share has continued to shrink. Meanwhile, jobs growth volatility originating in professional and business services has increased sharply.

Sector Volatility

How much any sector contributes to the U.S. economy's ups and downs depends on three factors: the sector's own volatility, its share of business activity, and its tendency to move with or against the overall economy. This cataloging is analogous to the familiar notion that any given stock contributes more to a portfolio's riskiness the more volatile its returns, the larger its portfolio share, and the greater the correlation between its return and returns on the portfolio's other stocks.[3]

We traced various sectors' contributions to the volatility of quarterly growth in GDP and jobs over three periods: the 25 years starting in 1959 and running through 1983, the 12 years from 1984 through 1995 and the nearly 12 years from 1996 through the second quarter of 2007. Each of these intervals includes at least one economic expansion, recession and recovery.

The most recent period is interesting because it was marked by rapid growth in international trade and financial flows and the spread of new, more flexible labor market arrangements. These are the kinds of structural changes that might be expected to affect the stability of economic growth. This period was also marked by large swings in the real price of oil.[4] Insofar as oil price shocks were responsible for some of the economy's pre-1984 instability, we might expect a return of some of that volatility.

GDP Growth Volatility

We can measure GDP growth's volatility by looking at the range within which growth has fallen 95 percent of the time. Between 1959 and 1983, for example, annualized GDP growth averaged 3.6 percent and strayed outside a −5.3 to 12.5 percent range only 5 percent of the time. The margin of error for GDP growth over this period was plus or minus 8.9 percentage points (*Chart 1*).

Between 1984 and 1995, growth was 3.2 percent, plus or minus 4.3 points—a margin of error less than half of what it had been. Finally, from 1996 to 2007, GDP growth averaged 3.1 percent, plus or minus 4.1 points.

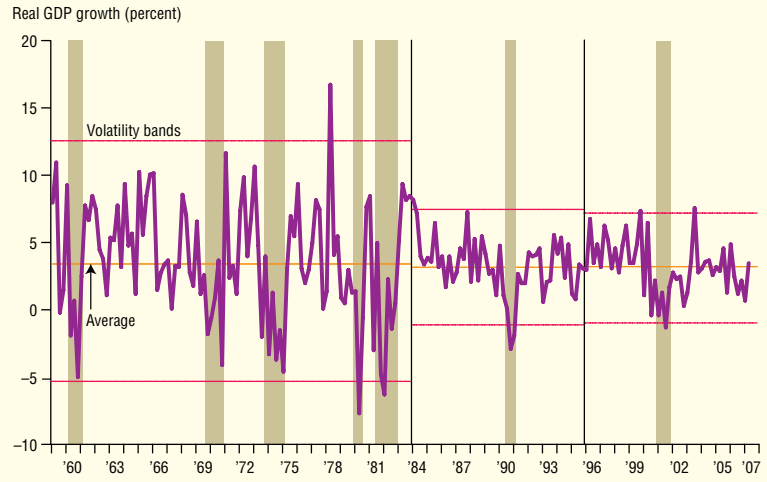
By convention, analysts measure a series' volatility by its standard deviation, which is one-half the margin of error. In percentage points, the standard deviations for GDP growth are 4.47 for 1959–83, 2.14 for 1984–95 and 2.04 for 1996–2007.

The big decline in GDP growth volatility occurred during the mid-1980s. Since then, it has stayed relatively constant. Sustaining this low volatility over the past 12 years is impressive, however, given the large swings in oil prices and business investment during that period. This suggests the economy's increased stability is due to more than good luck.

So, if not purely good luck, then what? A sector-by-sector breakdown reveals expenditure categories whose volatility contributions fell most sharply from 1959–83 to 1984–95 (*Table 1*). Inventory investment's contribution

Chart 1

GDP Growth Volatility Dropped Off Sharply in the Mid-1980s



NOTE: Shaded areas denote recessions.

SOURCES: Bureau of Economic Analysis; National Bureau of Economic Research.

Sustaining low volatility over the past 12 years is impressive, given the large swings in oil prices and business investment during that period.

declined from 1.82 to 0.69 percentage points, consumer durables' from 0.83 to 0.44 points, residential investment's from 0.57 to 0.25 points and nonresidential fixed investment's from 0.71 to 0.42 points.

