

Greenspan's Monetary Policy in Retrospect Discretion or Rules?

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Executive Summary

Is Alan Greenspan to blame for the current housing bubble and the ongoing financial crisis? A growing chorus charges the former Federal Reserve chairman with being an “inflationist” whose loose monetary policy caused or significantly contributed to our current economic troubles. However, although Greenspan’s policies weren’t perfect, his monetary policy was in fact tight, and his legacy is one of having overseen low and stable inflation and a striking dampening of the business cycle.

Critics charge Greenspan with having carried on an excessively expansionary monetary policy, particularly following the recession of 2001. They note how low interest rates were from 2002 through 2004 and argue that those low rates paved the way for everything from high prices at the pump to high prices at the supermarket, from the housing crisis to the financial crisis.

In so doing, those critics make the classic mistake of using interest rates to evaluate monetary policy, reasoning that if interest rates are low, recent monetary policy must have been expansionary. It is not the Federal Reserve but supply and demand that ultimately determines interest rates. Although central banks can push rates up or down to some degree, the globally integrated financial system reduces the Fed’s ability to significantly influence rates.

This paper should not be construed as a defense of all of Greenspan’s policies, nor of central banking or the Federal Reserve. In fact, our preference would be to abolish the Fed and deregulate the banking industry. Barring that, we argue that Federal Reserve policy ought to abide by the rules rather than the discretion of its chairman.

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Introduction

Former Federal Reserve chairman Alan Greenspan has become everyone's favorite scapegoat. His policies allegedly caused, or at least contributed to, the current financial crisis. He is attacked from the left for lax financial regulation, from the right for loose monetary policy, and from the middle for both. Yet two years ago, on leaving office, Greenspan was widely heralded as a financial wizard whose wise, discretionary macromanagement had brought an unprecedented two decades of low inflation, high prosperity, and infrequent and mild recessions. Both viewpoints, in reality, are mistaken.¹

During the Keynesian dark ages, persisting through the mid-1970s, no one, except a few monetary cranks along with monetarist economists cloistered in their academic ivory towers, believed that the Federal Reserve's monetary policy even mattered. This was a period when Paul Samuelson, who would go on to win the 1970 Nobel Prize in Economics the second time it was awarded, could proclaim in a 1969 *Newsweek* column that "there is no sight in the world more awful than that of an old-time economist, foam-flecked at the mouth and hell-bent to cure inflation by monetary discipline. God willing, we shan't soon see his like again." Today almost everyone—economists, investors, and the general public alike—seems to have swerved to the opposite extreme. The Fed not only controls inflation but allegedly everything else that happens to the American economy, whether good or bad. The truth, however, is somewhere in the middle.²

We are not arguing that Greenspan's policies were perfect. Nor should anything that follows be construed as a defense of central banking or of the Federal Reserve. Particularly alarming is the way the lender-of-last-resort function has been expanding the moral-hazard safety net and mispricing risk, a trend to which Greenspan no doubt contributed. Our preferred ideal would combine abolition of the Fed and unregulated free banking.

Nonetheless, Alan Greenspan stands out as

the most competent—and arguably the only competent—helmsman of United States monetary policy since the creation of the Federal Reserve System. As Milton Friedman observed upon Greenspan's retirement, "For the first 70 years after it opened in 1914, the Fed did far more harm than good, presiding over inflation in two World Wars, converting a moderate recession into the great depression, and then in 1970s, producing the most serious peacetime inflation in our nation's history." By contrast, Greenspan's "performance has indeed been remarkable."³

Greenspan not only oversaw relatively low and stable inflation, but also ushered in a striking decline in the volatility of real gross domestic product. Although defenders of macroeconomic intervention often suggest that government policies after World War II dampened business cycles, the truly significant change should be dated at 1987, the year Greenspan assumed office. The current fuss about a recession that may not even have happened yet testifies to how high his legacy has raised the bar. Until a year or so ago, many observers had therefore credited Greenspan with being the best at reading the economic tea leaves. But as we will demonstrate, the source of Greenspan's apparent success has little to do with monetary discretion.⁴

Freezing Total Reserves

Recently converted critics are now charging Greenspan with having carried on an excessively expansionary monetary policy, particularly following the recession of 2001 and possibly during the dot-com boom that preceded it. But an objective examination of his record of nearly two decades shows that he did not. Instead, however unintentionally and unwittingly, he came close to freezing the *domestic* monetary base and deregulated the broader monetary aggregates.