These results suggest—but don't prove—that tighter inventory controls, consumers' improved access to credit and financial deregulation played important roles in the economy's greater stability.

Although the decline in overall GDP growth volatility has been small since 1995, some shifts in sector contributions are significant. For example, consumption's contribution over the most recent 12 years is half what it was over the previous 12. Most of this decline can be attributed to consumer durables, but nondurables also show a drop.

The recent reduction in consumption's volatility contribution is, however, offset by net exports' increased contribution. In 1959–83 and 1984–95, the trade sector subtracted about 0.3 percentage points from GDP volatility.

Table 1

Contributions to Volatility in GDP Growth

(Percentage points)

	1959–83	1984–95	1996–2007
Consumption	**1.42**	**.82**	**.41**
Durables	.83	.44	.12
Nondurables	.39	.24	.18
Services	.20	.14	.11
Investment	**3.10**	**1.36**	**1.34**
Nonresidential fixed	.71	.42	.51
Residential	.57	.25	.17
Inventory	1.82	.69	.66
Government	**.22**	**.24**	**.17**
Net exports	**–.26**	**–.28**	**.12**
Total	**4.47**	**2.14**	**2.04**

NOTES: The total is the standard deviation of GDP growth. 2007 data are through the second quarter. Numbers may not add up due to rounding.

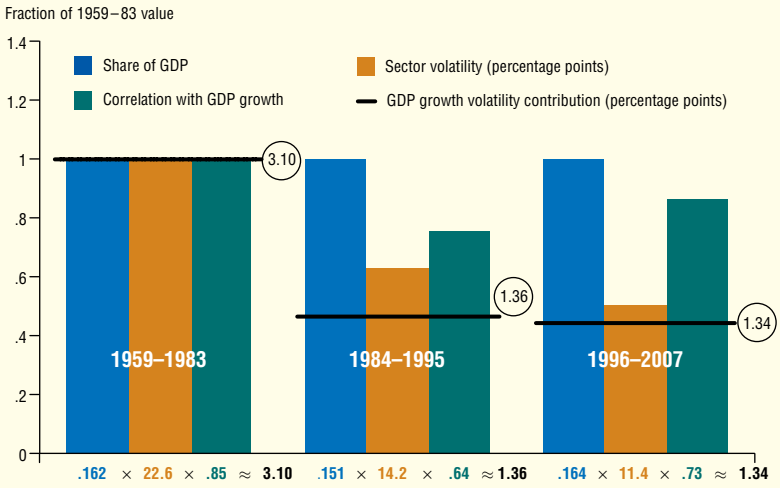
SOURCE: Bureau of Economic Analysis.

Chart 2

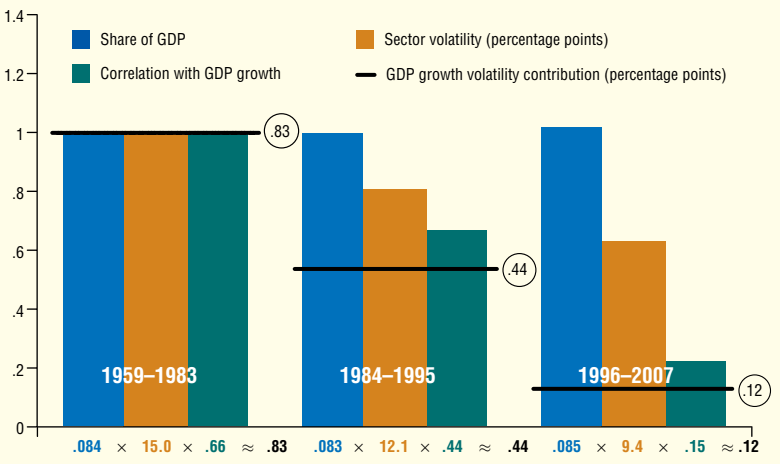
Investment, Consumer Spending on Durables Key to Post-1983 GDP Stability

For each period, the black horizontal line represents the contribution of investment (A) or consumer spending on durables (B) to GDP growth volatility. To a close approximation, the line's height is the product of the heights of the three bars.

A. Investment Expenditures



B. Durable Goods Spending



SOURCE: Bureau of Economic Analysis.

This reflects net exports' historical tendency to act as an automatic stabilizer, rising when the U.S. economy is weak and falling when it's strong. Since 1995, though, the correlation between quarterly changes in net exports and GDP has turned slightly positive, and the category has added 0.1 point to aggregate volatility.

Let's take a closer look at investment and consumer durables, which are primarily responsible for output's increased post-1983 stability. Changes in these sectors' relative size didn't contribute much to the decline in overall GDP volatility. Most of the impact came from reductions in their volatility and their correlation with the overall economy.

For investment, the standard deviation of sector growth fell from 22.6 to 14.2 to 11.4 percentage points over the sample periods, and the correlation between sector and GDP growth declined from 0.85 to 0.64 before bouncing back up to 0.73 (*Chart 2A*).

Meanwhile, investment's share of GDP held steady at about 0.16 (16 percent). The net result was a sharp decline in the sector's contribution to GDP growth volatility from 1959–83 to 1984–95 and very little change from 1984–95 to 1996–2007.

For consumer durables, the standard deviation of sector growth fell from 15.0 to 12.1 to 9.4 percentage points, and the correlation between sector and GDP growth dropped from 0.66 to 0.44 to 0.15.

At the same time, the sector share held steady at about 0.084 (8.4 percent). Consequently, consumer durables' contribution to the volatility of GDP growth fell substantially from sample period to sample period, up to and including 1996–2007 (*Chart 2B*).

Before 1984, the key categories to watch in tracking GDP fluctuations were inventory investment, consumer durables spending and nonresidential fixed investment. Inventory and nonresidential fixed investment remain important sources of volatility today, but consumer durables ranks as an

also-ran. Now tied for third in importance are consumer expenditures on nondurable goods, residential investment and government expenditures.[5]

Jobs Growth Volatility

When it comes to overall volatility, jobs growth exhibits a decline that's similar to the one we saw for GDP growth but smaller in magnitude (*Chart 3*). The margin of error needed to encompass 95 percent of jobs growth's variation narrows from 5.1 percentage points for 1959–83, to 3 points for 1984–95, to 2.7 points for 1996–2007. The standard deviation of jobs growth drops from 2.53 to 1.52 to 1.33 points in those periods.

Average annual jobs growth has declined, too, going from 2.3 percent in 1959–83 to 2.1 percent in 1984–95 and 1.4 percent in 1996–2007.

Manufacturing was mainly responsible for the sharp fall in jobs growth volatility after 1983. Its contribution dropped from 1.25 percentage points in 1959–83 to 0.32 points in 1984–95 and 0.34 in 1996–2007 (*Table 2*). Construction has caused less volatility in the past 12 years, but it's doubtful this decline will survive the current slowdown in residential building.

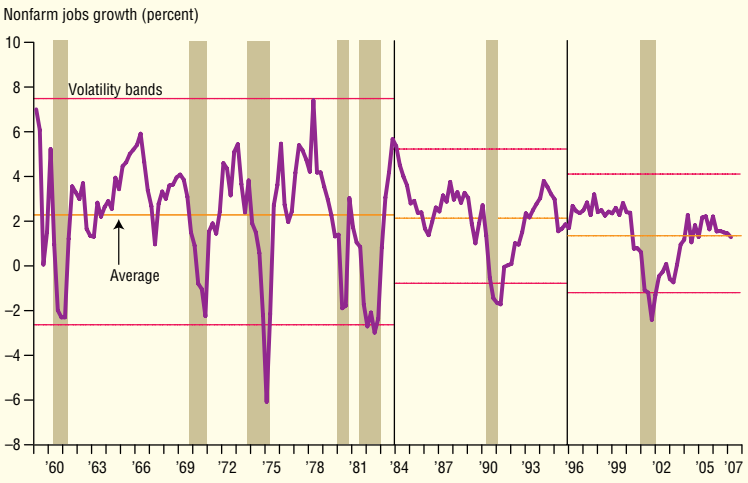
Overall, private services' contribution to the economy's volatility hasn't changed much. Within services, however, we see a marked tendency for the volatility from the professional and business services sector to rise over the three periods—from 0.13 percentage points to 0.19 points to 0.37 points. The contribution from trade, transportation and utilities, on the other hand, has declined.