Why do people now believe Greenspan was an "inflationist"? For one main reason: they note how low interest rates were from 2002 through 2004. But interest rates have never

proved an adequate gauge of what the Fed is doing: not during the Great Depression, when rates were very low despite a collapsing money stock; not during the Great Inflation of the 1970s, when rates were high despite an expanding money stock; and not under Greenspan. A focus on interest rates not only obscures the well-known distinction between nominal and real rates (nominal rates equal real rates plus expected inflation), it also ignores the simple fact that interest rates can change as a result of real factors involving supply and demand.

The market ultimately determines interest rates. Although central banks are big enough players in the loan market (and the quintessential noise traders to boot) that they can push short-term rates up or down somewhat, that ability is increasingly diminished, even for a major central bank like the Fed, as globalization integrates world financial markets. In defending his actions, Greenspan is correct in attributing the unusually low interest rates early this decade mainly to a massive flow of savings from emerging Asian economies and elsewhere.⁵

A better, although now unfashionable, way to judge monetary policy is to look at the monetary measures: MZM, M2, M1, and the monetary base. Since 2001, the annual year-to-year growth rate of MZM fell from over 20 percent to nearly 0 percent by 2006. During that same time, M2 growth fell from over 10 percent to around 2 percent and M1 growth fell from over 10 percent to negative rates. Admittedly the Fed's control over the broader monetary aggregates has become quite attenuated, for reasons elucidated below. But even the year-to-year annual growth rate of the monetary base since 2001 fell from 10 percent to below 5 percent in 2006 and by June of 2008 was around 1.5 percent, despite Ben S. Bernanke's alleged deflation. When all of these measures agree, it suggests that monetary policy was not all that expansionary during 2002 and 2003 under Greenspan, despite the low interest rates.⁶

The key to what was really going on is the monetary base, which the Federal Reserve directly controls. The base consists of reserves

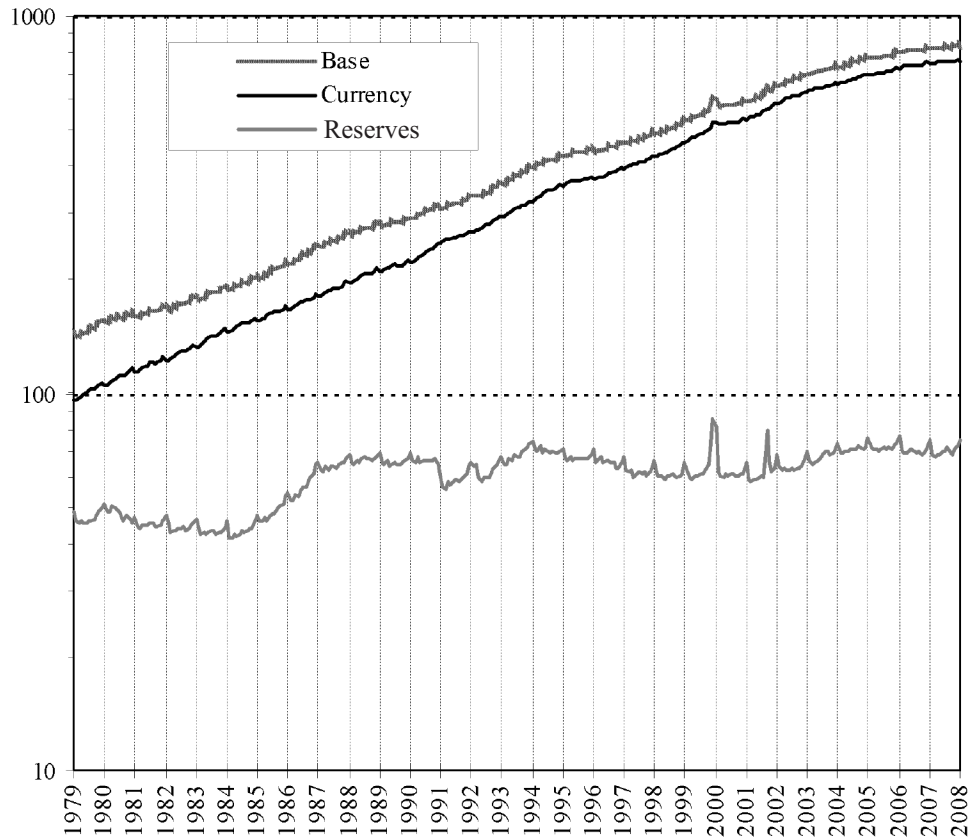
held by the banks and other depositories, either in their accounts at the Fed or as vault cash, plus currency in circulation among the general public. Between December 1986, 8 months before Greenspan became Fed chairman, and December 2005, 19 years later, the monetary base rose by a hefty amount, from \$248 billion to \$802 billion (no figures are seasonally adjusted). True, that doesn't sound like a freeze. But virtually the whole increase was in currency in circulation. (See Figure 1.) During that same time, total bank reserves grew from \$65 billion to \$73 billion, for an average annual growth rate of a mere 0.65 percent. (These figures are unadjusted for any changes in reserve requirements and—unlike the somewhat misleading reserve totals reported by the Fed's board of governors—include all vault cash, clearing balances, and float.) In some years aggregate reserves rose; in others they fell, with the major bump surrounding Y2K, when the accumulation of reserves by banks appears to have induced the Fed to accommodate a 40 percent jump followed by a 30-percent drop. Total reserves are also the one monetary measure that show a slight uptick into 2003, when interest rates were down.⁷