What's going on in manufacturing and professional and business services, the two sectors with the most notable change in their contributions to overall volatility?

Part of the story in manufacturing is foreign competition and productivity-enhancing technologies, which have combined to reduce the sector's share of total employment from 25 percent to 17 percent to 12 percent (*Chart 4*).

Chart 3

Jobs Growth Volatility Declined Markedly in the Mid-1980s



NOTE: Shaded areas denote recessions.

SOURCES: Bureau of Labor Statistics; National Bureau of Economic Research.

Table 2

Contributions to Volatility in Jobs Growth

(Percentage points)

	1959–83	1984–95	1996–2007
Goods	**1.54**	**.56**	**.46**
Resources	.04	.01	.00
Construction	.25	.23	.12
Manufacturing	1.25	.32	.34
Private services	**.88**	**.89**	**.86**
Trade, transportation and utilities	.40	.40	.29
Information	.10	.04	.10
Financial	.04	.06	.03
Professional and business	.13	.19	.37
Education and health	.07	.01	−.03
Leisure	.12	.13	.08
Other	.03	.06	.01
Government	**.11**	**.07**	**.01**
Total	**2.53**	**1.52**	**1.33**

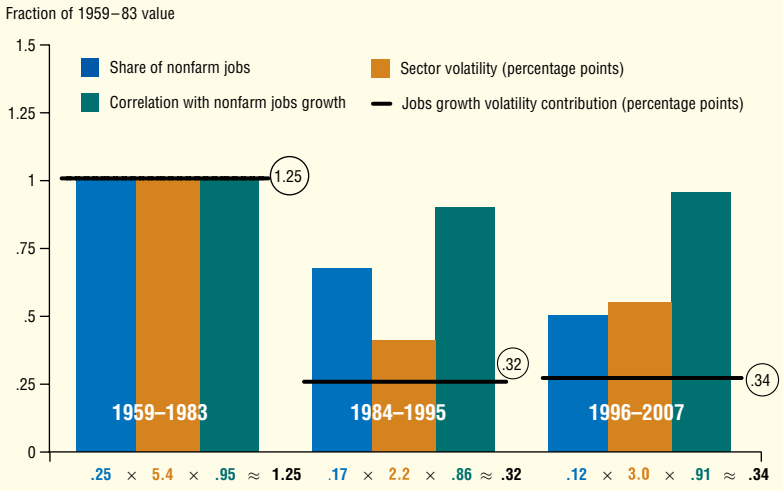
NOTES: The total is the standard deviation of jobs growth. 2007 data are through the second quarter.

SOURCE: Bureau of Labor Statistics.

Chart 4

Manufacturing Much Less Important As Source of Jobs Growth Volatility

For each period, the black horizontal line represents manufacturing's contribution to jobs growth volatility. To a close approximation, the line's height is the product of the heights of the three bars.



SOURCE: Bureau of Labor Statistics.

The standard deviation of manufacturing's volatility growth rate is generally lower now, too. It fell sharply from 5.4 percentage points in 1959–83 to 2.2 points in 1984–95, before rising slightly—to 3 points—over the past 12 years. This lower jobs growth volatility probably reflects the more stable growth in investment and consumer goods expenditures we've already discussed.

Finally, it's interesting that the correlation between total and manufacturing jobs growth has changed so little over the years, fluctuating from 0.95 to 0.86 to 0.91. Perhaps more flexible labor market practices have offset the weaker links between investment expenditures and GDP and between consumer goods expenditures and GDP.

Manufacturing has traditionally been a source of economic instability, but volatility from a segment of the usually stable services sector may be something of a surprise. Professional and business services' increasing contribution to overall volatility has been driven mainly by two factors: the sector's growing relative size—its share of total jobs has gone from 8 to 10 to over 12 percent—and rising internal volatility—the standard deviation of its growth is up from 1.9 to 2.3 to 3.2 percentage points (*Chart 5*). The sector's correlation with aggregate jobs growth has held fairly steady.