During the same 19 years, currency in circulation exploded faster than the monetary base, at an annual rate of 7.54 percent. Prior to this explosion, currency was less than three quarters of the total monetary base; today it is over 90 percent. In a period when debit cards and possibly ATMs were reducing currency demand, analysts were aware that all this new cash was not bulging in the wallets and purses of the average American. It was going abroad, as a stable dollar evolved into an international currency. These growing foreign holdings of Federal Reserve notes became an additional factor increasing money demand and keeping U.S. inflation in check during the 1990s.⁸

Ideally we should adjust the monetary base and monetary aggregates downward, to account for this drain abroad. Richard G. Anderson of the St. Louis Fed estimates that the proportion of U.S. currency held abroad doubled between 1986 and 2005, from 25 to nearly 50 percent. Although his estimates

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Figure 1
Monetary Base (in billions)



may be too low, the Fed makes no such adjustment. Doing so would reduce the annual growth rate of the monetary base between December 1986 and December 2005 from 6.4 to 4.9 percent.⁹

Furthermore, in a fully deregulated monetary system, private banks—not the Fed—would be the institutions issuing currency. Currency would become an additional bank liability like deposits, responding to market forces. The Fed tries to duplicate this result by allowing the public to determine how much of the base becomes currency. In other words, it controls only the total base whereas currency passively expands to accommodate people’s preferences. This suggests that a more meaningful approximation of the base would be simply to subtract all currency in circulation, leaving us with only aggregate reserves as our

proxy. Thus, the virtual freezing of reserves turns out to be the most salient yet ignored feature of Greenspan’s tenure. Interestingly, the late Milton Friedman, in the 1980s, had recommended something similar to what Greenspan did de facto: freeze the base.¹⁰

Greenspan also helped deregulate the broader monetary aggregates: M2, MZM, and M3. The Depository Institutions Deregulation and Monetary Control Act of 1980 had begun phasing out interest-rate ceilings on deposits and modified reserve requirements in complex ways. Combined with subsequent administrative deregulation under Greenspan through January 1994, these changes left all the financial liabilities that M2 adds to M1—savings deposits, small time deposits, money market deposit accounts, and retail money market mutual fund shares—utterly free of reserve

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requirements and allowed banks to reclassify many M1 checking accounts as M2 savings deposits. M2 and the broader measures became quasi-deregulated aggregates with no legal link to the size of the monetary base.¹¹

A result, and one that Milton Friedman noted in 2003, is that changes in the velocity of M2 were automatically offset by changes in the amount of M2. Interestingly, this is exactly what monetary economists George A. Selgin and Lawrence H. White predicted would happen under free banking, that is, a market-determined monetary system without any government involvement. They argued that free banking would automatically adjust the quantity of money to changes in velocity. If velocity rose, signaling a fall in money demand, market mechanisms would cause banks to reduce the quantity of money they created. And if velocity fell, signaling a rise in money demand, banks would enlarge the quantity of money. The response of M2 to changes in velocity in the 1990s offers stunning confirmation of this claim. The result was that inflation was held in check.¹²

Thus, during the dot-com boom of the 90s, the velocity of M2 rose as people shifted into stocks. But this was perfectly offset by the declining growth rate of M2, which fell to near zero between 1994 and 1996. Assorted Fed watchers reached opposite conclusions, depending on which variable they chose to focus on. Some warned that Greenspan's policies were deflationary, while others looked at the higher growth rates of the base and M1, which remains more closely tied to the base and more distorted by currency going abroad, and predicted higher inflation. Both were wide of the mark, of course, but not because of Greenspan's miraculous central-bank discretion. The result was a product of market process, and when the collapse of the dot-com boom burst the M2 velocity bubble, it induced a new spike in M2 growth.¹³

Why Any Inflation?

If Greenspan approximately froze total reserves, why was there any inflation at all dur-

ing his tenure? Rather than averaging 2.5 percent annually, shouldn't prices have remained constant or actually fallen? The answer relates to the market's extraordinary capacity for financial innovation. Because bank reserves in the U.S. currently pay no interest (except for required clearing balances arising from the Fed's check-clearing operations), banks have a strong incentive to economize on their use. They can figure out ways to do so even under reserve requirements, as amply illustrated by the origins and growth of the Federal funds market, where banks regularly loan each other excess reserves. Financial deregulation gave the process an additional boost. From December 1986 to December 2005, the same period during which aggregate reserves remained almost constant, the aggregate, de facto reserve ratio of the banking system as whole backing M2 fell in half: from 2.52 percent to 1.23 percent. So the quantity of M2 deposits grew at a secular rate of 4.6 percent, enough to generate mild, positive, sustained inflation. And the quantity of *domestically held* currency grew alongside at an accommodating rate.¹⁴

This steady, long-term decline of reserve ratios cannot easily be halted and confronts government fiat money with a fatal long-run problem. Retightening of reserve requirements would only burden banks with an implicit tax not faced by other financial institutions, encouraging the development of new, highly liquid money substitutes that effectively evade the requirements. Congress has, moreover, moved in the opposite direction, permitting the Fed to eliminate all remaining reserve requirements in 2011, thereby bringing the U.S. into line with such countries as Australia, New Zealand, Canada, the United Kingdom, and Sweden, which have already done so. The same act, the Financial Services Regulatory Relief Act of 2006, also authorizes the Fed, beginning in 2011, to pay interest on bank reserves held as deposits with the Fed. But any resulting increase in the demand for bank reserves stems from, in effect, transforming that portion of the monetary base into Treasury securities.¹⁵

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ments are essentially replacing money with a sophisticated network of computerized barter. The demand for base money will thus asymptotically approach zero. As long as the base remains fiat money, with no other source of demand, the price level will inexorably head toward infinity. Only a commodity base, with a nonmonetary demand—say gold, although it could just as well be silver, some combination of the two, or a more complex basket of commodities or financial assets—will anchor the price level over the long haul. Gold will continue to provide the unit of account, the common numeraire in nearly all transactions, without ever needing to be used as a medium of exchange.¹⁶

Greenspan cannot be held responsible for this ultimate lack of viability of fiat money, although his deregulation accelerated the inflationary bias. A steady, secular contraction of total reserves could in theory have offset the declining reserve ratio, delivering a constant price level or even secular deflation over the last two decades. But the continued fall of base-money demand is itself inevitable, as long as developed economies wish to capture the enormous welfare gains of financial innovation and a more efficient allocation of savings.

Conclusion

So what actually caused the current financial crisis? That is similar to asking what caused the minor recessions of 1990 and 2001. Unlike the cause of inflation, the cause of business cycles is not obvious, which is why economists still vigorously debate the question. Minor blips in total reserves under Greenspan may have played some poorly understood role in any of these three events. Because Greenspan only imperfectly implemented Milton Friedman's rule of freezing the monetary base, without intending to do so, his policy may have ended up slightly *too* discretionary. But that possibility hardly justifies the "asset bubble" hubris of those economic prognosticators who, only well after the fact, declaim with absolutely certainty and scant attention to the monetary measures,

how the Fed could have pricked or prevented such bubbles.