The expansion of professional and business services has been well documented. This sector includes business managers and knowledge-based employees like lawyers, accountants and computer-system designers, whose jobs are in increasing demand and relatively difficult to send overseas. The sector's rising volatility reflects the high-tech boom and bust of the late 1990s and early 2000s. The 2001 downturn was widely considered a white-collar recession. Unfortunately, the detailed subsector data we need to be able to say more are simply not available for before 1990.

Factoring in all these changes, which were the most important sources of jobs growth variation before the Great Moderation and which are the most important now? Between 1959 and 1983, manufacturing; trade, transportation and utilities; and construction—in that order—were the main drivers of aggregate jobs growth fluctuations. Today, the big three are professional and business services; manufacturing; and trade, transportation and utilities. Given that service-sector developments increasingly drive the U.S. economy today, it's no surprise that two of the three most important sectors to monitor fall into the services category.[6]

Summary and Conclusions

GDP and jobs growth became more stable about 24 years ago. Most of the decline in output growth volatility is attributable to smaller swings in investment and consumer durables purchases, swings that are also less synchronized with fluctuations in the overall economy. The reduction in jobs growth volatility is due almost entirely to a shrunken and less variable manufacturing sector.

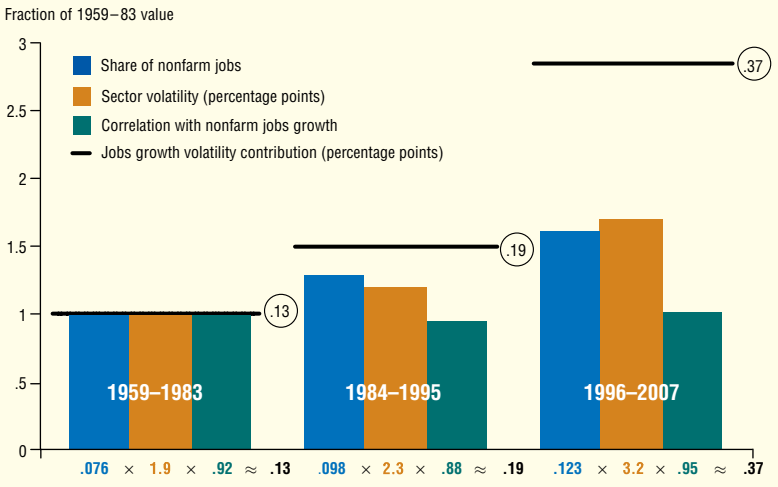
Changes in GDP and jobs growth volatility since 1984 have been relatively modest. Beneath the surface, however, sector contributions have shifted. Consumer spending—especially on durable goods—accounts for an ever-smaller fraction of short-run variability in GDP growth. On the other hand, net exports have become less of a stabilizing influence.

Two decades ago, keeping tabs on shifts in investment spending and consumer durables purchases was crucial for understanding swings in GDP growth. Tracking shifts in investment spending remains critical, but changes in household spending on nondurable goods are now more important than

Chart 5

Professional and Business Services More Important Source of Jobs Growth Volatility

For each period, the black horizontal line represents the contribution of the professional and business services sector to jobs growth volatility. To a close approximation, the line's height is the product of the heights of the three bars.



SOURCE: Bureau of Labor Statistics.

movements in consumer durables. Meanwhile, the fraction of jobs growth volatility attributable to firms in professional and business services has risen to the point where this sector has become the largest contributor to short-run swings in aggregate jobs growth.

While the underlying causes of the economy's increased stability remain the subject of debate, the stability's persistence suggests that it's unlikely to be entirely the result of good luck. Improved monetary policy may well have played a role, but the timing of the volatility reduction and its sectoral composition also suggest other factors have been at work. They include improved inventory management, changes in the financial system that have made it easier for households to smooth out their spending over time, and the elimination of ceilings on bank deposit interest rates, which has helped reduce the construction sector's cyclicality.

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Notes

The authors thank Christine Rowlette and Jessica Renier for research assistance.