The misunderstanding of Alan Greenspan's management of the U.S. money stock has an ironic coda. Before his appointment, the Federal Reserve had proved so palpably inept as to all but discredit discretionary monetary policy. Both monetarist rules and free banking were gaining adherents among economists. But today, despite the recent financial turmoil, most observers interpret Greenspan's record as showing either that discretionary policy can be done right or that what is needed is some activist pseudo-rule such as that developed by John B. Taylor of Stanford University. Central bankers, after half a century or more of failure, have allegedly learned from their past mistakes. Finally, according to this view, they have the knowledge to centrally plan the money stock properly.¹⁷

In a review of Greenspan's memoirs, Harvard economist Benjamin Friedman claims that Greenspan was a practitioner par excellence of monetary discretion (despite his paying lip service to *laissez faire*) and that Greenspan's major failing was that he was not more of a regulator. Benjamin Friedman is wrong on both counts. Greenspan, like the Wizard of Oz, was a lousy wizard—but he was a good deregulator. And that made all the difference. His success stems from the approximation of a rigid monetary rule and the very deregulation that Benjamin Friedman deplores. Rather than demonstrating that monetarist rules are obsolete and free banking unnecessary, Greenspan's policies suggest that the more thoroughly either of those two objectives is implemented, the greater the macroeconomic stability our economy will enjoy.¹⁸

Notes

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1. Compare, for instance, the criticism of Greenspan in “The Bernanke Reflation,” *Wall Street Journal*, February 29, 2008, p. A16, with the earlier praise of Greenspan in “The Chairman’s Mystique,” *Wall Street Journal*, January 31, 2006, p. A14.

2. *Newsweek* column for June 1969, reprinted in Paul Samuelson, *The Samuelson Sampler* (Glen Ridge, NJ: Thomas Horton, 1973), p. 55.

3. Milton Friedman, “The Greenspan Story: ‘He Has Set a Standard,’” *Wall Street Journal*, January 31, 2006, p. A14.

4. Christina D. Romer was the first to point out that the apparent improvement of the U.S. macroeconomy after World War II was a statistical anomaly, in “Spurious Volatility in Historical Unemployment Data,” *Journal of Political Economy* 94 (February 1986): 1–17; and “Is the Stabilization of the Postwar Economy a Figment of the Data,” *American Economic Review* 76 (June 1986): 314–34. Although her strong claim of no difference between prewar and postwar performance (after throwing out the Great Depression as a statistical outlier) is controversial, even her strongest critics cannot deny that the improvement beginning around 1987 has dwarfed any postwar improvement.

5. Alan Greenspan, *The Age of Turbulence: Adventures in a New World* (New York: Penguin Press, 2007), pp. 385–88; Alan Greenspan, “A Response to My Critics,” *Financial Times*, April 6, 2008; and Greg Ip, “His Legacy Tarnished, Greenspan Goes on Defensive,” *Wall Street Journal*, April 8, 2008. This explanation was anticipated by Ben S. Bernanke, before he replaced Greenspan as chair of the Fed, in “The Global Saving Glut and the U.S. Current Account Deficit,” March 10, 2005, <http://www.federalreserve.gov/boarddocs/speeches/2005/200503102/default.htm>. Agreeing with Greenspan is financial columnist Martin Wolf, “Why Greenspan Does Not Bear Most of the Blame,” *Financial Times*, April 9, 2008. See also Diego Valderrama, “Are Global Imbalances Due to Financial Underdevelopment of Emerging Economies?” Federal Reserve Bank of San Francisco Economic Letter no. 2008-12, April 12, 2008. One of the strongest academic critics of the Greenspan-Bernanke savings-glut thesis is John B. Taylor, “Housing and Monetary Policy,” Remarks before the Symposium on Housing, Housing Finance, and Monetary Policy, Jackson Hole, Wyoming, www.stanford.edu/~johntayl/Housing%20and%20Monetary%20Policy-Taylor-Jackson%20Hole%202007.pdf. But Taylor’s condemnation of Greenspan is mainly for his failure to raise the Federal Funds rate sooner, not for his pushing it down too far initially. For statistical analysis of world savings over this period, see International Monetary Fund, “Global Imbalances: A Saving and Investment Perspective,” *World*

Economic Outlook, September 2005, pp. 91–124.

6. All of our numbers come from the enormously convenient website of the St. Louis Federal Reserve, <http://research.stlouisfed.org/fred2/>. M1 consists of currency in circulation, travelers’ checks, and transaction deposits (accounts that permit unlimited checking). M2 adds to M1 savings deposits, small time deposits, money market deposit accounts, and retail money market mutual fund shares. M3 (which the Fed ceased reporting in March 2006) adds to M2 bank-issued repurchase agreements, Eurodollar deposits held by U.S. residents in foreign branches of U.S. banks, large certificates of deposit (over \$100,000), and institutional money market mutual fund shares. MZM (short for Money of Zero Maturity and reported only by the St. Louis Fed) is M2 minus small time deposits plus institutional money market mutual fund shares.

7. For the monetary base, we have used Board of Governors Monetary Base (monthly and not seasonally adjusted), Not Adjusted for Changes in Reserve Requirements: BOGUMBNS. For currency in circulation, we have used Currency Component of M1 (monthly and not seasonally adjusted): CURRNS. We have subtracted the latter from the former to get total reserves. The St. Louis Fed website does give several alternative direct estimates of reserves. But those compiled by the St. Louis Fed are adjusted for changes in reserve requirements, whereas those compiled by the board of governors exclude any excess reserves held in the form of vault cash, all required clearing balances, and Fed float. (You can find this critical detail only in the footnotes of the Fed’s H.3 release.) For some idea of how massive the resulting distortion can be, consider December 2007. The board of governors reported total reserves (monthly, not seasonally, adjusted, and not adjusted for changes in reserve requirements) of \$42.7 billion. If you add in vault cash not covering reserve requirements, that number jumps to \$60.3 billion. And when you bring in required clearing balances and float, the number rises to \$72.6 billion, 70 percent greater than the board’s estimate. If the distortion were consistent across time, the board’s reserve totals would still tell us something. But the distortion is not close to consistent across time, in part because banks increasingly used vault cash in their ATMs. Required clearing balances arise out of the Fed’s check-clearing operations, pay interest, and are explained in E. J. Stevens, “Required Clearing Balances,” *Federal Reserve Bank of Cleveland Economic Review* 29 (1993, Quarter 4): 2–14.

8. Debit cards unambiguously reduce the demand for currency. ATMs have two opposing impacts. By making currency more readily available, ATMs tend to both increase the number of currency

transactions (increasing demand of the general public) and decrease the average amount people hold (decreasing demand of the general public). Our impression that the latter effect dominates is supported by Kenneth N. Daniels and Neil B. Murphy, "The Impact of Technological Change on the Currency Behavior of Households: An Empirical Cross-section Study," *Journal of Money, Credit and Banking* 26 (November 1994): 867–74. ATMs also tend to shift the composition of bank reserves toward vault cash and away from deposits at the Fed.

9. Richard G. Anderson and Marcela M. Williams, "U.S. Currency at Home and Abroad," *Federal Reserve Bank of St. Louis Monetary Trends*, March 2007; Anderson "Some Tables of Historical U.S. Currency and Monetary Aggregates Data," Federal Reserve Bank of St. Louis Working Paper 2003-006A (April 2003); and Anderson and Robert H. Rasche, "The Domestic Adjusted Monetary Base," Federal Reserve Bank of St. Louis Working Paper 2000-002A (December 1999). One reason we suspect that these estimates of the increase in currency held abroad are too low is that they leave currency in domestic circulation still growing at the annual rate of 5.3 percent, higher than the growth rate of M2 deposits (4.6 percent). A good lower-bound estimate for the growth of domestic currency is the growth of that component of currency not issued by the Fed—Treasury coins—which is unlikely to be exported in significant amounts. The annual growth rate is about 4 percent over a comparable period. Federal Reserve Bulletin no. 73, March 1987, pp. A4, A10, and Federal Reserve Statistical Release H.4.1, "Factors Affecting Reserve Balances," December 29, 2005.

10. Milton Friedman, "Monetary Policy for the 1980s," in *To Promote Prosperity: U.S. Domestic Policy in the Mid-1980s*, ed. John H. Moore (Stanford: Hoover Institution Press, 1984), and "Monetary Policy: Tactics versus Strategy," in *The Search for Stable Money*, ed. James A. Dorn and Anna Jacobson Schwartz (Chicago: University of Chicago Press, 1987). Another advocate of freezing the base is monetary historian Richard H. Timberlake; see his "Institutional Evolution of Federal Reserve Hegemony," *Cato Journal* 5 (Winter 1986): 760–61.