[1] Among the earliest articles documenting the reduction in GDP volatility are "Has the U.S. Economy Become More Stable? A Bayesian Approach Based on a Markov-Switching Model of the Business Cycle," by Chang-Jin Kim and Charles Nelson, *Review of Economics and Statistics*, vol. 81, November 1999, pp. 608–16; "Output Fluctuations in the United States: What Has Changed Since the Early 1980's?" by Margaret M. McConnell and Gabriel Perez-Quiros, *American Economic Review*, vol. 90, December 2000, pp. 1464–76; and "The Long and Large Decline in U.S. Output Volatility," by Olivier Blanchard and John Simon, *Brookings Papers on Economic Activity*, no. 1, 2001, pp. 135–64. (Blanchard and Simon see the 1984 volatility reduction as part of a longer-term trend.)

For evidence on jobs growth volatility, see "The Declining Volatility of U.S. Employment: Was Arthur Burns Right?" by M. V. Cacdac Warnock and Francis E. Warnock, Federal Reserve Board of Governors, International Finance Discussion Paper no. 677, August 2000.

Inflation has been lower and more stable, too. However, we focus on real activity.

[2] Good summaries of the Great Moderation literature include "The Great Moderation," a speech by Federal Reserve Chairman Ben S. Bernanke at the meetings of the Eastern Economic Association, Feb. 20, 2004, and "Has the Business Cycle Changed? Evidence and Explanations," by James H. Stock and Mark W. Watson, a paper presented at the Federal Reserve Bank of Kansas City symposium "Monetary Policy and Uncertainty," Jackson Hole, Wyo., Aug. 28–30, 2003. Also, see "On the Causes of the Increased Stability of the U.S. Economy," by James A. Kahn, Margaret M. McConnell and Gabriel Perez-Quiros, Federal Reserve Bank of New York *Economic Policy Review*, May 2002, pp. 183–202; "New Economy, New Recession?" by Evan F. Koenig, Thomas F. Siems and Mark A. Wynne, Federal Reserve Bank of Dallas *Southwest Economy*, March/April 2002, pp. 11–16; and "Has Monetary Policy Become More Effective?" by Jean Boivin and Marc P. Giannoni, *Review of Economics and Statistics*, vol. 88, August 2006, pp. 445–62.

[3] Suppose that the random variable X is the weighted sum of n other random variables, X_i, for $i = 1, 2, \ldots n$: $X = \Sigma\alpha_i X_i$, where the weights, α_i, are fixed. From the definition of the correlation coefficient, ρ_{XX_i}, we know that $\text{Cov}(X, X_i) = \rho_{XX_i}\sigma_X\sigma_{X_i}$, where σ_X and σ_{X_i} are the standard deviations of X and X_i, respectively. Hence, $\sigma^2_X = \text{Cov}(X, \Sigma\alpha_i X_i) = \Sigma\alpha_i \text{Cov}(X, X_i) = \Sigma\alpha_i \rho_{XX_i}\sigma_X\sigma_{X_i}$, and $\sigma_X = \Sigma\alpha_i \rho_{XX_i}\sigma_{X_i}$. In practice, there is often small period-to-period variation in the α_i. Consequently, this formula is only approximately valid.

[4] The standard deviation of the four-quarter change in real oil prices was 36.3 percentage

points over the 24 years from 1960 through 1983, 22.7 points over 1984–95 and 32.7 points over 1996–2007. Looking only at the standard deviation of oil price increases (some claim increases have a much bigger economic impact than decreases), the standard deviations are 52.5, 15.1 and 25.9 points over the three periods.

[5] An alternative ranking, based solely on correlations between sector and GDP growth, has consumer durables expenditures, nonresidential fixed investment and inventory investment in a virtual dead heat over 1959–83, with correlations of 0.66, 0.65 and 0.64. In today's economy, the top-ranking sectors by this criterion are nonresidential investment (0.56), inventory investment (0.46) and consumer expenditures on nondurable goods (0.46).

[6] A ranking based entirely on the correlation between sector and aggregate jobs growth puts manufacturing in first place over 1959–83, with a correlation of 0.95, followed by the professional and business services and trade, transportation and utilities sectors in a virtual tie, with correlations of 0.92 and 0.91, respectively. In today's economy, the tables are turned. Professional and business services and trade, transportation and utilities both have correlation coefficients of 0.95, while manufacturing has slipped to third, with a correlation coefficient of 0.91.

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