11. Richard G. Anderson and Robert H. Rasche, "Retail Sweep Programs and Bank Reserves, 1994–1999," *Federal Reserve Bank of St. Louis Review* 83 (January/February 2001): 51–72. After passage of the Depository Institutions Deregulation and Monetary Control Act of 1980, nonpersonal time deposits were the only component of M2 (not included in M1) against which the board of governors could impose reserve requirements. In December of 1990 the Fed reduced that requirement from 3 to 0 percent, as well as the reserve requirement against Eurocurrency liabilities. The

Fed also reduced the highest marginal reserve requirement on net transaction deposits (checking accounts) from 12 percent to 10 percent in April 1992.

12. Milton Friedman, "The Fed's Thermostat," *Wall Street Journal*, August 19, 2003, p. A8; George A. Selgin, *The Theory of Free Banking: Money Supply under Competitive Note Issue* (Totowa, NJ: Rowman and Littlefield, 1988); Lawrence H. White, *The Theory of Monetary Institutions* (Malden, MA: Blackwell, 1999). See also Stephen Horwitz, *Monetary Evolution, Free Banking and Economic Order* (Boulder, CO: Westview Press, 1992). Robert L. Greenfield and Leland Yeager reach the same conclusion using a different argument under a slightly different set of constraints in "Can Monetary Disequilibrium Be Eliminated?" *Cato Journal* 9 (Fall 1989): 405–19.

13. Again, all estimates of the monetary aggregates came from the St. Louis Fed website: <http://research.stlouisfed.org/fred2/>. We calculated income velocity using nominal GDP.

14. Reserve ratios are calculated using our estimates of total reserves as described in n. 7.

15. For the text of the Financial Services Regulatory Relief Act of 2006 (signed by President Bush on October 13), go to frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_cong_bills&docid=f:s2856enr.txt.pdf. Bank reserves that pay interest cease, in economic jargon, to be outside money (i.e., assets only), and unless the dollar is redeemable for some nonmonetary good(s), only the demand for pure outside fiat money itself fixes the dollar's purchasing power. As Don Patinkin in *Money, Interest, and Prices: An Integration of Monetary and Value Theory*, 2nd ed. (New York: Harper and Row, 1965), pp. 15–33, taught economists years ago, the medium of account must actually be traded on some market (or combination of markets) for the price level to be determinate. By converting part of the monetary base into government debt earning no seigniorage, interest on reserves also will exacerbate some of the potential interactions between fiscal and monetary policy discussed at length in the extensive literature surrounding Thomas J. Sargent and Neil Wallace's classic article, "Some Unpleasant Monetarist Arithmetic," *Federal Reserve Bank of Minneapolis Quarterly Review* 5 (Fall 1981): 1–17.

16. Economists will no doubt notice the similarity between this evolution and the Walrasian model of general equilibrium, where one good is arbitrarily designated numeraire without ever serving as a medium of exchange. This evolution is also what is essentially predicted by the legal-restrictions theory of monetary demand: see Neil Wallace, "A Legal Restrictions Theory of the Demand for 'Money' and the Role of Monetary Policy," *Federal Reserve*

Bank of Minneapolis Quarterly Review (Winter 1983): 1–7; Robert E. Hall, “Monetary Trends in the United States and the United Kingdom: A Review from the Perspective of New Developments in Monetary Economics,” *Journal of Economic Literature* 20 (December 1982): 1552–56; and Tyler Cowen and Randall Kroszner, *Explorations in the New Monetary Economics* (Oxford: Blackwell, 1994).

17. John B. Taylor, “Estimation and Control of a Macroeconomic Model with Rational Expectations,” *Econometrica* 47 (September 1979): 1267–86, and John

B. Taylor, “Discretion Versus Policy Rules in Practice,” *Carnegie-Rochester Conference Series on Public Policy* 39 (1993): 195–214. For Milton Friedman’s critique of the Taylor Rule, one of the last things he wrote before his death, see his “Tradeoffs in Monetary Policy,” in *David Laidler’s Contributions to Macroeconomics*, ed. Robert Lesson (forthcoming), and online at <http://www.stanford.edu/~johntayl/Friedman2006.pdf>.

18. Benjamin M. Friedman, “Chairman Greenspan’s Legacy,” *New York Review of Books* 55 (March 20, 2008): 25–28.

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